Chapter 5

The Science Curriculum

The first part of Chapter 5 presents information about the curricular goals in the TIMSS 2003 countries, referred to as the intended curriculum. Information is provided about the science subjects offered in each country, whether the participating countries have national curricula and public examinations in science, how the curriculum is supported and monitored within each country, whether countries differentiate the curricula for students with different levels of ability, and the approaches and processes that are emphasized in the intended curriculum. The second part of the chapter presents data about the coverage of the TIMSS science topics in the intended curriculum for each country, as well as teachers' reports about the science topics actually taught to their students, also known as the implemented curriculum.

In comparing achievement across countries, it is important to consider differences in students' curricular experiences and how they may affect the science they have studied. Students' opportunity to learn the content, skills, and processes tested in the TIMSS 2003 science assessment depends to a large degree on the curricular goals and intentions inherent in each country's policies for science education. Just as important as what students are expected to learn, however, is what their teachers choose to teach them. The lessons provided by the teacher ultimately determine the science students are taught.

This chapter presents information about the curricular goals in science in the TIMSS 2003 countries and teachers' reports about the science content studied. Teachers' instructional programs for their classes are usually guided by an "official curriculum" that describes the science education that should be provided. The official curriculum can be communicated by means of documents or statements of various types (often called guides, guidelines, or frameworks) prepared by the education ministry or by national or regional education departments. These documents or statements, together with supporting material such as instructional guides or mandated textbooks, are referred to as the *intended curriculum*. To collect information about the intended science curriculum in each of the TIMSS 2003 countries, the National Research Coordinators (NRCs) responsible for implementing the study completed curriculum questionnaires, often with the assistance of curriculum specialists, and responded to follow-up queries.

In many cases, teachers need to interpret and adapt the intended curriculum according to their perceptions of the needs, abilities, and interests of their students, and this evolves into the *implemented curriculum*. Research has shown that the implemented curriculum, even in highly regulated educational systems, is not identical to the intended

Taipei, Indonesia, Lebanon, Morocco, and the Philippines, were teaching some or all of biology, chemistry, physics, and earth science as separate subjects (in some cases chemistry and physics or biology and earth science are combined), although not necessarily contemporaneously. Elsewhere, the common practice was to integrate the sciences into a general science curriculum.

Countries	Separate Science Courses Offered	Science Subjects and Grades Taught
	●	I . 8 , . It 8 Ie 8 , t , el. e. 8
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	●	I . 8 Ie 8 , t , el. e. 8
	○	F . . _/It . t . . el. e.
	●	I . 6,7,8 , . It 7,8 Ie 7,8 , t , el. e. 8
	○	F . . _/It . t . . el. e.
	●	I . 7 Ie / . It 8
	●	I . 7 , . It 8 Ie 8 F . . _ 8
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	●	I . 7,8 F . . _ 7,8 , . It 8 Ie 8
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	●	I . 7,8 , . It 7,8 Ie 7,8 , t , el. e. 7,8
	●	I . 7,8 Ie , 7,8
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	●	I . 6-8 , . It 8 Ie 8
	●	I . _ , _t , el. e. 7,8 , . It 7,8 Ie 7,8
	●	t . t . . el. e. \ t . _ , _ " 5,6 F . . _ 6,7,8 I . 7,8 Ie 7,8 , . It 8
	●	\ t _ . el. e. 1-4 I . 5-8 F . . _ 5-8 , . It 7,8 Ie 7,8
	○	F . . _/It . t . . el. e.
	●	I . 5-8 F . . _ 5-8 Ie 6-8 , . It 7,8
	●	I . 8 , . It 8 Ie 8 , t , el. e. 8
	●	F . . _/It . t . . el. e. -6 I . 7,8 Ie / . It 7,8 F . . _ 7,8
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	○	F . . _/It . t . . el. e.
	●	t . t . . el. e. 1- . F . . _/It . t . . el. 0 5-8 Ie 8 , t .7(1 . 0-5 1 . 6. 31 0 . 0.0001 . (I . /-1 1 6 ()2
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At the fourth grade, Exhibit 5.2 shows that of the 26 countries that participated in TIMSS 2003 at this level, all but 3 reported having national curricula in fourth-grade science. Similar to the eighth grade, fourth-grade science curricula in Australia and the United States were determined at the state level, and school boards in Belgium (Flemish) developed their own curricula based on officially defined final attainment levels. Among benchmarkers, Indiana, Ontario, and Quebec had system-wide curricula determined at the state or provincial level, respectively.

At the time of the TIMSS 2003 assessment, the official fourth-grade science curriculum had been in place for five years or less in 20 of the participants, and nearly half of those were in revision. Of the nine participating entities with a fourth-grade science curriculum of more than five years standing, five were revising it at the time of the assessment. As at the eighth grade, curriculum renewal in Australia and the United States varied by state and was generally an ongoing process.

Public examinations with consequences for individual students are another common feature of many countries' educational systems. Although public examinations can provide information of interest to national and regional policymakers, their main purpose is to make decisions about individual students, such as promotion from one grade to another, entry to a higher school system, or graduation from secondary school. Among all TIMSS 2003 participants, 39 countries and one benchmarking entity reported having public examinations in science at one or more grades. Grade 12 was the most prevalent, with 33 countries giving students public examinations in science at this level.

Countries	National Curriculum	Year Curriculum Introduced	Curriculum Under Revision	Public Exams with Consequences for Individual Students	Grades Tested in Public Exams
	●	2000	○	●	10
	○		●	●	12
	●	2001	●	●	,10,11,12
1	○	1 7	○	○	-
	●	1 6	●	●	7,10,12
	●	1 7	●	●	12
	●	2002	●	●	12
	●	1 7	●	●	,12
	●	1 0	●	●	12
	●	2002	●	●	5,8,10,11
	●	2000	○	●	10,11,12
	●	1 7, 2002	●	●	,12
	●	1 87, 2001	○	●	
	●	2000	○	●	11,13 lt 11,13 le 11,13 11,13
	●	2000	○	●	12
	●	1 4	●	●	6, ,12
	●	2002	○	●	5,8,11,12
	●	1 8	○	●	11,12
2	●	1 7 , 2002	○	●	5,8,13
	●	2002	○	○	-
	●	1 4	●	●	12
	●	2002	○	●	,12
	●	1 7_ 2001	●	●	6, ,12
	●	1	●	○	-
	●	1 7, 2003	●	●	12 lt 12 le 12 12
	●	1 4	○	●	12
	●	1 0	●	●	6, ,11,13
	●	2003-2004	○	●	,11,12
	●	1 2-1 3	●	●	12
	●	1 8	●	●	10,11,12
	●	1 5	●	●	10,11,12
	●	1 7	○	○	-
	●	2002-2003	●	●	12
	●	2002	○	●	4,8
	●	1	●	●	12
	●	1 8	●	●	le l ,11 lt ,11 le ,11 - ,11
	●	1	●	●	12
	●	2000	○	●	10,11,12
	●	1 84-1 85	●	○	-
	●	2001	●	●	6,10,12
	●	1	●	○	-
	●	1 2003	●	○	-
	●	2001 (lt 1 8)	●	●	12.

How Do Countries Support and Monitor Curriculum Implementation?

Education systems use different ways to achieve the best match between the intended and the implemented curriculum. The use of public examinations as a mechanism to support and monitor implementation of the intended curriculum is prevalent among many countries, as noted above. Another way to help ensure alignment is to develop instruc-

by 22 participants. A system of school inspection or audit was used by 21 participants and mandated or recommended textbooks also by 21 participants. Similar to the eighth grade, the least widely used method at the fourth grade was national assessment based on student samples (10 participants).

An additional method countries often use to support curriculum implementation is to provide science teachers with specific preparation in how to teach the intended curriculum as part of their pre-service and/or in-service education. These data are given in Exhibit 6.5 of the next chapter.

Countries	Mandated or Recommended Textbook(s)	Instructional or Pedagogical Guide	0 178.713 657.471.4				
	●	●	●	●	●	○	○
	○	●	●	●	●	●	●
	○	●	●	●	●	○	●
	●	●	●	○	●	○	●
	●	●	●	●	●	○	●
	○	●	●	●	●	○	●
	●	●	●	○	●	○	●
	○	●	●	●	○	○	○
	●	●	●	●	●	○	●
	○	●	●	●	○	●	●
	●	●	●	●	●	●	●
	●	○	●	●	●	○	●
	●	●	●	●	○	●	●
	●	●	●	●	●	●	●
	●	●	●	○	●	○	●
	○	●	○	○	○	●	○
	○	●	○	●	●	○	●
	●	●	○	●	○	●	○
	●	●	●	●	●	●	●
	●	●	●	●	●	○	●
	○	●	○	●	●	●	●
	●	●	●	●	●	○	●
	●	●	●	●	●	○	○
	●	●	●	○	●	○	●
	●	●	○	●	●	●	○
	●	●	●	●	○	○	●
Benchmarking Participants							
	●	●	○	○	●	○	●
	●	●	●	●	●	○	○
	●	●	●	●	●	○	○

How Much Instructional Time is Intended for Science?

Percentage of Total Instructional Time Intended for Science

4

Countries	2	4	6	8
	-	5-	12-14	3-7
	5	5	14	6.25
	7	7	10	12
	5	5	5	10
	-	10	24	8
	-	8	10	14
	-	7.1	7.1	7.1
		13	6	5
	-	15	15	15
1	-	12	12	12
	-	15	15	20
	10	5	7	8
	○	○	○	○
	6.8	-	-	-
Benchmarking Participants				
	-	5	5	6.6
	150	180	180	200
	○	○	○	○
	○	-	-	11

1

Do Countries Differentiate the Intended Science Curriculum for Students with Different Levels of Ability?

The challenge of maximizing opportunity to learn for students with widely varying abilities is met differently in different countries. Exhibit

Countries			
	●	○	○
	○	●	○
	●	○	○
	○	●	○
	●	○	○
	●	○	○
	●	○	○
	●	○	○
	●	○	○
	●	○	○
	○	●	○
	●	○	○
	●	○	○
	○	●	○
	●	○	○
	●	○	○
	●	○	○
	○	●	○
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	●	○	○
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	k	j	j

k j j

, 1, 1, 1,.

The Way the Intended Science Curriculum Addresses the Issue of Students with Different Levels of Ability

4

Countries			
	●	○	○
	○	●	○
	●	○	○
	●	○	○
	●	○	○
	○	●	○
	●	○	○
	●	○	○
	●	○	○
	●	○	○
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	○	●	○
	●	○	○
	●	○	○
	●	○	○
	○	●	○
	●	○	○
Benchmarking Participants			
	●	○	○
	●	○	○
	●	○	○

What Approaches and Processes Do Countries Emphasize in their Intended Science Curriculum?

Exhibit 5.6 indicates the relative emphasis given to various aspects of science instruction in the intended curriculum of participating countries, for both eighth and fourth grade. At the eighth grade, "a lot of emphasis" was most commonly placed on understanding science concepts (34 participants) and knowing basic science facts (35 participants). Considerable emphasis also was placed on writing explanations about what was observed and why it happened (20 participants).

Less emphasis was placed internationally on experimental work, with conducting experiments or investigations emphasized a lot in the curricula of 16 participants, formulating hypotheses or predictions to be tested in the curricula of 12 participants, and designing and planning experiments or investigations in the curricula of 9 participants.

Understanding human impact on the environment was given a lot of emphasis in the intended eighth-grade curriculum of 16 participants, and learning about technology and its impact on society in that of 9 participants. Learning about the nature of science and inquiry received a lot of emphasis in 10 participating entities.

Relative to the other approaches and processes, participants reported placing less emphasis on integrating science with other subjects and incorporating the experiences of different ethnic/cultural groups. Only four participants (Botswana, Israel, Italy, and South Africa) reported placing a lot of emphasis on integrating science, and just two countries – South Africa and Sweden – reported placing a lot of emphasis on the multicultural approach in the intended curriculum.

In the intended science curriculum at the fourth grade, most emphasis was placed on understanding science concepts (15 participants emphasized a lot), knowing basic science facts (13 participants), and writing explanations about what was observed and why it happened (13 participants). Conducting experiments or investigations was given a lot of emphasis in 11 participating entities. Designing and

Emphasis on Approaches and Processes in the Intended Science Curriculum

8

Countries					
	●	○	◉	●	◉
	●	◉	●	●	◉
	●	●	●	◉	○
	◉	◉	●	●	○
	●	●	●	●	○
	●	●	◉	◉	○
	◉	◉	●	●	○
	◉	◉	◉	●	○
	◉	○	●	◉	○
	●	●	●	●	◉
	●	◉	●	●	◉
	●	●	◉	●	◉
	●	●	◉	●	◉
	●	●	●	●	◉
	◉	○	◉	◉	○
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	●	◉	●	●	◉
	●	◉	●	●	◉
	●	◉	◉	◉	◉
	●	◉	◉	◉	●
	●	●	●	●	◉
	●	●	●	●	●
	◉	○	○	◉	◉
	◉	○	◉	◉	○
	●	◉	◉	●	◉
Benchmarking Participants					
	◉	●	◉	●	◉
	●	●	●	●	◉
	◉	●	●	●	●
	●	◉	●	●	○

● [illegible]

● [illegible]

◉ [illegible]

○ [illegible]

Countries						
	●	●	⊙	⊙	⊙	⊙
	⊙	●	⊙	⊙	●	⊙
	●	⊙	○	○	⊙	⊙
	●	⊙	⊙	⊙	⊙	⊙
	⊙	●	●	○	●	⊙
	●	●	⊙	●	●	⊙
	⊙	⊙	⊙	⊙	⊙	⊙
	●	⊙	⊙	⊙	⊙	⊙
	⊙	⊙	●	⊙	⊙	⊙
	●	●	●	●	●	●
	●	●	●	●	●	⊙
	⊙	⊙	⊙	⊙	⊙	⊙
	⊙	⊙	⊙	⊙	⊙	⊙

planning experiments or investigations, integrating science with other subjects, understanding human impact on the environment, and learning about technology and its impact on the environment were among the approaches receiving less emphasis in the intended curriculum, while incorporating the experiences of different ethnic/cultural groups was emphasized least in the fourth-grade science curriculum.

Are the TIMSS Science Topics Included In the Intended Curriculum?

The ability of policymakers to make sound judgments about relative strengths and weaknesses of science education in their systems depends on achievement measures being based, as closely as possible, on what students in their systems have actually been taught. *The TIMSS Assessment Frameworks and Specifications: 2003* served as the basis for the TIMSS 2003 science assessment.[4] It delineates the science content and skills to be assessed at both the eighth and fourth grades, and represents

It delineatesmajorakers toarticiprience andvfer . Howes r

and if so, whether the topics were intended to be taught to "all or almost all students" or "only the more able students."

Exhibit 5.7 shows that, for most countries, a great deal of the science content addressed by the TIMSS 2003 assessment was included in their intended curricula. On average, across participants at the eighth grade, 71 percent of the assessment topics were intended for all or almost all students, and a further 4 percent for only the more able students. In only eight countries were less than half of the topics included in the eighth-grade curriculum: Belgium (Flemish), Botswana, Cyprus, Indonesia, Lebanon, Morocco, South Africa, and Tunisia. Coverage of the TIMSS science topics was particularly sparse in South Africa and Tunisia, with just 16 and 7 percent of the topics, respectively, in the intended curriculum for all or almost all students.

It is noteworthy that in most countries, those topics included in the curriculum were intended for all students. Only in Hong Kong SAR, New Zealand, Scotland, South Africa, Sweden, the Basque Country, and Quebec were more than 10 percent of science topics intended only for the more able students.

Each of the five content areas in the TIMSS eighth-grade science assessment – life science, chemistry, physics, earth science, and environmental science – was included in the intended curriculum in about equal proportions (65-75%), on average. In life science, 73 percent of the topics, on average, were included in participants' intended curriculum for all or almost all students. At least 10 of the 12 life science topics were included in the curriculum of about half of the participants (25). Participants with relatively low coverage (no more than half of the 12 topics) included Botswana, Bulgaria, Cyprus, Indonesia, Iran, Lebanon, Morocco, Slovenia, Tunisia, and Quebec.

Chemistry had fewer topics than life science (8 vs. 12) but a proportionally similar level of inclusion in the intended curriculum – 70 percent of topics, on average. Ten participants included all eight chemistry topics in their curricula, and a further 13 participants included seven of the eight topics. None of the chemistry topics were

included in the intended curriculum in Belgium (Flemish), Indonesia, and Tunisia.

Summary of TIMSS Science Topics in the Intended Curriculum

8

Countries	Percentage of TIMSS Science Topics Intended to be Taught Up to and Including Eighth Grade*								
	Overall (44 topics)			Life Science (12 topics)			Chemistry (8 topics)		
	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8
	1	5	5	67	17	17	100	0	0
	55	0	45	58	0	42	50	0	50
	1	0		100	0	0	88	0	13
	23	7	70	67	17	17	0	0	100
	30	0	70	50	0	50	13	0	88
	75	0	25	33	0	67	88	0	13
	64	0	36	2	0	8	75	0	25
	70	0	30	100	0	0	88	0	13
	23	2	75	8	8	83	38	0	63
	86	0	14	83	0	17	100	0	0
	84	0	16	2	0	8	88	0	13
	100	0	0	100	0	0	100	0	0
	5	0	5	100	0	0	88	0	13
	64	16	20	67	17	17	25	38	38
	1	0		100	0	0	100	0	0
	48	0	52	50	0	50	0	0	100
	61	0	3	42	0	58	100	0	0
	77	0	23	67	0	33	75	0	25
	8	0	2	100	0	0	100	0	0
	73	0	27	58	0	42	88	0	13
	100	0	0	100	0	0	100	0	0
	52	0	48	58	0	42	38	0	63
	82	0	18	58	0	42	100	0	0
	41	0	5	33	0	67	63	0	38
	8	0	2	100	0	0	88	0	13
	8	0	11	83	0	17	100	0	0
	5	0	41	67	0	33	75	0	25
	8	0	2	100	0	0	88	0	13
	43	7	50	50	0	50	75	0	25
	73		18	2	0	8	75	25	0
	57	27	16	58	25	17	50	38	13
	80	0	20	2	0	8	63	0	38
	86	0	14	2	0	8	75	0	25
	70	5	25	100	0	0	38	13	50
	82	0	18	2	0	8	100	0	0
	86	0	14	75	0	25	88	0	13
	75	0	25	2	0	8	50	0	50
	75	18	7	83	17	0	88	13	0
	8	0	2	100	0	0	88	0	13
	77	0	23	58	0	42	88	0	13
	82	5	14	67	0	33	75	25	0
	77	0	23	50	0	50	88	0	13
	16	32	52	25	42	33	13	38	50
	77	11	11	2	0	8	63	38	0
	57	7	36	67	25	8	38	0	63
	7	0	3	25	0	75	0	0	100
	5	2	2	100	0	0	75	13	13
	71	4	25	73	4	23	70	5	25
Benchmarking Participants									
	48	27	25	50	17	33	38	25	38
	3	0	7	100	0	0	63	0	38
	84	0	16	83	0	17	50	0	50
	50	11	3	42	8	50	50	0	50

* 100 5. 5.13

	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8
	100	0	0	100	0	0	100	0	0
	60	0	40	55	0	45	33	0	67
	100	0	0	73	0	27	100	0	0
( )	0	0	100	0		1	67	0	33
	40	0	60	18	0	82	0	0	100
	100	0	0	1	0		67	0	33
	50	0	50	36	0	64	67	0	33
	70	0	30	45	0	55	0	0	100
				50	06 _		50	06 _	

Countries	Average Percentage of Students Taught the TIMSS Science Topics					
	Overall* (44 topics)	(12 topics)	Chemistry (8 topics)	Physics (10 topics)	Earth Science (11 topics)	Environmental Science
	0 (0.7)	71 (2.1)	7 (1.2)	8 (1.0)	6 (2.5)	
	52 (1.3)	51 (1.7)	58 (1.5)	50 (1.6)	53 (2.2)	37 (3.3)
	55 (0.8)	64 (0.)	70 (1.3)	0 (1.2)	12 (1.4)	12 (1.6)
	48 (1.3)	70 (1.5)		25 (1.6)	24 (1.7)	
	28 (0.)	41 (1.6)	15 (1.3)	37 (1.2)	16 (1.2)	23 (2.1)
	88 (0.)	81 (1.6)	81 (1.8)	5 (1.1)	4 (0.)	
	7 (1.1)	0 (1.1)	84 (1.8)	66 (2.0)	74 (1.)	7 (2.6)
	78 (1.0)		0 (0.7)	68 (1.4)		
	56 (0.4)		46 (0.5)	4 (0.4)	77 (0.8)	
	2 (0.)	2 (0.)	6 (1.0)	3 (1.1)	8 (1.3)	84 (2.0)
	73 (0.)	61 (1.4)	84 (1.3)	54 (1.5)	5 (0.7)	
	48 (1.3)	55 (1.5)	64 (1.6)	44 (1.6)	32 (2.3)	4 (3.5)
	53 (1.3)	63 (1.8)	5 (2.2)	70 (1.7)	21 (1.6)	51 (3.)
	84 (0.7)	83 (1.1)	7 (0.8)	81 (1.0)	71 (2.3)	
	75 (0.7)	72 (1.1)		7 (0.8)		
	84 (1.0)	80 (1.3)	88 (1.1)	0 (1.3)	80 (1.5)	76 (2.6)
	56 (1.5)	4 (2.0)	76 (1.)	5 (1.4)	45 (3.4)	3 (4.0)
	77 (1.0)	1 (0.8)	80 (1.7)	68 (1.8)	74 (1.7)	5 (2.)
	52 (0.7)	3 (1.1)	80 (1.6)	68 (1.1)	46 (1.2)	1 (0.7)
	75 (1.5)	75 (2.3)	77 (1.)	87 (1.5)	66 (2.1)	63 (2.)
	54 (1.7)	4 (1.7)	44 (2.1)	68 (2.2)	64 (2.5)	23 (2.7)
	64 (1.4)	65 (2.6)		62 (2.2)		
	73 (1.5)	74 (2.0)	88 (1.4)	83 (1.5)	51 (3.5)	60 (3.)
	70 (0.8)	68 (2.1)	67 (1.6)	47 (2.1)	5 (1.0)	
	8 (0.3)	7 (0.6)	8 (1.3)	8 (0.6)	2 (1.6)	
	64 (1.1)	78 (0.)	81 (1.6)	74 (1.3)	25 (2.1)	67 (3.0)
	80 (1.4)	68 (3.6)	4 (1.4)	77 (2.0)	7 (3.4)	
		55 (2.6)	67 (3.0)	61 (3.4)	31 (2.7)	
	58 (1.5)	73 (1.8)	33 (2.4)	52 (1.)	5 (2.5)	
	45 (1.5)	46 (2.3)	5 (2.4)	48 (1.7)	36 (2.1)	30 (3.6)
	45 (1.3)	41 (2.0)	3 (2.1)	33 (1.4)	68 (2.0)	32 (3.4)
	68 (1.4)	68 (1.6)	73 (1.7)	81 (1.5)	61 (2.1)	42 (3.5)
	63 (1.8)	88 (1.5)	38 (3.7)	30 (3.2)	77 (3.2)	8 (2.)
	6 (0.4)	6 (0.7)	5 (1.0)	6 (1.3)	5 (1.2)	
	70 (1.6)	73 (1.)	63 (2.5)	65 (2.5)	77 (1.8)	68 (3.7)
	61 (1.2)	64 (1.5)	75 (1.3)	70 (1.6)	42 (2.4)	41 (2.8)
	6 (0.6)	4 (1.2)	5 (1.5)	5 (1.1)	4 (1.)	
	58 (1.0)	67 (1.1)	75 (1.6)	77 (1.1)	17 (1.5)	48 (2.4)
	81 (0.8)	82 (1.8)	75 (1.4)	77 (0.7)	0 (1.7)	
	67 (0.8)	77 (1.2)	78 (1.5)	44 (1.6)		
	4 (2.2)	57 (2.4)	54 (2.5)	46 (2.5)	37 (3.3)	63 (3.4)
	63 (1.2)	66 (1.6)	70 (1.4)	64 (1.6)		35 (3.4)
	32 (1.4)	66 (1.3)	14 (2.1)	11 (1.8)	27 (1.7)	31 (3.2)
	7 (1.2)	86 (1.7)	73 (2.3)	70 (1.)	86 (1.5)	6 (3.0)
¶				3 (1.2)		
	67 (0.2)	70 (0.3)	70 (0.3)	66 (0.3)	61 (0.3)	4 (0.6)
Benchmarking Participants						
	68 (1.5)	66 (1.)	54 (2.8)	66 (2.8)	82 (2.2)	70 (4.0)
	84 (1.6)	8 (2.4)	7 (3.3)	78 (3.0)	8 (3.1)	80 (4.6)
	72 (1.3)	75 (1.)	60 (2.2)	72 (2.2)	76 (2.6)	74 (3.)
	52 (1.3)	42 (2.3)	50 (1.8)	34 (1.8)	78 (2.1)	71 (3.6)

	58 (2.0)	74 (2.0)	45 (2.7)	57 (2.2)
( )	43 (1.2)	5 (1.8)	30 (1.3)	44 (1.5)
	63 (1.5)	68 (1.5)	63 (1.)	56 (1.)
	55 (1.7)	61 (2.2)	54 (1.)	51 (2.0)
	6 (1.3)	71 (2.1)	74 (1.7)	62 (1.8)
	62 (1.)	62 (2.5)	67 (2.6)	53 (1.)
	71 (1.5)	88 (1.5)	61 (2.1)	68 (2.0)
	68 (1.)	6 (2.4)	68 (2.1)	68 (2.2)
	65 (1.1)	72 (1.1)	55 (1.6)	72 (1.7)
	37 (1.2)	35 (1.5)	46 (1.6)	24 (1.4)
	81 (1.0)	6 (0.8)	67 (1.7)	85 (1.1)
	75 (1.5)	83 (1.7)	58 (2.3)	1 (1.3)
	47 (1.6)	65 (2.0)	31 (2.1)	4 (2.2)
	62 (1.6)	73 (1.7)	54 (1.7)	60 (2.3)
	55 (1.6)	63 (1.8)	45 (1.)	62 (2.0)
	83 (1.)	1 (1.6)	7 (2.2)	78 (2.7)
	4 (1.6)	60 (2.3)	44 (2.0)	45 (2.4)
	58 (1.3)	65 (1.7)	68 (1.4)	37 (1.5)
	56 (1.8)	63 (2.4)	53 (2.0)	52 (1.)
	54 (1.4)	68 (1.)	54 (1.6)	3 (2.0)
	6 (1.2)	74 (1.6)	60 (1.7)	75 (1.4)

At the fourth grade, Exhibit 5.8 shows that internationally, on average, 61 percent of the students tested in TIMSS 2003 had been taught the TIMSS science topics, with the percentage ranging from 83 percent in Lithuania to 37 percent in Japan. The majority of students in every participating entity except Belgium (Flemish), Japan, the Netherlands, and Quebec had been taught the topics.

Consistent with the data reported on the intended science curriculum at the fourth grade (Exhibit 5.7), life science was the content area with the greatest percentage of students taught the topics, on average (69%). Percentages were greatest in Lithuania (96%) and the Philippines (91%) and least in Japan (35%). For physical science and earth science, the average percentages of fourth-grade students taught the TIMSS science topics were similar, 56 percent and 58 percent, respectively. The percentage of students taught physical science ranged from 79 percent in the Philippines to 30 and 31 percent in Belgium (Flemish) and the Netherlands, respectively. Although earth science topics did not figure prominently in the intended curriculum at the fourth grade, teachers' reports indicated that students have to a considerable extent been taught the topics. According to teachers' reports,

Countries												
	●	--	70 (5.2)	⦿	--	86 (3.2)	●	8	54 (5.5)	○	--	34 (5.1)
	○	10	70 (3.3)	●	7	4 (4.2)	●	7	26 (3.3)	○	10	40 (4.2)
	●	6-8	77 (2.4)	●	2,4,5	43 (3.4)	●	6,8	51 (3.0)	●	3	15 (2.)
( )	●	--	0 (2.6)	○	--	4 (3.7)	●	--	86 (2.7)	○	--	21 (3.7)
	●	8	2 (4.4)	○		14 (3.3)	●	8	32 (3.)	○		5 (2.1)
	○		6 (1.7)	○		0 (2.4)	○	-10	66 (4.4)	○		25 (4.3)
	●	6,7,	5 (1.8)	●	8,10,12	1 (2.2)	●	7,8	85 (2.6)	●	8,11	78 (3.3)
	●	7		●	7		●	7		●	7	
	○			⦿	7		○			○		
	●	4,5,10	8 (1.1)	●	--	81 (3.4)	○	--	8 (1.1)	●	6	80 (3.0)
	●	4,7, ,11	88 (2.8)	●	2-4,7-8,11	5 (1.8)	●	2,4, ,11	24 (4.6)	●	2,4-5,8-,12	26 (4.8)
	●	7	88 (3.0)	●	7-8	42 (4.7)	●	8	6 (4.3)	●	8	10 (3.1)
	●	8	(0.8)	○	10	40 (4.6)	●	7	78 (4.0)	●	6	54 (4.)
	●	8	86 (2.3)	●	8	8 (2.5)	●	8	5 (4.1)	●	7	67 (3.)
	●	6-7	100 (0.0)	○	10	87 (3.1)	○		16 (3.3)	○		48 (4.3)
	○	-11	88 (2.5)	○	-11	82 (3.2)	○	-11	8 (2.5)	○	-11	75 (3.)
	○	-12	52 (3.8)	●	--	58 (4.3)	○	-12	77 (3.7)	○	-12	30 (3.6)
	●	4-7	(0.7)	●	4-7	7 (1.1)	●	8	83 (2.8)	●	8	6 (3.5)
	●	6-8,10-12	88 (3.0)	●	3-12	55 (4.5)	●	5, -12	3 (1.2)	○	-12	8 (2.2)
	●	4,6,8	1 (2.7)	●	4,6,7	76 (3.5)	●	7	56 (4.)	●	4	5 (4.5)
,	●	8	8 (2.0)	●	3-4	27 (3.)	○		44 (3.)	○		20 (3.3)
	●	7-8	8 (1.5)	●	7	87 (4.0)	○		57 (6.0)	●	7-	77 (4.)

Chemistry topics were also generally included in participants' eighth-grade intended curricula and widely taught, as shown in Exhibit 5.10. The most frequently reported topic – "classification and composition of matter" – was included for all or almost all students in 43 of the participating entities and taught to 85 percent of students, on average. Of "properties of solutions," "the particulate structure of matter," and "properties and uses of water," each was included in the curricula of at least 35 participants, and each was taught to 78 percent of students. In contrast, "classification of familiar chemical transformations" was included in the intended curriculum of just 17 participants, and was taught to just 47 percent of students, on average. Most participants indicated that this topic would be taught in later grades.

The TIMSS physics topics were widely included in participants' intended curricula at the eighth grade. Of the ten physics topics, three were in the curricula of at least 40 participants ("physical states and changes of matter," "the processes of melting, freezing, evaporation,

Chemistry

Countries												
{	●	--	(1.1)	●	--	(1.1)	●	8,10	100 (0.0)	●	--	(1.1)
{ \	●	--	0 (2.7)	●	7	84 (2.8)	●	--	67 (4.0)	○	11-12	72 (3.2)
{	●	6-8	8 (2.5)	●	6,8	81 (3.0)	●	6,8	100 (0.0)	●	1-4	26 (3.0)
\ (\ )	○	--		○	--		○	--		○	--	
	○	10	18 (3.5)	○		11 (3.0)	○	10	5 (2.1)	●	6	75 (4.4)
\ {	●	6	(0.)	●	6-7,10	60 (4.2)	●	6-8	100 (0.0)	●	6	80 (4.0)
\	●	6,8	6 (1.7)	○	--	5 (1.5)	●	7,10,12	4 (1.)	●	8-	3 (1.8)
	●	8	100 (0.0)	●	8	(0.7)	●	8	(0.7)	●	8	8 (1.1)
{	○	--	61 (1.0)	○	--	15 (1.0)	○	12	25 (1.3)	●	8	8 (0.6)
	●											

A 5:

.11 Intended and Taught TIMSS Physics Topics

Physics												
Countries												
	●	5	100 (0.4)	●	5	7 (1.3)	●	5	6 (1.7)	●	4	64 (4.7)
	●	--	85 (2.5)	○	11	1 (2.0)	○	11	65 (4.2)	○	--	43 (3.8)
	●	3,5-7	86 (2.2)	●	2,5,7	5 (1.5)	●	5,7	3 (1.6)	●	5	83 (2.3)
	○	--	43 (4.8)	○	--	60 (4.)	○	--	32 (5.2)	○	--	25 (5.3)
	●	6	2 (2.5)	●	7	8 (3.2)	●	6	65 (4.4)	○	11	16 (3.5)
	●	6	6 (1.)	●	8	(0.)	●	8	(0.7)	●	8	6 (1.7)
	●	7	3 (2.0)	●	8	6 (1.4)	●	6,10	3 (2.0)	○	10	77 (3.4)
	●	8	(0.7)	●	8	(0.8)	○		60 (4.1)	●	8	75 (3.5)
	●	7-	5 (1.6)	●	7-10	100 (0.0)	●	7-	84 (2.7)	●	7-	100 (0.0)
	●	5	7 (1.5)	●	5,8	(0.6)	●	5,8	(0.)	●	8	5 (1.8)
	●	1,7-8,10	82 (3.2)	●	1,2,5, -10	3 (4.5)	●	5,7-	50 (5.0)	●	7, -10	45 (4.)
	●	7	8 (2.6)	●	7-8	83 (3.2)	●	8-	73 (4.2)	●	8	28 (4.5)
	●	7	85 (3.6)	●	7	85 (3.2)	●	7	87 (3.4)	●	7	73 (3.8)
	●	7	8 (1.1)	●	7	1 (2.0)	●	7	4 (1.5)	●	7	3 (2.2)
	●	7	7 (1.8)	●	6	7 (1.7)	●	6	100 (0.5)	●	8	6 (1.)
	●	5-8	6 (1.5)	●	5-6,8	(0.7)	●	6-8	6 (1.6)	●	6-8	3 (2.0)
	●	7-8	8 (1.3)	●	7-8	8 (1.0)	○		40 (3.6)	●	7-	2 (1.7)
	●	6-7	5 (1.5)	●	6	4 (1.7)	●	5-8	80 (3.0)	●	6-7	85 (2.6)
	○	10-12	53 (4.0)	●	7,10-12	1 (2.5)	○	-12	(2.2)	●	4,7,10-12	50 (4.3)
	●	3,5,7	1 (2.7)	●	3,6-7	87 (2.7)	●	2,5,6,8	84 (3.1)	●	7	65 (4.1)
	●	7	78 (3.3)	●	7	88 (2.7)	●	5, -10	46 (3.)	●	4	64 (4.0)
	●	8-	100 (0.0)	●	8-	62 (6.8)	●	8-	60 (6.7)	●	8-	70 (6.1)
	○	--	7 (1.3)	○		7 (1.4)	●	8,12	1 (4.5)	○	11	0 (2.7)
	●	5-8	83 (3.5)	●	7-8	12 (3.0)	●	5-8	51 (4.8)	●	7-8	24 (4.1)
	●	7	(0.6)	●	7	(0.6)	●	7	(0.6)	●	7	(0.6)
	●	7	4 (2.2)	●	7	7 (1.6)	●	7	5 (2.1)	●	7	74 (3.8)
	●	6	1 (2.)	●	6-7	8 (3.)	●	7	1 (3.5)	●	8	88 (2.8)
	●	--	74 (6.)	●	--	86 (5.6)	○	--	21 (6.6)	●	--	4 (3.5)
	●	--	68 (5.5)	●	--	84 (3.7)	●	--	76 (5.0)	○	10	18 (4.0)
	●	8-	86 (3.8)	●	8-	2 (3.5)	⦿	8-	76 (4.4)	○	11-12	38 (5.5)
	●	8	86 (3.1)	○	10	81 (3.3)	○	-10	25 (3.6)	○	10	46 (4.4)
	●	7,11-12	1 (2.4)	●	7, -12	2 (2.3)	●	3-6, -12	85 (2.8)	●	7,10	78 (3.3)
	●	7	37 (4.4)	●	7-	34 (4.3)	●	7, -10	40 (4.3)	○	-10	22 (4.2)
	●	3,6,11	5 (2.0)	●	4,7-8,11	8 (1.2)	●	6,7, ,11	2 (2.6)	●	6,11	7 (1.8)
	●	7		●	7-8		●	7-8		●	7-8	
	●	--	87 (3.1)	●	--	82 (3.6)	○		31 (6.3)	○	10	50 (5.4)
	●	7	8 (2.2)	●	7	0 (2.4)	●	8	7 (1.0)	⦿	8	68 (3.)
	●	6	5 (1.)	●	7	4 (1.7)	●	7-8	3 (1.)	●	7	1 (2.3)
	●	8	8 (1.8)	○		76 (2.2)	●	7	82 (2.1)	●	7	73 (2.8)
	●	6	(1.0)	●	8	8 (0.5)	●	8	8 (3.3)	●	8	4 (1.7)
	●	7	81 (3.3)	●	8	31 (4.3)	●	8	75 (4.0)	●	8	50 (4.7)
	⦿	--	66 (4.1)	⦿	--	65 (3.)	●	--	70 (3.6)	○	--	28 (4.1)
	●	8	82 (3.3)	●	8	88 (2.6)	○		46 (4.0)	●	8	48 (3.5)
	○	--		○			○			○		
	○	10	5 (2.1)	○	10	17 (3.5)	○	10	17 (3.7)	○	10	11 (2.8)
	●	--	86 (2.1)	●	--	84 (2.2)	●	--	76 (2.6)	●	--	66 (3.1)
¶	●	,1,6	7 (1.0)	●	4,6		●	6-8	6 (1.8)	●	7	82 (4.0)
			85 (0.4)			82 (0.4)			72 (0.5)			66 (0.5)
Benchmarking Participants												
	⦿	10	3 (1.)	●	--	8 (3.5)	●	--	75 (3.8)	●	--	71 (4.4)
	●	--	7 (1.6)	●	--	3 (3.0)	●	--	80 (5.2)	●	--	80 (5.0)
	●	5-8	88 (3.0)	●	5-8	3 (2.6)	●	7	84 (3.6)	●	7	7 (4.1)
	●	--	64 (5.1)	●	--	78 (4.2)	●	--	68 (4.5)	⦿	10	63 (5.4)

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50 0%. f

50%. f

( ).

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68 percent for the “Earth’s water cycle” to 54 percent for “weather data and maps, and changes in weather patterns.”

Environmental science had just three topics in the TIMSS eighth-grade science assessment; and, as noted earlier, did not receive as much emphasis as topics in other areas either in the intended or the implemented curriculum. As shown in detail in Exhibit 5.13, the three topics were included for most students in the intended curricula of between 30 and 39 participants. “Changes in environments” and “use and conservation of natural resources” were included in the curricula of 39 and 38 participants, respectively, and had the greatest percentages of students who were taught them – 53 percent and 56 percent, respectively. “Trends in human population and its effects on the environment” was included in 30 participants’ curricula and was taught to just 38 percent of students, on average.

At the fourth grade, 10 of the 32 TIMSS science topics were in life science. As shown in Exhibit 5.14, three of the topics – “types, characteristics, and classification of living things,” “major body structures and their function in humans and other organisms,” and “the general steps in the life cycle of familiar organisms” – were included in two-thirds or more of participants’ intended curricula and were generally well-covered in the classroom. On average, 82 percent, 77 percent, and 78 percent of students, respectively, were taught these topics. The remaining life science topics were included in fewer participants’ curricula, from a maximum of 17 to a minimum of 13. The average percentage of students taught these topics ranged from 80 percent for “ways of maintaining good health, including diet and exercise” to 53 percent for “plant and animal reproduction.”

As shown in Exhibit 5.15, the 13 TIMSS physical science topics vary considerably, both in terms of inclusion in the intended curriculum and in being taught in the classroom. Just three of the topics were included in the curricula of 20 or more participants – “classification of objects and materials based on physical properties,” "properties and uses of water,” and “changes in state of water by heating and

Earth Science

Countries

Earth Science

Countries

(● 5 6 (2.) ●

Environmental Science

Countries									
	●	8,10		●	8,10		●	-8	
	○	--	25 (3.2)	○	--	46 (3.)	●	--	40 (4.1)
	●	4-6	7 (2.1)	●	4-7	17 (2.4)	●	1,4,6-7	13 (2.0)
( )	○	--		●	--		●	--	
	○	11	8 (2.5)	○	10	53 (4.5)	○	10	7 (2.2)
	●	8		○			●	8-	
	○	--	64 (4.0)	●	5,8	88 (2.7)	●	6,8	84 (2.)
	○			○			○		
	○	--		○	--		○	--	
	●	6,10	67 (3.7)	●	6	7 (1.2)	●	6,	87 (2.8)
	●	2,8-		●	5-7		●	6-11	
	●	8-	40 (4.5)	●	7-	47 (4.6)	●	7-	60 (4.6)
	●	6	28 (4.6)	●	6	60 (5.0)	●	6	65 (5.0)
	○	10		○	10		●	8	
	○			●	5		●	7	
	○	-11	74 (3.4)	○	-11	78 (3.3)	○	-11	78 (3.5)
	●	5-8	36 (4.1)	●	5-8	38 (4.4)	●	5-8	44 (4.7)
	○	--	40 (3.8)	●	8	68 (3.8)	●	8	68 (3.)
	○	--	0 (0.0)	●	6, -12	2 (1.2)	○	-12	2 (1.2)
	●	6	4 (4.0)	●	4-6,8	81 (3.4)	●	6	60 (4.4)
,	○	11	20 (3.0)	--					

Life Science

Countries

	●	--		●	--		●	--		●	--	
	●	--	85 (3.0)	●	--	70 (4.2)	●	--	76 (3.2)	●	--	0 (2.)
	●	--	4 (3.)	⦿	5	40 (4.0)	⦿	5	58 (4.2)	○	6	70 (3.4)
	●	3	1 (2.2)	●	3-4	2 (2.3)	●	3-4	6 (3.8)	●	3-4	76 (3.3)
	●	4-5	6 (1.6)	●	1-6	77 (3.5)	○	--	50 (4.3)	●	1-3	68 (3.7)
	●	1,3	84 (3.5)	●	,4	85 (3.5)	●	3-4	82 (3.7)	●	4	85 (3.6)
	●	2	74 (4.6)	●	4	87 (3.4)	○	6	87 (3.3)	●	2	62 (4.6)
	●	2	5 (1.)	●	2	8 (2.6)	○	7	86 (2.7)	●	4	8 (2.)
	●	1-4	1 (2.6)	●	2-4	4 (1.8)	●	1-4	71 (3.)	○	5,6,8	76 (4.1)
	●	4-6	7 (1.2)	●	4-7	71 (3.1)	●	4-6	50 (3.3)	●	4-7	3 (1.7)
	●	3-12	53 (4.0)	●	3-12	30 (3.8)	●	4,6,8-12	24 (3.5)	●	3-12	85 (2.8)
	●	--		●	--		○	--		○	6-	
	●	1-4	3 (1.8)	●	3-4	8 (1.2)	○	5-6	8 (0.8)	●	1-4	(0.8)
	●	--	81 (3.6)	●	--	5 (1.8)	●	--	87 (3.4)	●	--	85 (2.5)
	⦿	--		⦿	--		●	--		⦿	--	
	●	--	71 (4.6)	●	--	72 (4.0)	●	--	72 (4.0)	●	--	72 (4.1)
	●	1-4	87 (2.4)	●	2-3	77 (3.4)	●	2-3	63 (3.7)	●	2-3	88 (2.0)
	●	1,4-5,8	60 (4.0)	●	3-10	70 (3.6)	●	2-10	63 (4.4)	●	3-5	67 (4.2)
	○	5,8	8 (1.4)	●	3-4,8	6 (2.4)	○	5,8	1 (3.2)	●	4	8 (1.7)

( ) . ( ) ((1) .1(.) (-)-1 ( ) . ( ) ((0 - 0 -

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Life Science

Countries

	●	4,8		●	4,10	
	○	--	46 (4.3)	○	--	2 (2.3)
	⦿	6	55 (3.6)	⦿	6	85 (2.7)
	○	7	42 (4.0)	○	7	67 (3.6)
	○	--	24 (3.)	⦿	4	43 (4.2)
	○	--	3 (4.6)	●	4	2 (2.4)
	○	5	60 (5.0)	●	4	5 (2.3)
	●	3	85 (2.5)	●	4	7 (1.5)
	○	5,6	50 (4.8)	●	1-4	7 (3.4)
	○	5-8	27 (2.6)	○	--	4 (3.4)
	○	--	22 (3.5)	○	--	40 (4.1)
	○	5		○	5	
	●	3-4	3 (1.8)	●	1-4	5 (1.7)
	●	--	7 (3.4)	●	--	0 (2.6)
	⦿	--		⦿	--	
	●	--	35 (4.8)	●	--	85 (3.6)
	●	-12	52 (3.8)	●	-12	7 (0.8)
	●	2	72 (3.6)	●	2	82 (3.1)
	○	5	88 (3.3)	●	3-6	3 (2.8)
	●	3-4		●	3-4	
	●	--	3-4-- 4 (3.4)			

cooling." These were taught, respectively, to 61 percent, 80 percent, and 83 percent of students, on average. The remaining topics were in the intended curricula of between 13 and 19 participants, with the percentage of students taught the topics ranging from 35 to 69 percent, on average. The topics taught to the least percentages of students were "properties and uses of metals" (38%) and "forming and separating mixtures" (35%).

As described before, earth science topics did not figure prominently in the intended fourth-grade science curricula of the participating countries, and they were taught to fewer students than the other science content areas. As shown in Exhibit 5.16, "water on Earth" was the topic included in the curriculum of most participants (18). Other topics included in the curricula of about half the participants were: "rocks, minerals, sand, and soil," "air," "common features of the Earth's

scie18soilhad
mixtlostartintage of students taught the topics ras(27

.1 Intended and Taught TIMSS Physical Science Topics *(Continued...)*

Physical Science												
Countries												
	●	4		●	4		●	4		●	4	
	○	5	33 (4.4)	●	--	3 (4.2)	●	--	72 (4.0)	●	--	70 (3.7)
	○	7	16 (2.4)	○	6	28 (2.8)	●	--	6 (3.8)	●	--	52 (3.5)
	○	5	42 (4.0)	○	6	67 (4.0)	●	3-4	75 (4.0)	○	6	8 (2.2)
	○	--	18 (3.5)	●	2-4	76 (4.6)	●	2,4	0 (2.4)	○	6	38 (4.3)
	○	--	48 (5.0)	●	4	4 (1.)	●	4	5 (2.0)	○	--	43 (5.1)
	●	4	77 (4.7)	○	7	85 (3.8)	●	3	0 (3.3)	○	5	64 (5.5)
	○	7	41 (4.3)	●	3	8 (2.4)	●	3	5 (1.4)	○	7	67 (4.8)
	○	5	25 (4.4)	●	2-4	80 (3.7)	●	2-4	61 (4.3)	●	1-4	68 (4.3)
	●	4-8	65 (3.7)	●	3,6-7	8 (2.4)	●	3,6	4 (1.8)	○	5,8	48 (3.4)
	●	4-12	6 (2.0)	●	4,7,10-12	61 (4.1)	●	4,7.10-12	65 (4.1)	○	-12	37 (4.5)
	○	8-		○	8-		○	8-		●	--	
	●	3-4	73 (3.3)	●	3-4	55 (3.5)	●	3-4	87 (2.2)	●	1-4	7 (1.4)
	●	--	53 (5.0)	●	--	3 (1.)	●	--	6 (1.6)	●	--	65 (4.2)
	○	--		○	--		⦿	--		○	--	
	●	--	28 (4.5)	○	--	22 (4.2)	○	--	65 (4.7)	●	--	64 (4.4)
	⦿	4-5	43 (3.5)	⦿	2-5	53 (3.6)	●	2-3	7 (2.7)	○	6-7	56 (3.5)
	●	1	48 (4.4)	●	3	42 (4.6)	●	3	88 (2.3)	○	10	70 (3.8)
	○	5	3 (2.)	●	3	5 (1.6)	○	5	4 (2.4)	●	3,5,7,10	1 (3.1)
	○	6-7		●	3-4		●	3-4		○	6-7	
	○	--	13 (3.3)	○	--	48 (5.3)	○	--	76 (4.4)	●	--	51 (4.6)
	○	6	26 (3.5)	●	4	6 (1.6)	●	4	8 (1.1)	○	6	83 (3.2)
	○	7	25 (4.3)	●	4	6 (4.0)	○	5	86 (3.4)	○	6	80 (3.7)
	○	10	73 (3.5)	○	10	0 (2.)	○	10	87 (3.3)	○		87 (3.0)
	○	--	56 (3.3)	●	--	74 (2.)	●	--	80 (2.6)	●	--	68 (3.2)
	○	6		○	7,10		●	4,6		●	4,6, -11	
			43 (0.8)			6 (0.8)			83 (0.7)			66 (0.)
Benchmarking Participants												
	○	8	61 (5.)	○	5	76 (5.3)	○	5	81 (4.)	●	--	67 (5.5)
	●	3-4	36 (4.8)	●	2	4 (5.3)	●	2	61 (4.4)	●	1	64 (4.6)
	○	6	17 (3.4)	●	--	54 (4.6)	○	7	75 (3.8)	●	--	38 (4.4)

Physical Science

Countries

	●	4,6		⦿	6		○	8		●	--	
	●	--	33 (4.6)	●	--	30 (4.4)	●	--	32 (4.7)	●	--	53 (5.3)
	●	--	73 (3.4)	⦿	5	22 (3.1)	○	7	(1.8)	○	7	16 (2.7)
	●	4	77 (3.7)	○	8	76 (3.5)	●	3-4	67 (4.3)	●	2	74 (3.8)
	●	3	44 (4.3)	●	2-3	30 (4.1)	●	4	75 (4.0)	●	2-3	66 (4.4)
	●	3	45 (4.7)	●	,2	6 (5.3)	●	1,3	85 (3.6)	●	2	83 (4.0)
	●	2	66 (5.1)	●	3	70 (4.6)	●	4	3 (2.4)	●	1	72 (5.5)
	○	5	73 (4.2)	○	5	4 (4.1)	○	8	21 (3.5)	●	3	74 (4.0)
	○	7	61 (4.8)	○	5	76 (4.1)	●	4	6 (1.6)	●	1,4	8 (1.1)
	○	6-8	4 (3.8)	○	6-8	34 (3.4)	○	6-8	11 (2.1)	○	6-8	14 (2.1)
	○	5, -12	77 (3.6)	●	3,7,10-12	33 (4.0)	●	3,4,8,10-12	81 (3.3)	●	3	1 (2.6)
	●	--		○	8-		○	8-		○	8-	
	●	1-4	2 (2.0)	●	3-4	73 (3.6)	●	1-4	77 (3.2)	●	3-4	51 (4.0)
	●	--	62 (4.5)	●	--	50 (4.7)	●	--	33 (4.1)	○	--	37 (4.5)
	⦿	--		○	--		⦿	--		○	--	
	●	--	41 (4.5)	●	--	23 (4.2)	○	--	12 (2.4)	●	--	26 (4.2)
	⦿	4-5	40 (3.3)	●	2-5	50 (3.5)	●	2-5	56 (3.7)	●	2-3	55 (3.7)
	●	3,5,8	61 (4.8)	○	6	58 (4.4)	○					

.1 Intended and Taught TIMSS Physical Science Topics

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Physical Science			
Countries			
	⦿	--	
	●	--	58 (5.0)
( )	○	6	13 (2.2)
	○	6	56 (4.1)
	●	3	41 (4.6)
	●	,1,3	77 (4.4)
	○	6	27 (4.7)
	○	7	26 (3.8)
	○	6	52 (4.8)
	○	6-8	30 (3.3)
	○	5,7, -12	5 (1.8)
	○	8-	
	●	1-4	2 (3.2)
	○	--	34 (4.3)
	○	--	
	●	--	20 (3.)
	⦿	2-3	51 (3.4)
	●	4	58 (4.5)
	●	3,6-7,10	77 (4.5)
	○	7	
	●	--	51 (5.1)
	○	6	18 (3.4)
	●	3	22 (3.7)
	○	10	60 (3.4)
	●	--	68 (3.0)
	●	4,6	
			42 (0.)
Benchmarking Participants			
	●	--	60 (4.7)
	●	3	65 (4.6)
	○	6	20 (3.8)

● ⦿ ○

( )

( ) 50 0% 5% 50%

Earth Science

Countries

	⦿	--		●	--		●	--		⦿	--	
	●	--	36 (5.0)	○	--	57 (4.3)	○	--	43 (4.2)	●	--	66 (4.4)
	○	6	8 (1.7)	●	--	5 (3.6)	●	--	30 (3.2)	○	6	3 (3.6)
	○	7	27 (3.5)	○		71 (3.6)	●	3	71 (3.8)	○		43 (4.2)
	●	4	46 (4.4)	○	--	37 (4.4)	●	4	1 (2.1)	○	--	51 (4.6)
	●	2	68 (4.4)	●	4	64 (4.1)	●	4	65 (4.6)	●	1-4	42 (4.5)
	○	--	2 (4.2)	●	3	38 (4.5)	●	4	8 (1.2)	●	4	67 (4.6)
	○	5	53 (4.6)	○	5	78 (3.6)	○	5	65 (4.3)	○	5	2 (2.4)
	●	1,4	5 (1.8)	●	1,3	64 (4.7)	●	2-4	57 (4.4)	○	5-8	78 (4.3)
	●	3-8	68 (3.8)	●	3-7	85 (2.8)	●	4,6-7	87 (2.3)	●	3-8	76 (3.0)
	○	6,7,10-12	5 (1.8)	○	5,8,10-12	34 (4.0)	●	4,7,10-12	27 (3.6)	●	4,7,10-12	15 (3.0)
	●	3-4		●	3-4		○	--		●	--	
	○	7-8	66 (3.4)	●	3-4	6 (1.1)	○	5-6	87 (2.8)	●	3-4	0 (2.4)
	●	--	86 (3.1)	●	--	6 (1.8)	●	--	(0.)	●	--	4 (2.2)
	○	--		○	--		○	--		○	--	
	●	--	31 (4.6)	●	--	5 (5.0)	○	--	47 (4.6)	●	--	71 (4.4)
	⦿	2-5	43 (3.6)									

Intended and Taught TIMSS Earth Science Topics *(...Continued)*

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Earth Science			
Countries			
	●	8	
	○	5	6 (4.1)
	○	6	3 (4.0)
	○	7	46 (3.8)
	○	--	13 (2.7)
	●	4	83 (4.1)
	○	6	1 (3.7)
	○	6	67 (4.0)
	●	4	(0.8)
	○	5,8	27 (3.2)
	●	4, -12	60 (3.)
	●	2-4	
	●	1-4	2 (2.4)
	●	--	2 (2.5)
	○	--	
	●	--	18 (3.6)
	●	1-5	80 (2.6)
	●	4,8	7 (1.2)
	○	5,7	80 (4.3)
	●	3-4	
	○	--	5 (4.)
	○	5	26 (3.6)
	●	3,6	32 (4.6)
	○	11	12 (3.0)
	●	--	74 (2.6)
	●	4,7	
			56 (0.8)
Benchmarking Participants			
	○	5,6	58 (4.7)
	○	6	23 (4.5)
	○	6	42 (4.4)

● ○

50% 0% 5%