

# Introduction

## What is TIMSS?

TIMSS 2003 is the most recent in a very ambitious series of international assessments conducted in nearly 50 countries to measure trends in mathematics and science learning. The aim of TIMSS, the Trends in International Mathematics and Science Study, is to improve the teaching and learning of mathematics and science by providing data about students' achievement in relation to different types of curricula, instructional practices, and school environments. The variation across the nearly 50 participating countries provides a unique opportunity to study different approaches to educational practices and how these can improve achievement.

TIMSS is a project of the International Association for the Evaluation of International Achievement (IEA), an independent international cooperative of national research institutions and government agencies that has been conducting studies of cross-national achievement since 1959. Conducted first in 1995 and then in 1999, the regular four-year cycle of TIMSS studies provides countries with an unprecedented opportunity to obtain comparative information about their students' achievement in mathematics and science.

Even more important, TIMSS also collects a rich array of contextual information about how mathematics and science learning takes place in each country. TIMSS asks students, their teachers, and their school principals to complete questionnaires about the curriculum,

schools, classrooms, and instruction. This data gives policy makers, curriculum specialists, and researchers a dynamic picture of implementation of educational policies and practices around the world, providing an invaluable perspective from which to consider educational reform and improvement. TIMSS results, which were first reported in 1996, have stirred debate and spurred reform efforts around the world.<sup>1</sup>

TIMSS 1995 compared the mathematics and science achievement of students in 41 countries at five grade levels. TIMSS 1999 was designed to provide trends in eighth-grade mathematics and science achievement. Also, 1999 represented four years since the first TIMSS, and the population of students originally assessed as fourth-graders had advanced to the eighth grade. Thus, TIMSS 1999 also provided information about whether the relative performance of these students had changed in the intervening years. TIMSS 2003 was administered at the eighth and fourth grades. For countries that participated in previous assessments, TIMSS 2003 provides three-cycle trends at the eighth grade (1995, 1999, 2003) and data over two points in time at the fourth grade (1995 and 2003). In countries new to the study, the 2003 results can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of the mathematics and science programs.

### Who Conducts TIMSS?

TIMSS is a major undertaking of the IEA, and together with PIRLS, comprises the core of IEA's regular cycle of studies.<sup>2</sup> The IEA delegated responsibility for the overall direction and management of the project 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 project, the TIMSS & PIRLS International Study Center works closely with the IEA Secretariat in Amsterdam, the IEA Data Processing Center in Hamburg, Statistics Canada in Ottawa, and Educational Testing Service in Princeton, New Jersey.

1 Robitaille, D.F., Beaton, A.E., and Plomp, T., eds. (2000), *The Impact of TIMSS on the Teaching and Learning of Mathematics and Science*, Vancouver, BC: Pacific Educational Press.

2 PIRLS is the IEA's Progress in International Reading Literacy Study developed to assess students' reading achievement at fourth grade. Thirty-five countries participated in PIRLS 2001, and nearly 50 countries are participating in PIRLS 2006.

To coordinate the TIMSS project nationally and to work with the international team, each participating country designates an individual to be the National Research Coordinator (NRC). The NRCs have the formidable 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 complex sampling, data collection, and scoring tasks involved. Continuing the tradition of superlative work established in 1995 and 1999, the TIMSS 2003 NRCs performed their many tasks with great dedication, competence, and energy, and should be commended for their commitment to the project and the high quality of their work (see Appendix G for a list of the TIMSS 2003 NRCs).

### **Which Countries Participated in TIMSS 2003?**

Exhibit 1 shows the 49 countries that participated in TIMSS 2003. The decision to participate in any IEA study is coordinated through the IEA secretariat in Amsterdam and made solely by each member country according to its own data needs and resources. Exhibit 1 shows that 23 countries also participated in TIMSS 1995 and TIMSS 1999. For these participants, trend data across three-points in time are included in this report. Eleven countries participated in TIMSS 2003 and TIMSS 1999 only, while three countries participated in TIMSS 2003 and TIMSS 1995. These countries have trend data for two points in time. TIMSS 2003 is proud to welcome 12 new participating countries to the study. TIMSS 2003 is equally proud of its fledgling benchmarking program, whereby regions or localities of countries can participate in the study to compare to international standards. TIMSS 2003 included four benchmarking participants (one US state, two Canadian provinces, and Spain's Basque Country) in addition to its 49 countries.

At the eighth grade, results are presented for 46 countries and 4 benchmarking participants. At the fourth grade, results are presented for 25 countries and three benchmarking participants. Argentina was unable to complete the steps necessary to have its data available for

**Exhibit 1: Countries Participating in TIMSS**

**2003, 1999, and 1995**

- Australia
- Belgium (Flemish)
- Bulgaria
- Cyprus
- England
- Hong Kong, SAR
- Hungary
- Iran, Islamic Rep. of
- Israel
- Italy
- Japan
- Korea, Rep. of
- Latvia
- Lithuania
- Netherlands
- New Zealand
- Romania
- Russian Federation
- Singapore
- Slovak Republic
- Slovenia
- South Africa
- United States
- Ontario Province, Can.
- Quebec Province, Can.



**2003 and 1999**

- Argentina
- Chile
- Chinese Taipei
- Indonesia
- Jordan
- Macedonia, Rep. of
- Malaysia
- Moldova, Rep. of
- Morocco
- Philippines
- Tunisia
- Indiana State, US

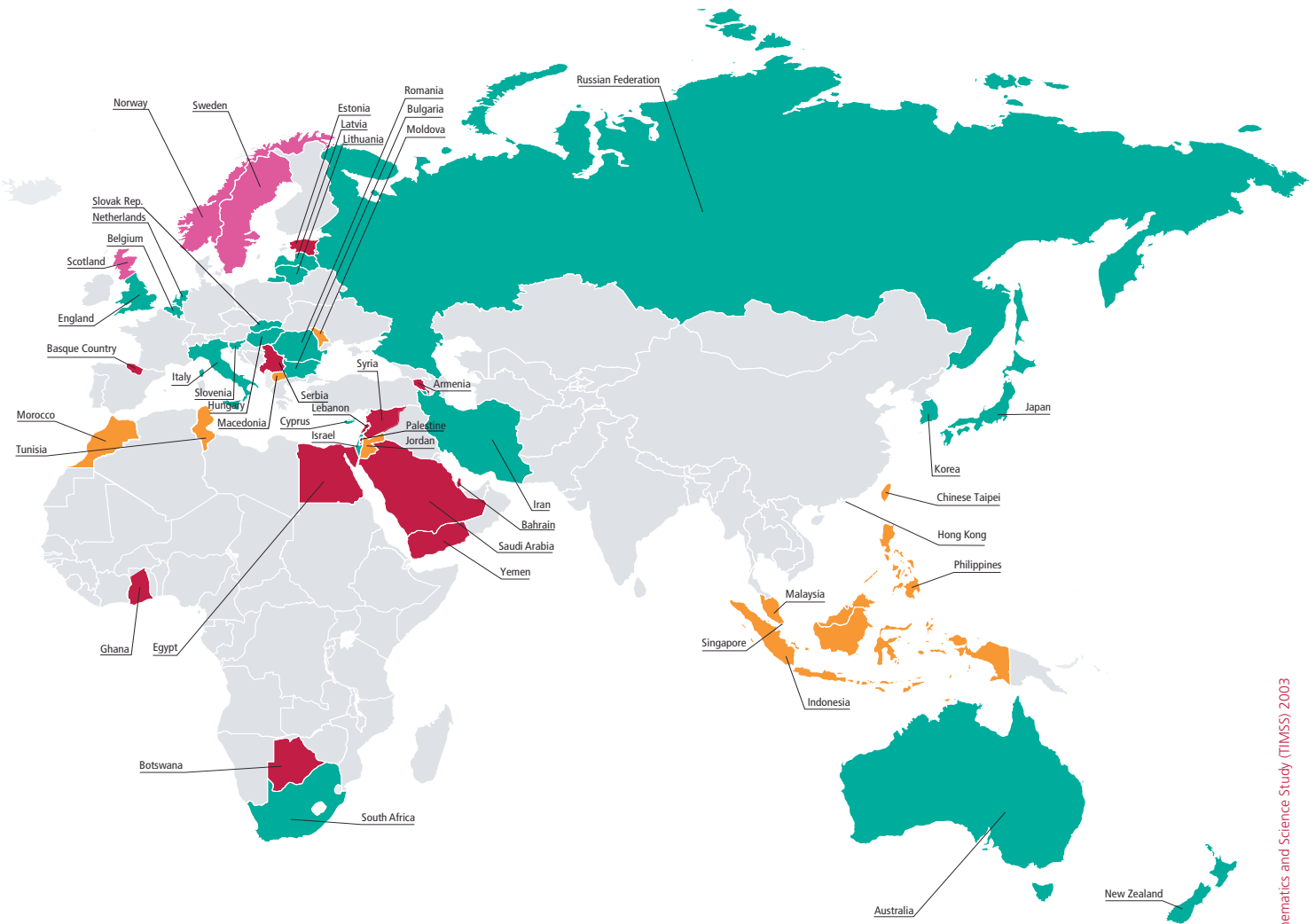


**2003 and 1995**

- Norway
- Scotland
- Sweden

**2003**

- Armenia
- Bahrain
- Botswana
- Egypt
- Estonia
- Ghana
- Lebanon
- Palestinian National Authority
- Saudi Arabia
- Serbia
- Syrian Arab Republic
- Yemen
- Basque Country, Spain



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Argentina administered the TIMSS 2003 data collection one year late, and did not score and process its data in time for inclusion in this report. Because the characteristics of their samples are not completely known, achievement data for Syria and Yemen are presented in Appendix F of this report.

analysis for this report. Because the characteristics of their samples are not completely known, the results for Syrian Arab Republic and Yemen are presented in Appendix F.

For the sake of comparability across countries and across assessments, all testing was conducted at the end of the school year, except in Korea. As noted in the Exhibits in this report, Korea tested the same cohort of students as other countries, but later in 2003 at the beginning of the next school year. The seven countries on a Southern Hemisphere school schedule (Australia, Botswana, Chile, Malaysia, New Zealand, Singapore, and South Africa) tested in October through December of 2002, which was the end of the school year there. The remaining countries tested towards the end of the 2002-2003 school year, most often in April, May, or June of 2003.

### **What Is the Comparability Across the Grades and Ages Tested?**

Exhibit 2 contains information about the grade(s) tested in each country. Because TIMSS studies the effectiveness of curriculum and instruction on student learning, it is designed to assess mathematics and science achievement at the same point in schooling across countries. More specifically, TIMSS tries to assess students at two points – at the end of four years of formal schooling and at the end of eight years of formal schooling.

Exhibit 2 reveals that, with few exceptions, the grade(s) tested in each country represented the eighth year of formal schooling and the fourth year of formal schooling. Thus, solely for convenience, the report usually refers to the grade tested as the eighth or the fourth grade, respectively.

As can be seen from the first two columns in Exhibit 2, countries have different policies and practices about the age of entry to primary school. This information is extremely valuable and important in considering the achievement results, since differences in these policies can affect achievement through the grades. Everything else being equal,

students who start their formal schooling at a younger age will be younger than their counterparts at the grades assessed and those who start their schooling at an older age will be older. Again, everything else being equal, students who are older may be considered more mature. In many countries, students must be 6 years old to start school and they do start school at that age. In several countries, students must be six, but they do not need to start school at that age and can wait. In this case, students or their parents may wait, most often for economic reasons, so that the older students may come from disadvantaged backgrounds. Also, in a number of countries children must be 7 years old. On the other hand, in several countries some or all of the students are younger than six when they start school, including Australia, Cyprus, England, Jordan, Scotland, and Tunisia.

Besides the age of entry, policies on promotion and retention also can effect how old students are when they reach a particular grade. If students have been retained, they will be older when they are assessed. Most often, it is the lower achievers who are retained and consequently the older students have lower achievement. Consistent with most educational endeavors, the interaction between grade and age in school is complicated. As can be seen from Exhibit 2, the variation in policies and practices across the countries assessed resulted in a considerable range in the average age of the students assessed. At the eighth grade, for example, Scotland with an additional year of schooling because they start school at such a comparatively early age (4.5 to 5.5 years old), had the youngest students assessed – 13.7 years old on average. At the other end of the spectrum, students in Ghana start school closer to age 7 and may be retained because of attendance problems; as a result they were the oldest students assessed at 15.5 years old. Despite this wide range, however, eighth grade students in most countries were between 14 and 15 years old. Similarly, fourth grade students averaged between 10 and 11 years old, even though those in Scotland were 9.7 years old and those in Latvia had an average age of 11.1.

## Exhibit 2: Information About the Students Tested in TIMSS 2003



Countries	Policy on Age of Entry to Primary School <sup>1</sup>	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling <sup>2</sup>	Average Age at Time of Testing
Armenia	Children must be 7 years old	6.5 to 7	Automatic	Grade 8	8	14.9
Australia	Children must be 5 or 6 years old, depending on state or territory	5 or 6	Automatic	Year 8	8 or 9	13.9
Bahrain	Children must be 6 years old	6	Automatic in grade 1, students in grades 2-8 must demonstrate a certain amount of academic progress	Second intermediate	8	14.1
Belgium (Flemish)	Children begin school during the calendar year in which they become 6 years old	6	Students must show progress, based on exam by teachers	Second grade of secondary education	8	14.1
Botswana	Children must be 6 years old by June	6 to 7	Students can be retained if found to be extremely deficient, after consultation with parents and teachers; students can repeat a maximum of 3 grades	Form 1	8	15.1
Bulgaria	Children must be 6 years old by the end of June to begin school the following September	7	Students must demonstrate basic knowledge and skills	Grade 8	8	14.9
Chile	Children must be 6 years old in March or before	6	Automatic in grades 1-4, dependent on marks and approval in grades 5-8	Eighth grade of basic education	8	14.2
Chinese Taipei	Children must be 6 years old	6	Automatic	Junior high school, grade 2	8	14.2
Cyprus	Children must be 5 years, 6 months old	5 years, 6 months to 6 years, 5 months	Automatic in grades 1-6, dependent on progress in grades 7-8	2nd grade - gymnasium	8	13.8
Egypt	Children must be 6 years old, space permitting (otherwise 7)	6 to 7	Students in grades 1-5 must pass an exam but if retained are automatically promoted the following year, students in grades 6-8 must pass an exam and are not automatically promoted the following year	Preparatory 3	8	14.4
England	Children must begin school at the start of the term following their 5th birthday	5	Automatic	Year 9	9	14.3
Estonia	Children must be 7 years old by October 1	7	Students must have positive marks, and in grades 7-8 must also pass a school exam	Grade 8	8	15.2
Ghana	Children must be 6 years old	6 to 7	Students are retained with parental consent if fail to satisfy certain conditions such as adequate attendance	Junior secondary school II (JSS II)	8	15.5
Hong Kong, SAR	Children must be 6 years old	6	Determined by schools but retention rate cannot exceed 3%; in practice 99% of students are promoted	Secondary 2 (S2)	8	14.4
Hungary	Children must be 6 years old	6 or older	Automatic	Grade 8	8	14.5
Indonesia	Children must be 6 years old	6	Based on student achievement, usually small number are retained	2nd grade of junior secondary school	8	14.5
Iran, Islamic Rep. of	Children must be 6 years old	6	Students must pass a final examination	Third grade of guidance school	8	14.4
Israel	Children must be 6 years old	6	Mostly automatic, but students diagnosed as having difficulties are transferred to remedial classes	Grade 8	8	14.0
Italy	Children may begin school when 5 years old if their birth date is before April 30 of the academic year, otherwise 6	6	Students must demonstrate a certain amount of academic progress	Grade 8 (III media)	8	13.9
Japan	Children must be 6 years old	6	Automatic	2nd grade at the lower secondary school	8	14.4
Jordan	Children must be 5 years, 8 months old	5 years, 8 months	Retention rate cannot exceed 5%	Grade 8	8	13.9
♦♦ Korea, Rep. of	Children must be 6 years old	6	Automatic	Middle school, 2nd grade	8	14.6
Latvia	Children must be 7 years old in the calendar year	7	Automatic	Grade 8	8	15.0

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

♦♦ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.



## Exhibit 2: Information About the Students Tested in TIMSS 2003 (Continued...)



Countries	Policy on Age of Entry to Primary School <sup>1</sup>	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling <sup>2</sup>	Average Age at Time of Testing
Lebanon	Children must be 6 or 7 years old	6 or 7	Dependent on final exams	Grade 8	8	14.6
Lithuania	Children must be 6 or 7 years old, depending on child's development and parents' wishes	7 or older	Students must have sufficient marks (at least 4 on a scale of 1-10) in all subjects, and approval by the School Teachers' Board	Grade 8	8	14.9
Macedonia, Rep. of	Children must be 7 years old by September 1	6.5 to 7	Automatic in grades 1-4; students in grades 5-8 must have marks of at least 3 (on a scale 1-5) in all subjects, but if do not finish grade 8 by age 17 are transferred to schools for adults	Grade 8	8	14.6
Malaysia	Children must be 6 years old by January 1 of the academic year	6 or older	Automatic	Form 2	8	14.3
Moldova, Rep. of	Children must be 6 or 7 years old, parents decide	6 or 7	If students fail any subjects they are promoted with negative marks for those subjects, students with more than 5 negative marks are retained	Grade VIII	8	14.9
Morocco	Children must be 7 years old	7	Automatic except for students in grade 6 who must pass provincial exams	2° secondary	8	15.2
Netherlands	Children must be 6 years old	6	Essentially automatic, but students can be retained if have serious learning difficulties or fall behind because of illness	Grade 8	8	14.3
New Zealand	Children must attend primary school from their 6th birthday, but have the right to be enrolled from age 5	Almost all start on or near 5th birthday	Automatic	Year 9	8.5 - 9.5	14.1
Norway	Children begin school the year they become 7 years old	7	Automatic	Grade 8 (these students started in Grade 2)	7	13.8
Palestinian Nat'l Auth.	Children must be 6 years old for governmental schools, 5.5 years old for special schools	6	Automatic in grades 1-4, students in grades 5-8 must have at least 50% passing marks in all subjects and if do not must pass exams in the relevant subjects	Grade 8	8	14.1
Philippines	Children must be 6 years old	6 to 7	Students must repeat and pass any subjects they failed before being promoted	Second year high school	8	14.8
Romania	Children must be 7 years old	7	Students in grades 1-4 must receive a "satisfactory" grade in all subjects, students in grades 5-8 must receive grades of at least 5 (on a scale of 1-10) in all subjects	Grade 8	8	15.0
Russian Federation	For 4-year primary schools, children must be 6 years old by September 1 but require special medical confirmation; for 3-year primary schools, children must be 7 years old by September 1 but parents have a right to keep children at home until age 8	6 or 7	Automatic	Eighth grade	7 or 8	14.2
Saudi Arabia	Children must be 6 years old	6	Students must achieve a satisfactory level in all subjects	Second year of middle school	8	14.1
Scotland	Children can begin school between the ages of 4.5 and 6; those with a March-August birth date automatically begin school in September following their 5th birthday; parents of children with a September-December birth date can defer school entry until the following year (most choose not to defer)	4.5 to 5.5	Automatic	Secondary 2 (S2)	9	13.7
Serbia	Children begin school during the calendar year in which they turn 7, but may enter school earlier with parental consent if mature enough and ready for school	7	Students must have marks of at least 2 (on a scale 1-5) in all subjects	8th grade of primary school	8	14.9
Singapore	Children must be 6 years old	6	Automatic in grades 1-5, students in grade 6 must satisfy basic requirements on national exam to be promoted to grade 7	Secondary 2	8	14.3

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

## Exhibit 2: Information About the Students Tested in TIMSS 2003 (...Continued)



Countries	Policy on Age of Entry to Primary School <sup>1</sup>	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling <sup>2</sup>	Average Age at Time of Testing
Slovak Republic	Children must be 6 years old	6	Automatic	Grade 8	8	14.3
Slovenia	For 8-year elementary schools, children must be 7 years old in the calendar year; for 9-year elementary schools, children must be 7 years old in the calendar year, but are promoted from grade 5 of 8-year elementary school directly to grade 7 of 9-year elementary school	6.5	Automatic	Grade 7 of 8-year elementary school; Grade 8 of 9-year elementary school	7 or 8	13.8
South Africa	Children must be 6 years old by June 30 of the academic year, which begins in January	7	Automatic in grades 1-3, students in grades 4-8 must pass an exam	Grade 8	8	15.1
Syrian Arab Republic	--	--	--	Grade 8	8	14.0
Sweden	Children begin school during the calendar year of their 7th birthday	7	Automatic	Year 8	8	14.9
Tunisia	Children must be 6 years old	5.5 to 6	Students must demonstrate a certain amount of academic progress	8th year of basic school	8	14.8
United States	Varies by state; 6 or 7, depending on birth date	6 or 7	Automatic	Grade 8	8	14.2
<b>International Avg.</b>					<b>8</b>	<b>14.5</b>
<b>Benchmarking Participants</b>						
Basque Country, Spain	Children must be 6 years old	6	At the end of each cycle of 2 years, students with low achievement may be retained upon teachers' decision	2nd year of compulsory secondary education	8	14.1
Indiana State, US	No official state policy	6 to 7	Promotion/retention decisions are made by individual schools	Grade 8	8	15.1
Ontario Province, Can.	Children must be 6 years old by December 31	6	Automatic	Grade 8	8	13.8
Quebec Province, Can.	Children must be 7 years old by October 1	6	Automatic	Secondary II	8	14.2

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

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

## Exhibit 2: Information About the Students Tested in TIMSS 2003 (Continued...)

SCIENCE  
Grade 4

Countries	Policy on Age of Entry to Primary School <sup>1</sup>	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling <sup>2</sup>	Average Age at Time of Testing
Armenia	Children must be 7 years old	6.5 to 7	Automatic	Grade 4	4	10.9
Australia	Children must be 5 or 6 years old, depending on state or territory	5 or 6	Automatic	Year 4	4 or 5	9.9
Belgium (Flemish)	Children begin school during the calendar year in which they become 6 years old	6	Students must show progress, based on exam by teachers	Fourth grade of primary education	4	10.0
Chinese Taipei	Children must be 6 years old	6	Automatic	Elementary school, grade 4	4	10.2
Cyprus	Children must be 5 years, 8 months old	5 years, 8 months to 6 years, 7 months	Automatic	4th grade - primary	4	9.9
England	Children must begin school at the start of the term following their 5th birthday	5	Automatic	Year 5	5	10.3
Hong Kong, SAR	Children must be 6 years old	6	Determined by schools but retention rate cannot exceed 3%; in practice 99% of students are promoted	Primary 4 (P4)	4	10.2
Hungary	Children must be 6 years old	6 or older	Automatic	Grade 4	4	10.5
Iran, Islamic Rep. of	Children must be 6 years old	6	Students must pass a final examination	Fourth grade of primary school	4	10.4
Italy	Children may begin school when 5 years old if their birth date is before April 30 of the academic year, otherwise 6	6	Students must demonstrate a certain amount of academic progress	Grade 4 (IV elementare)	4	9.8
Japan	Children must be 6 years old	6	Automatic	4th grade at the elementary school	4	10.4
Latvia	Children must be 7 years old in the calendar year	7	Automatic	Grade 4	4	11.1
Lithuania	Children must be 6 or 7 years old, depending on child's development and parents' wishes	7 or older	Students must have sufficient marks (at least 4 on a scale of 1-10) in all subjects, and approval by the School Teachers' Board	Grade 4	4	10.9
Moldova, Rep. of	Children must be 6 or 7 years old, parents decide	6 or 7	If students fail any subjects they are promoted with negative marks for those subjects, students with more than 5 negative marks are retained	Grade IV	4	11.0
Morocco	Children must be 7 years old	7	Automatic	4° primary	4	11.0
Netherlands	Children must be 6 years old	6	Essentially automatic, but students can be retained if have serious learning difficulties or fall behind because of illness	Grade 4	4	10.2
New Zealand	Children must attend primary school from their 6th birthday, but have the right to be enrolled from age 5	Almost all start on or near 5th birthday	Automatic	Year 5	4.5 - 5.5	10.0
Norway	Children begin school the year they become 6 years old, but the first year is called "Grade 1/Preschool"	6	Automatic	Grade 4	4	9.8
Philippines	Children must be 6 years old	6 to 7	Students must repeat and pass any subjects they failed before being promoted	Grade 4	4	10.8
Russian Federation	For 4-year primary schools, children must be 6 years old by September 1 but require special medical confirmation; for 3-year primary schools, children must be 7 years old by September 1 but parents have a right to keep children at home until age 8	6 or 7	Automatic	Fourth grade for 4-year primary school; Third grade for 3-year primary school	3 or 4	10.6

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

## Exhibit 2: Information About the Students Tested in TIMSS 2003 (...Continued)



Countries	Policy on Age of Entry to Primary School <sup>1</sup>	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling <sup>2</sup>	Average Age at Time of Testing
Scotland	Children can begin school between the ages of 4.5 and 6; those with a March-August birth date automatically begin school in September following their 5th birthday; parents of children with a September-December birth date can defer school entry until the following year (most choose not to defer)	4.5 to 5.5	Automatic	Primary 5 (P5)	5	9.7
Singapore	Children must be 6 years old	6	Automatic	Primary 4	4	10.3
Slovenia	For 8-year elementary schools, children must be 7 years old in the calendar year; for 9-year elementary schools, children must be 6 years old in the calendar year	5.5 or 6.5	Automatic	Grade 3 of 8-year elementary school; Grade 4 of 9-year elementary school	3 or 4	9.8
Tunisia	Children must be 6 years old	5.5 to 6	Students must demonstrate a certain amount of academic progress	4th year of basic school	4	10.4
United States	Varies by state; 6 or 7, depending on birth date	6 or 7	Automatic	Grade 4	4	10.2
Yemen	Children must be 6 years old	6 or older	Automatic	Grade 4	4	10.9
<b>International Avg.</b>					<b>4</b>	<b>10.3</b>
<b>Benchmarking Participants</b>						
Indiana State, US	No official state policy	6 to 7	Promotion/retention decisions are made by individual schools	Grade 4	4	11.0
Ontario Province, Can.	Children must be 6 years old by December 31	6	Automatic	Grade 4	4	9.8
Quebec Province, Can.	Children must be 7 years old by October 1	6	Automatic	Second year of the second cycle	4	10.1

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

2 Represents years of schooling counting from the first year of ISCED Level 1.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

Having valid and efficient samples in each country is crucial to the quality and integrity of the study. The accuracy of the survey results depends on the quality of the sampling information available, and particularly on the quality of the samples. TIMSS developed procedures and guidelines to ensure that the national samples were of the highest quality possible. Standards were established and well documented for coverage of the target population and participation rates. For the most part, the national samples were drawn in accordance with the TIMSS standards, and achievement results can be compared with confidence. Countries that deviated from the guidelines are specially noted in this report.

### **What Was the Nature of the Science Test and Background Questionnaires?**

A particular challenge for TIMSS 2003 was updating the set of frameworks underlying the assessments. The publication entitled *TIMSS Assessment Frameworks and Specifications 2003* serves as the basis of TIMSS 2003 and beyond.<sup>3</sup> It describes in some detail the mathematics and science content to be assessed in mathematics and science. Content areas are elaborated with objectives specific to the eighth and fourth grades. In general, the science content areas are life science, chemistry, physics, earth science, and environmental science.

Developing the TIMSS tests for 2003 was a cooperative venture involving all of the NRCs during the entire process. The TIMSS & PIRLS International Study Center began the process with an item-writing workshop for NRCs 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 Science and Mathematics Item Review Committee. The NRCs had several opportunities to review the items and scoring criteria. The resulting TIMSS 2003 science tests contained 189 items at the eighth grade and 152 items at the fourth grade.<sup>4</sup>

3 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S.J., and O'Connor, K.M. (2003), *TIMSS Assessment Frameworks and Specifications 2003 (2nd Edition)*, Chestnut Hill, MA: Boston College.

The TIMSS frameworks developed 1995 also were used for 1999. See, Robitaille, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raisen, S.A., and Nicol, C. (1993), *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*, Vancouver, BC: Pacific Educational Press.

4 For more detail, see Appendix A.

At both fourth and eighth grades, about two-fifths of the questions were in the constructed-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted almost half of the testing time. Chapter 2 of this report contains example items illustrating the range of science concepts and processes covered in the TIMSS 2003 tests. Appendix A contains more information about test development for TIMSS 2003.

To guide questionnaire development, the TIMSS frameworks document also describes the contextual factors associated with students' learning in mathematics and science. A special effort was made for TIMSS 2003 to reduce burden for students, teachers, and schools and to address emerging policy concerns. In particular, TIMSS worked to examine curricular goals; the educational resources and facilities provided; the teaching force and how it is educated, equipped, and supported; classroom activities and characteristics; home support and involvement; and the experiences and attitudes that students themselves bring to the educational enterprise.

### **How Do Country Characteristics Differ?**

International studies of student achievement provide valuable comparative information about student performance, instructional practice, and curriculum. It is important, however, to consider the results in light of country-wide demographic and economic factors. Some selected demographic characteristics of the TIMSS 2003 countries are presented in Exhibit 3. As can be seen, countries range widely in population size and in geographic area. Countries also vary widely on indicators of health, such as life expectancy at birth and infant mortality rate. The economic indicators, such as gross national income per capita, reveal there is great disparity in the economic resources available to countries. Finally, there are differences in enrollment rates and pupil-teacher ratios. For the enrollment rates, figures only were available for primary and secondary school and not specifically for fourth and

eighth grades. For the fourth grade, it can be seen that the countries generally had 90 percent or more of their children enrolled in primary school. The figures pertinent to the eighth grade in particular were not available, but they most certainly would be higher than those provided for the secondary school.

## Exhibit 3: Selected Characteristics of TIMSS 2003 Countries



Countries	Population Size <sup>1</sup> (in Millions)	Area of Country <sup>2</sup> (1000 Square Kilometers)	Life Expectancy at Birth <sup>3</sup> (Years)	Infant Mortality Rate <sup>4</sup> (per 1000 Live Births)	Gross National Income per Capita <sup>5</sup> (in U.S. Dollars)
Argentina	36.5	2780	74	16	4220
Armenia	3.1	30	75	30	790
Australia	19.7	7741	79	6	19530
<sup>12</sup> Bahrain	0.7	1	74	18	10500
<sup>10</sup> Belgium (Flemish)	9.8	31	79	5	22940
Botswana	1.7	582	38	80	3010
Bulgaria	8.0	111	72	14	1770
Chile	15.6	757	76	10	4250
<sup>9</sup> Chinese Taipei	23.0	36	76	5	11627
<sup>12</sup> Cyprus	0.8	9	77	7	12320
Egypt	66.4	1001	69	33	1470
<sup>11</sup> England	59.2	243	77	5	25510
Estonia	1.4	45	71	10	4190
Ghana	20.3	239	55	60	270
Hong Kong, SAR	6.8	1	80	–	24690
Hungary	10.2	93	72	8	5290
Indonesia	211.7	1905	67	32	710
Iran, Islamic Rep. of	65.5	1648	69	34	1720
Israel	6.6	21	79	6	16020
Italy	57.7	301	78	4	19080
Japan	127.2	378	82	3	34010
Jordan	5.2	89	72	27	1760
Korea, Rep. of	47.6	99	74	5	9930
Latvia	2.3	65	70	17	3480
Lebanon	4.4	10	71	28	3990
Lithuania	3.5	65	73	8	3670
Macedonia, Rep. of	2.0	26	73	22	1710
Malaysia	24.3	330	73	8	3540
Moldova, Rep. of	4.3	34	67	27	460
Morocco	29.6	447	68	39	1170
Netherlands	16.1	42	78	5	23390
New Zealand	3.9	271	78	6	13260
Norway	4.5	324	79	4	38730
<sup>12</sup> Palestinian Nat'l Auth.	–	–	72	–	–
Philippines	79.9	300	70	28	1030
Romania	22.3	238	70	19	1870
Russian Federation	144.1	17075	66	18	2130
Saudi Arabia	21.9	2150	73	23	8530
<sup>11</sup> Scotland	59.2	243	77	5	25510
Serbia	8.2	102	73	16	1400
Singapore	4.2	1	78	3	20690
Slovak Republic	5.4	49	73	8	3970
Slovenia	2.0	20	76	4	10370
South Africa	45.3	1221	46	52	2500
Sweden	8.9	450	80	3	25970
Syrian Arab Republic	17.0	185	70	23	1130
Tunisia	9.8	164	73	21	1990
United States	288.4	9629	77	7	35400
Yemen	18.6	528	57	83	490

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Estimates are for mid-year 2002, 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. World Bank's *2004 World Development Indicators*, p. 38-41.

2 Area is the total surface area in square kilometers, comprising all land area, inland bodies of waters, and some coastal water ways. World Bank's *2004 World Development Indicators*, p. 14-17.

3 Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life. World Bank's *2004 World Development Indicators*, p. 108-111.

4 Infant mortality rate is the number of deaths of infants under one year of age during 2002 per 1,000 live births in the same year. World Bank's *2004 World Development Indicators*, p. 108-111.

5 GNI per Capita in U.S. dollars is converted using the World Bank Atlas method. World Bank's *2004 World Development Indicators*, p. 14-17.

6 An international dollar has the same purchasing power over GNI as a U.S. dollar in the United States.

World Bank's *2004 World Development Indicators*, p. 14-17.

7 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 Classification of Education 1997. World Bank's *2004 World Development Indicators*, p. 76-79.

8 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). World Bank's *2004 World Development Indicators*, p. 72-75 and *Global Education Digest 2004* by UNESCO Institute for Statistics.

9 Data provided by the NRC of Chinese Taipei.

10 Figures for Belgium (Flemish) are for the whole country of Belgium.

11 Figures for England and Scotland are for the whole region of United Kingdom.

12 Data for Bahrain, Cyprus and Palestinian Nat'l Auth. was obtained from *Global Education Digest 2004* by UNESCO Institute for Statistics and *The World Fact Book 2004*.

A dash (–) indicates data are not available.



## Exhibit 3: Selected Characteristics of TIMSS 2003 Countries



GNI per Capita <sup>6</sup> (Purchasing Power Parity)	Net Enrollment Ratio in Education <sup>7</sup> (% of Relevant Group)		Primary Pupil-Teacher Ratio <sup>8</sup>	Countries
	Primary	Secondary		
10190	100	81	20.0	Argentina
3230	85	85	18.8	Armenia
27440	96	88	18.1	Australia
–	91	81	16.4	<sup>12</sup> Bahrain
28130	100	–	12.1	<sup>10</sup> Belgium (Flemish)
7740	81	55	26.6	Botswana
7030	90	87	16.8	Bulgaria
9420	89	75	32.2	Chile
–	98	93	18.6	<sup>9</sup> Chinese Taipei
–	95	88	17.2	<sup>12</sup> Cyprus
3810	90	78	22.3	Egypt
26580	100	95	18.2	<sup>11</sup> England
11630	98	92	14.1	Estonia
2080	60	30	32.1	Ghana
27490	98	72	20.0	Hong Kong, SAR
13070	90	87	10.5	Hungary
3070	92	47	20.9	Indonesia
6690	87	–	24.3	Iran, Islamic Rep. of
19000	100	88	12.2	Israel
26170	100	88	10.7	Italy
27380	100	100	20.4	Japan
4180	91	80	20.2	Jordan
16960	99	91	32.1	Korea, Rep. of
9190	91	89	15.0	Latvia
4600	90	–	16.8	Lebanon
10190	97	92	16.0	Lithuania
6420	93	82	18.0	Macedonia, Rep. of
8500	95	69	19.6	Malaysia
1600	78	68	19.5	Moldova, Rep. of
3730	88	31	28.3	Morocco
28350	99	90	9.8	Netherlands
20550	98	92	14.8	New Zealand
36690	100	95	–	Norway
–	95	81	–	<sup>12</sup> Palestinian Nat'l Auth.
4450	93	56	35.4	Philippines
6490	93	80	19.6	Romania
8080	–	–	17.1	Russian Federation
12660	59	53	12.3	Saudi Arabia
26580	100	95	18.2	<sup>11</sup> Scotland
–	75	–	–	Serbia
23730	–	–	25.4	Singapore
12590	89	75	19.0	Slovak Republic
18480	93	96	12.6	Slovenia
9810	90	62	37.1	South Africa
25820	100	96	11.4	Sweden
3470	98	39	24.0	Syrian Arab Republic
6440	97	68	21.9	Tunisia
36110	94	87	15.4	United States
800	67	35	29.8	Yemen

1 Estimates are for mid-year 2002, 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. World Bank's 2004 *World Development Indicators*, p. 38-41.

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