

# Introduction



This report contains the results from the TIMSS 2007 science assessment at the fourth and eighth grades, including trends over time in achievement and the educational contexts for science instruction. The mathematics results are contained in a companion volume, the *TIMSS 2007 International Mathematics Report*.<sup>1</sup> Intended as a companion to both the mathematics and science reports, the *TIMSS 2007 Encyclopedia*<sup>2</sup> describes the national contexts for mathematics and science education and the mathematics and science curricula in the participating countries. The *TIMSS 2007 Assessment Frameworks*<sup>3</sup> contains the mathematics and science frameworks underlying the assessments at the fourth and eighth grades, and the contextual framework for the questionnaires. The *TIMSS 2007 Technical Report*<sup>4</sup> provides technical documentation about the development and implementation of the assessment. This report and the four other publications can be found on the TIMSS website ([timssandpirls.bc.edu](http://timssandpirls.bc.edu)).

Also, achievement results for the TIMSS 2007 participants are influenced by a great many factors, and the international report typically is complemented by a national report prepared by each country. In a national report, the countries can explore their data in more detail, make comparisons with smaller sets of countries of interest, or examine aspects of particular contextual factors not examined in the international report.

1 Mullis, I.V.S., Martin, M.O., & Foy, P. (with Olson, J.F., Preuschoff, C., Erberber, E., Arora, A., & Galia, J.). (2008). *TIMSS 2007 international mathematics report: Findings from IEA's Trends in International Mathematics and Science Study at the fourth and eighth grades*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

2 Mullis, I.V.S., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., & Stanco, G.M. (Eds.). (2008). *TIMSS 2007 encyclopedia: A guide to mathematics and science education around the world*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

3 Mullis, I.V.S., Martin, M.O., Ruddock, G.J., O'Sullivan, C.Y., Arora, A., & Erberber, E. (2005). *TIMSS 2007 assessment frameworks*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

4 Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). (2008). *TIMSS 2007 technical report*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

## What Is TIMSS?

TIMSS 2007, involving approximately 425,000 students from 59 countries around the world, is the most recent in an ambitious series of international assessments. The goal is to provide comparative information about educational achievement across countries to improve teaching and learning in mathematics and science.

TIMSS (Trends in International Mathematics and Science Study) measures trends in mathematics and science achievement at the fourth and eighth grades, as well as monitoring curricular implementation and identifying the most promising instructional practices from around the world. TIMSS is a project of the IEA (International Association for the Evaluation of Educational Achievement), which is an independent international cooperative of national research institutions and government agencies that has been conducting studies of cross-national achievement in a wide range of subjects since 1959.

Conducted on a regular 4-year cycle, TIMSS has assessed mathematics and science in 1995, 1999, 2003, and 2007 with planning underway for 2011. In addition to monitoring trends in achievement at the fourth and eighth grades, TIMSS provides information about relative progress across grades as the cohort of students assessed at the fourth grade in one cycle moves to the eighth grade four years later (i.e., the fourth grade students of 2003 became the eighth grade students of 2007). Also, to provide comparative perspectives on trends in achievement in the context of different educational systems, school organizational approaches, and instructional practices, TIMSS collects a rich array of background information.

### **Which Countries Participated in TIMSS 2007?**

TIMSS 2007 involved widespread participation from around the world. Exhibit 1 shows a map of the world identifying the TIMSS 2007 countries and benchmarking participants (regional entities). In Exhibit 1, the 59 participating countries and 8 benchmarking participants are listed alphabetically and shown by their geographic location. The benchmarking participants are regional entities that follow all of the rigorous quality standards established by TIMSS. Their data are comparable to the countries' data, and they can use the TIMSS results as a benchmark. The decision to participate in any IEA study is coordinated through the IEA Secretariat in Amsterdam and made by each member country according to its own data needs and resources.

For the sake of comparability across countries and across assessments, TIMSS 2007 testing was generally conducted at the end of the school year. The countries on a Southern Hemisphere school schedule tested during October through December of 2006, which was the end of the school year for them. The remaining countries tested towards the end of the 2006-2007 school year, most often in April, May, or June of 2007.

Exhibit 1 **Countries Participating in TIMSS 2007**

**TIMSS2007** 4<sup>th</sup> & 8<sup>th</sup>  
**Mathematics & Science** Grades

- |                        |                         |
|------------------------|-------------------------|
| Algeria                | Mongolia                |
| Armenia                | Morocco                 |
| Australia              | Netherlands             |
| Austria                | New Zealand             |
| Bahrain                | Norway                  |
| Bosnia and Herzegovina | Oman                    |
| Botswana               | Palestinian Nat'l Auth. |
| Bulgaria               | Qatar                   |
| Chinese Taipei         | Romania                 |
| Colombia               | Russian Federation      |
| Cyprus                 | Saudi Arabia            |
| Czech Republic         | Scotland                |
| Denmark                | Serbia                  |
| Egypt                  | Singapore               |
| El Salvador            | Slovak Republic         |
| England                | Slovenia                |
| Georgia                | Sweden                  |
| Germany                | Syrian Arab Republic    |
| Ghana                  | Thailand                |
| Hong Kong SAR          | Tunisia                 |
| Hungary                | Turkey                  |
| Indonesia              | Ukraine                 |
| Iran, Islamic Rep. of  | United States           |
| Israel                 | Yemen                   |
| Italy                  |                         |
| Japan                  |                         |
| Jordan                 |                         |
| Kazakhstan             |                         |
| Korea, Rep. of         |                         |
| Kuwait                 |                         |
| Latvia                 |                         |
| Lebanon                |                         |
| Lithuania              |                         |
| Malaysia               |                         |
| Malta                  |                         |

**Benchmarking Participants**

- Alberta, Canada
- Basque Country, Spain
- British Columbia, Canada
- Dubai, UAE
- Massachusetts, US
- Minnesota, US
- Ontario, Canada
- Quebec, Canada

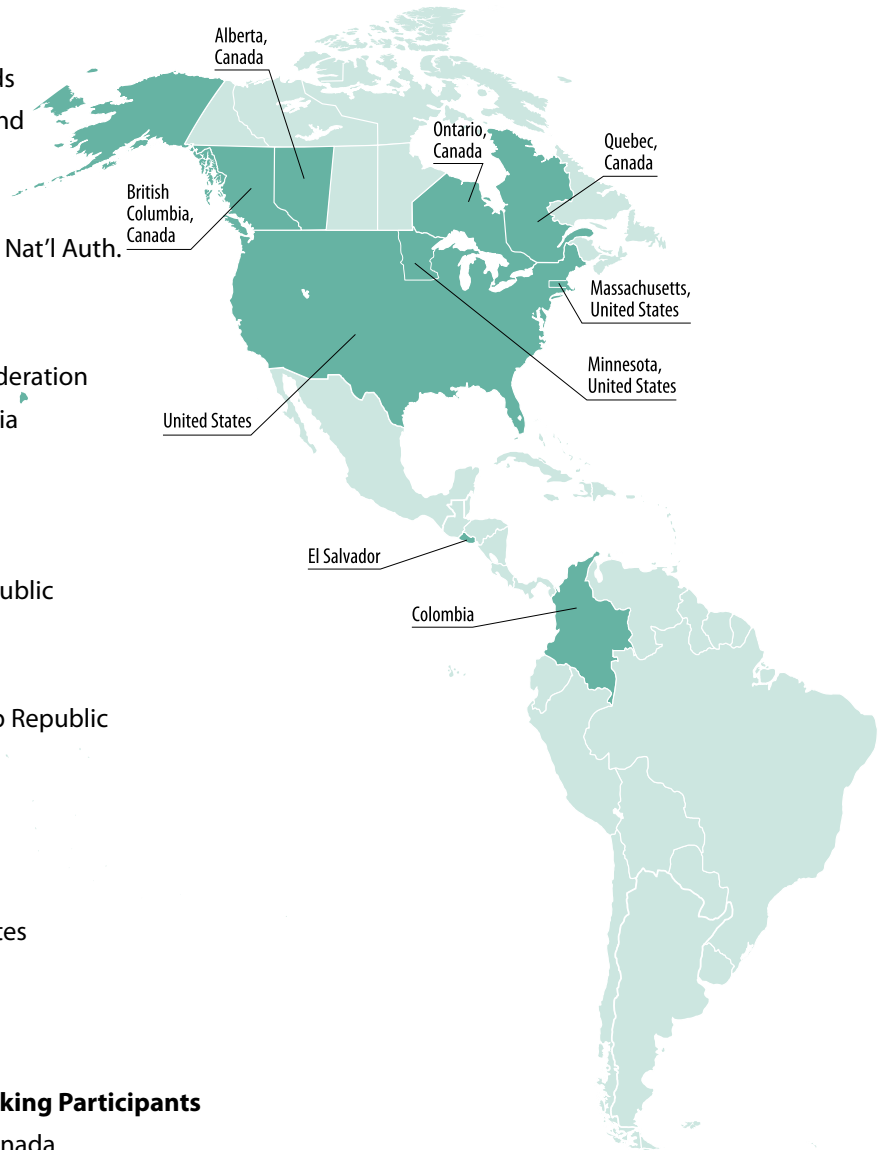


Exhibit 1 Countries Participating in TIMSS 2007 (Continued)

TIMSS2007  
Mathematics & Science  
4<sup>th</sup> & 8<sup>th</sup> Grades



Exhibit 2 lists the TIMSS 2007 participants, and indicates the grade(s) at which they participated and the previous cycles they participated in at that grade. It can be seen that many of the TIMSS 2007 participants have data for both the fourth and eighth grades. At the fourth grade, this report contains TIMSS 2007 data for 37 countries and 7 benchmarking participants, including 12 countries and 3 benchmarking entities that participated at the fourth grade for the first time. In all, 183,150 students participated at the fourth grade. At the eighth grade, the report contains data for 50 countries and 7 benchmarking participants, including 9 countries and 1 benchmarking entity participating at the eighth grade for the first time. In all, 241,613 students participated at the eighth grade. Because the quality of the Mongolian data is not well documented, the achievement results for Mongolia are presented in Appendix E.

Exhibit 2 also shows that most TIMSS 2007 participants have trend data and, for each participant, whether it is for two, three, or four points in time: 1995, 1999, 2003, and 2007. In several cases, countries participated in previous TIMSS assessments but some procedures were improved or changed for TIMSS 2007 and the earlier data are not comparable. The trend tables in this report include 23 countries and 4 benchmarking participants at the fourth grade and 35 countries and 6 benchmarking participants at the eighth grade.

Exhibit 3 presents selected information about the demographic and economic characteristics of the TIMSS 2007 countries, because such factors can influence educational policies and decision-making. As can be seen, the TIMSS 2007 countries vary widely in population size and geographic area, as well as in population density. The countries also vary widely on indicators of health, such as life expectancy and infant mortality rate. The majority of countries had life expectancies of 70 to 79 years, and infant mortality rates of between 3 and 20 out of 1,000 births. However, at one end of the continuum, 11 of the countries had a life expectancy of 80 years or more and a low infant mortality rate (5 or fewer infant deaths per 1,000 live births), while Ghana and Yemen had life expectancies of about 60 years and Botswana of 50 years,

and these three had the highest infant mortality rates (approximately 75 and 90 infant deaths per 1,000 live births, respectively).

The economic indicators in Exhibit 3, such as the data for gross national income per capita, reveal great disparity in the economic resources available, and also that different policies exist about the percentage of funds spent on education. Economically, the TIMSS 2007 countries ranged from Kuwait, Norway, Singapore, and the United States with relatively high gross national incomes per capita (in U.S. dollars adjusted for purchasing power parity) to Egypt, Georgia, Ghana, Indonesia, Jordan, Mongolia, Morocco, and Syria with relatively low gross national incomes per capita. Although a number of countries had 95 percent or more of their primary and secondary students enrolled in school, there were differences in enrollments rates, especially at the secondary level. It should be noted that enrollment data are for primary and secondary schools, not for the fourth and eighth grades *per se*.

## Exhibit 2 Countries Participating in TIMSS 1995 Through 2007

TIMSS2007  
Mathematics & Science  
4<sup>th</sup> & 8<sup>th</sup>  
Grades

Country	Grade 4			Grade 8			
	2007	2003	1995	2007	2003	1999	1995
Algeria	●			●			
Armenia	●	●		●	●		
Australia	●	●	●	●	●	●	●
Austria	●		●				●
Bahrain				●	●		
Bosnia and Herzegovina				●			
Botswana				●	●		
Bulgaria				●	●	●	●
Chinese Taipei	●	●		●	●	●	
Colombia	●			●			●
Cyprus		●	●	●	●	●	●
Czech Republic	●		●	●		●	●
Denmark	●						●
Egypt				●	●		
El Salvador	●			●			
England	●	●	●	●	●	●	●
Georgia	●			●			
Germany	●						●
Ghana				●	●		
Hong Kong SAR	●	●	●	●	●	●	●
Hungary	●	●	●	●	●	●	●
Indonesia				●	●	●	●
Iran, Islamic Rep. of	●	●	●	●	●	●	●
Israel			●	●	●	●	●
Italy	●	●	●	●	●	●	●
Japan	●	●	●	●	●	●	●
Jordan				●	●	●	
Kazakhstan	●						
Korea, Rep. of			●	●	●	●	●
Kuwait	●		●	●			●
Latvia	●	●	●		●	●	●
Lebanon				●	●		
Lithuania	●	●		●	●	●	●
Malaysia				●	●	●	
Malta				●			
Mongolia	●			●			
Morocco	●	●		●	●	●	
Netherlands	●	●	●		●	●	●
New Zealand	●	●	●		●	●	●
Norway	●	●	●	●	●		●
Oman				●			
Palestinian Nat'l Auth.				●	●		
Qatar	●			●			
Romania				●	●	●	●
Russian Federation	●	●		●	●	●	●
Saudi Arabia				●	●		

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007



Exhibit 2 Countries Participating in TIMSS 1995 Through 2007 (Continued) TIMSS2007  
Mathematics & Science **4<sup>th</sup> & 8<sup>th</sup> Grades**

Country	Grade 4			Grade 8			
	2007	2003	1995	2007	2003	1999	1995
Scotland	●	●	●	●	●		●
Serbia				●	●		
Singapore	●	●	●	●	●	●	●
Slovak Republic	●				●	●	●
Slovenia	●	●	●	●	●	●	●
Sweden	●			●	●		●
Syrian Arab Republic				●	●		
Thailand			●	●		●	●
Tunisia	●	●		●	●	●	
Turkey				●		●	
Ukraine	●			●			
United States	●	●	●	●	●	●	●
Yemen	●	●					
<b>Benchmarking Participants</b>							
Alberta, Canada	●		●			●	●
Basque Country, Spain				●	●		
British Columbia, Canada	●			●		●	
Dubai, UAE	●			●			
Massachusetts, US	●			●		●	
Minnesota, US	●		●	●			●
Ontario, Canada	●	●	●	●	●	●	●
Quebec, Canada	●	●	●	●	●	●	●

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

## Exhibit 3 Selected Characteristics of TIMSS 2007 Countries

TIMSS2007  
Mathematics & Science 4<sup>th</sup> & 8<sup>th</sup>  
Grades

Country	Population Size (in Millions) <sup>1</sup>	Area of Country (Square Kilometers) <sup>2</sup>	Population Density (People per Square Kilometer) <sup>3</sup>	Urban Population (% of Total) <sup>4</sup>	Life Expectancy at Birth (Years) <sup>5</sup>	Infant Mortality Rate (per 1,000 Live Births) <sup>6</sup>	Gross National Income per Capita (in US Dollars) <sup>7</sup>	GNI per Capita (Purchasing Power Parity) <sup>8</sup>
Algeria	33.4	2381700	14	64	72	33	3030	5940
Armenia	3.0	28200	107	64	72	21	1920	4950
Australia	20.7	7682300	3	88	81	5	35860	33940
Austria	8.3	82500	100	66	80	4	39750	36040
Bahrain	0.7	700	1041	97	76	9	19350	34310
Bosnia and Herzegovina	3.9	51200	77	46	75	13	3230	6780
Botswana	1.9	566700	3	58	50	90	5570	11730
Bulgaria	7.7	108600	71	70	73	12	3990	10270
Chinese Taipei	23.0	36000	634	70	78	5	17294	–
Colombia	45.6	1109500	41	73	73	17	3120	6130
Cyprus	0.8	9300	84	70	79	3	23270	25060
Czech Republic	10.3	77300	133	74	77	3	12790	20920
Denmark	5.4	42400	128	86	78	4	52110	36190
Egypt	74.2	995500	75	43	71	29	1360	4940
El Salvador	6.8	20720	326	60	72	22	2680	5610
England	50.4	130000	390	90	79	5	40560	33650
Georgia	4.4	69500	64	52	71	28	1580	3880
Germany	82.4	348800	236	75	79	4	36810	32680
Ghana	23.0	227500	101	49	60	76	510	1240
Hong Kong SAR	6.9	1000	6581	100	82	–	29040	39200
Hungary	10.1	89600	112	67	73	6	10870	16970
Indonesia	223.0	1811600	123	49	68	26	1420	3310
Iran, Islamic Rep. of	70.1	1628600	43	67	71	30	2930	9800
Israel	7.1	21600	326	92	80	4	20170	23840
Italy	58.8	294100	200	68	81	4	31990	28970
Japan	127.8	364500	351	66	82	3	38630	32840
Jordan	5.5	88200	63	83	72	21	2650	4820
Kazakhstan	15.3	2699700	6	58	66	26	3870	8700
Korea, Rep. of	48.4	98700	490	81	79	5	17690	22990
Kuwait	2.6	17800	146	98	78	10	30630	48310
Latvia	2.3	62400	37	68	71	8	8100	14840
Lebanon	4.1	10200	396	87	72	26	5580	9600
Lithuania	3.4	62700	54	67	71	7	7930	14550
Malaysia	26.1	328600	80	68	74	10	5620	12160
Malta	0.4	300	1269	96	79	5	15310	20990
Mongolia	2.6	1566500	2	57	67	34	1000	2810
Morocco	30.5	446300	68	59	71	34	2160	3860
Netherlands	16.3	33900	482	81	80	4	43050	37940
New Zealand	4.2	267700	16	86	80	5	26750	25750
Norway	4.7	304300	15	78	80	3	68440	50070
Oman	2.5	309500	8	72	76	10	11120	19740
Palestinian Nat'l Auth.	3.9	6000	648	57	72	29	1374	–
Qatar	0.8	11000	75	96	76	18	–	–
Romania	21.6	230000	94	54	72	16	4830	10150
Russian Federation	142.5	16381400	9	73	66	14	5770	12740
Saudi Arabia	23.7	2000000	12	81	73	21	13980	22300
Scotland	5.1	78000	66	82	77	5	40560	33650
Serbia	7.4	102000	84	52	73	7	4030	9320
Singapore	4.5	700	6508	100	80	2	28730	43300
Slovak Republic	5.4	48100	112	56	74	7	9610	17060
Slovenia	2.0	20100	100	51	78	3	18660	23970
Sweden	9.1	410300	22	84	81	3	43530	34310
Syrian Arab Republic	19.4	183800	106	51	74	12	1560	4110
Thailand	63.4	510900	124	33	70	7	3050	7440
Tunisia	10.1	155400	65	66	74	19	2970	6490
Turkey	73.0	769600	95	68	72	24	5400	8410
Ukraine	46.8	579400	81	68	68	20	1940	6110
United States	299.4	9161900	33	81	78	7	44710	44070
Yemen	21.7	527900	41	28	62	75	760	2090

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007



## Exhibit 3 Selected Characteristics of TIMSS 2007 Countries (Continued)

TIMSS2007  
Mathematics & Science 4<sup>th</sup> & 8<sup>th</sup> Grades

Public Expenditure on Education (% of GDP) <sup>9</sup>	Net Enrollment Ratio in Education (% of Relevant Group) <sup>10</sup>		Primary Pupil-Teacher Ratio <sup>11</sup>	Country
	Primary	Secondary		
–	95	66	25	Algeria
–	82	86	21	Armenia
5	96	86	–	Australia
5	97	–	12	Austria
–	96	90	–	Bahrain
–	–	–	–	Bosnia and Herzegovina
9	86	61	25	Botswana
3	93	89	16	Bulgaria
4	99	95	17	<sup>12</sup> Chinese Taipei
5	88	65	28	Colombia
6	100	94	18	Cyprus
4	93	–	16	Czech Republic
8	96	91	–	Denmark
–	94	83	26	Egypt
3	94	54	40	El Salvador
5	99	95	22	England
3	89	79	15	Georgia
5	–	–	14	Germany
5	66	38	32	Ghana
4	93	78	18	Hong Kong SAR
5	89	90	10	Hungary
1	95	57	20	Indonesia
5	94	77	19	Iran, Islamic Rep. of
7	97	89	13	Israel
5	99	92	10	Italy
4	100	100	19	Japan
–	91	79	20	Jordan
3	90	86	17	Kazakhstan
5	98	94	28	Korea, Rep. of
4	83	–	10	Kuwait
5	90	–	12	Latvia
3	82	73	14	Lebanon
5	88	94	14	Lithuania
6	99	72	17	Malaysia
–	86	84	11	Malta
5	91	82	33	Mongolia
7	88	35	27	Morocco
5	98	87	10	Netherlands
7	99	–	16	New Zealand
8	98	96	11	Norway
5	74	77	14	Oman
11	80	95	25	Palestinian Nat'l Auth.
2	96	90	11	Qatar
3	91	81	17	Romania
4	92	–	17	Russian Federation
7	93	60	15	Saudi Arabia
5	100	100	16	Scotland
–	96	–	–	Serbia
–	–	–	24	Singapore
4	92	–	18	Slovak Republic
6	96	91	15	Slovenia
7	97	99	10	Sweden
–	92	63	–	Syrian Arab Republic
4	94	71	18	Thailand
7	97	–	20	Tunisia
4	90	66	–	Turkey
6	90	84	17	Ukraine
6	92	88	14	United States
–	75	37	–	Yemen

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

All data taken from the 2008 World Development Indicators (World Bank, 2008) unless otherwise noted.

- <sup>1</sup> Includes all residents regardless of legal status or citizenship except refugees not permanently settled in the country of asylum as they are generally considered to be part of their country of origin (pp. 40–43). Data for Palestinian National Authority, England, and Scotland provided by the National Research Coordinator (NRC).
- <sup>2</sup> Area is the total surface area in square kilometers, excluding the area under inland water bodies and national claims to the continental shelf and exclusive economic zones (pp. 130–133). Data for Palestinian National Authority, England, and Scotland provided by the NRC.
- <sup>3</sup> Mid-year population is divided by land area in square kilometers (pp. 14–17). Data for Palestinian National Authority, England, and Scotland provided by the NRC.
- <sup>4</sup> Urban population is the mid-year population of areas defined as urban in each country and reported to the United Nations. It is measured here as the percentage of the total population (pp. 170–173). Data for Palestinian National Authority, England, and Scotland provided by the NRC.
- <sup>5</sup> Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life (pp. 118–121). Data for Palestinian National Authority, England, and Scotland provided by the NRC.
- <sup>6</sup> Infant mortality rate is the number of deaths of infants under 1 year of age, per 1,000 live births in the same year (118–121). Data for Palestinian National Authority, England, and Scotland provided by the NRC.
- <sup>7</sup> GNI per capita in U.S. dollars is converted using the World Bank Atlas method (pp. 14–17). Data for Palestinian National Authority provided by the NRC. Figures for England and Scotland are for the whole region of the United Kingdom.
- <sup>8</sup> An international dollar has the same purchasing power over GNI as a U.S. dollar in the United States (pp. 14–17). Figures for England and Scotland are for the whole region of the United Kingdom.
- <sup>9</sup> Current and capital public expenditure on primary, secondary, and tertiary education expressed as a percentage of GDP (pp. 76–79). Data for Palestinian National Authority provided by the NRC. Figures for England and Scotland are for the whole region of the United Kingdom.
- <sup>10</sup> Ratio of the children of official school age who are enrolled in school to the population of the corresponding official school age, based on the International Standard Classification of Education 1997 (pp. 80–83). Data also provided by the Global Education Digest 2007, UNESCO Institute for Statistics (pp. 81–89, 101–109). Figures for England are for the whole region of the United Kingdom. Figures for Scotland provided by the NRC.
- <sup>11</sup> Primary pupil-teacher ratio is the number of pupils enrolled in primary school divided by the number of primary school teachers (regardless of their assignment (pp. 76–79)). Data for England and Scotland provided by the NRC.
- <sup>12</sup> Data for Chinese Taipei provided by the NRC.

A dash (–) indicates comparable data are not available.



## What Was the Nature of the TIMSS 2007 Science Test?

Chapters 1 through 3 of this report contain data about students' achievement on the science assessment. At both fourth and eighth grades, the TIMSS 2007 science assessment is organized around two dimensions, a content dimension specifying the subject matter domains to be assessed within science and a cognitive dimension specifying the thinking processes or domains to be assessed.

The publication entitled *TIMSS 2007 Assessment Frameworks*<sup>5</sup> contains the science framework for the fourth and eighth grades. The content domains differ for the fourth and eighth grades, reflecting the nature and difficulty of the science widely taught at each grade.<sup>6</sup> At the fourth grade, the three content domains are life science, physical sciences, and earth science. At the eighth grade, the four content domains are biology, chemistry, physics, and earth science. At each grade, the science framework describes each content domain in terms of the specific topic areas covered and the objectives within each topic.

The cognitive domains are the same for both grades—knowing, applying, and reasoning. Each cognitive domain is described according to the sets of processing behaviors expected of students as they engage with the science content. The emphasis across the cognitive domains is such that the majority of the items assess the applying or reasoning domains.

TIMSS 2007 included a very extensive test development effort to support the science assessment framework. At the fourth grade, the test includes 174 items totaling 194 score points and at the eighth grade the test includes 214 items totaling 240 score points. At both grades, approximately half the items are constructed-response and half are multiple-choice. Chapter 2 contains more information about the content of the science assessment, including example items. Appendix A contains further information about the numbers of items by type in each domain.

Developing the TIMSS tests for 2007 was a cooperative venture involving representatives from the participating countries throughout the entire process. The TIMSS & PIRLS International Study Center began the process

5 Mullis, I.V.S., Martin, M.O., Ruddock, G.J., O'Sullivan, C.Y., Arora, A., & Erberber, E. (2005). *TIMSS 2007 assessment frameworks*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

6 With each cycle, TIMSS updates the assessment frameworks. For example, in 2003 the frameworks were expanded to provide specific objectives for assessing students at the fourth and eighth grades, and in 2007 the content domains were presented separately for the two grades. Also, there was an effort to consolidate the major content areas and, particularly at the fourth grade, to adjust the topic areas and objectives to make them better reflect fourth-grade curricula.

with an item-writing workshop for the National Research Coordinators from the participating countries and their colleagues. Through a series of efforts, countries then submitted items that were reviewed by science subject-matter specialists. Participating countries field-tested the items with representative samples of students, and all of the potential new items were reviewed by the TIMSS 2007 Science and Mathematics Item Review Committee of subject area experts. The National Research Coordinators had several opportunities to review the items and scoring criteria to ensure the items were measuring objectives in the frameworks, and were appropriate for students in the countries.

### **How Was Information Collected About the Contexts for Learning Science?**

TIMSS uses the curriculum, broadly defined, as the major organizing concept in considering how educational opportunities are provided to students, and the factors that influence how students use these opportunities. IEA's curriculum model has three aspects, the intended curriculum specified by countries, the implemented curriculum actually taught, and the achieved curriculum—what students have learned. While Chapters 1 through 3 of this report present the data about students' science learning, Chapters 4 through 8, together with the *TIMSS 2007 Encyclopedia* provide comprehensive information about the national contexts for science education including information about the intended curriculum and the implemented curriculum.

To collect information about the intended curriculum, the TIMSS 2007 participants each completed a chapter for the *TIMSS 2007 Encyclopedia* published as a companion to the TIMSS 2007 international reports. For each TIMSS 2007 participant, the encyclopedia summarizes the major components of the curriculum in mathematics and science and describes what supports there are for curriculum implementation—for example, the types of teacher education required, and any formal testing programs and/or assessments. Also, countries completed questionnaires about their national situations for

education and aspects of their intended curricula, including identifying the TIMSS topics included (see Chapter 5).

Data about the instructional methods used to implement the curriculum were collected via questionnaires completed by the teachers and principals of the assessed students and by the students themselves. Corresponding to the information about the intended curriculum, teachers provided information about each of the TIMSS topics taught to the students (also in Chapter 5). The students that were assessed provided information about their home and classroom experiences, and their teachers and school principals provided information about instructional practices, school resources, and the school climate for learning.

To guide questionnaire development, the *TIMSS 2007 Assessment Frameworks* document includes a framework describing the contextual factors associated with students' learning in mathematics and science. Advice throughout the development process was provided by the TIMSS 2007 Questionnaire Item Review Committee.

### Who Conducts TIMSS?

TIMSS is a major undertaking of IEA, and together with PIRLS, comprises the core of IEA's regular cycle of studies. PIRLS (Progress in International Reading Literacy Study) has been assessing reading comprehension at the fourth grade since 2001 on a regular 5-year cycle. Forty countries participated in PIRLS 2006<sup>7</sup> and PIRLS 2011 is underway. IEA has delegated responsibility for the overall direction and management of these two projects to the TIMSS & PIRLS International Study Center at Boston College. Headed by Michael O. Martin and Ina V.S. Mullis, the study center is located in the Lynch School of Education.

In carrying out the projects, the TIMSS & PIRLS International Study Center works closely with the IEA Secretariat in Amsterdam, the IEA Data Processing and Research Center in Hamburg, Statistics Canada in Ottawa, and Educational Testing Service in Princeton, New Jersey. TIMSS expends enormous energy to ensure the reliability, validity, and comparability of the data through careful planning and documentation, cooperation among

<sup>7</sup> Kennedy, A.M., Mullis, I.V.S., Martin, M.O., & Trong, K.L. (Eds.). (2007). *PIRLS 2006 encyclopedia: A guide to reading education in the forty PIRLS 2006 countries*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Kennedy, A.M., & Foy, P. (2007). *PIRLS 2006 international report: IEA's Progress in International Reading Literacy Study in primary schools in 40 countries*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

participating countries, standardized procedures, and rigorous attention to quality control throughout. The data are collected according to rigorous scientific standards detailed in manuals, and countries receive training every step of the way.

TIMSS 2007 was conducted in many different languages, involving a substantial effort in translating all of the assessment instruments. The translations underwent a complex verification procedure coordinated by the IEA Secretariat, while the test booklet layouts were verified by the TIMSS & PIRLS International Study Center.

The student sampling for TIMSS 2007 was conducted with careful attention to quality and comparability. The sampling was designed to ensure that the data provided accurate and economical estimates of the student population. To maintain high quality standards, a uniform approach was specified and staff from Statistics Canada worked with the participants on all phases of the sampling activities. If procedures did not satisfy the TIMSS standards, the data are annotated in the report (or not reported at all). Appendix A contains further information on target populations, sample implementation, and participation rates.

Adherence to the test administration procedures was monitored through the use of international quality control observers arranged by the IEA Secretariat, and within-country quality control procedures. The TIMSS & PIRLS International Study Center conducted several training sessions to ensure that the constructed-response scoring was done correctly. Reliability data were collected for within-country scoring and across assessment cycles using special procedures developed by the IEA Data Processing and Research Center (see Appendix A). The IEA Data Processing and Research Center checked each country's data files for internal consistency and accuracy, and interacted with countries to resolve data issues.

The TIMSS & PIRLS International Study Center reviewed achievement item statistics for every country and consulted with Educational Testing Service on the methods and results of the scaling process. The primary approach to reporting the TIMSS 2007 achievement data was based on

item response theory (IRT) scaling methods. In order to measure trends in mathematics achievement across assessments, the TIMSS achievement scales for mathematics were designed to provide reliable measures on a common metric established originally with the 1995 assessment, and now spanning the 1995, 1999, 2003, and 2007 assessments. More information about the TIMSS 2007 procedures for scaling and data analysis can be found in Appendix A.

To coordinate the TIMSS project nationally and to work with the international team, each participating country designated an individual (or two) to be its National Research Coordinator (NRC). The NRCs had the crucial and complex task of implementing the TIMSS study in their countries in accordance with the TIMSS guidelines and procedures. The quality of the assessments depends on the work of the NRCs and their colleagues in carrying out the very detailed sampling, data collection, and scoring tasks involved. The TIMSS NRCs performed their many tasks with great dedication, competence, and energy, and are to be commended for their commitment to the project and high quality of their work.

Appendix F lists the names of many of those responsible for the management, coordination, and conduct of TIMSS 2007, including the NRCs from every country and benchmarking participant.





