

# Chapter 1



## *International Student Achievement in Science*

Chapter 1 contains the TIMSS 2007 achievement results for fourth and eighth grade students in science for each of the participating countries and benchmarking entities. It also presents trends in science achievement over time for participants in previous TIMSS assessments in 1995, 1999, and 2003. Achievement differences by gender at both grades are also described.

### **How Do Countries Differ in Science Achievement?**

Exhibit 1.1 shows the distribution of student achievement for the participants in TIMSS 2007, including the average (mean) scale score with its 95 percent confidence interval and the ranges in performance for the middle half of the students (25th to 75th percentiles) as well as the extremes (5th and 95th percentiles). The first page of Exhibit 1.1 presents the distribution for the achievement for the 36 countries and 7 benchmarking participants at the fourth grade and the second page presents the distribution of student achievement for the 49 countries and 7 benchmarking participants at the eighth grade.<sup>1</sup> For each grade in Exhibit 1.1, countries are shown in decreasing order of average (mean) scale score (with the exception of Morocco at the eighth grade<sup>2</sup>) followed by the benchmarking participants also ordered from highest to lowest average achievement. The benchmarking participants followed the same procedures and met the same standards as the countries, the difference being that they are regional entities (in some cases parts of

1 Because characteristics of their samples and data are not completely known, achievement results for Mongolia at the fourth and eighth grades are presented in Appendix E.

2 Morocco did not meet the school participation rates as specified in the TIMSS guidelines due to a procedural difficulty with some schools, and consequently, its results are shown below a line.

countries shown above). Because there often are relatively small differences between participants in average achievement, Exhibit 1.2 shows whether or not the differences in average achievement are statistically significant.

TIMSS used item response theory (IRT) methods to summarize the achievement for each grade on a scale with a mean of 500 and a standard deviation of 100.<sup>3</sup> The TIMSS science scales for the fourth and eighth grades were established based on the 1995 assessments and the methodology enables comparable trend measures from assessment to assessment within each grade. It should be noted that the results for the fourth and eighth grades are not directly comparable. While the scales for the two grades are expressed in the same numerical units, they are not directly comparable in terms of being able to say how much achievement or learning at one grade equals how much achievement or learning at the other grade. That is, achievement on the TIMSS scales cannot be described in absolute terms (like all such scales developed using IRT technology). Comparisons can only be made in terms of relative performance (higher or lower), for example, among countries and population groups as well as between assessments.

In Exhibit 1.1, there is a symbol by a participant's average scale score indicating if the average achievement is significantly higher (up arrow) or lower (down arrow) than the scale average of 500. It should be noted that the scale average referenced in Exhibit 1.1 is different from the international average referenced in previous TIMSS reports. The TIMSS scale metric for the fourth grade and for the eighth grade was established in 1995 by setting the average of the mean scores of the countries that participated in TIMSS 1995 to 500 and the standard deviation to 100. To enable comparisons across TIMSS assessments, with each subsequent assessment the data from 1999, 2003, and 2007 also were placed on this metric so that scores are equivalent from assessment to assessment. Thus, the scale average has remained at 500 with each cycle of TIMSS and provides a fixed point of comparison through time. That is, a score of 500 in eighth or fourth grade science in 2007 is equivalent to a score of 500 in eighth or fourth grade science, respectively, in 2003, in 1999 (eighth grade only), and in 1995.

3 Given the matrix-sampling approach, the scaling process averages students' responses in a way that accounts for differences in the difficulty of different subsets of items. It allows students' performance to be summarized on a common metric even though individual students responded to different items in the science test. For further information, see the "IRT Scaling and Data Analysis" section of Appendix A.

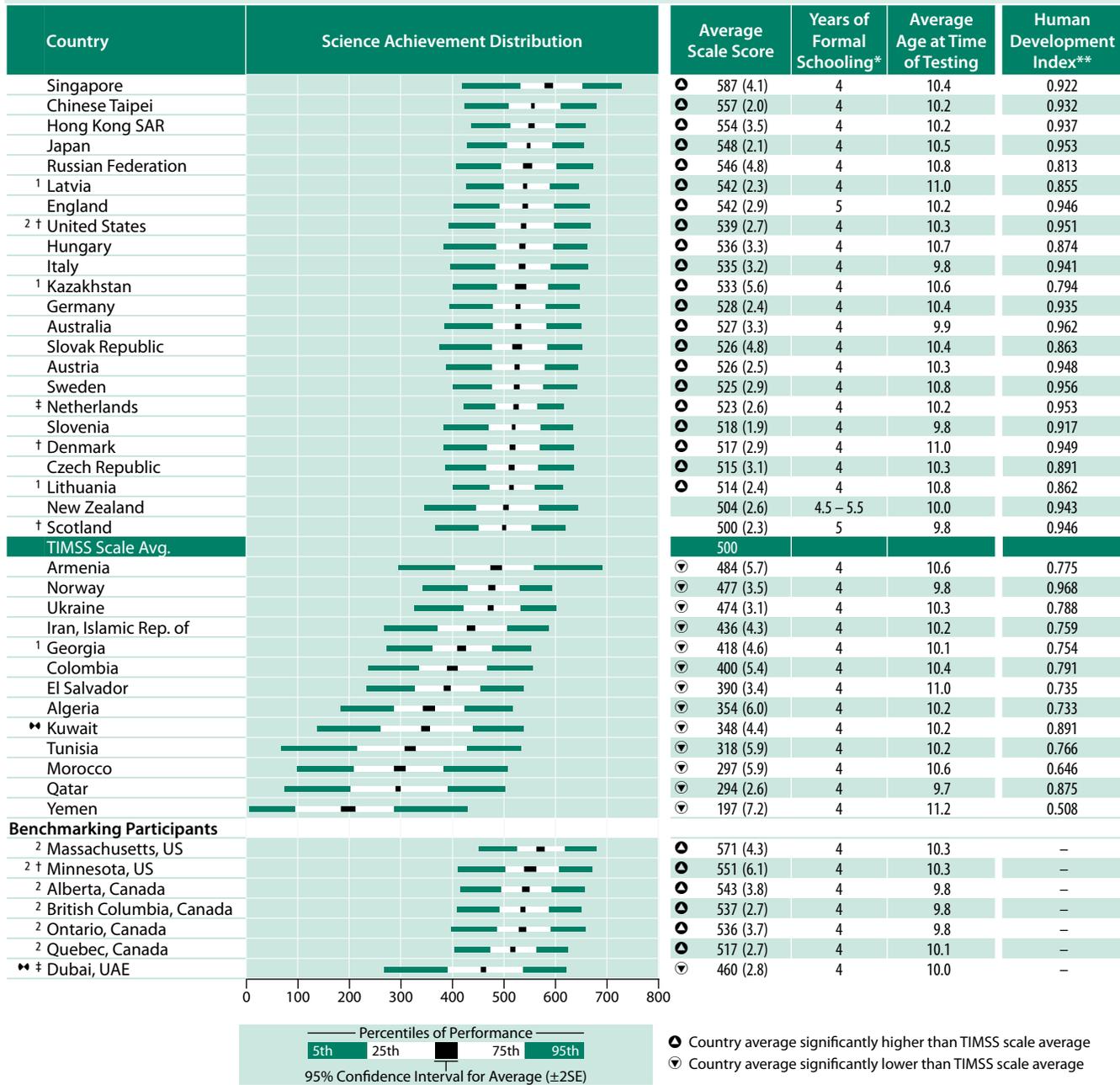
In contrast, the international average, obtained by averaging across the mean scores for each of the participating countries, needs to be recomputed for each new cycle based on the set of participating countries and has changed from cycle to cycle, becoming lower with each assessment, particularly at the eighth grade, depending on the set of countries taking part.<sup>4</sup> Using a point of reference that can change substantially from cycle to cycle depending on which countries participate creates the possibility for misinterpretations, particularly if countries gauge their progress in terms of how far they are above or below this point. For example, in 2003 using the international average may have given the erroneous impression that some countries at the eighth grade had improved, when actually it was only that the international average had become lower. Thus, to avoid misinterpretations based on movement of the international average between cycles, TIMSS 2007 adopted the fixed average approach by using the scale average as the point of reference, and this approach will be used for all future cycles of TIMSS (i.e., in 2011, 2016, and so on). It can be noted that the same approach is used in PIRLS. In PIRLS 2001, the average of the mean scale scores of the countries was set to 500 (the scale average) and the standard deviation to 100, and the fixed reference point approach (scale average instead of international average) was adopted for use from then on.

Similar to earlier TIMSS assessments, Asian countries top Exhibit 1.1 at both the fourth and eighth grades. Singapore was the top performing country at the fourth grade, with an average score 87 points above the 500 scale average. Using Exhibit 1.2 to help interpret the typically small differences in achievement among countries, it can be seen that Singapore had higher achievement than all of the other countries. Singapore was followed by Chinese Taipei and Hong Kong SAR, that were outperformed only by Singapore. Next came Japan and the Russian Federation, that were outperformed only by Singapore and Chinese Taipei, and then Latvia and England, that were outperformed only by Singapore, Chinese Taipei, and Hong Kong SAR. The United States, Hungary, Italy, and Kazakhstan also performed very well, and were outperformed only by the top four Asian

4 In 1995, the scale average for science and the international average were both 500 at the fourth grade and at the eighth grade. In 1999, the scale average remained at 500; however, because different countries participated in 1999 than 1995, the international average at the eighth grade for TIMSS 1999 changed to 488, somewhat lower than the scale average. With yet a larger and different set of countries participating in TIMSS 2003, including some with low average achievement, the international average at grade 8 dropped to 474. At the fourth grade in 2003, the international average was 489 in science.

Exhibit 1.1 TIMSS 2007 Distribution of Science Achievement

TIMSS2007  
Science 4<sup>th</sup> Grade



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

\* Represents years of schooling counting from the first year of ISCED Level 1.  
 \*\* Taken from United Nations Development Programme's *Human Development Report 2007/2008*, p.229–232, except for Chinese Taipei taken from Directorate-General of Budget, Accounting and Statistics, Executive Yuan, *R.O.C. Statistical Yearbook 2007*. Data for England and Scotland are for the United Kingdom.  
 † Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).  
 ‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).  
<sup>1</sup> National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

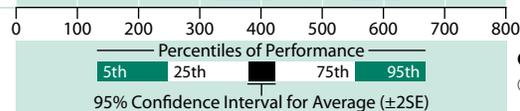
<sup>2</sup> National Defined Population covers 90% to 95% of National Target Population (see Appendix A).  
 ♦♦ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.  
 ( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.  
 A dash (–) indicates comparable data are not available.  
 Note: See Exhibit D.1 for percentiles of achievement in science.

Exhibit 1.1 TIMSS 2007 Distribution of Science Achievement (Continued)

TIMSS2007  
Science 8<sup>th</sup> Grade

Country	Science Achievement Distribution	Average Scale Score	Years of Formal Schooling*	Average Age at Time of Testing	Human Development Index**
Singapore		567 (4.4)	8	14.4	0.922
Chinese Taipei		561 (3.7)	8	14.2	0.932
Japan		554 (1.9)	8	14.5	0.953
Korea, Rep. of		553 (2.0)	8	14.3	0.921
† England		542 (4.5)	9	14.2	0.946
Hungary		539 (2.9)	8	14.6	0.874
Czech Republic		539 (1.9)	8	14.4	0.891
Slovenia		538 (2.2)	7 or 8	13.8	0.917
† Hong Kong SAR		530 (4.9)	8	14.4	0.937
Russian Federation		530 (3.9)	7 or 8	14.6	0.802
2 † United States		520 (2.9)	8	14.3	0.951
1 Lithuania		519 (2.5)	8	14.9	0.862
Australia		515 (3.6)	8	13.9	0.962
Sweden		511 (2.6)	8	14.8	0.956
<b>TIMSS Scale Avg.</b>		<b>500</b>			
† Scotland		496 (3.4)	9	13.7	0.946
Italy		495 (2.8)	8	13.9	0.941
Armenia		488 (5.8)	8	14.9	0.775
Norway		487 (2.2)	8	13.8	0.968
Ukraine		485 (3.5)	8	14.2	0.788
Jordan		482 (4.0)	8	14.0	0.773
Malaysia		471 (6.0)	8	14.3	0.811
Thailand		471 (4.3)	8	14.3	0.781
1 2 Serbia		470 (3.2)	8	14.9	0.810
3 Bulgaria		470 (5.9)	8	14.9	0.824
3 Israel		468 (4.3)	8	14.0	0.932
Bahrain		467 (1.7)	8	14.1	0.866
Bosnia and Herzegovina		466 (2.8)	8 or 9	14.7	0.803
Romania		462 (3.9)	8	15.0	0.813
Iran, Islamic Rep. of		459 (3.6)	8	14.2	0.759
Malta		457 (1.4)	9	14.0	0.878
Turkey		454 (3.7)	8	14.0	0.775
Syrian Arab Republic		452 (2.9)	8	13.9	0.724
Cyprus		452 (2.0)	8	13.8	0.903
Tunisia		445 (2.1)	8	14.5	0.766
Indonesia		427 (3.4)	8	14.3	0.728
Oman		423 (3.0)	8	14.3	0.814
1 Georgia		421 (4.8)	8	14.2	0.754
♣ Kuwait		418 (2.8)	8	14.4	0.891
Colombia		417 (3.5)	8	14.5	0.791
Lebanon		414 (5.9)	8	14.4	0.772
Egypt		408 (3.6)	8	14.1	0.708
Algeria		408 (1.7)	8	14.5	0.733
Palestinian Nat'l Auth.		404 (3.5)	8	14.0	0.731
Saudi Arabia		403 (2.4)	8	14.4	0.812
El Salvador		387 (2.9)	8	15.0	0.735
Botswana		355 (3.1)	8	14.9	0.654
Qatar		319 (1.7)	8	13.9	0.875
Ghana		303 (5.4)	8	15.8	0.553
‡ Morocco		402 (2.9)	8	14.8	0.646
<b>Benchmarking Participants</b>					
2 Massachusetts, US		556 (4.6)	8	14.2	–
2 † Minnesota, US		539 (4.8)	8	14.3	–
2 Ontario, Canada		526 (3.6)	8	13.8	–
3 British Columbia, Canada		526 (2.7)	8	13.9	–
3 Quebec, Canada		507 (3.1)	8	14.2	–
Basque Country, Spain		498 (3.0)	8	14.1	–
♣ ‡ Dubai, UAE		489 (2.8)	8	14.2	–

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



▲ Country average significantly higher than TIMSS scale average  
▼ Country average significantly lower than TIMSS scale average

\* Represents years of schooling counting from the first year of ISCED Level 1.  
 \*\* Taken from United Nations Development Programme's *Human Development Report 2007/2008*, p.229–232, except for Chinese Taipei taken from Directorate-General of Budget, Accounting and Statistics, Executive Yuan, *R.O.C. Statistical Yearbook 2007* and for Serbia taken from *Human Development Analyses of Serbia 2007*. Data for England and Scotland are for the United Kingdom.  
 † Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).  
 ‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).  
 ‡ Did not satisfy guidelines for sample participation rates (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).  
 2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).  
 3 National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).  
 ♣ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.  
 ( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.  
 A dash (–) indicates comparable data are not available.  
 Note: See Exhibit D.1 for percentiles of achievement in science.

Exhibit 1.2 TIMSS 2007 Multiple Comparisons of Average Science Achievement

TIMSS2007  
Science 4<sup>th</sup> Grade

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Country	Average Scale Score	Singapore	Chinese Taipei	Hong Kong SAR	Japan	Russian Federation	Latvia	England	United States	Hungary	Italy	Kazakhstan	Germany	Australia	Slovak Republic	Austria	Sweden	Netherlands	Slovenia	Denmark	Czech Republic	Lithuania	New Zealand	Scotland	Armenia	Norway	Ukraine	Iran, Islamic Rep. of	Georgia	Colombia	El Salvador
Singapore	587 (4.1)		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	557 (2.0)	▼																													
Hong Kong SAR	554 (3.5)	▼																													
Japan	548 (2.1)	▼	▼																												
Russian Federation	546 (4.8)	▼	▼																												
Latvia	542 (2.3)	▼	▼	▼																											
England	542 (2.9)	▼	▼	▼																											
United States	539 (2.7)	▼	▼	▼	▼																										
Hungary	536 (3.3)	▼	▼	▼	▼																										
Italy	535 (3.2)	▼	▼	▼	▼																										
Kazakhstan	533 (5.6)	▼	▼	▼	▼																										
Germany	528 (2.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Australia	527 (3.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Slovak Republic	526 (4.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Austria	526 (2.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																				
Sweden	525 (2.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																				
Netherlands	523 (2.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																				
Slovenia	518 (1.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																			
Denmark	517 (2.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																		
Czech Republic	515 (3.1)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																	
Lithuania	514 (2.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼																
New Zealand	504 (2.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼															
Scotland	500 (2.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼														
Armenia	484 (5.7)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													
Norway	477 (3.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												
Ukraine	474 (3.1)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											
Iran, Islamic Rep. of	436 (4.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										
Georgia	418 (4.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									
Colombia	400 (5.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								
El Salvador	390 (3.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							
Algeria	354 (6.0)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						
Kuwait	348 (4.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Tunisia	318 (5.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Morocco	297 (5.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Qatar	294 (2.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Yemen	197 (7.2)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		
<b>Benchmarking Participants</b>																															
Massachusetts, US	571 (4.3)	▼	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Minnesota, US	551 (6.1)	▼																													
Alberta, Canada	543 (3.8)	▼	▼	▼																											
British Columbia, Canada	537 (2.7)	▼	▼	▼	▼																										
Ontario, Canada	536 (3.7)	▼	▼	▼	▼																										
Quebec, Canada	517 (2.7)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Dubai, UAE	460 (2.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼

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

Note: 5% of these comparisons would be statistically significant by chance alone.

Exhibit 1.2 TIMSS 2007 Multiple Comparisons of Average Science Achievement (Continued)

TIMSS2007  
Science 4<sup>th</sup> Grade

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Algeria	Kuwait	Tunisia	Morocco	Qatar	Yemen	Benchmarking Participants	Average Scale Score	Country
▲	▲	▲	▲	▲	▲	Massachusetts, US	587 (4.1)	Singapore
▼	▼	▼	▼	▼	▼	Minnesota, US	557 (2.0)	Chinese Taipei
▲	▲	▲	▲	▲	▲	Alberta, Canada	554 (3.5)	Hong Kong SAR
▲	▲	▲	▲	▲	▲	British Columbia, Canada	548 (2.1)	Japan
▲	▲	▲	▲	▲	▲	Ontario, Canada	546 (4.8)	Russian Federation
▲	▲	▲	▲	▲	▲	Quebec, Canada	542 (2.3)	Latvia
▲	▲	▲	▲	▲	▲	Dubai, UAE	542 (2.9)	England
▲	▲	▲	▲	▲	▲		539 (2.7)	United States
▲	▲	▲	▲	▲	▲		536 (3.3)	Hungary
▲	▲	▲	▲	▲	▲		535 (3.2)	Italy
▲	▲	▲	▲	▲	▲		533 (5.6)	Kazakhstan
▲	▲	▲	▲	▲	▲		528 (2.4)	Germany
▲	▲	▲	▲	▲	▲		527 (3.3)	Australia
▲	▲	▲	▲	▲	▲		526 (4.8)	Slovak Republic
▲	▲	▲	▲	▲	▲		526 (2.5)	Austria
▲	▲	▲	▲	▲	▲		525 (2.9)	Sweden
▲	▲	▲	▲	▲	▲		523 (2.6)	Netherlands
▲	▲	▲	▲	▲	▲		518 (1.9)	Slovenia
▲	▲	▲	▲	▲	▲		517 (2.9)	Denmark
▲	▲	▲	▲	▲	▲		515 (3.1)	Czech Republic
▲	▲	▲	▲	▲	▲		514 (2.4)	Lithuania
▲	▲	▲	▲	▲	▲		504 (2.6)	New Zealand
▲	▲	▲	▲	▲	▲		500 (2.3)	Scotland
▲	▲	▲	▲	▲	▲		484 (5.7)	Armenia
▲	▲	▲	▲	▲	▲		477 (3.5)	Norway
▲	▲	▲	▲	▲	▲		474 (3.1)	Ukraine
▲	▲	▲	▲	▲	▲		436 (4.3)	Iran, Islamic Rep. of
▲	▲	▲	▲	▲	▲		418 (4.6)	Georgia
▲	▲	▲	▲	▲	▲		400 (5.4)	Colombia
▲	▲	▲	▲	▲	▲		390 (3.4)	El Salvador
▲	▲	▲	▲	▲	▲		354 (6.0)	Algeria
▲	▲	▲	▲	▲	▲		348 (4.4)	Kuwait
▼	▼	▼	▼	▼	▼		318 (5.9)	Tunisia
▼	▼	▼	▼	▼	▼		297 (5.9)	Morocco
▼	▼	▼	▼	▼	▼		294 (2.6)	Qatar
▼	▼	▼	▼	▼	▼		197 (7.2)	Yemen
▲	▲	▲	▲	▲	▲	Benchmarking Participants		
▲	▲	▲	▲	▲	▲	Massachusetts, US	571 (4.3)	Massachusetts, US
▲	▲	▲	▲	▲	▲	Minnesota, US	551 (6.1)	Minnesota, US
▲	▲	▲	▲	▲	▲	Alberta, Canada	543 (3.8)	Alberta, Canada
▲	▲	▲	▲	▲	▲	British Columbia, Canada	537 (2.7)	British Columbia, Canada
▲	▲	▲	▲	▲	▲	Ontario, Canada	536 (3.7)	Ontario, Canada
▲	▲	▲	▲	▲	▲	Quebec, Canada	517 (2.7)	Quebec, Canada
▲	▲	▲	▲	▲	▲	Dubai, UAE	460 (2.8)	Dubai, UAE

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

▲ Average achievement significantly higher than comparison country    ▼ Average achievement significantly lower than comparison country



Exhibit 1.2 TIMSS 2007 Multiple Comparisons of Average Science Achievement (Continued)

TIMSS2007 Science 8<sup>th</sup> Grade

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

	Turkey	Syrian Arab Republic	Cyprus	Tunisia	Indonesia	Oman	Georgia	Kuwait	Colombia	Lebanon	Egypt	Algeria	Palestinian Nat'l Auth.	Saudi Arabia	Morocco	El Salvador	Botswana	Qatar	Ghana	Benchmarking Participants	Average Scale Score	Country	
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	567 (4.4)	Singapore
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	561 (3.7)	Chinese Taipei
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	554 (1.9)	Japan
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	553 (2.0)	Korea, Rep. of
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	542 (4.5)	England
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	539 (2.9)	Hungary
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	539 (1.9)	Czech Republic
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	538 (2.2)	Slovenia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	530 (4.9)	Hong Kong SAR
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	◀	530 (3.9)	Russian Federation
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	520 (2.9)	United States
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	519 (2.5)	Lithuania
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	515 (3.6)	Australia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	511 (2.6)	Sweden
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	496 (3.4)	Scotland
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	495 (2.8)	Italy
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	488 (5.8)	Armenia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	487 (2.2)	Norway
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	485 (3.5)	Ukraine
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	482 (4.0)	Jordan
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	471 (6.0)	Malaysia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	471 (4.3)	Thailand
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	470 (3.2)	Serbia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	470 (5.9)	Bulgaria
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	468 (4.3)	Israel
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	467 (1.7)	Bahrain
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	466 (2.8)	Bosnia and Herzegovina
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	462 (3.9)	Romania
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	459 (3.6)	Iran, Islamic Rep. of
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	457 (1.4)	Malta
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	454 (3.7)	Turkey
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	452 (2.9)	Syrian Arab Republic
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	452 (2.0)	Cyprus
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	445 (2.1)	Tunisia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	427 (3.4)	Indonesia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	423 (3.0)	Oman
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	421 (4.8)	Georgia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	418 (2.8)	Kuwait
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	417 (3.5)	Colombia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	414 (5.9)	Lebanon
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	408 (3.6)	Egypt
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	408 (1.7)	Algeria
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	404 (3.5)	Palestinian Nat'l Auth.
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	403 (2.4)	Saudi Arabia
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	402 (2.9)	Morocco
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	387 (2.9)	El Salvador
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	355 (3.1)	Botswana
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	319 (1.7)	Qatar
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	303 (5.4)	Ghana
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	556 (4.6)	Massachusetts, US
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	539 (4.8)	Minnesota, US
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	526 (3.6)	Ontario, Canada
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	526 (2.7)	British Columbia, Canada
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	507 (3.1)	Quebec, Canada
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	498 (3.0)	Basque Country, Spain
	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	489 (2.8)	Dubai, UAE

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

▶ Average achievement significantly higher than comparison country

◀ Average achievement significantly lower than comparison country

countries. Among the benchmarking participants, the state of Massachusetts in the United States was outperformed by Singapore but had higher average achievement than all other countries. The state of Minnesota was outperformed only by Singapore and Massachusetts; was not significantly different from Chinese Taipei, Hong Kong SAR, Japan, the Russian Federation, Latvia, England, the United States, and the benchmarking participant Alberta, Canada; and performed better than all other countries. The Canadian provinces of Alberta, British Columbia, and Ontario also performed very well in comparison to the other countries.

At the fourth grade, in addition to the 11 highest achieving countries mentioned above, ten more countries had average achievement higher than the scale average of 500, including Germany, Australia, the Slovak Republic, Austria, Sweden, the Netherlands, Slovenia, Denmark, the Czech Republic, and Lithuania. In addition to the benchmarking states of Massachusetts and Minnesota, the four Canadian provinces also performed above the scale average—Alberta, British Columbia, Ontario, and Quebec.

At the eighth grade, Exhibit 1.1 shows Singapore and Chinese Taipei with the highest average achievement in science. Using the information in Exhibit 1.2, it can be seen that these two countries performed similarly, with averages more than 60 points above the TIMSS scale average. Singapore had higher achievement than all of the other countries except Chinese Taipei, which, in turn, outperformed all countries except Singapore, Japan, and Korea. Japan and Korea had higher average achievement than all countries except Singapore and Chinese Taipei. England, Hungary, the Czech Republic, Slovenia, Hong Kong SAR, and the Russian Federation also performed well. At the eighth grade, among the benchmarking participants, the two U.S. states, Massachusetts and Minnesota, and the three Canadian provinces, Ontario, British Columbia, and Quebec, performed above the scale average. Average science achievement in Massachusetts was similar to that of the four top Asian countries (Singapore, Chinese Taipei, Japan, and Korea) and higher than all other countries and benchmarking participants. Minnesota was outperformed by the four Asian countries, had achievement similar to

England, Hungary, the Czech Republic, Slovenia, Hong Kong SAR, and the Russian Federation, and performed better than all other countries.

At the fourth grade, looking at the other end of the achievement continuum in Exhibit 1.2, Colombia (400) and El Salvador (390) performed similarly and had higher achievement than Algeria (354) and Kuwait (348), which performed similarly to each other and had higher achievement than Tunisia (318). Tunisia performed better than Morocco (297) and Qatar (294), and these two in turn had higher achievement than Yemen (197). At the eighth grade, Egypt, Algeria, the Palestinian National Authority, Saudi Arabia, and Morocco performed similarly and had higher achievement than El Salvador (387). El Salvador outperformed Botswana (355), which in turn outperformed Qatar (319), which had higher achievement than Ghana (303).

At both grades, TIMSS 2007 involved countries from around the world and from a wide variety of circumstances. It might then be anticipated that the results would reveal substantial differences in science achievement between the highest- and lowest-performing countries, and this proved to be the case (587 in Singapore compared with 197 in Yemen at fourth grade and 567 in Singapore compared with 303 in Ghana at eighth grade). The percentiles shown in Exhibit 1.1 also show, however, the wide range of achievement within countries. The difference between the 95th and 5th percentiles within countries is often approximately 300 scale points, which is similar to the difference across countries.

TIMSS devoted considerable energy to maximizing comparability across the grades and ages tested, but this is difficult considering the variation internationally in many educational policies, primarily school entry ages and policies concerning retention and promotion from grade to grade. For the most part, TIMSS participants are to assess students in the fourth year of schooling and the eighth year of schooling. However, to avoid testing very young children, the guidelines specify that the average age of the students tested should not be below 9.5 years old for fourth grade or 13.5 years old for eighth grade. Thus, countries where students start school at a very young age assess students at the next higher grade in accordance with the TIMSS guidelines.

Exhibit 1.1 includes the years of formal schooling and average age at time of testing of the students in each country. Every country tested the correct year of schooling in accordance with the TIMSS guidelines, which was the fourth grade and the eighth grade in most countries and why, for the matter of convenience in this report, the students will be referred to as fourth grade students or eighth grade students. It should be noted that five countries (England, Scotland, New Zealand, Malta, and Bosnia and Herzegovina) tested students in their fifth and/or ninth year of schooling in accordance with TIMSS guidelines, because their students start school at a very early age and otherwise would have been very young. Also, both the Russian Federation and Slovenia have been undergoing structural reforms requiring students to start school at a younger age so that students at the fourth and eighth grades would be the same age as students previously were in the third and seventh grades, but having had an additional year of schooling. To monitor this change, these two countries assessed students in the third and seventh years of schooling in previous assessments. The transition has been completed at the fourth grade, but not at the eighth grade where some of the students assessed in these two countries were in the seventh year of schooling.

Given that students typically are in their fourth or eighth year of schooling and the majority begins school at age 6 (see Appendix A), they are expected to be approximately 10 or 14 years old, on average, respectively. This was the case in most countries including the five countries testing students in their fifth and/or ninth years of schooling. In some countries, however, students do not start school until age 7 and, consequently, are expected to be approximately 11 or 15 years old, on average, respectively. Considering the cultural and economic diversity of the TIMSS countries as well as variation in age of entry to school and retention policies, students with the same amount of schooling are of different ages.<sup>5</sup> The interaction among these various factors and achievement is complicated, differing country by country. For example, the TIMSS data show the countries performing above the scale average ranging in students' average age from 9.8 to 11.0 years old at the fourth grade and from 13.8 to 14.9 years at the eighth grade. Students in

5 Martin, M.O., Mullis, I.V.S., & Foy. (2008). Interrelationships among reading achievement, grade level, and age in PIRLS 2006. In C. Papanastasiou (Ed.), *Proceedings of the IEA International Research Conference (IRC): PIRLS volume*. Nicosia, Cyprus: Cyprus University Press.

countries performing below the scale average also range in average age, from 9.7 to 11.2 years at the fourth grade and from 13.8 to 15.8 years at the eighth grade.

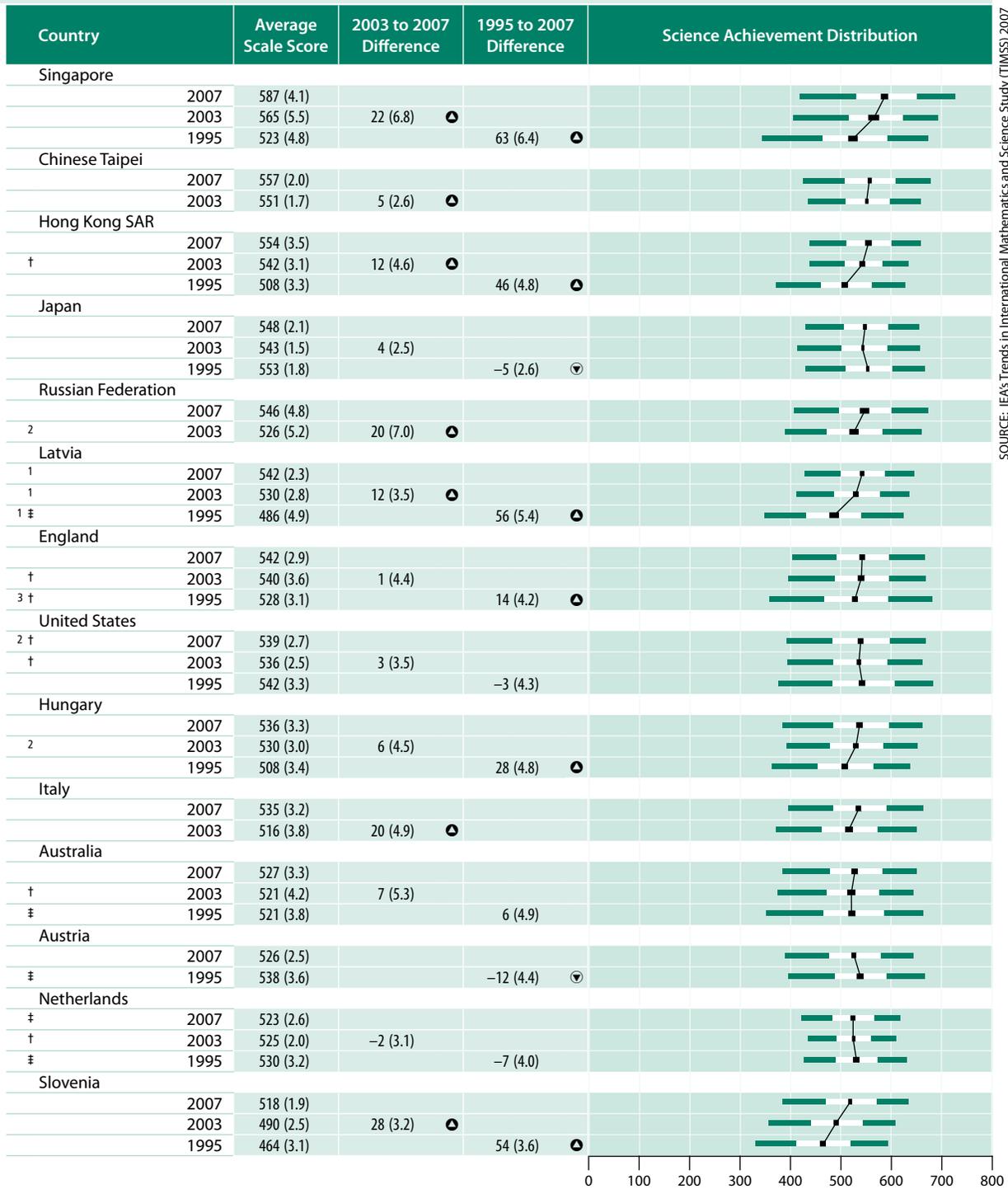
To provide some context about the economic and educational development of the TIMSS participants, Exhibit 1.1 also includes each one's value on the Human Development Index provided by the United Nations Development Programme. The index has a minimum value of 0.0 and a maximum of 1.0. Countries with high values on the index have a long life expectancy, high levels of school enrollment and adult literacy, and a good standard of living, as measured by per capita Gross Domestic Product. Nearly all the TIMSS participants had index values in the 0.7 to 0.9 range, except Botswana and Morocco (0.6) and Ghana and Yemen (0.5). At both grades, the countries performing above the 500 scale average had index values in the 0.8 to 0.9 range (the lowest is Kazakhstan (0.794) at the fourth grade) and those countries with values below 0.8 typically had average achievement below 500. However, not all countries with average achievement below the scale average had low index values. The countries with average achievement significantly below 500 included 3 with index values 0.8 or higher at the fourth grade and 14 at the eighth grade.

### **How Has Science Achievement Changed Since 1995, 1999, and 2003?**

Exhibit 1.3 displays changes in average science achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments at the fourth and eighth grades. The participants are shown in descending order of their average TIMSS 2007 achievement. At the fourth grade, 23 countries and 4 benchmarking participants have data from 1995 and 2003 or from either 1995 or 2003 that can be compared to 2007. There was no fourth grade assessment in TIMSS 1999. Thus, participants at the fourth grade have data from two or three points in time. At the eighth grade, 35 countries and 6 benchmarking participants have data from at least one previous assessment that can be compared with 2007, with 25 countries and 2 benchmarking participants having comparable data from three or all four TIMSS assessments—1995, 1999, 2003, and 2007.

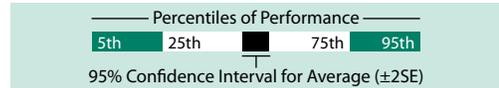
Exhibit 1.3 Trends in Science Achievement – 1995 Through 2007

TIMSS2007  
Science 4<sup>th</sup> Grade



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

▲ 2007 average significantly higher  
▼ 2007 average significantly lower

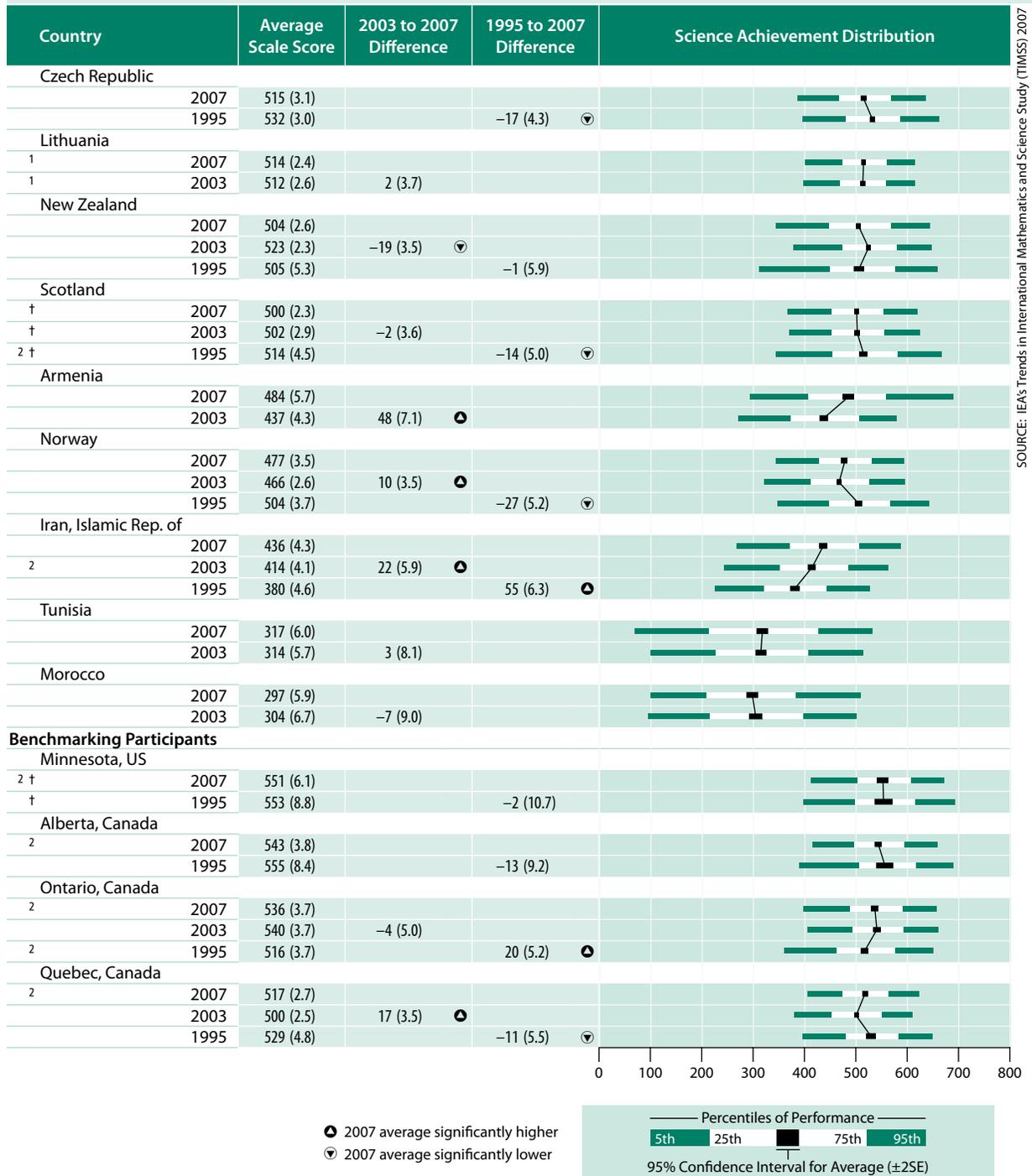


† Met guidelines for sample participation rates only after replacement schools were included.  
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.  
‡ Did not satisfy guidelines for sample participation rates.  
1 National Target Population does not include all of the International Target Population defined by TIMSS.

2 National Defined Population covers 90% to 95% of National Target Population.  
3 National Defined Population covers less than 90% of National Target Population (but at least 77%).  
Trend notes: Data are not shown for Kuwait, because comparable data from previous cycles are not available. Data for Tunisia do not include private schools.  
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit 1.3 Trends in Science Achievement – 1995 Through 2007 (Continued)

TIMSS2007  
Science 4<sup>th</sup> Grade



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

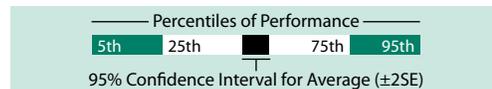
Exhibit 1.3 Trends in Science Achievement – 1995 Through 2007 (Continued)

TIMSS2007  
Science 8<sup>th</sup> Grade



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

▲ 2007 average significantly higher  
▼ 2007 average significantly lower

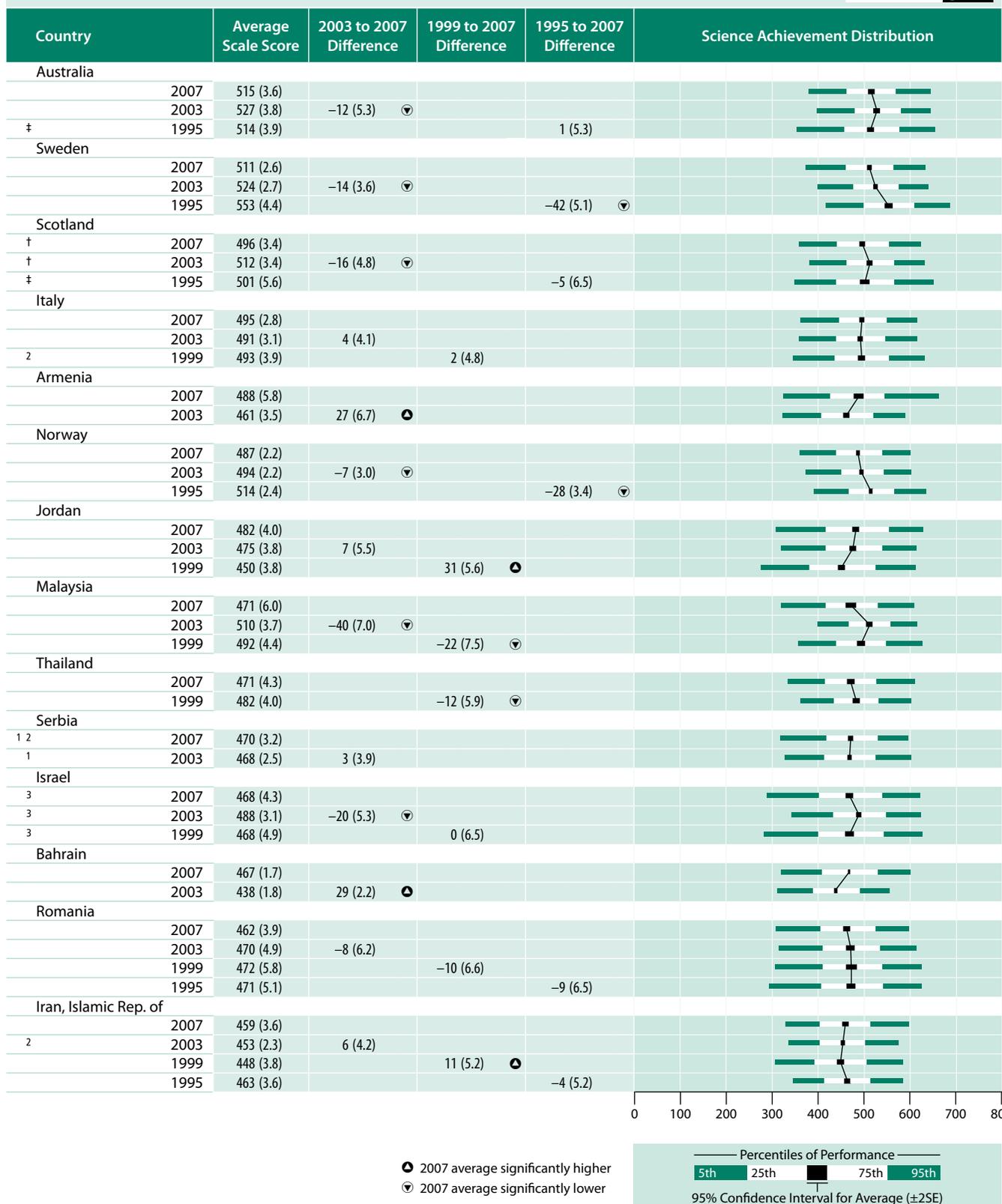


† Met guidelines for sample participation rates only after replacement schools were included.  
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.  
§ Did not satisfy guidelines for sample participation rates.

1 National Target Population does not include all of the International Target Population defined by TIMSS.  
2 National Defined Population covers 90% to 95% of National Target Population.  
3 National Defined Population covers less than 90% of National Target Population (but at least 77%).

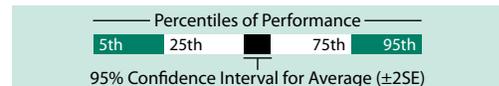
Exhibit 1.3 Trends in Science Achievement – 1995 Through 2007 (Continued)

TIMSS2007  
Science 8<sup>th</sup> Grade



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

▲ 2007 average significantly higher  
▼ 2007 average significantly lower



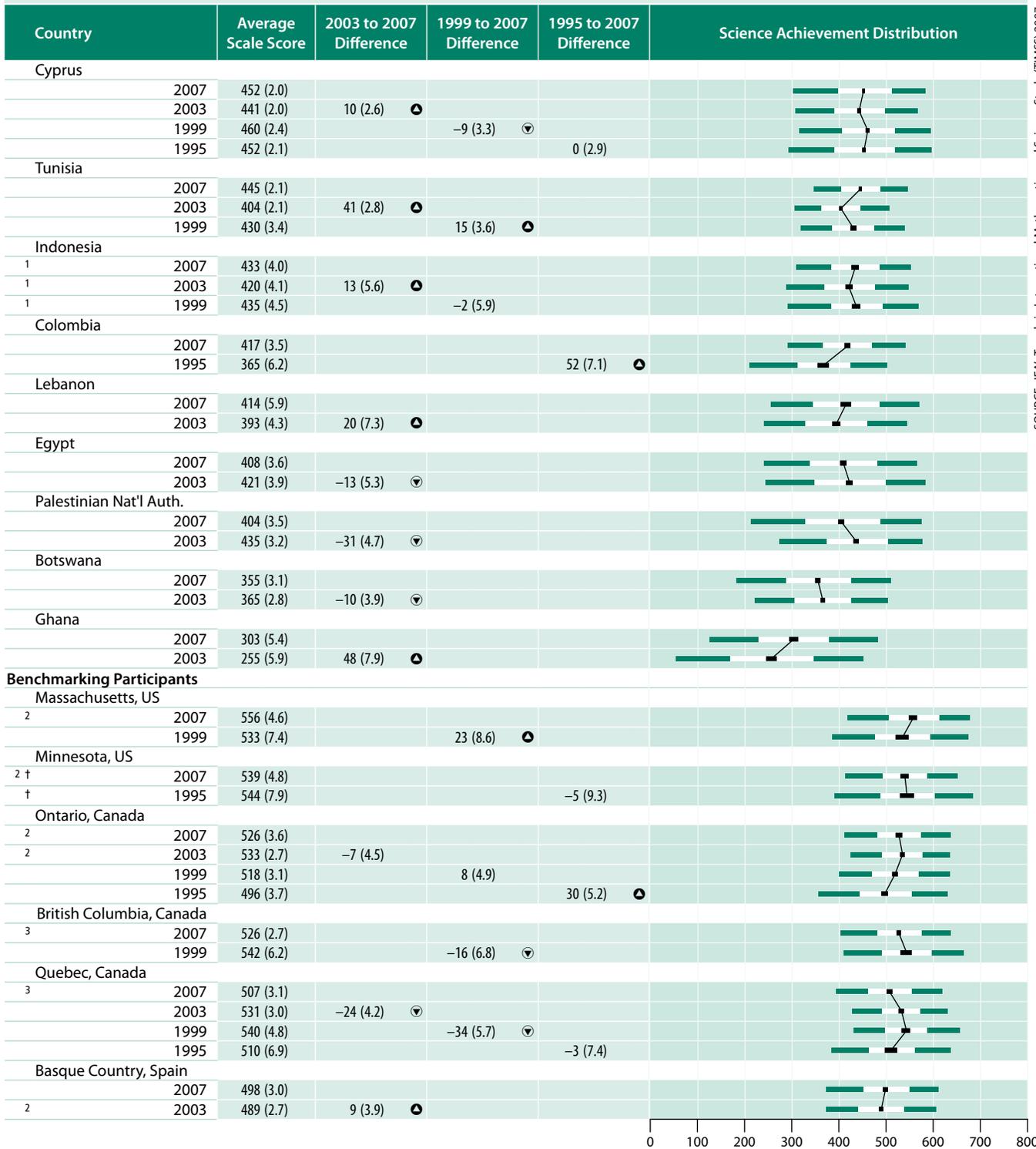
♦ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

Trend notes: Data are not shown for Bulgaria, Kuwait, Morocco, Saudi Arabia, and Turkey, because comparable data from previous cycles are not available. Data for Indonesia do not include Islamic schools.

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

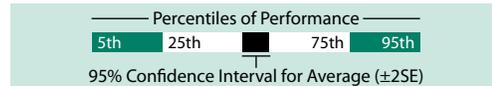
Exhibit 1.3 Trends in Science Achievement – 1995 Through 2007 (Continued)

TIMSS2007  
Science 8<sup>th</sup> Grade



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

▲ 2007 average significantly higher  
▼ 2007 average significantly lower



It is interesting to consider the TIMSS 2007 achievement results in light of the information countries provided in the *TIMSS 2007 Encyclopedia*. For example, the trend results illustrate how TIMSS data can be used to monitor the impact of structural and curricular changes in education systems. Many countries are engaged in implementing important structural, curricular, and instructional reforms. For example, according to ongoing reforms described in the *TIMSS 2007 Encyclopedia*, improvement in the Russian Federation and Slovenia may have been anticipated. As described previously, these two countries have been undergoing structural changes in their educational system that involved adding one more year of schooling at the primary level, as well as associated curricular and instructional reforms. For trend participants, Exhibit A.8 in Appendix A documents the years of formal schooling, average ages, percentages of exclusions, and participation rates for each assessment. In general, these have been relatively stable across the participants from assessment to assessment. However, as mentioned, there have been some structural changes in educational systems.

Looking at trends across all of the participating countries, not taking into account whether countries have participated in two, three, or four cycles (eighth grade) of TIMSS, more showed improvement in average achievement between their first cycle of participation and TIMSS 2007 than declines at both fourth and eighth grades, although the pattern was less pronounced at eighth grade. At the fourth grade, 11 countries had higher average achievement in 2007 than in their first TIMSS assessment, 5 had lower average achievement, and 7 showed no significant change. At the eighth grade, 11 countries had higher average achievement in 2007 than in their initial assessment, 8 lower average achievement, and 16 showed no significant change. Proportionately more countries showed no change at eighth grade than at fourth grade and proportionately fewer countries had higher or lower achievement.

Comparing only across the past 12 years, at the fourth grade, 16 countries have comparison data between 1995 and 2007. Of those, 7 had increased average achievement in 2007 compared to 1995, 4 had similar achievement, and 5 had decreases. At the eighth grade, of the 19 countries with 1995 data,

5 had increased average achievement in 2007, 11 similar achievement, and 3 had decreases. Taking an even closer look at the 12 countries that have trend data between 1995 and 2007 at both grades, this pattern persists, with slightly more improvements at the fourth than the eighth grade. Six of the 12 countries had higher achievement at the fourth grade in 2007 than in 1995 but only 2 showed improvements at the eighth grade (Hong Kong SAR and Slovenia, which also improved at the fourth grade). Eight of the 12 countries showed no achievement difference between 1995 and 2007 at the eighth grade, compared to only two countries (the United States and Australia) at fourth grade. Four of the 12 countries showed a decrease at fourth grade in average achievement between 1995 and 2007, but only two countries (the Czech Republic and Norway) at eighth grade. Thus, even in the same countries, between 1995 and 2007 there has been a tendency toward more improvement than declines at the fourth grade accompanied by less improvement at the eighth grade.

There was a more consistent pattern between fourth and eighth grades in changes between 2003 and 2007, although there were more countries with declines at eighth grade. Looking across countries with trend data between 2003 and 2007, average achievement at the fourth grade either increased (10 countries) or stayed the same (10 countries) in most countries, with only one country having a decrease. At the eighth grade less than one-third of the countries (9) showed improvements, more than one-third (11) stayed the same, and more than one-third (12) showed declines. Among the 17 countries that participated in both grades, the pattern was maintained. At the fourth grade, 9 countries showed improvement and no country had a decline, whereas at the eighth grade, 4 countries had improvements and 5 had declines. There were 8 countries at each grade showing no achievement difference between 2003 and 2007. Five of these (Japan, England, the United States, Hungary, and Lithuania) showed no change at both grades.

At the fourth grade, 7 countries and one benchmarking participant showed higher average science achievement in 2007 than in 1995. Five of these countries had significant improvement from 1995 together with

significant improvement from 2003 to 2007—Singapore, Hong Kong SAR, Latvia, Slovenia, and Iran—suggesting a sustained improvement over the 12-year period from 1995 to 2007. England, Hungary, and the province of Ontario also had higher average achievement in 2007 than 1995, but not between the two most recent assessments, indicating that the gains were essentially between 1995 and 2003. Chinese Taipei and Armenia showed increased average achievement between 2003 and 2007, the two assessments they participated in. The Russian Federation and Italy also showed increased achievement between 2003 and 2007 (although Italy participated in TIMSS 1999 and the Russian Federation in both 1995 and 1999, these countries do not have comparable data from these assessments). Norway and the province of Quebec appear to have partly recovered from a decrease between 1995 and 2003, with significant improvement between 2003 and 2007 partly mitigating the earlier decline. However, average achievement in 2007 was still below that of 1995.

At the fourth grade, 4 countries (in addition to Norway and the province of Quebec described above) had lower average science achievement in 2007 than in 1995. Of these, the decline in Japan and Scotland occurred between 1995 and 2003, whereas Austria and the Czech Republic have previous data only from 1995. In New Zealand, there was an increase between 1995 and 2003 that was offset by a decline between 2003 and 2007. In the United States, Australia, the Netherlands, the state of Minnesota, and the province of Alberta, average science achievement has remained essentially the same since 1995. In Lithuania, Tunisia, and Morocco, average science achievement is basically unchanged since 2003.

At the eighth grade, Korea, Hong Kong SAR, and Lithuania, and the province of Ontario participated in all four assessments and had higher average science achievement in 2007 than in 1995. After a decline from 1999, the Russian Federation improved from 2003 to 2007. Slovenia improved from 1995 to 2007 and from 2003 to 2007. Jordan participated in the 1999, 2003, and 2007 assessments and showed improvement, mostly from 1999 to 2003. Tunisia and Indonesia also participated in these three assessments. Tunisia

improved over this period, but with a decline from 1999 to 2003. Average science achievement in Indonesia was about at the same level in 2007 as in 1999, having recovered from a decline from 1999 to 2003. Armenia, Bahrain, Lebanon, Ghana, and the Basque Country of Spain showed improvement between 2003 and 2007, the two assessments in which they participated. Average achievement increased in Colombia between 1995 and 2007, but it did not participate in the interim assessments. The state of Massachusetts improved between its two assessments in 1999 and 2007.

Average science achievement at the eighth grade remained relatively constant across assessments in Singapore, Japan, England, the United States, Italy, Serbia, Romania, and the state of Minnesota. Also, several countries participating at the eighth grade have had compensating increases and decreases in average science achievement from assessment to assessment. For example, after an initial increase in 1999, Hungary had a decrease in 2003 that essentially balanced it out. Australia had an increase between 1995 and 2003 that was balanced out by a decrease in 2007. Similarly, Israel had an increase between 1999 and 2003 that was balanced out by a decrease in 2007. Cyprus had higher achievement in 2007 than 2003, essentially recovering from a previous decline and returning back to their 1995 level of achievement. After an initial increase, the province of Quebec had decreases in 2003 and 2007, bringing achievement back to their 1995 level.

At the eighth grade, only three countries had lower average science achievement in 2007 than in 1995—the Czech Republic, Sweden, and Norway. In the Czech Republic, the decrease was almost entirely from 1995 to 1999, while in Sweden and Norway there were declines from both 1995 and 2003. Chinese Taipei, Scotland, Egypt, the Palestinian National Authority, and Botswana had decreases from 2003 to 2007. Thailand and the provinces of British Columbia and Quebec had a decrease between 1999 and 2007. Malaysia had lower average achievement in 2007 than in 2003 and in 1999, despite an improvement from 1999 to 2003.

### Trends Across Grades: Fourth to Eighth Grade Cohort Analysis

Because TIMSS is conducted on a four-year cycle, the cohort of students that was assessed in the fourth grade in 2003 had reached the eighth grade by 2007, and thus was assessed as the eighth grade in 2007. This enables the 17 countries and 2 benchmarking participants that assessed both grades in both assessments to examine how their performance relative to each other changed as the fourth grade students of 2003 became the eighth grade students of 2007. The results are presented in Exhibit 1.4, which shows average science achievement as a difference from the TIMSS scale average (500) for the fourth grade students in 2003 (upper-left panel) and in 2007 (top-right panel). The exhibit shows also achievement for the eighth grade students in 2003 (bottom-left panel) and in 2007 (bottom-right panel). The trends for fourth and eighth grade, however, were presented more fully in Exhibit 1.3. The purpose of Exhibit 1.4 is to provide information about relative progress across grades as the cohort of students assessed at the fourth grade in 2003 moved to the eighth grade four years later in 2007. That is, to compare relative performance at the fourth grade in 2003 (upper-left panel) to relative performance at the eighth grade in 2007 (lower-right panel) as indicated by the arrow pointing diagonally downward.

Ten countries, including Singapore, Chinese Taipei, Japan, Hong Kong SAR, England, the United States, Hungary, the Russian Federation, Australia, and Lithuania, as well as the Canadian province of Ontario performed above the scale average at the fourth grade in 2003 and again at the eighth grade in 2007 (although not in the same order of average achievement). Scotland had achievement similar to the scale average in both 2003 and 2007. Armenia, Norway, Iran, and Tunisia also retained the same relative positions, performing below the scale average in the fourth grade in 2003 and again at the eighth grade in 2007. In comparison, Slovenia moved from being below the scale average at the fourth grade in 2003 to being above it at eighth grade in 2007, and the province of Quebec moved from being similar to the scale average at fourth grade in 2003 to above it at eighth grade in 2007. Italy had achievement at the fourth grade above the scale average in 2003, but similar to it at the eighth grade in 2007.

Exhibit 1.4 Cohort Comparison: 2003 Fourth Grade Students in Eighth Grade in 2007

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

2003 – Fourth Grade			2007 – Fourth Grade		
Country	Difference From TIMSS Scale Avg.		Country	Difference From TIMSS Scale Avg.	
Singapore	65 (5.5)	▲	Singapore	87 (4.1)	▲
Chinese Taipei	51 (1.7)	▲	Chinese Taipei	57 (2.0)	▲
Japan	43 (1.5)	▲	Hong Kong SAR	54 (3.5)	▲
Hong Kong SAR	42 (3.1)	▲	Japan	48 (2.1)	▲
England	40 (3.6)	▲	Russian Federation	46 (4.8)	▲
United States	36 (2.5)	▲	England	42 (2.9)	▲
Hungary	30 (3.0)	▲	United States	39 (2.7)	▲
Russian Federation	26 (5.2)	▲	Hungary	36 (3.3)	▲
Australia	21 (4.2)	▲	Italy	35 (3.2)	▲
Italy	16 (3.8)	▲	Australia	27 (3.3)	▲
Lithuania	12 (2.6)	▲	Slovenia	18 (1.9)	▲
Scotland	2 (2.9)	▲	Lithuania	14 (2.4)	▲
Slovenia	-10 (2.5)	▼	Scotland	0 (2.3)	▲
Norway	-34 (2.6)	▼	Armenia	-16 (5.7)	▼
Armenia	-63 (4.3)	▼	Norway	-23 (3.5)	▼
Iran, Islamic Rep. of	-86 (4.1)	▼	Iran, Islamic Rep. of	-64 (4.3)	▼
Tunisia	-186 (5.7)	▼	Tunisia	-182 (5.9)	▼
<b>TIMSS Scale Avg.</b>	<b>500</b>		<b>TIMSS Scale Avg.</b>	<b>500</b>	
<b>Benchmarking Participants</b>			<b>Benchmarking Participants</b>		
Ontario, Canada	40 (3.7)	▲	Ontario, Canada	36 (3.7)	▲
Quebec, Canada	0 (2.5)	▲	Quebec, Canada	17 (2.7)	▲

2003 – Eighth Grade			2007 – Eighth Grade		
Country	Difference From TIMSS Scale Avg.		Country	Difference From TIMSS Scale Avg.	
Singapore	78 (4.3)	▲	Singapore	67 (4.4)	▲
Chinese Taipei	71 (3.5)	▲	Chinese Taipei	61 (3.7)	▲
Hong Kong SAR	56 (3.0)	▲	Japan	54 (1.9)	▲
Japan	52 (1.7)	▲	England	42 (4.5)	▲
England	44 (4.1)	▲	Hungary	39 (2.9)	▲
Hungary	43 (2.8)	▲	Slovenia	38 (2.2)	▲
United States	27 (3.1)	▲	Hong Kong SAR	30 (4.9)	▲
Australia	27 (3.8)	▲	Russian Federation	30 (3.9)	▲
Slovenia	20 (1.8)	▲	United States	20 (2.9)	▲
Lithuania	19 (2.1)	▲	Lithuania	19 (2.5)	▲
Russian Federation	14 (3.7)	▲	Australia	15 (3.6)	▲
Scotland	12 (3.4)	▲	Scotland	-4 (3.4)	▲
Norway	-6 (2.2)	▼	Italy	-5 (2.8)	▲
Italy	-9 (3.1)	▼	Armenia	-12 (5.8)	▼
Armenia	-39 (3.5)	▼	Norway	-13 (2.2)	▼
Iran, Islamic Rep. of	-47 (2.3)	▼	Iran, Islamic Rep. of	-41 (3.6)	▼
Tunisia	-96 (2.1)	▼	Tunisia	-55 (2.1)	▼
<b>TIMSS Scale Avg.</b>	<b>500</b>		<b>TIMSS Scale Avg.</b>	<b>500</b>	
<b>Benchmarking Participants</b>			<b>Benchmarking Participants</b>		
Ontario, Canada	33 (2.7)	▲	Ontario, Canada	26 (3.6)	▲
Quebec, Canada	31 (3.0)	▲	Quebec, Canada	7 (3.1)	▲

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

▲ Country average significantly higher than TIMSS scale average  
▼ Country average significantly lower than TIMSS scale average

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

### What Are the Gender Differences in Science Achievement?

Exhibit 1.5 shows gender differences in fourth- and eighth-grade science achievement in 2007. It presents average achievement separately for girls and boys for the TIMSS 2007 countries and benchmarking participants, as well as the difference between the averages. The difference between the average achievement for girls and for boys is shown by a bar indicating the amount of the difference, whether the direction of the difference was positive for girls or boys, and whether the difference is statistically significant (indicated by a darkened bar). Countries are shown in increasing order of this difference in average achievement between girls and boys. International averages also are shown. These were obtained by averaging across the mean scores for girls in each of the countries and the mean scores for boys in each of the countries. Benchmarking participants were not included in the calculation of the international averages.

At the fourth grade, average science achievement for girls was a little higher than for boys across the participating countries (by three points), although the situation varied from country to country. In more than half the countries (22), the difference in average achievement in science between girls and boys was negligible at the fourth grade. Boys had higher average science achievement than girls in 8 countries, including the Czech and Slovak Republics, the Netherlands, Italy, El Salvador, Austria, Germany, and Colombia. Girls had higher average achievement than boys in 6 countries, including Algeria, Georgia, Armenia, Qatar, Tunisia, and Kuwait. Among the benchmarking participants, boys had higher achievement than girls in the U.S. state of Massachusetts, while girls performed better than boys in Dubai, UAE.

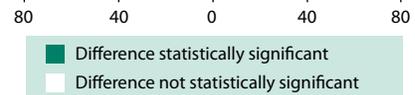
At the eighth grade, on average across the TIMSS 2007 countries, girls had higher average achievement than boys (6 points). Girls had higher achievement than boys in 14 of the participating countries, including Romania, Bulgaria, Cyprus, Egypt, Thailand, Botswana, Georgia, Jordan, the Palestinian National Authority, Saudi Arabia, Kuwait, Oman, Bahrain, and Qatar. Girls had higher average achievement than boys in many, but not all,

Exhibit 1.5 TIMSS 2007 Average Science Achievement by Gender

TIMSS2007  
Science 4<sup>th</sup> Grade

Country	Girls		Boys		Difference (Absolute Value)	Gender Difference	
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher	Boys Scored Higher
Slovenia	49 (0.8)	518 (2.4)	51 (0.8)	518 (2.4)	0 (2.8)		
Singapore	49 (0.8)	587 (4.3)	51 (0.8)	587 (4.4)	0 (3.0)		
Japan	49 (0.6)	548 (2.5)	51 (0.6)	547 (2.4)	1 (2.6)		
<sup>1</sup> Kazakhstan	51 (1.3)	533 (5.5)	49 (1.3)	532 (6.3)	1 (3.6)		
<sup>†</sup> Scotland	51 (0.8)	500 (3.0)	49 (0.8)	501 (2.4)	2 (3.0)		
Sweden	50 (1.0)	526 (2.7)	50 (1.0)	524 (3.7)	2 (2.9)		
Chinese Taipei	48 (0.5)	556 (2.3)	52 (0.5)	558 (2.4)	2 (2.5)		
Ukraine	48 (0.9)	475 (3.4)	52 (0.9)	473 (3.5)	2 (3.1)		
Norway	50 (1.0)	475 (3.8)	50 (1.0)	478 (4.2)	2 (3.9)		
Hungary	51 (1.1)	535 (4.4)	49 (1.1)	538 (3.6)	3 (4.5)		
Hong Kong SAR	49 (1.1)	553 (3.6)	51 (1.1)	556 (4.3)	3 (3.7)		
England	49 (1.0)	543 (3.1)	51 (1.0)	540 (3.4)	3 (3.0)		
Russian Federation	50 (1.0)	548 (5.1)	50 (1.0)	544 (5.0)	4 (3.2)		
<sup>1</sup> Lithuania	49 (1.0)	516 (2.7)	51 (1.0)	512 (2.9)	4 (3.0)		
New Zealand	50 (1.0)	506 (2.8)	50 (1.0)	502 (3.5)	4 (3.5)		
<sup>2</sup> <sup>†</sup> United States	51 (0.6)	536 (3.0)	49 (0.6)	541 (3.1)	5 (2.7)		
Australia	51 (1.0)	525 (4.0)	49 (1.0)	530 (3.5)	5 (3.5)		
<sup>†</sup> Denmark	51 (1.2)	514 (3.2)	49 (1.2)	520 (3.6)	6 (3.9)		
<sup>1</sup> Latvia	48 (1.0)	545 (2.8)	52 (1.0)	539 (3.0)	6 (3.6)		
Czech Republic	47 (1.1)	511 (3.7)	53 (1.1)	518 (3.4)	7 (3.3)		
Slovak Republic	49 (0.8)	521 (5.2)	51 (0.8)	530 (4.8)	8 (2.9)		
Morocco	49 (1.1)	302 (6.4)	51 (1.1)	292 (6.8)	10 (6.1)		
Algeria	50 (0.9)	359 (6.5)	50 (0.9)	349 (6.0)	10 (3.2)		
<sup>1</sup> Georgia	47 (1.0)	423 (4.7)	53 (1.0)	413 (5.1)	10 (3.6)		
<sup>‡</sup> Netherlands	48 (1.0)	518 (3.0)	52 (1.0)	528 (2.8)	11 (2.5)		
Italy	49 (0.7)	529 (3.2)	51 (0.7)	541 (3.7)	13 (2.6)		
El Salvador	49 (1.2)	383 (4.5)	51 (1.2)	396 (4.6)	13 (6.1)		
Austria	48 (1.0)	519 (2.7)	52 (1.0)	532 (2.9)	13 (2.6)		
Iran, Islamic Rep. of	49 (1.7)	443 (5.6)	51 (1.7)	429 (6.0)	14 (7.9)		
Germany	49 (0.6)	520 (2.6)	51 (0.6)	535 (2.9)	15 (2.7)		
Colombia	50 (1.1)	393 (5.5)	50 (1.1)	408 (6.0)	15 (3.7)		
Armenia	48 (0.9)	493 (7.3)	52 (0.9)	476 (5.2)	17 (5.3)		
Yemen	44 (2.7)	209 (9.9)	56 (2.7)	188 (8.1)	21 (10.8)		
Qatar	51 (0.2)	307 (2.9)	49 (0.2)	281 (2.8)	26 (2.7)		
Tunisia	47 (1.0)	335 (6.4)	53 (1.0)	304 (6.2)	31 (4.8)		
<sup>**</sup> Kuwait	52 (1.5)	379 (4.6)	48 (1.5)	315 (7.3)	64 (8.6)		
International Avg.	49 (0.2)	477 (1.2)	51 (0.2)	474 (1.2)	3 (0.7)		
<b>Benchmarking Participants</b>							
<sup>2</sup> Quebec, Canada	51 (0.9)	516 (3.1)	49 (0.9)	518 (3.5)	2 (3.8)		
<sup>2</sup> British Columbia, Canada	49 (0.7)	538 (2.9)	51 (0.7)	536 (3.1)	2 (2.7)		
<sup>2</sup> <sup>†</sup> Minnesota, US	50 (1.5)	549 (6.9)	50 (1.5)	554 (6.3)	5 (5.2)		
<sup>2</sup> Alberta, Canada	48 (1.1)	540 (3.7)	52 (1.1)	545 (4.6)	6 (3.5)		
<sup>2</sup> Ontario, Canada	48 (1.1)	532 (4.1)	52 (1.1)	539 (4.3)	7 (4.0)		
<sup>2</sup> Massachusetts, US	51 (1.0)	566 (4.3)	49 (1.0)	576 (4.7)	10 (2.8)		
<sup>**</sup> <sup>‡</sup> Dubai, UAE	47 (4.7)	473 (4.5)	53 (4.7)	448 (4.9)	26 (8.3)		

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



<sup>†</sup> Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

<sup>‡</sup> Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

<sup>1</sup> National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

<sup>2</sup> National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

<sup>\*\*</sup> Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

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

Exhibit 1.5 TIMSS 2007 Average Science Achievement by Gender (Continued)

TIMSS2007  
Science 8<sup>th</sup> Grade

Country	Girls		Boys		Difference (Absolute Value)	Gender Difference	
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher	Boys Scored Higher
Algeria	49 (0.6)	408 (1.9)	51 (0.6)	408 (2.2)	1 (2.3)		
Norway	49 (0.7)	487 (2.4)	51 (0.7)	486 (3.0)	1 (3.2)		
<sup>1</sup> Lithuania	50 (1.1)	518 (3.2)	50 (1.1)	519 (2.7)	1 (2.9)		
Indonesia	51 (1.0)	426 (3.8)	49 (1.0)	428 (3.6)	2 (3.2)		
Ukraine	52 (0.8)	484 (3.9)	48 (0.8)	486 (3.6)	2 (3.0)		
Slovenia	50 (0.8)	536 (2.6)	50 (0.8)	539 (2.7)	2 (3.0)		
Malta	51 (0.3)	456 (1.8)	49 (0.3)	458 (2.2)	2 (2.9)		
Sweden	48 (0.9)	512 (3.0)	52 (0.9)	510 (2.8)	2 (2.8)		
Bosnia and Herzegovina	49 (0.8)	464 (3.4)	51 (0.8)	467 (2.9)	3 (2.8)		
<sup>1 2</sup> Serbia	49 (0.7)	472 (3.7)	51 (0.7)	469 (3.8)	3 (4.0)		
Japan	50 (1.0)	552 (2.8)	50 (1.0)	556 (2.5)	4 (3.8)		
Chinese Taipei	48 (1.3)	559 (3.7)	52 (1.3)	563 (4.4)	5 (3.5)		
† Hong Kong SAR	50 (1.3)	533 (4.5)	50 (1.3)	528 (6.6)	5 (5.6)		
Turkey	47 (0.8)	457 (4.0)	53 (0.8)	452 (4.0)	5 (3.0)		
† Scotland	51 (1.0)	493 (3.5)	49 (1.0)	498 (4.2)	5 (3.7)		
Russian Federation	52 (0.9)	527 (4.3)	48 (0.9)	533 (4.2)	6 (3.4)		
Lebanon	54 (1.8)	410 (6.2)	46 (1.8)	417 (6.7)	7 (4.9)		
Singapore	49 (0.9)	571 (4.7)	51 (0.9)	563 (5.2)	8 (4.4)		
Korea, Rep. of	48 (2.7)	549 (2.7)	52 (2.7)	557 (2.5)	8 (3.2)		
Italy	48 (0.7)	491 (3.3)	52 (0.7)	499 (3.1)	8 (3.1)		
Armenia	50 (0.9)	492 (7.1)	50 (0.9)	484 (5.2)	8 (4.8)		
Romania	49 (0.9)	466 (4.1)	51 (0.9)	458 (4.6)	8 (4.1)		
† England	51 (1.9)	537 (4.6)	49 (1.9)	546 (5.8)	9 (5.5)		
Czech Republic	48 (0.8)	534 (2.2)	52 (0.8)	543 (2.4)	9 (2.7)		
<sup>3</sup> Israel	53 (1.6)	472 (4.9)	47 (1.6)	463 (5.2)	9 (5.2)		
Malaysia	53 (1.5)	475 (6.4)	47 (1.5)	466 (6.7)	9 (5.5)		
Syrian Arab Republic	52 (1.9)	448 (3.3)	48 (1.9)	457 (4.2)	9 (4.7)		
<sup>2</sup> † United States	51 (0.7)	514 (3.0)	49 (0.7)	526 (3.2)	12 (2.3)		
<sup>3</sup> Bulgaria	47 (1.4)	477 (6.2)	53 (1.4)	464 (6.8)	12 (5.9)		
Iran, Islamic Rep. of	46 (1.5)	466 (4.6)	54 (1.5)	453 (5.4)	12 (7.2)		
Hungary	50 (1.1)	533 (3.5)	50 (1.1)	545 (3.3)	12 (3.3)		
Cyprus	50 (0.6)	460 (2.8)	50 (0.6)	444 (2.4)	16 (3.2)		
Egypt	49 (2.7)	417 (4.8)	51 (2.7)	400 (4.6)	17 (6.3)		
Thailand	50 (1.3)	480 (4.5)	50 (1.3)	462 (4.9)	18 (4.2)		
Australia	48 (1.9)	505 (5.1)	52 (1.9)	524 (5.4)	18 (7.7)		
Tunisia	52 (0.8)	436 (2.3)	48 (0.8)	455 (2.6)	19 (2.4)		
El Salvador	52 (1.4)	377 (3.7)	48 (1.4)	399 (4.1)	22 (5.1)		
Botswana	53 (0.8)	365 (3.7)	47 (0.8)	343 (3.6)	22 (4.1)		
<sup>1</sup> Georgia	50 (1.0)	432 (4.8)	50 (1.0)	410 (5.2)	22 (3.2)		
Ghana	45 (0.8)	288 (5.9)	55 (0.8)	316 (5.6)	29 (4.2)		
Jordan	48 (2.0)	499 (5.8)	52 (2.0)	466 (5.5)	34 (8.2)		
Colombia	51 (1.6)	400 (4.4)	49 (1.6)	435 (3.7)	35 (4.5)		
Palestinian Nat'l Auth.	51 (1.4)	422 (4.5)	49 (1.4)	386 (5.1)	36 (6.5)		
Saudi Arabia	48 (1.6)	426 (2.9)	52 (1.6)	383 (3.9)	43 (4.6)		
♦ Kuwait	54 (2.1)	441 (3.4)	46 (2.1)	391 (4.2)	49 (5.1)		
Oman	52 (2.0)	452 (3.6)	48 (2.0)	391 (4.6)	61 (5.9)		
Bahrain	49 (0.4)	499 (1.9)	51 (0.4)	437 (2.6)	62 (3.0)		
Qatar	50 (0.2)	354 (2.3)	50 (0.2)	284 (2.3)	70 (3.1)		
‡ Morocco	53 (1.3)	403 (3.7)	47 (1.3)	401 (3.6)	2 (4.5)		
<b>International Avg.</b>	<b>50 (0.2)</b>	<b>469 (0.8)</b>	<b>50 (0.2)</b>	<b>463 (0.7)</b>	<b>6 (0.7)</b>		
<b>Benchmarking Participants</b>							
<sup>3</sup> British Columbia, Canada	51 (1.1)	523 (2.9)	49 (1.1)	529 (3.3)	7 (3.1)		
<sup>2</sup> † Minnesota, US	52 (1.3)	535 (4.3)	48 (1.3)	542 (6.1)	7 (4.4)		
<sup>3</sup> Quebec, Canada	49 (1.5)	503 (3.3)	51 (1.5)	511 (4.1)	8 (4.2)		
<sup>2</sup> Ontario, Canada	50 (1.1)	521 (3.8)	50 (1.1)	531 (4.3)	10 (3.6)		
<sup>2</sup> Massachusetts, US	50 (1.0)	551 (5.1)	50 (1.0)	561 (5.0)	11 (4.3)		
♦ ‡ Dubai, UAE	49 (4.8)	495 (5.1)	51 (4.8)	483 (6.1)	11 (9.9)		
Basque Country, Spain	48 (1.7)	490 (3.6)	52 (1.7)	505 (3.9)	15 (4.7)		

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Did not satisfy guidelines for sample participation rates (see Appendix A).

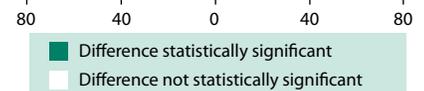
<sup>1</sup> National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

<sup>2</sup> National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

<sup>3</sup> National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).

♦ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

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



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

of the countries in the Middle East. Boys had higher achievement than girls in 11 countries, including Korea, Italy, the Czech Republic, the Syrian Arab Republic, the United States, Hungary, Australia, Tunisia, El Salvador, Ghana, and Colombia, as well as in 2 Canadian provinces, British Columbia and Ontario, the U.S. state of Massachusetts, and the Basque Country of Spain.

Exhibit 1.6 shows changes in average achievement separately for boys and girls. At the fourth grade, changes are shown between 2003 and 2007 and between 1995 and 2007 (fourth grade was not assessed in 1999). Across the TIMSS participants, fourth grade girls showed improvement in 7 countries compared to 1995. In 3 of these countries, Latvia, Singapore, and Slovenia, there also was improvement from 2003 to 2007. Also, girls in Armenia, Chinese Taipei, Italy, Japan, the Russian Federation, and Tunisia, as well as the province of Quebec, had higher average science achievement in 2007 than in 2003. Girls had decreased average achievement across the 12-year period in Austria, the Czech Republic, Norway, and Scotland, and from 2003 to 2007 in New Zealand.

Fourth grade boys often showed increases or decreases in achievement in the same countries as girls, indicating overall trends typically were reflected in trends for both sexes. The most notable exceptions to this pattern were in Japan and the Netherlands, where boys showed decreases between 1995 and 2007 compared to no change for girls, and Tunisia, where boys had no change from 2003 while girls had an increase.

At the eighth grade, looking at the changes by gender between 1995 and 2007, girls had increases in average achievement in 8 countries and one province, and declines in 2 countries. The increases were in Colombia, England, Hong Kong SAR, Iran, Japan, Korea, Lithuania, Slovenia, and the Canadian province of Ontario; and girls in these countries did not show declines between the intervening assessments except for Hong Kong SAR.

In addition to these changes, girls also had increases between 1999 and 2007 in the Czech Republic, Jordan, Tunisia, and the U.S. state of Massachusetts. Countries showing improvement for girls only from 2003 to 2007 included Armenia, Bahrain, Cyprus, Ghana, Indonesia, Lebanon, and the Russian Federation.

There were fewer countries with improvements for boys than for girls. Only 3 countries and one province had an increase for boys from 1995 to 2007, compared with 9 countries with a decrease. The increases were in Colombia, Lithuania, Slovenia, and the province of Ontario. Participants with increases for boys from 1999 to 2007 included Jordan and Tunisia, as well as the state of Massachusetts, while countries with increases from 2003 to 2007 included Armenia, Bahrain, Ghana, Lebanon, and the Russian Federation.

The two countries with declines from 1995 to 2007 in average achievement for girls at the eighth grade were Norway and Sweden. In addition to these, however, Chinese Taipei, Hong Kong SAR, Malaysia, the Palestinian National Authority, and Scotland had decreases for girls from 2003, and the Canadian provinces of British Columbia and Quebec had decreases from 1999.

The 9 countries with a decrease from 1995 to 2007 in average achievement for boys at the eighth grade included Cyprus, the Czech Republic, Iran, Japan, Norway, Romania, Scotland, Singapore, and Sweden. A further 4 countries (Chinese Taipei, Hungary, Malaysia, and Thailand) and the province of Quebec had a decrease from 1999, and a further 7 countries a decrease from 2003 (Botswana, Egypt, Hong Kong SAR, Israel, Korea, the Palestinian National Authority, and the United States).

Exhibit 1.6 Trends in Average Science Achievement by Gender – 1995 Through 2007

TIMSS2007  
Science 4<sup>th</sup> Grade

Country	Girls			Boys		
	2007 Average Scale Score	2003 to 2007 Difference	1995 to 2007 Difference	2007 Average Scale Score	2003 to 2007 Difference	1995 to 2007 Difference
Armenia	493 (7.3)	52 (8.6) ▲	◇ ◇	476 (5.2)	44 (7.0) ▲	◇ ◇
Australia	525 (4.0)	3 (5.5)	6 (5.4)	530 (3.5)	11 (6.5)	6 (6.0)
Austria	519 (2.7)	◇ ◇	-11 (5.2) ▼	532 (2.9)	◇ ◇	-13 (5.1) ▼
Chinese Taipei	556 (2.3)	8 (3.1) ▲	◇ ◇	558 (2.4)	3 (3.3)	◇ ◇
Czech Republic	511 (3.7)	◇ ◇	-12 (5.1) ▼	518 (3.4)	◇ ◇	-22 (4.8) ▼
England	543 (3.1)	1 (4.5)	18 (4.7) ▲	540 (3.4)	2 (5.7)	10 (5.2)
Hong Kong SAR	553 (3.6)	9 (4.9)	52 (5.0) ▲	556 (4.3)	15 (5.3) ▲	41 (5.8) ▲
Hungary	535 (4.4)	8 (5.8)	34 (5.8) ▲	538 (3.6)	5 (4.9)	22 (5.3) ▲
Iran, Islamic Rep. of	443 (5.6)	17 (8.9)	66 (7.8) ▲	429 (6.0)	22 (7.6) ▲	46 (9.5) ▲
Italy	529 (3.2)	15 (5.3) ▲	--	541 (3.7)	24 (5.3) ▲	--
Japan	548 (2.5)	6 (3.1) ▲	1 (3.2)	547 (2.4)	2 (3.1)	-12 (3.2) ▼
Latvia	545 (2.8)	11 (4.0) ▲	58 (6.3) ▲	539 (3.0)	13 (4.8) ▲	54 (6.2) ▲
Lithuania	516 (2.7)	3 (4.0)	◇ ◇	512 (2.9)	-1 (4.1)	◇ ◇
Morocco	302 (6.4)	-3 (10.2)	◇ ◇	292 (6.8)	-11 (9.6)	◇ ◇
Netherlands	518 (3.0)	-3 (3.7)	-1 (4.5)	528 (2.8)	-1 (3.6)	-15 (4.8) ▼
New Zealand	506 (2.8)	-19 (4.2) ▼	-5 (5.6)	502 (3.5)	-19 (4.2) ▼	3 (7.8)
Norway	475 (3.8)	8 (5.0)	-21 (5.3) ▼	478 (4.2)	12 (5.1) ▲	-32 (6.4) ▼
Russian Federation	548 (5.1)	21 (7.8) ▲	◇ ◇	544 (5.0)	19 (7.0) ▲	◇ ◇
Scotland	500 (3.0)	3 (4.4)	-12 (5.4) ▼	501 (2.4)	-6 (4.6)	-15 (5.8) ▼
Singapore	587 (4.3)	21 (6.9) ▲	66 (7.3) ▲	587 (4.4)	22 (7.8) ▲	61 (6.9) ▲
Slovenia	518 (2.4)	27 (3.8) ▲	60 (4.1) ▲	518 (2.4)	28 (4.0) ▲	49 (4.8) ▲
Tunisia	334 (6.5)	18 (8.9) ▲	◇ ◇	302 (6.2)	-10 (8.6)	◇ ◇
United States	536 (3.0)	3 (3.9)	1 (4.7)	541 (3.1)	3 (4.1)	-7 (4.5)
<b>Benchmarking Participants</b>						
Alberta, Canada	540 (3.7)	◇ ◇	-12 (9.8)	545 (4.6)	◇ ◇	-13 (9.7)
Minnesota, US	549 (6.9)	◇ ◇	-8 (12.6)	554 (6.3)	◇ ◇	4 (11.2)
Ontario, Canada	532 (4.1)	-5 (5.7)	19 (5.8) ▲	539 (4.3)	-4 (6.3)	21 (6.0) ▲
Quebec, Canada	516 (3.1)	16 (4.1) ▲	-8 (6.1)	518 (3.5)	18 (4.7) ▲	-14 (7.2) ▼

- ▲ 2007 average significantly higher  
▼ 2007 average significantly lower

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

Trend notes: Data are not shown for Kuwait, because comparable data from previous cycles are not available. Data for Tunisia do not include private schools.

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

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

A diamond (◇) indicates the country did not participate in the assessment.

**Exhibit 1.6 Trends in Average Science Achievement by Gender – 1995 Through 2007 (Continued)**

**TIMSS2007**  
Science **8<sup>th</sup>** Grade

Country	Girls				Boys			
	2007 Average Scale Score	2003 to 2007 Difference	1999 to 2007 Difference	1995 to 2007 Difference	2007 Average Scale Score	2003 to 2007 Difference	1999 to 2007 Difference	1995 to 2007 Difference
Armenia	492 (7.1)	25 (8.2) ▲	0 0	0 0	484 (5.2)	29 (6.2) ▲	0 0	0 0
Australia	505 (5.1)	-12 (6.9)	--	-2 (6.4)	524 (5.4)	-14 (7.1)	--	4 (7.6)
Bahrain	499 (1.9)	46 (3.3) ▲	0 0	0 0	437 (2.6)	14 (3.5) ▲	0 0	0 0
Botswana	365 (3.7)	1 (4.9)	0 0	0 0	343 (3.6)	-23 (4.9) ▼	0 0	0 0
Chinese Taipei	559 (3.7)	-12 (5.3) ▼	-2 (5.4)	0 0	563 (4.4)	-8 (5.8)	-14 (7.2) ▼	0 0
Colombia	400 (4.4)	0 0	0 0	48 (7.9) ▲	435 (3.7)	0 0	0 0	56 (9.3) ▲
Cyprus	460 (2.8)	16 (3.6) ▲	5 (4.2)	6 (4.0)	444 (2.4)	4 (3.6)	-22 (3.8) ▼	-7 (3.4) ▼
Czech Republic	534 (2.2)	0 0	11 (5.3) ▲	-3 (6.1)	543 (2.4)	0 0	-13 (5.4) ▼	-28 (5.3) ▼
Egypt	417 (4.8)	-5 (6.8)	0 0	0 0	400 (4.6)	-21 (7.2) ▼	0 0	0 0
England	537 (4.6)	0 (6.6)	15 (7.7) ▲	15 (6.1) ▲	546 (5.8)	-4 (7.7)	-8 (7.8)	3 (8.4)
Ghana	288 (5.9)	51 (8.7) ▲	0 0	0 0	316 (5.6)	45 (8.6) ▲	0 0	0 0
Hong Kong SAR	533 (4.5)	-19 (5.7) ▼	10 (6.3)	41 (8.0) ▲	528 (6.6)	-33 (7.6) ▼	-9 (8.3)	3 (9.1)
Hungary	533 (3.5)	3 (4.9)	-7 (5.3)	8 (5.1)	545 (3.3)	-10 (4.4) ▼	-20 (5.6) ▼	-3 (4.8)
Indonesia	432 (4.3)	18 (5.8) ▲	5 (7.7)	0 0	435 (4.4)	9 (6.4)	-10 (6.5)	0 0
Iran, Islamic Rep. of	466 (4.6)	12 (6.1)	36 (7.3) ▲	18 (7.4) ▲	453 (5.4)	0 (6.6)	-7 (7.0)	-22 (7.1) ▼
Israel	472 (4.9)	-7 (5.9)	11 (7.8)	--	463 (5.2)	-35 (6.7) ▼	-12 (7.6)	--
Italy	491 (3.3)	5 (4.3)	7 (5.3)	--	499 (3.1)	3 (4.9)	-3 (6.4)	--
Japan	552 (2.8)	4 (4.1)	9 (4.0) ▲	7 (3.4) ▲	556 (2.5)	-1 (3.7)	-1 (4.4)	-8 (3.4) ▼
Jordan	499 (5.8)	11 (7.3)	40 (7.7) ▲	0 0	466 (5.5)	4 (7.9)	24 (8.1) ▲	0 0
Korea, Rep. of	549 (2.7)	-3 (3.4)	11 (4.8) ▲	19 (3.7) ▲	557 (2.5)	-7 (3.1) ▼	-2 (4.1)	-2 (3.8)
Lebanon	410 (6.2)	18 (7.9) ▲	0 0	0 0	417 (6.7)	23 (9.0) ▲	0 0	0 0
Lithuania	518 (3.2)	2 (4.2)	40 (5.5) ▲	66 (5.4) ▲	519 (2.7)	-3 (3.6)	20 (5.7) ▲	42 (5.2) ▲
Malaysia	475 (6.4)	-30 (7.8) ▼	-13 (8.5)	0 0	466 (6.7)	-49 (7.9) ▼	-32 (8.9) ▼	0 0
Norway	487 (2.4)	-2 (3.3)	0 0	-18 (3.5) ▼	486 (3.0)	-12 (4.2) ▼	0 0	-37 (4.6) ▼
Palestinian Nat'l Auth.	422 (4.5)	-19 (5.8) ▼	0 0	0 0	386 (5.1)	-42 (7.3) ▼	0 0	0 0
Romania	466 (4.1)	1 (6.8)	-2 (7.6)	2 (6.7)	458 (4.6)	-16 (6.8) ▼	-18 (7.9) ▼	-20 (7.3) ▼
Russian Federation	527 (4.3)	18 (5.6) ▲	7 (8.3)	11 (6.2)	533 (4.2)	14 (5.9) ▲	-7 (7.5)	2 (6.6)
Scotland	493 (3.5)	-13 (5.3) ▼	0 0	6 (6.2)	498 (4.2)	-19 (5.5) ▼	0 0	-16 (7.9) ▼
Serbia	472 (3.7)	7 (4.7)	0 0	0 0	469 (3.8)	-2 (4.6)	0 0	0 0
Singapore	571 (4.7)	-5 (6.1)	14 (9.2)	-3 (8.1)	563 (5.2)	-16 (7.2) ▼	-14 (11.0)	-23 (8.7) ▼
Slovenia	536 (2.6)	19 (3.5) ▲	--	32 (3.8) ▲	539 (2.7)	15 (3.6) ▲	--	15 (4.3) ▲
Sweden	512 (3.0)	-9 (4.4)	0 0	-34 (5.6) ▼	510 (2.8)	-19 (3.9) ▼	0 0	-49 (5.6) ▼
Thailand	480 (4.5)	0 0	-1 (6.4)	--	462 (4.9)	0 0	-22 (6.6) ▼	--
Tunisia	436 (2.3)	43 (3.3) ▲	19 (4.0) ▲	0 0	455 (2.6)	39 (3.7) ▲	13 (5.1) ▲	0 0
United States	514 (3.0)	-5 (4.5)	9 (5.5)	9 (6.2)	526 (3.2)	-10 (4.6) ▼	1 (6.3)	6 (6.8)
<b>Benchmarking Participants</b>								
Basque Country, Spain	490 (3.6)	9 (4.7)	0 0	0 0	505 (3.9)	9 (5.1)	0 0	0 0
British Columbia, Canada	523 (2.9)	0 0	-16 (7.0) ▼	0 0	529 (3.3)	0 0	-15 (7.8)	0 0
Massachusetts, US	551 (5.1)	0 0	24 (9.1) ▲	0 0	561 (5.0)	0 0	22 (9.4) ▲	0 0
Minnesota, US	535 (4.3)	0 0	0 0	1 (9.2)	542 (6.1)	0 0	0 0	-11 (11.3)
Ontario, Canada	521 (3.8)	-4 (4.9)	13 (5.1) ▲	33 (5.2) ▲	531 (4.3)	-10 (5.1)	3 (5.5)	25 (6.4) ▲
Quebec, Canada	503 (3.3)	-19 (5.0) ▼	-33 (7.4) ▼	-3 (8.5)	511 (4.1)	-30 (5.2) ▼	-34 (6.3) ▼	-4 (8.6)

▲ 2007 average significantly higher  
▼ 2007 average significantly lower

Trend notes: Data are not shown for Bulgaria, Kuwait, Morocco, Saudi Arabia, and Turkey, because comparable data from previous cycles are not available. Data for Indonesia do not include Islamic schools.

A dash (–) indicates comparable data are not available.  
A diamond (0) indicates the country did not participate in the assessment.

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

