Science Grade 8

Average Science Achievement

Average Achievement and Scale Score Distributions

The TIMSS 2019 eighth grade science assessment was based on a comprehensive assessment framework developed collaboratively with the participating countries to reflect their curricular goals. The eighth grade science assessment included four content areas—biology (35%), chemistry (20%), physics (25%), and Earth science (20%). In accordance with the framework, the majority of TIMSS 2019 science items assessed eighth grade students' applying and reasoning skills, and there is a cross-cutting inquiry strand. To cover the framework at the eighth grade, the TIMSS 2019 science assessment comprised 220 assessment items. This cycle marked the beginning of the transition to a computer-based assessment system. More than half of the TIMSS 2019 countries administered the assessment in an "e" (electronic) format and almost half administered the assessment in a paper format, as in TIMSS 2015. The "e" countries also administered the trend items in the paper format to provide a bridge to the TIMSS 2015 and TIMSS 2019 paper-based assessments. The assessment was carefully designed and analyzed, so that the TIMSS 2019 science achievement results for all 39 countries are reported on the same TIMSS eighth grade science scale.

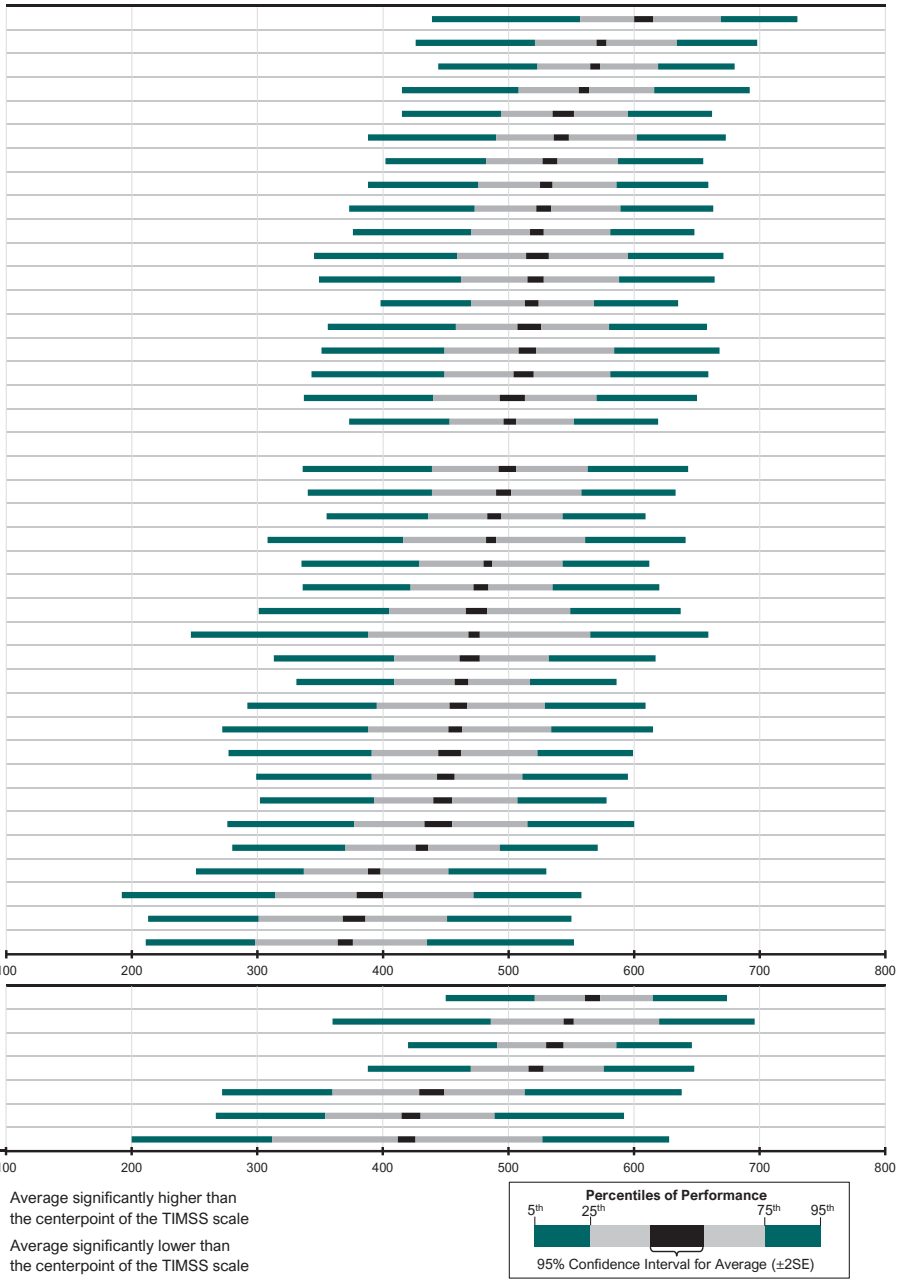
Exhibit 4.1 presents the average achievement at the eighth grade for each participating country (from highest to lowest) together with the scale score distribution underlying the average scale score. Exhibit 4.2 shows whether relatively small differences in average achievement between one country and the next are statistically significant.

Singapore had the highest average achievement, followed by Chinese Taipei and Japan, whose students performed similarly and had higher average achievement than all of the other countries. These three countries were followed by Korea, whose eighth grade students had higher average achievement than students in all of the other countries except the three top-performing countries. Next, the Russian Federation and Finland, followed by Lithuania, and then by Hungary and Australia, and then Ireland and the United States, all performed very well. Essentially, Exhibit 4.2 shows clusters of several similarly performing countries, followed by the next highest achieving clusters of similarly performing countries, and so on.

A number of eighth grade TIMSS 2019 participants performed well. Sixteen countries (including those discussed above) had higher average achievement than the centerpoint of 500 (Exhibit 4.1), which is a point of reference on the TIMSS eighth grade science scale that remains constant from TIMSS assessment to TIMSS assessment. However, there was a considerable difference between the highest average achievement and the lowest. Also, the scale score distributions in Exhibit 4.1 show that there is wide variation in achievement in every country. Every country has some higher achieving and some lower achieving students.

Exhibit 4.1: Average Science Achievement and Scale Score Distributions

Country	Average Scale Score	
[2] Singapore	608 (3.9)	▲
Chinese Taipei	574 (1.9)	▲
Japan	570 (2.1)	▲
Korea, Rep. of	561 (2.1)	▲
[2] Russian Federation	543 (4.2)	▲
Finland	543 (3.1)	▲
Lithuania	534 (3.0)	▲
Hungary	530 (2.6)	▲
Australia	528 (3.2)	▲
Ireland	523 (2.9)	▲
† United States	522 (4.7)	▲
[2] Sweden	521 (3.2)	▲
Portugal	519 (2.9)	▲
England	517 (4.8)	▲
Turkey	515 (3.7)	▲
[3] Israel	513 (4.2)	▲
† Hong Kong SAR	504 (5.2)	
Italy	500 (2.6)	
TIMSS Scale Centerpoint	**500**	
† New Zealand	499 (3.5)	
† Norway (9)	495 (3.1)	
France	489 (2.7)	▽
Bahrain	486 (1.9)	▽
Cyprus	484 (1.9)	▽
[2] Kazakhstan	478 (3.1)	▽
Qatar	475 (4.4)	▽
United Arab Emirates	473 (2.2)	▽
Romania	470 (4.2)	▽
Chile	462 (2.9)	▽
Malaysia	460 (3.5)	▽
Oman	457 (2.9)	▽
Jordan	452 (4.7)	▽
Iran, Islamic Rep. of	449 (3.6)	▽
[1] Georgia	447 (3.9)	▽
Kuwait	444 (5.7)	▽
[2] Saudi Arabia	431 (2.6)	▽
Morocco	394 (2.7)	▽
[2] Egypt	389 (5.4)	▽
Lebanon	377 (4.6)	▽
Ψ South Africa (9)	370 (3.1)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	567 (2.9)	▲
[2] Dubai, UAE	548 (2.0)	▲
‡ Quebec, Canada	537 (3.6)	▲
Ontario, Canada	522 (3.0)	▲
Western Cape, RSA (9)	439 (5.1)	▽
Gauteng, RSA (9)	422 (3.9)	▽
Abu Dhabi, UAE	420 (3.6)	▽



The TIMSS achievement scale was established in 1995 based on the combined achievement distribution of all countries that participated in TIMSS 1995. To provide a point of reference for country comparisons, the scale centerpoint of 500 was located at the mean of the combined achievement distribution. The units of the scale were chosen so that 100 scale score points corresponded to the standard deviation of the distribution.

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.2: Significance of Differences Between Countries' Average Science Achievement

Read across the row for a country to compare performance with the countries listed along the top of the chart. If no statistically significant difference was found, no symbol is present. If the difference is significant ($p < 0.05$), a symbol indicates whether the estimated achievement of the country in the row is higher (▲) than that of the comparison country, or lower (▽).

Country	Average Scale Score	Singapore	Chinese Taipei	Japan	Korea, Rep. of	Russian Federation	Finland	Lithuania	Hungary	Australia	Ireland	United States	Sweden	Portugal	England	Turkey	Israel	Hong Kong SAR	Italy	New Zealand	Norway (9)	France	Bahrain	Cyprus	Kazakhstan	Qatar	United Arab Emirates	Romania	Chile	Malaysia	Oman	Jordan	Iran, Islamic Rep. of	Georgia	Kuwait
Singapore	608 (3.9)		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	574 (1.9)	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	570 (2.1)	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	561 (2.1)	▽	▽	▽		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	543 (4.2)	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	543 (3.1)	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	534 (3.0)	▽	▽	▽	▽		▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	530 (2.6)	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	528 (3.2)	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ireland	523 (2.9)	▽	▽	▽	▽	▽	▽	▽									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	522 (4.7)	▽	▽	▽	▽	▽	▽	▽									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	521 (3.2)	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Portugal	519 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	517 (4.8)	▽	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Turkey	515 (3.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	513 (4.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong SAR	504 (5.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	500 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	499 (3.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway (9)	495 (3.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
France	489 (2.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bahrain	486 (1.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	484 (1.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲
Kazakhstan	478 (3.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲
Qatar	475 (4.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲
United Arab Emirates	473 (2.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲
Romania	470 (4.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲
Chile	462 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲
Malaysia	460 (3.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲
Oman	457 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲
Jordan	452 (4.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽							
Iran, Islamic Rep. of	449 (3.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽					
Georgia	447 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				
Kuwait	444 (5.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				
Saudi Arabia	431 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Morocco	394 (2.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Egypt	389 (5.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Lebanon	377 (4.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
South Africa (9)	370 (3.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Benchmarking Participants																																			
Moscow City, Russian Fed.	567 (2.9)	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Dubai, UAE	548 (2.0)	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec, Canada	537 (3.6)	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario, Canada	522 (3.0)	▽	▽	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Western Cape, RSA (9)	439 (5.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				
Gauteng, RSA (9)	422 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Abu Dhabi, UAE	420 (3.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽

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

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.2: Significance of Differences Between Countries' Average Science Achievement

(Continued)

Country	Average Scale Score	Saudi Arabia	Morocco	Egypt	Lebanon	South Africa (9)	Benchmarking Participants	Moscow City, Russian Fed.	Dubai, UAE	Quebec, Canada	Ontario, Canada	Western Cape, RSA (9)	Gauteng, RSA (9)	Abu Dhabi, UAE
Singapore	608 (3.9)	▲	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	574 (1.9)	▲	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲
Japan	570 (2.1)	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	▲
Korea, Rep. of	561 (2.1)	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	▲
Russian Federation	543 (4.2)	▲	▲	▲	▲	▲		▽			▲	▲	▲	▲
Finland	543 (3.1)	▲	▲	▲	▲	▲		▽			▲	▲	▲	▲
Lithuania	534 (3.0)	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲	▲
Hungary	530 (2.6)	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲	▲
Australia	528 (3.2)	▲	▲	▲	▲	▲		▽	▽			▲	▲	▲
Ireland	523 (2.9)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
United States	522 (4.7)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Sweden	521 (3.2)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Portugal	519 (2.9)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
England	517 (4.8)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Turkey	515 (3.7)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Israel	513 (4.2)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Hong Kong SAR	504 (5.2)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Italy	500 (2.6)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
New Zealand	499 (3.5)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Norway (9)	495 (3.1)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
France	489 (2.7)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Bahrain	486 (1.9)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Cyprus	484 (1.9)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Kazakhstan	478 (3.1)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Qatar	475 (4.4)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
United Arab Emirates	473 (2.2)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Romania	470 (4.2)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Chile	462 (2.9)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Malaysia	460 (3.5)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Oman	457 (2.9)	▲	▲	▲	▲	▲		▽	▽	▽	▽	▲	▲	▲
Jordan	452 (4.7)	▲	▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Iran, Islamic Rep. of	449 (3.6)	▲	▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Georgia	447 (3.9)	▲	▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Kuwait	444 (5.7)	▲	▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Saudi Arabia	431 (2.6)		▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Morocco	394 (2.7)	▽			▲	▲		▽	▽	▽	▽	▽	▽	▽
Egypt	389 (5.4)	▽				▲		▽	▽	▽	▽	▽	▽	▽
Lebanon	377 (4.6)	▽	▽					▽	▽	▽	▽	▽	▽	▽
South Africa (9)	370 (3.1)	▽	▽	▽				▽	▽	▽	▽	▽	▽	▽
Benchmarking Participants														
Moscow City, Russian Fed.	567 (2.9)	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	▲
Dubai, UAE	548 (2.0)	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲	▲
Quebec, Canada	537 (3.6)	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲	▲
Ontario, Canada	522 (3.0)	▲	▲	▲	▲	▲		▽	▽	▽		▲	▲	▲
Western Cape, RSA (9)	439 (5.1)		▲	▲	▲	▲		▽	▽	▽	▽		▲	▲
Gauteng, RSA (9)	422 (3.9)	▽	▲	▲	▲	▲		▽	▽	▽	▽	▽		
Abu Dhabi, UAE	420 (3.6)	▽	▲	▲	▲	▲		▽	▽	▽	▽	▽		

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

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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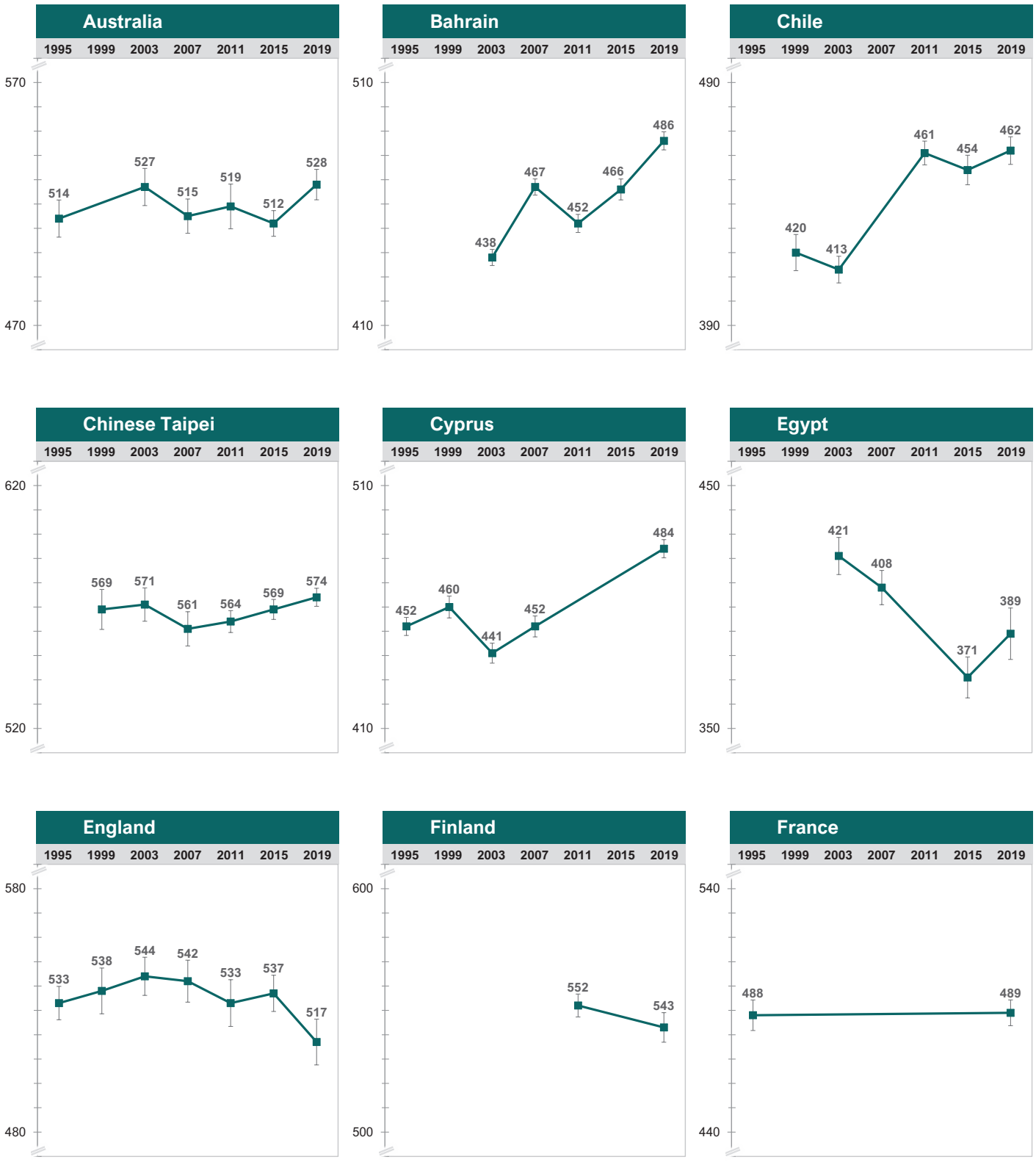
Trends in Average Achievement

Exhibit 4.3 graphs the differences in average science achievement between the assessments for TIMSS 2019 countries that have comparable data from previous assessments, while Exhibit 4.4 provides more details. The countries are presented in alphabetical order in both exhibits. The trends in science achievement at the eighth grade signal more improvements than downturns across the assessment cycles internationally. However, across the seven assessment cycles since 1995, most countries have had some periods of increases and decreases in average achievement as well as periods of stability.

Most recently, for the 33 countries that participated in both TIMSS 2015 and 2019, 11 had increases in average achievement and 5 had declines. Looking at trends between 2007 and 2019 as well as between 1995 and 2019 also shows moderate progress in average science achievement at the eighth grade over the long term, with more countries having increases than decreases. In 2019 compared with 2007, for the 23 countries in both assessments, there were 12 increases and 6 decreases. In 2019 compared with 1995, for the 18 countries in both assessments, there were 8 increases and 4 decreases.

Exhibit 4.3: Trend Plots of Average Science Achievement Across Assessment Years

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 4.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



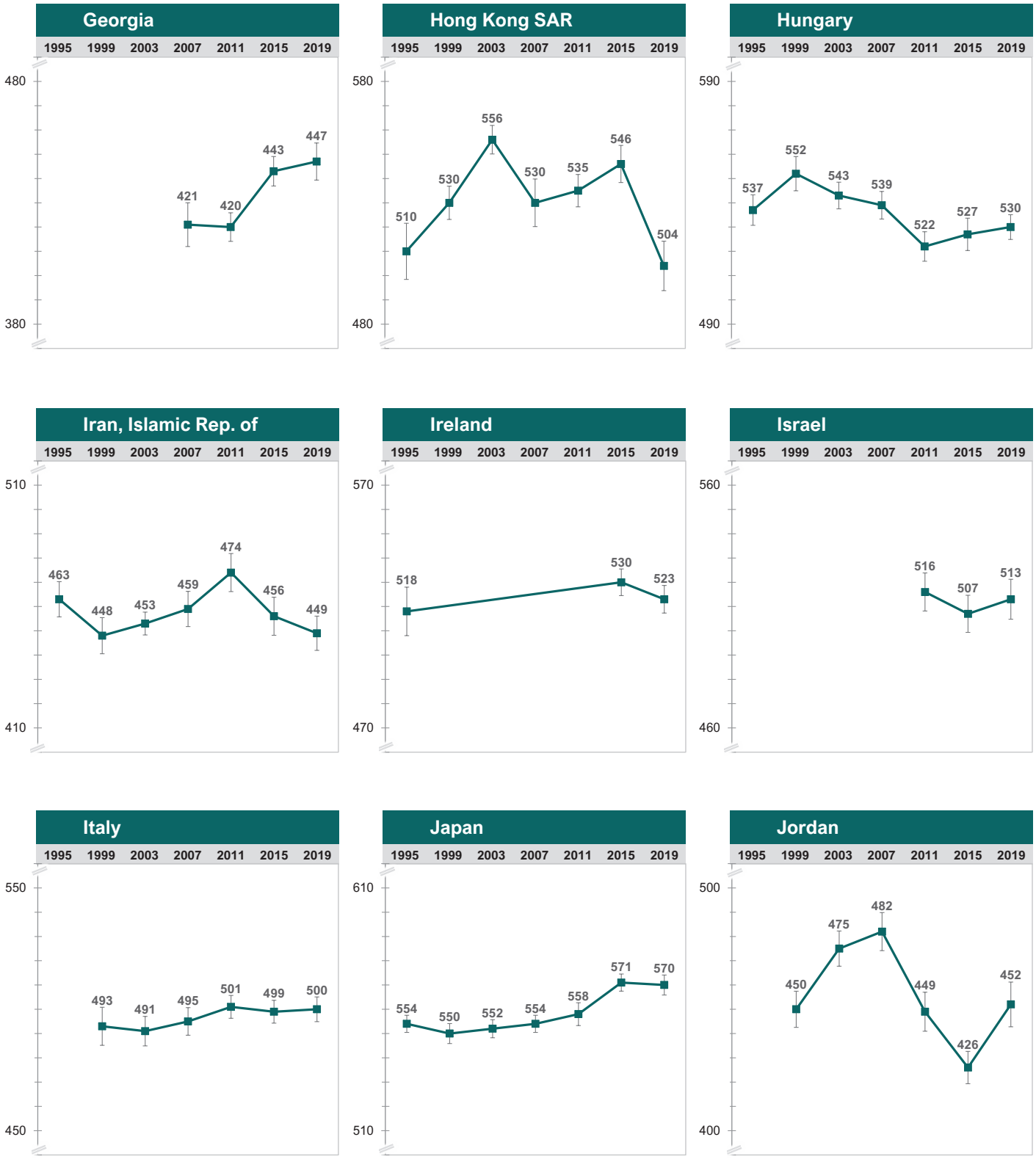
See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.3: Trend Plots of Average Science Achievement Across Assessment Years

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 4.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



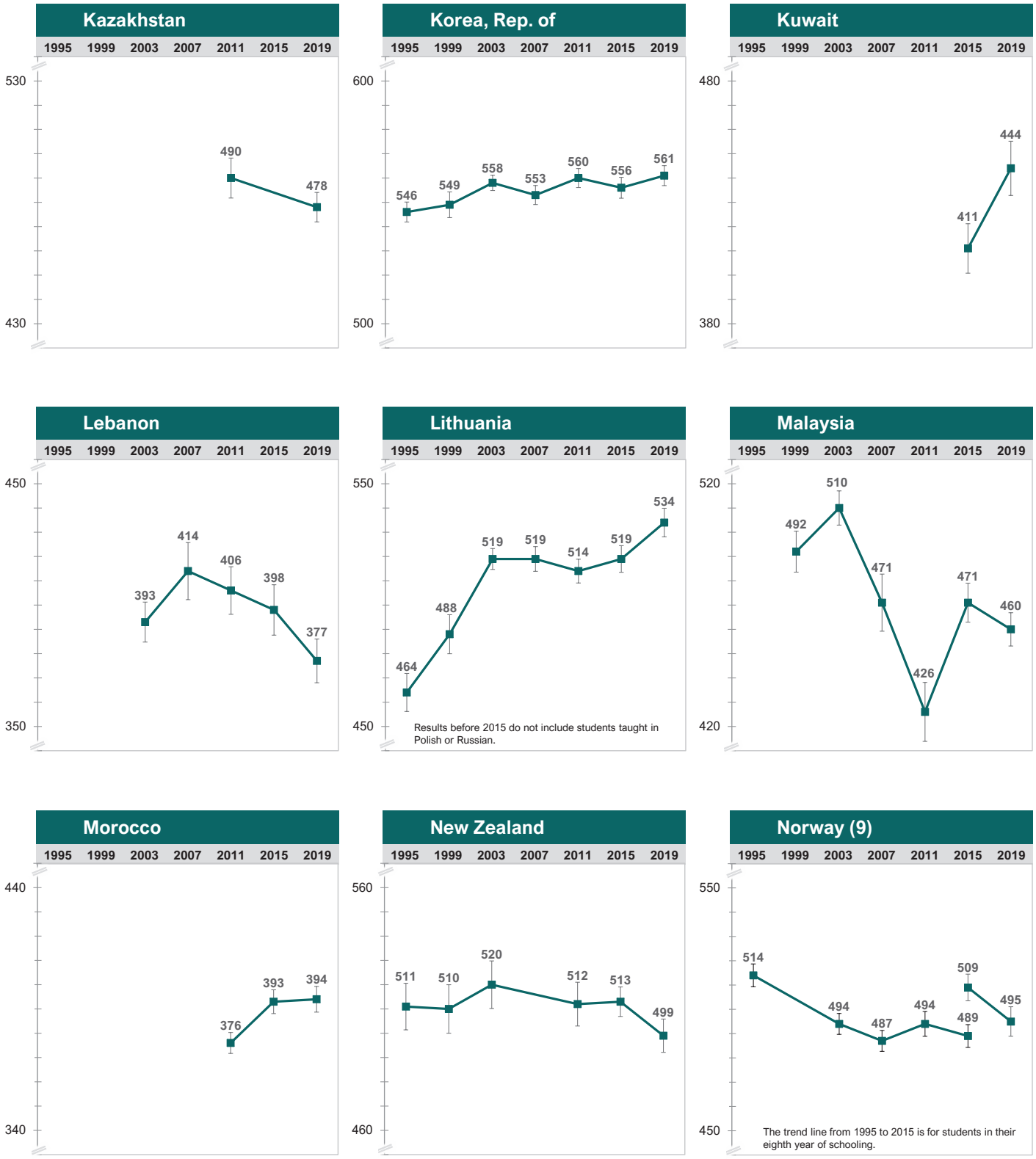
See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.3: Trend Plots of Average Science Achievement Across Assessment Years

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 4.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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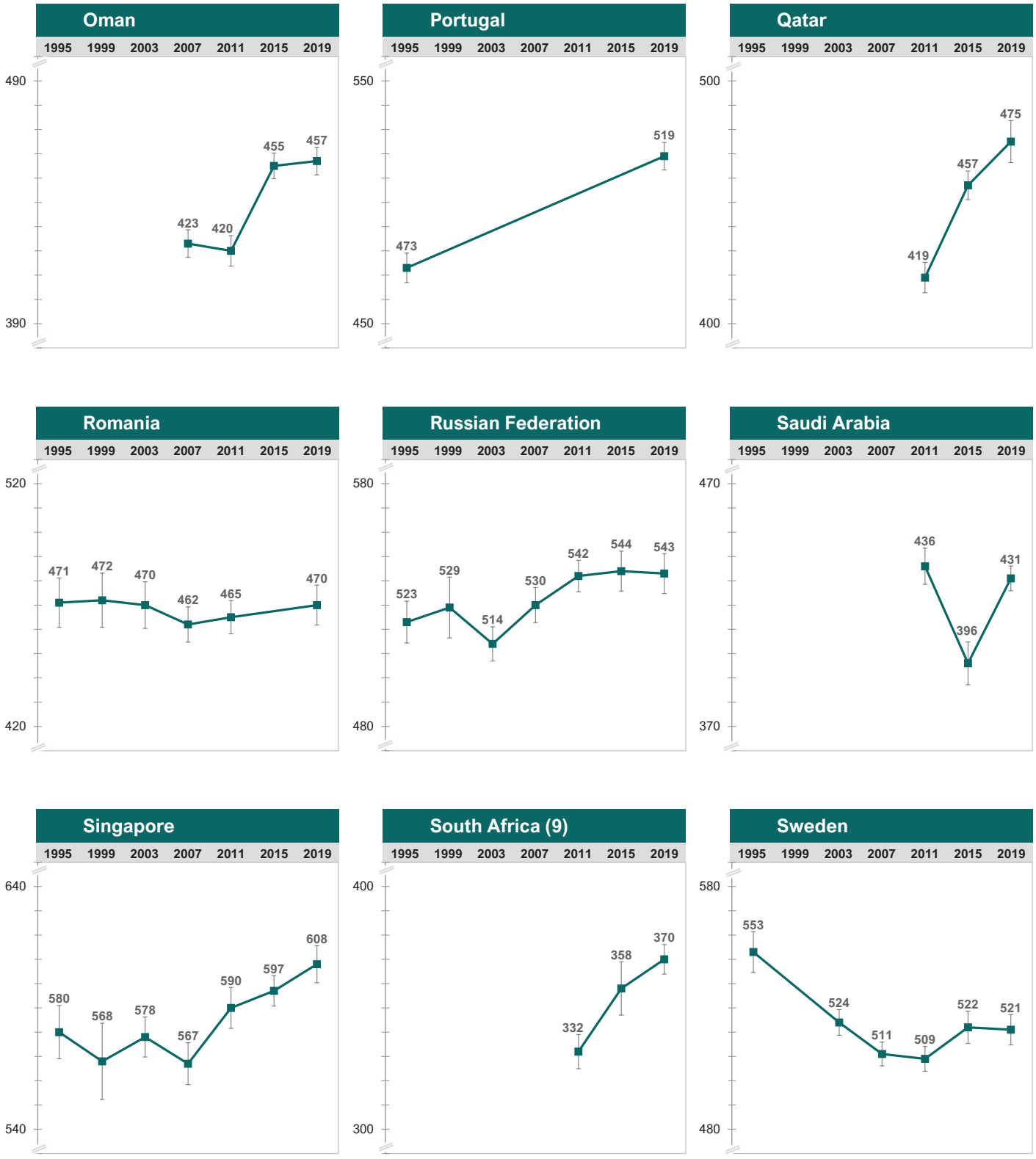
Exhibit 4.3: Trend Plots of Average Science Achievement Across Assessment Years

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 4.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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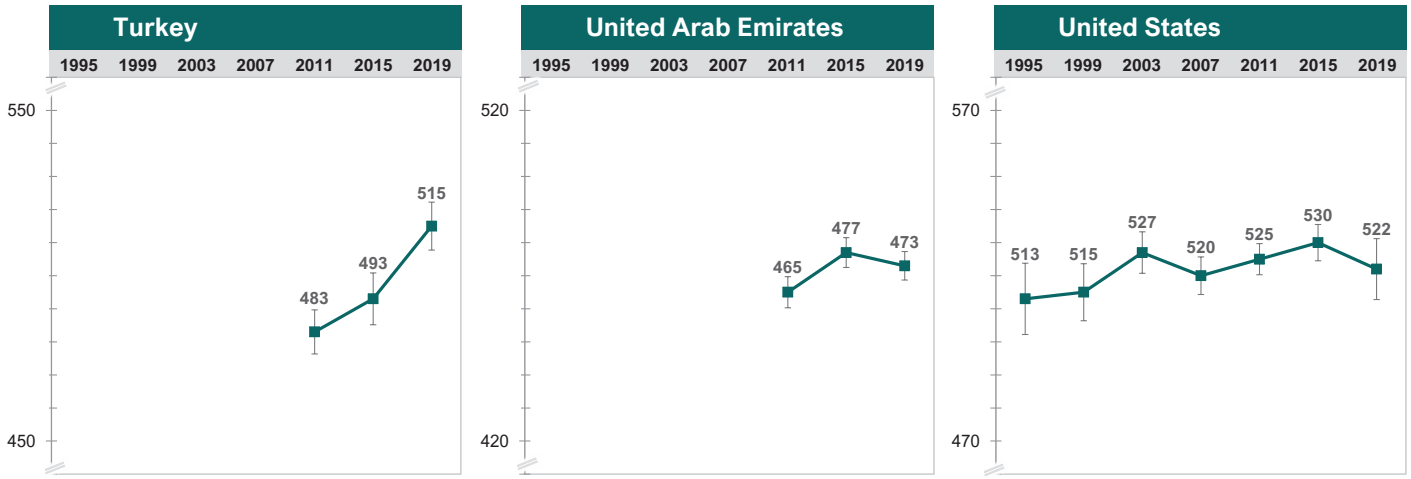
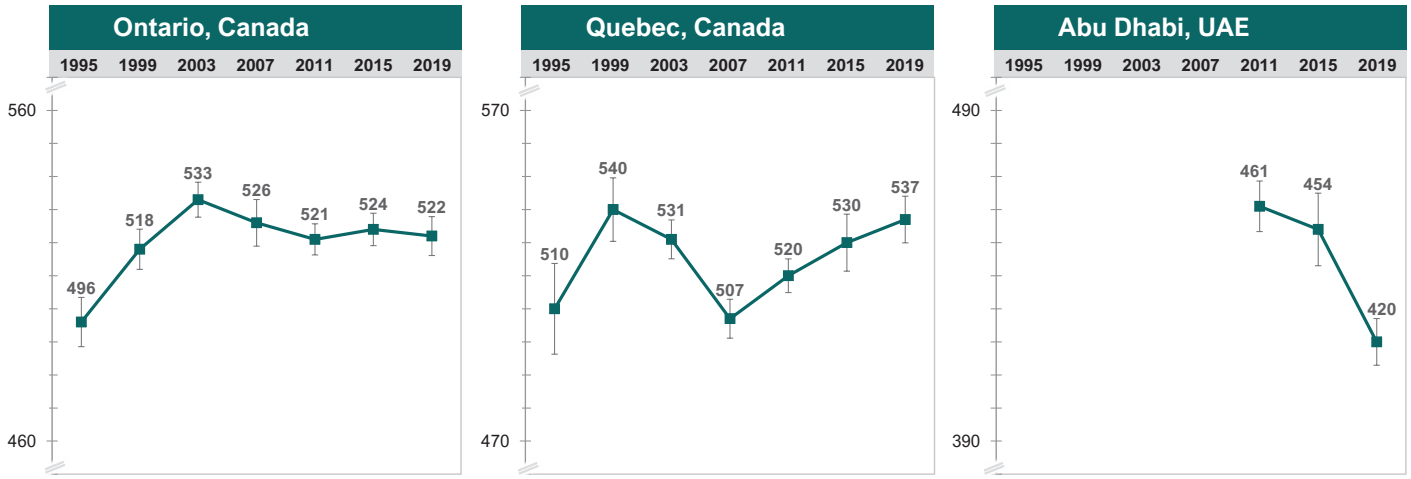
Exhibit 4.3: Trend Plots of Average Science Achievement Across Assessment Years

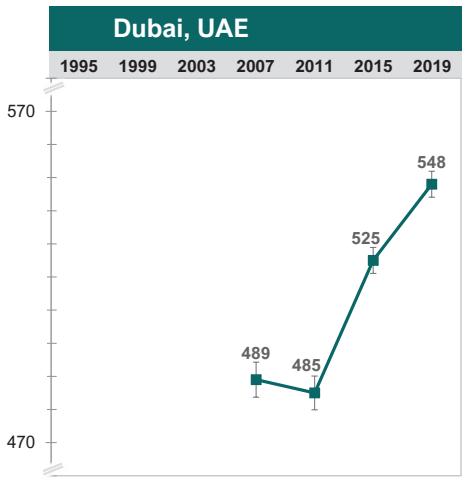
(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 4.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



Benchmarking Participants





See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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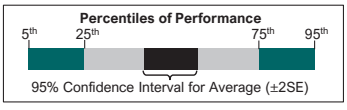
Exhibit 4.4: Differences in Average Science Achievement Across Assessment Years

Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▽) than the performance in the column year.

Country	Average Scale Score	Differences Between Years						Science Achievement Distribution
		2015	2011	2007	2003	1999	1995	
Australia								
2019	528 (3.2)	16 ▲	9	14 ▲	1		15 ▲	
2015	512 (2.7)		-7	-3	-15 ▽		-2	
2011	519 (4.7)			4	-8		6	
2007	515 (3.6)				-12 ▽		1	
2003	527 (3.9)						13 ▲	
‡ 1995	514 (3.9)							
Bahrain								
2019	486 (1.9)	20 ▲	34 ▲	19 ▲	48 ▲			
2015	466 (2.2)		13 ▲	-2	28 ▲			
2011	452 (1.9)			-15 ▽	14 ▲			
2007	467 (1.7)				29 ▲			
2003	438 (1.7)							
Chile								
2019	462 (2.9)	8 ▲	1		49 ▲	42 ▲		
2015	454 (3.1)		-7		41 ▲	34 ▲		
2011	461 (2.5)				49 ▲	41 ▲		
2003	413 (2.8)					-8		
1999	420 (3.8)							
Chinese Taipei								
2019	574 (1.9)	5	11 ▲	13 ▲	3	5		
2015	569 (2.1)		6	8 ▲	-2	0		
2011	564 (2.3)			3	-7	-5		
2007	561 (3.6)				-10 ▽	-8		
2003	571 (3.5)					2		
1999	569 (4.2)							
Cyprus								
2019	484 (1.9)			32 ▲	42 ▲	23 ▲	32 ▲	
2007	452 (2.2)				10 ▲	-9 ▽	0	
2003	441 (2.1)					-19 ▽	-11 ▽	
1999	460 (2.3)						8 ▲	
1995	452 (1.9)							
Egypt								
[2] 2019	389 (5.4)	19 ▲		-19 ▽	-32 ▽			
2015	371 (4.3)			-37 ▽	-50 ▽			
2007	408 (3.6)				-13 ▽			
2003	421 (3.9)							
England								
2019	517 (4.8)	-20 ▽	-16 ▽	-25 ▽	-27 ▽	-22 ▽	-17 ▽	
2015	537 (3.8)		4	-5	-7	-2	3	
‡ 2011	533 (4.9)			-9	-11	-5	0	
† 2007	542 (4.4)				-2	3	8	
≡ 2003	544 (4.0)					5	11 ▲	
† 1999	538 (4.8)						5	
[3] † 1995	533 (3.5)							
Finland								
2019	543 (3.1)		-10 ▽					
2011	552 (2.4)							
France								
2019	489 (2.7)						1	
1995	488 (3.2)							
Georgia								
[1] 2019	447 (3.9)	4	27 ▲	26 ▲				
[1 2] 2015	443 (3.1)		23 ▲	22 ▲				
[1] 2011	420 (3.0)			-1				
[1] 2007	421 (4.6)							
Hong Kong SAR								
† 2019	504 (5.2)	-42 ▽	-32 ▽	-27 ▽	-53 ▽	-26 ▽	-6	
2015	546 (3.9)		11 ▲	16 ▲	-10 ▽	16 ▲	36 ▲	
2011	535 (3.4)			5	-21 ▽	6	25 ▲	
† 2007	530 (5.0)				-26 ▽	1	20 ▲	
† 2003	556 (3.0)					27 ▲	46 ▲	
† 1999	530 (3.5)						20 ▲	
1995	510 (5.9)							

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower



See Appendix A for country participation in previous TIMSS assessments.
See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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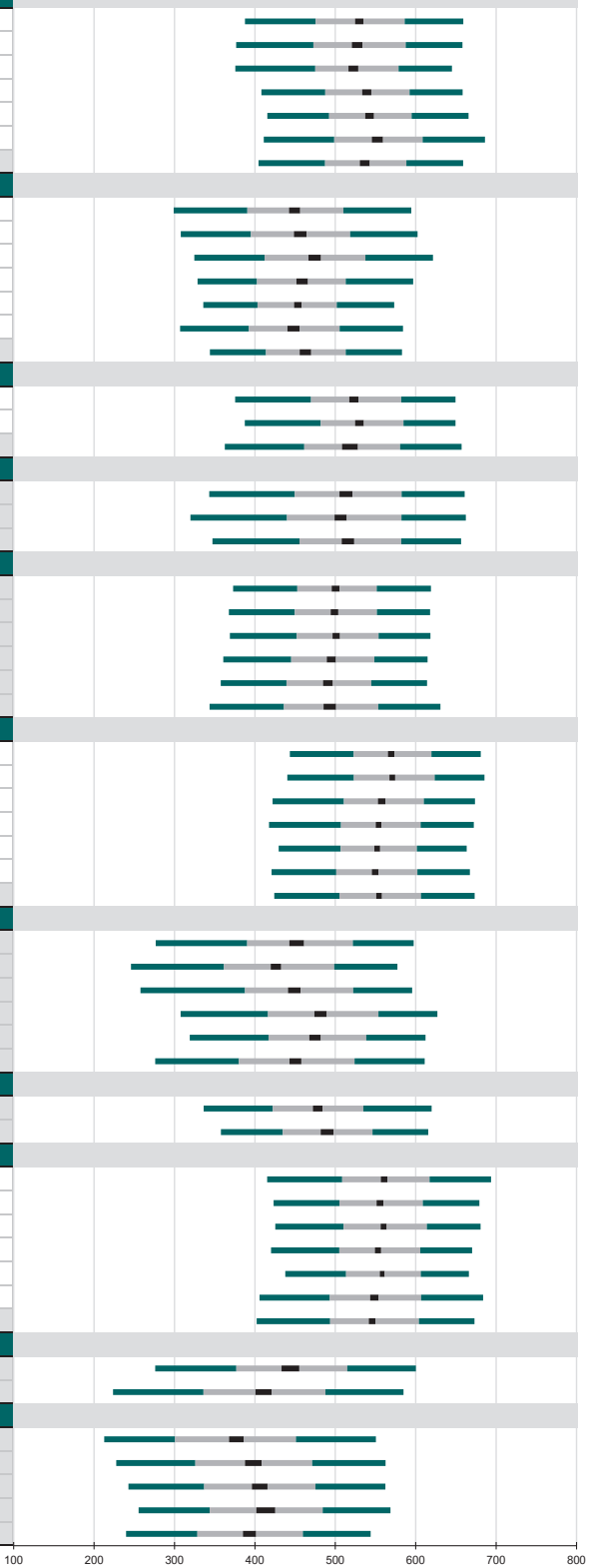
Exhibit 4.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years						Science Achievement Distribution
		2015	2011	2007	2003	1999	1995	
Hungary								
2019	530 (2.6)	2	7	-9 ▽	-13 ▽	-23 ▽	-7	
2015	527 (3.4)		5	-12 ▽	-16 ▽	-25 ▽	-9 ▽	
2011	522 (3.1)			-17 ▽	-20 ▽	-30 ▽	-14 ▽	
2007	539 (2.9)				-4	-13 ▽	2	
[2] 2003	543 (2.8)					-10 ▽	6	
1999	552 (3.6)						16 ▲	
1995	537 (3.2)							
Iran, Islamic Rep. of								
2019	449 (3.6)	-7	-25 ▽	-10	-4	1	-13 ▽	
2015	456 (4.0)		-18 ▽	-3	3	8	-6	
2011	474 (4.0)			15 ▲	21 ▲	26 ▲	12 ▲	
2007	459 (3.7)				6	11 ▲	-4	
[2] 2003	453 (2.4)					5	-9 ▽	
1999	448 (3.8)						-15 ▽	
1995	463 (3.7)							
Ireland								
2019	523 (2.9)	-7					5	
2015	530 (2.8)						12 ▲	
1995	518 (5.1)							
Israel								
[3] 2019	513 (4.2)	7	-2					
[3] 2015	507 (3.9)		-9					
[3] 2011	516 (4.0)							
Italy								
2019	500 (2.6)	2	-1	5	10 ▲	7		
[2] 2015	499 (2.4)		-2	4	8 ▲	6		
2011	501 (2.4)			6	10 ▲	8		
2007	495 (2.9)				4	2		
2003	491 (3.1)					-2		
[2] 1999	493 (4.0)							
Japan								
2019	570 (2.1)	-1	12 ▲	16 ▲	17 ▲	20 ▲	15 ▲	
2015	571 (1.8)		13 ▲	17 ▲	19 ▲	21 ▲	16 ▲	
2011	558 (2.4)			4	6	8 ▲	3	
2007	554 (1.8)				2	4	-1	
2003	552 (1.9)					3	-2	
1999	550 (2.1)						-5	
1995	554 (1.8)							
Jordan								
2019	452 (4.7)	26 ▲	3	-30 ▽	-23 ▽	2		
2015	426 (3.4)		-23 ▽	-56 ▽	-49 ▽	-24 ▽		
2011	449 (4.1)			-33 ▽	-26 ▽	-1		
2007	482 (4.0)				7	31 ▲		
2003	475 (3.7)					25 ▲		
1999	450 (3.8)							
Kazakhstan								
[2] 2019	478 (3.1)		-12 ▽					
2011	490 (4.2)							
Korea, Rep. of								
2019	561 (2.1)	5	1	8 ▲	2	12 ▲	15 ▲	
2015	556 (2.2)		-5	2	-3	7 ▲	10 ▲	
2011	560 (2.0)			7 ▲	2	12 ▲	14 ▲	
2007	553 (2.0)				-5 ▽	4	7 ▲	
2003	558 (1.6)					10 ▲	13 ▲	
1999	549 (2.7)						3	
1995	546 (2.1)							
Kuwait								
2019	444 (5.7)	33 ▲						
2015	411 (5.2)							
Lebanon								
2019	377 (4.6)	-21 ▽	-29 ▽	-37 ▽	-17 ▽			
2015	398 (5.3)		-8	-15	5			
2011	406 (5.0)			-8	13			
2007	414 (6.0)				20 ▲			
2003	393 (4.2)							



▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

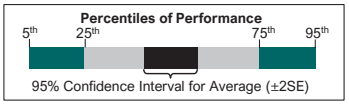


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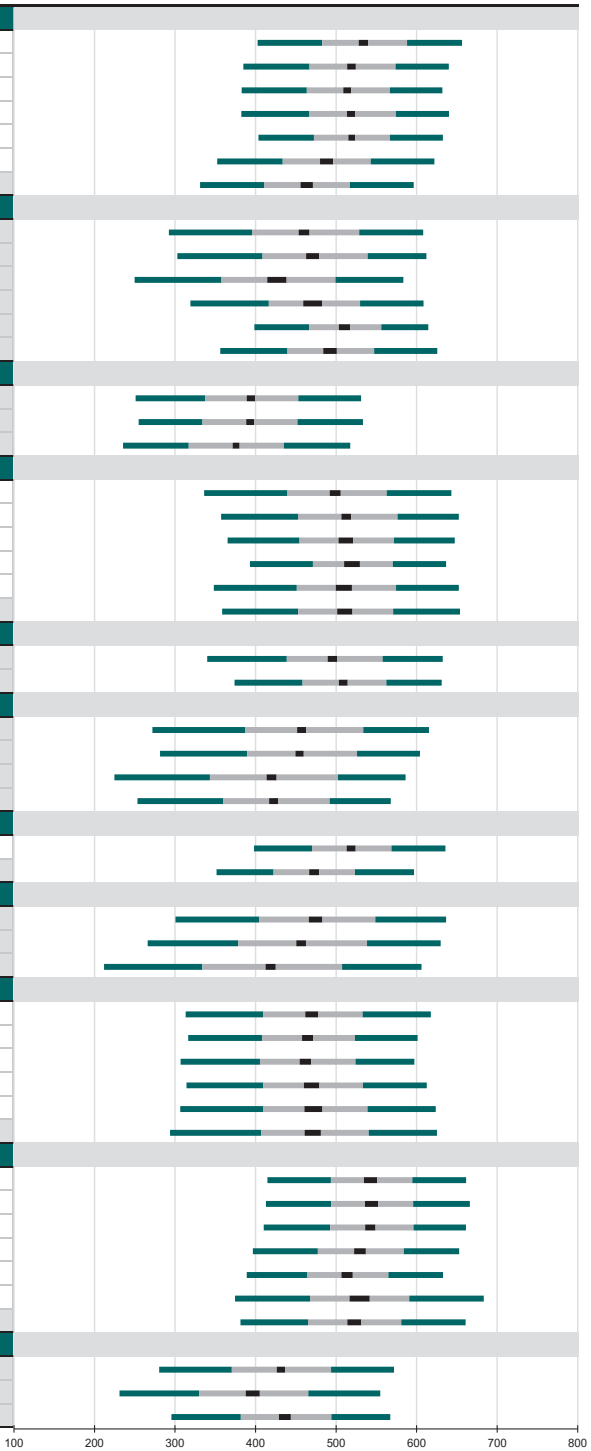
Exhibit 4.4: Differences in Average Science Achievement Across Assessment Years

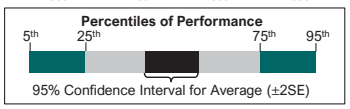
(Continued)

Country	Average Scale Score	Differences Between Years						Science Achievement Distribution
		2015	2011	2007	2003	1999	1995	
Lithuania								
2019	534 (3.0)	15 ▲	20 ▲	15 ▲	14 ▲	46 ▲	70 ▲	
[2] 2015	519 (2.8)		5	1	0	31 ▲	56 ▲	
[1] 2011	514 (2.5)			-5	-6	26 ▲	50 ▲	
[1] 2007	519 (2.6)				-1	30 ▲	55 ▲	
[1] 2003	519 (2.2)					31 ▲	56 ▲	
[1] 1999	488 (4.1)						25 ▲	
[1 2] 1995	464 (4.0)							
Malaysia								
2019	460 (3.5)	-11	34 ▲	-11	-50 ▽	-32 ▽		
2015	471 (4.1)		44 ▲	0	-40 ▽	-22 ▽		
2011	426 (6.2)			-44 ▽	-84 ▽	-66 ▽		
2007	471 (6.0)				-40 ▽	-22 ▽		
2003	510 (3.6)					18 ▲		
1999	492 (4.3)							
Morocco								
2019	394 (2.7)	1	18 ▲					
2015	393 (2.5)		17 ▲					
2011	376 (2.2)							
New Zealand								
† 2019	499 (3.5)	-14 ▽	-13 ▽		-21 ▽	-11	-12 ▽	
† 2015	513 (3.1)		1		-7	3	2	
2011	512 (4.6)				-8	2	1	
2003	520 (5.0)					10	9	
1999	510 (5.1)						-1	
1995	511 (4.9)							
Norway (9)								
† 2019	495 (3.1)	-13 ▽						
2015	509 (2.8)							
Oman								
2019	457 (2.9)	3	37 ▲	35 ▲				
2015	455 (2.7)		35 ▲	32 ▲				
2011	420 (3.2)			-3				
2007	423 (2.9)							
Portugal								
2019	519 (2.9)						46 ▲	
1995	473 (3.1)							
Qatar								
2019	475 (4.4)	18 ▲	56 ▲					
2015	457 (3.0)		38 ▲					
2011	419 (3.2)							
Romania								
2019	470 (4.2)		5	8	0	-2	-1	
2011	465 (3.5)			3	-5	-7	-6	
2007	462 (3.7)				-8	-10	-9	
2003	470 (4.9)					-2	-1	
1999	472 (5.7)						1	
1995	471 (5.2)							
Russian Federation								
[2] 2019	543 (4.2)	-1	0	13 ▲	29 ▲	14	20 ▲	
2015	544 (4.2)		2	15 ▲	30 ▲	15	22 ▲	
[2] 2011	542 (3.3)			13 ▲	29 ▲	13	20 ▲	
2007	530 (3.7)				16 ▲	0	7	
2003	514 (3.6)					-16 ▽	-9	
1999	529 (6.4)						7	
[2] 1995	523 (4.4)							
Saudi Arabia								
[2] 2019	431 (2.6)	35 ▲	-5					
2015	396 (4.5)		-40 ▽					
2011	436 (3.8)							



▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower



SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years						Science Achievement Distribution
		2015	2011	2007	2003	1999	1995	
Singapore								
[2] 2019	608 (3.9)	11 ▲	18 ▲	40 ▲	30 ▲	40 ▲	27 ▲	
[2] 2015	597 (3.2)		7	29 ▲	19 ▲	29 ▲	16 ▲	
[2] 2011	590 (4.3)			23 ▲	12 ▲	22 ▲	10	
2007	567 (4.4)				-11	-1	-13	
2003	578 (4.2)					10	-3	
1999	568 (8.0)						-12	
1995	580 (5.6)							
South Africa (9)								
Ψ 2019	370 (3.1)	12	38 ▲					
2015	358 (5.6)		26 ▲					
Ψ 2011	332 (3.6)							
Sweden								
[2] 2019	521 (3.2)	-1	12 ▲	11 ▲	-3		-31 ▽	
2015	522 (3.4)		13 ▲	12 ▲	-2		-30 ▽	
2011	509 (2.6)			-1	-15 ▽		-43 ▽	
2007	511 (2.5)				-14 ▽		-42 ▽	
2003	524 (2.7)						-28 ▽	
1995	553 (4.3)							
Turkey								
2019	515 (3.7)	22 ▲	32 ▲					
2015	493 (4.0)		10 ▲					
2011	483 (3.4)							
United Arab Emirates								
2019	473 (2.2)	-4	8 ▲					
2015	477 (2.3)		12 ▲					
2011	465 (2.4)							
United States								
† 2019	522 (4.7)	-8	-2	2	-5	7	10	
† 2015	530 (2.8)		5	10 ▲	3	15 ▲	17 ▲	
[2] 2011	525 (2.4)			5	-3	10	12 ▲	
[2] † 2007	520 (2.9)				-7	5	7	
‡ 2003	527 (3.2)					12 ▲	15 ▲	
1999	515 (4.4)						2	
† 1995	513 (5.5)							
Benchmarking Participants								
Ontario, Canada								
2019	522 (3.0)	-2	0	-5	-11 ▽	3	25 ▲	
2015	524 (2.5)		3	-2	-9 ▽	6	28 ▲	
[2] 2011	521 (2.4)			-5	-12 ▽	3	25 ▲	
[2] 2007	526 (3.6)				-7	8	30 ▲	
[2] 2003	533 (2.7)					15 ▲	37 ▲	
1999	518 (3.1)						22 ▲	
1995	496 (3.8)							
Quebec, Canada								
‡ 2019	537 (3.6)	7	17 ▲	30 ▲	6	-4	27 ▲	
≡ 2015	530 (4.4)		10	23 ▲	-1	-11	20 ▲	
2011	520 (2.6)			13 ▲	-11 ▽	-21 ▽	10	
[3] 2007	507 (3.0)				-24 ▽	-34 ▽	-3	
2003	531 (3.0)					-9	21 ▲	
1999	540 (4.9)						30 ▲	
1995	510 (7.0)							
Abu Dhabi, UAE								
2019	420 (3.6)	-34 ▽	-41 ▽					
2015	454 (5.6)		-7					
2011	461 (3.9)							
Dubai, UAE								
[2] 2019	548 (2.0)	23 ▲	63 ▲	59 ▲				
2015	525 (2.0)		40 ▲	36 ▲				
2011	485 (2.6)			-4				
‡ 2007	489 (2.7)							

100 200 300 400 500 600 700 800

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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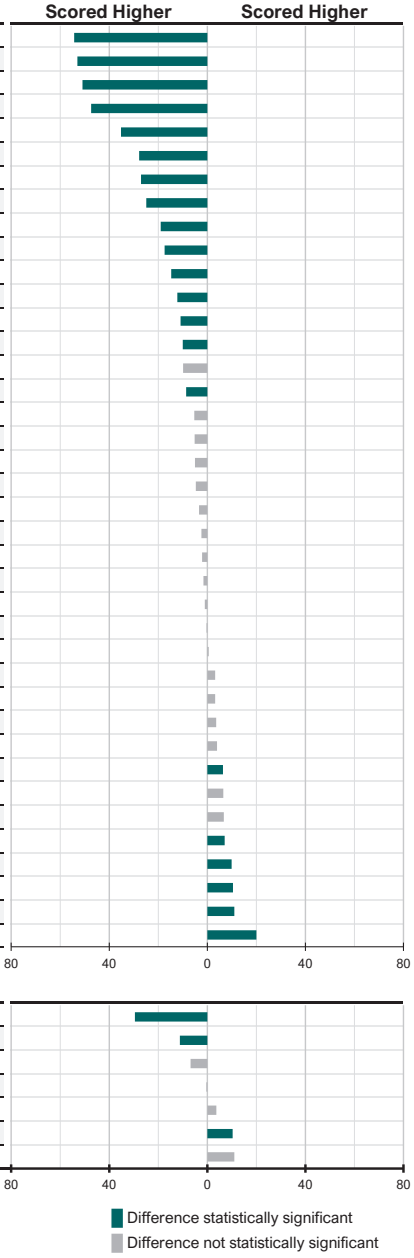
Average Achievement by Gender

Exhibit 4.5 shows the differences in average science achievement between girls and boys. In TIMSS 2019, girls had higher average achievement than boys in 15 countries, there was gender equity in average science achievement in 18 countries, and boys had higher average achievement than girls in 6 countries.

Exhibit 4.5: Average Science Achievement by Gender

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
Oman	48 (1.1)	485 (3.1)	52 (1.1)	431 (4.5)	54 (5.1)	
Jordan	48 (3.4)	480 (4.0)	52 (3.4)	427 (6.6)	53 (7.6)	
Bahrain	49 (0.9)	512 (2.6)	51 (0.9)	461 (2.8)	51 (3.7)	
[2] Saudi Arabia	49 (0.9)	455 (3.3)	51 (0.9)	408 (3.9)	47 (5.0)	
Kuwait	53 (2.2)	461 (5.7)	47 (2.2)	426 (9.4)	35 (10.3)	
Qatar	50 (2.4)	488 (5.2)	50 (2.4)	461 (6.0)	28 (7.4)	
[2] Egypt	55 (2.0)	402 (6.1)	45 (2.0)	374 (8.2)	27 (9.2)	
United Arab Emirates	48 (1.8)	486 (3.9)	52 (1.8)	461 (4.0)	25 (6.5)	
Finland	48 (0.8)	552 (3.1)	52 (0.8)	533 (3.9)	19 (3.5)	
Iran, Islamic Rep. of	47 (1.3)	459 (4.6)	53 (1.3)	441 (5.4)	17 (7.2)	
Cyprus	49 (0.6)	491 (2.4)	51 (0.6)	476 (2.5)	15 (3.1)	
Ψ South Africa (9)	52 (0.6)	376 (3.2)	48 (0.6)	364 (3.6)	12 (2.8)	
[2] Sweden	49 (0.9)	527 (3.7)	51 (0.9)	516 (3.8)	11 (4.0)	
Romania	51 (0.9)	475 (4.3)	49 (0.9)	465 (4.9)	10 (3.9)	
Turkey	50 (1.3)	520 (3.8)	50 (1.3)	510 (5.1)	10 (5.1)	
[2] Kazakhstan	49 (1.1)	483 (3.4)	51 (1.1)	474 (3.6)	9 (3.4)	
Malaysia	51 (1.1)	463 (3.5)	49 (1.1)	458 (4.3)	5 (3.7)	
Ireland	49 (1.1)	526 (3.0)	51 (1.1)	521 (3.9)	5 (3.8)	
Lebanon	49 (1.4)	379 (5.3)	51 (1.4)	374 (5.2)	5 (5.0)	
† United States	49 (0.9)	525 (3.9)	51 (0.9)	520 (6.1)	5 (4.3)	
England	53 (1.9)	518 (5.5)	47 (1.9)	515 (6.6)	3 (7.2)	
Lithuania	50 (1.0)	535 (3.0)	50 (1.0)	533 (3.6)	2 (2.9)	
† Hong Kong SAR	46 (2.1)	505 (5.9)	54 (2.1)	503 (6.3)	2 (6.5)	
Morocco	50 (0.7)	395 (2.9)	50 (0.7)	393 (2.9)	2 (2.4)	
[1] Georgia	48 (1.2)	447 (4.4)	52 (1.2)	446 (4.5)	1 (4.3)	
Australia	49 (1.5)	529 (3.1)	51 (1.5)	528 (4.6)	0 (4.7)	
† Norway (9)	49 (0.7)	495 (3.5)	51 (0.7)	496 (3.8)	1 (3.9)	
† New Zealand	48 (2.1)	497 (3.6)	52 (2.1)	500 (4.9)	3 (5.0)	
[3] Israel	52 (1.7)	512 (4.5)	48 (1.7)	515 (5.0)	3 (4.6)	
France	49 (0.8)	487 (2.6)	51 (0.8)	490 (3.6)	4 (3.4)	
Chinese Taipei	50 (0.9)	572 (2.4)	50 (0.9)	576 (2.5)	4 (2.9)	
Portugal	50 (1.1)	516 (3.2)	50 (1.1)	522 (3.4)	6 (3.1)	
[2] Singapore	49 (0.7)	604 (4.5)	51 (0.7)	611 (4.5)	7 (4.4)	
[2] Russian Federation	48 (1.0)	539 (4.5)	52 (1.0)	546 (4.6)	7 (3.5)	
Italy	50 (1.0)	497 (2.8)	50 (1.0)	504 (3.0)	7 (2.7)	
Japan	52 (1.0)	565 (2.4)	48 (1.0)	575 (2.5)	10 (2.5)	
Korea, Rep. of	48 (1.4)	555 (2.9)	52 (1.4)	566 (2.6)	10 (3.5)	
Chile	49 (1.6)	457 (3.6)	51 (1.6)	468 (3.9)	11 (4.7)	
Hungary	50 (0.9)	520 (2.9)	50 (0.9)	540 (3.2)	20 (3.1)	
International Average	**50 (0.2)**	**495 (0.6)**	**50 (0.2)**	**485 (0.8)**		
Benchmarking Participants						
Abu Dhabi, UAE	47 (2.1)	436 (6.9)	53 (2.1)	406 (5.8)	30 (10.6)	
Gauteng, RSA (9)	55 (0.9)	427 (4.1)	45 (0.9)	416 (4.3)	11 (3.4)	
[2] Dubai, UAE	50 (3.6)	551 (5.5)	50 (3.6)	544 (6.6)	7 (11.4)	
‡ Quebec, Canada	51 (2.0)	537 (4.1)	49 (2.0)	536 (4.0)	0 (3.7)	
Ontario, Canada	50 (0.9)	520 (3.4)	50 (0.9)	523 (3.5)	4 (3.3)	
Moscow City, Russian Fed.	48 (1.1)	561 (3.2)	52 (1.1)	572 (3.3)	10 (2.8)	
Western Cape, RSA (9)	55 (1.2)	434 (6.1)	45 (1.2)	445 (6.2)	11 (6.8)	



Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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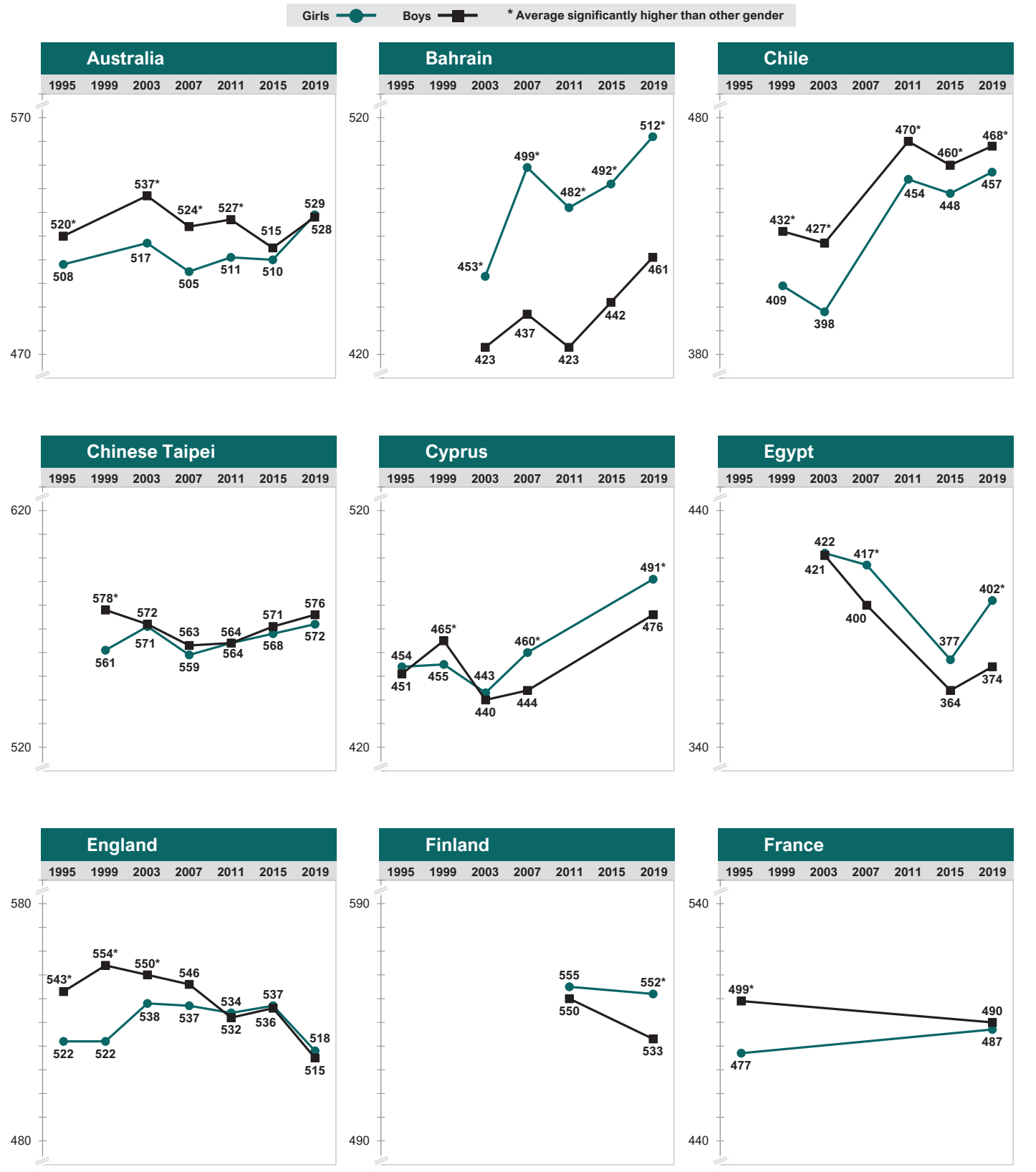
Trends in Average Achievement by Gender

For the TIMSS 2019 countries with comparable data from previous TIMSS assessments, Exhibit 4.6 contains graphs of average science achievement across assessments by gender. The countries are presented in alphabetical order. The difference in average science achievement between boys and girls has remained relatively stable in most countries, with any overall increases or decreases in achievement from assessment to assessment occurring similarly for both girls and boys. However, consistent with girls having average higher achievement than boys in more countries than the other way around, a number of countries with no gender gap in TIMSS 2015 had a gap favoring girls in TIMSS 2019, including Egypt, Iran, South Africa (ninth grade), and Sweden. (Finland, Kazakhstan, and Romania did not have comparable data from 2015, but had a gap favoring girls in TIMSS 2019 that did not exist in 2011.) The gender gap in average achievement favoring girls in TIMSS 2015 was closed in Lebanon, Malaysia, Morocco, and Turkey. Japan and Korea had no gender gap in 2015, but had a gap favoring boys in 2019. The gender gap in average achievement favoring boys in TIMSS 2015 was closed in Hong Kong SAR and the United States.

Exhibit 4.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender

This exhibit displays changes in achievement for girls and boys in each country and benchmarking participant that have comparable data from previous assessments. See Appendix A for country participation in previous assessments.



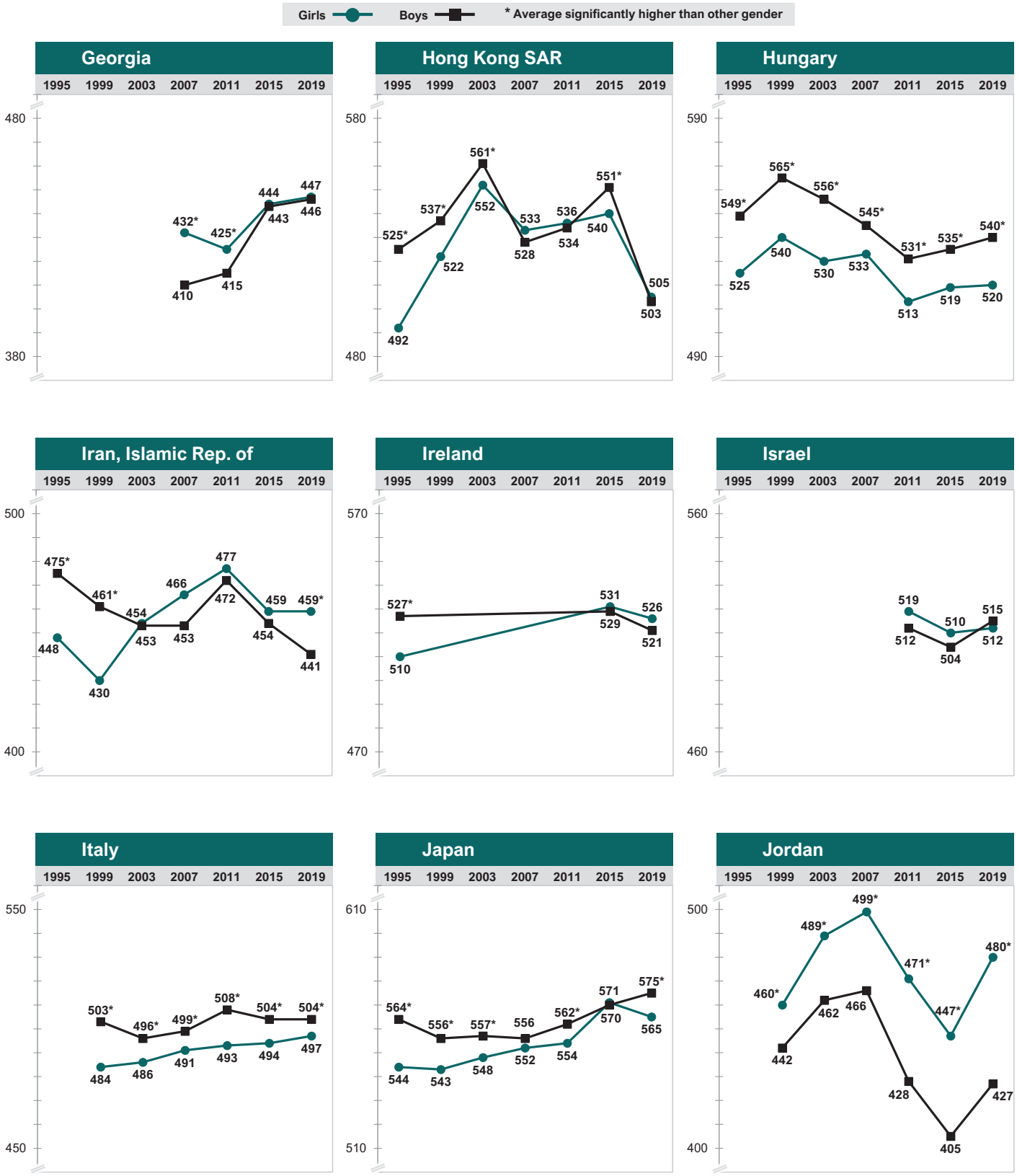
See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender

(Continued)

This exhibit displays changes in achievement for girls and boys in each country and benchmarking participant that have comparable data from previous assessments. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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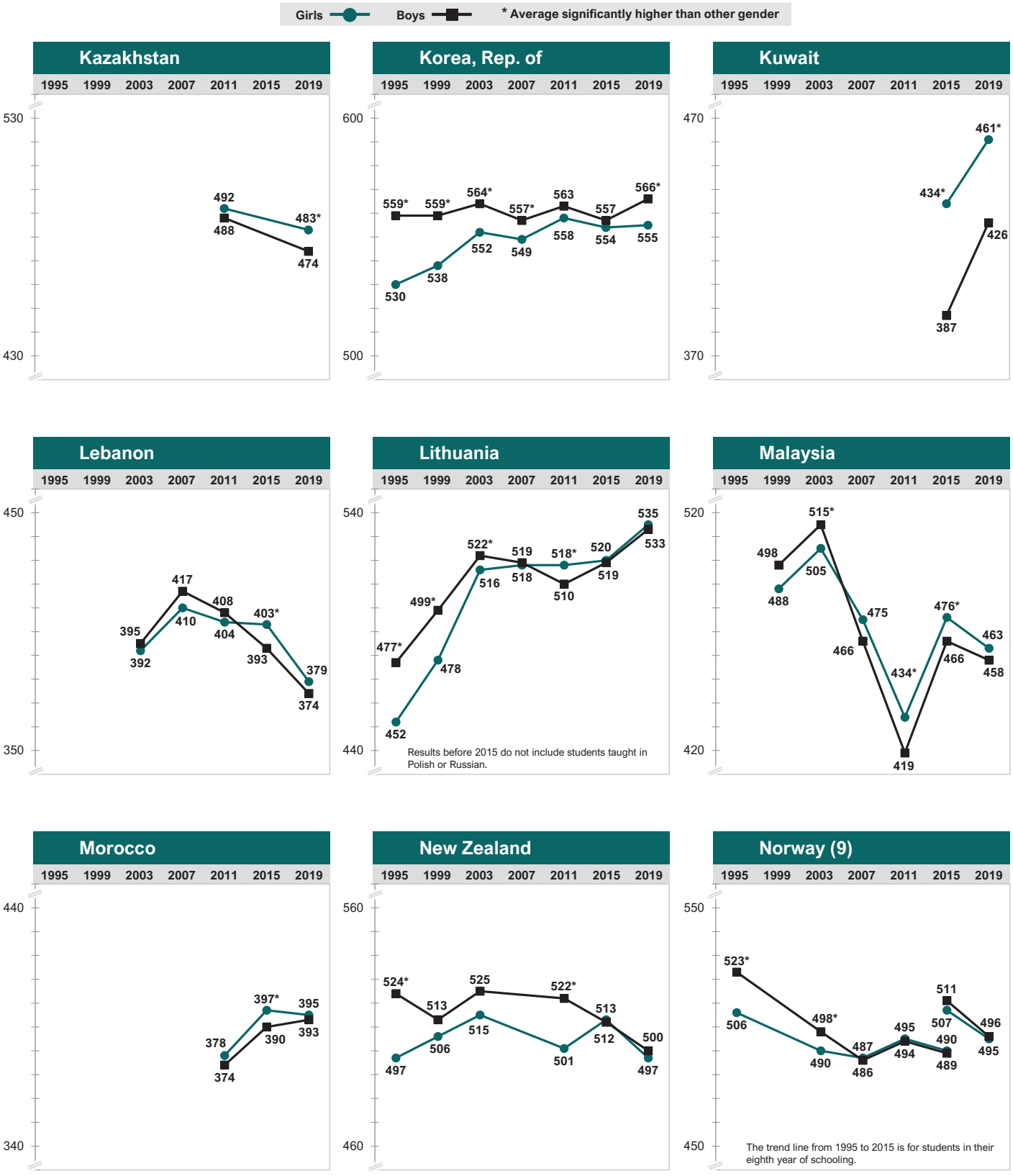
Exhibit 4.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender

(Continued)

This exhibit displays changes in achievement for girls and boys in each country and benchmarking participant that have comparable data from previous assessments. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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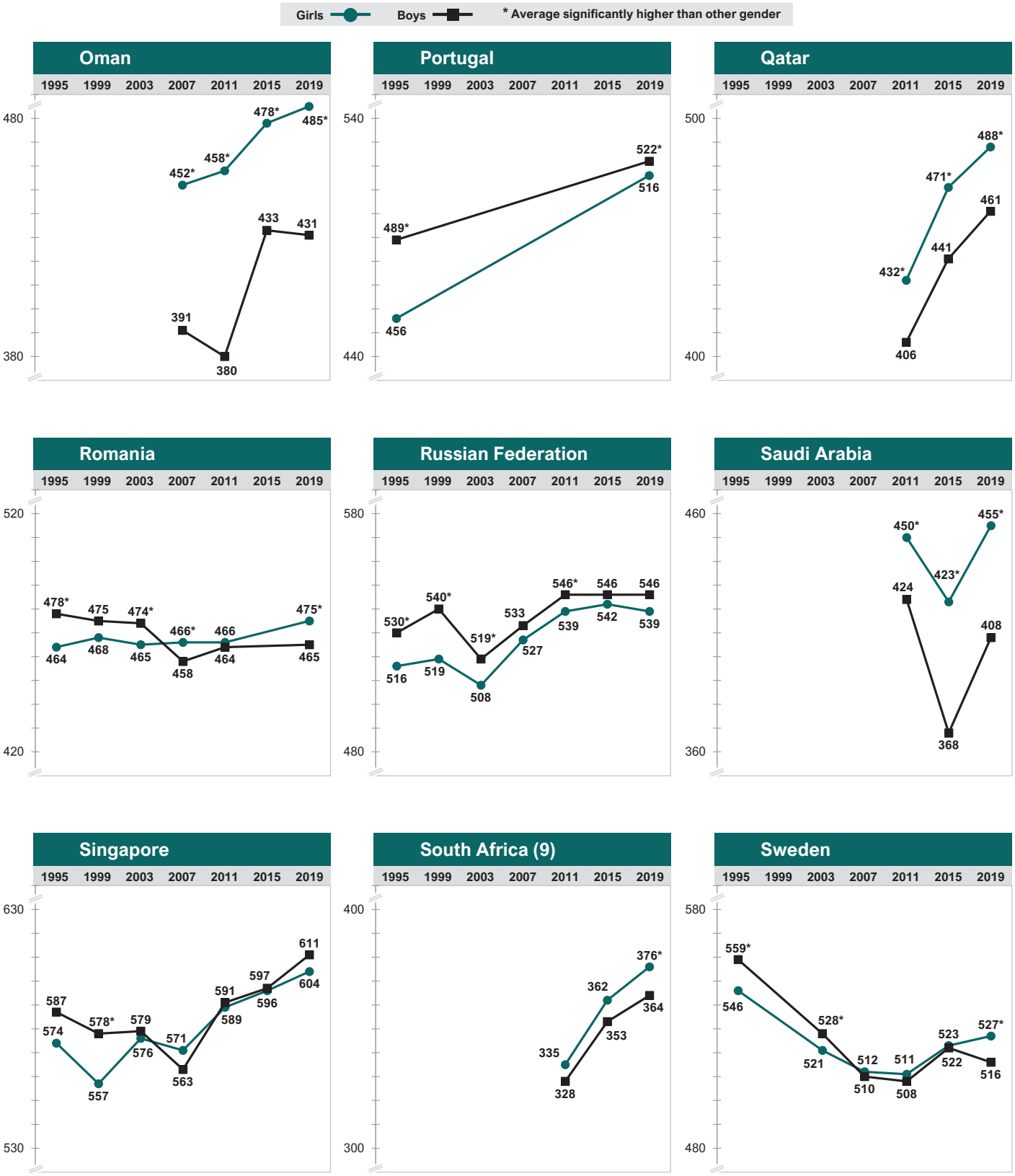
Exhibit 4.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender

(Continued)

This exhibit displays changes in achievement for girls and boys in each country and benchmarking participant that have comparable data from previous assessments. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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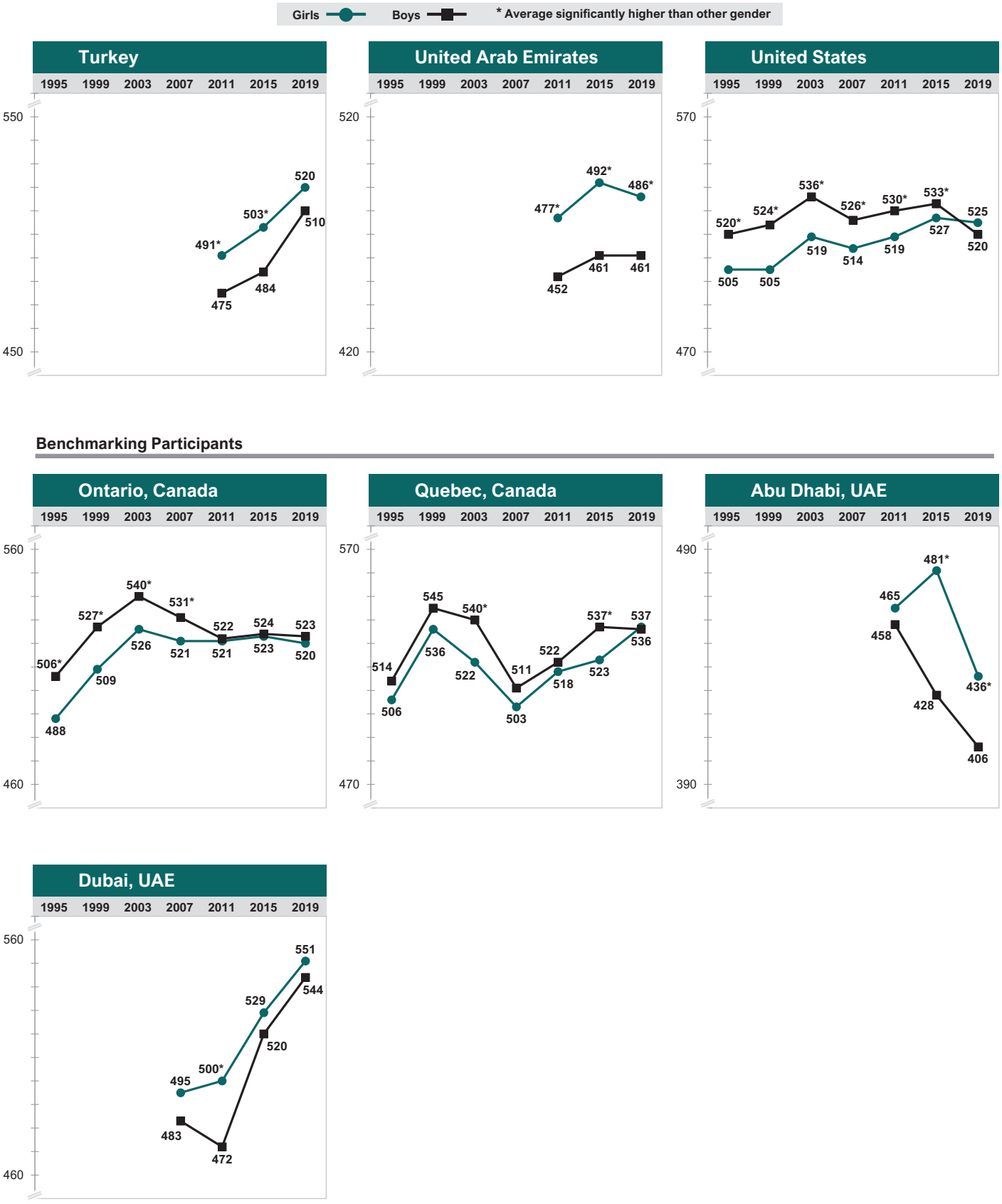
Exhibit 4.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender

(Continued)

This exhibit displays changes in achievement for girls and boys in each country and benchmarking participant that have comparable data from previous assessments. See Appendix A for country participation in previous assessments.



See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

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Performance at TIMSS International Benchmarks in Science

TIMSS 2019 International Benchmarks

To provide an interpretation of the results on the TIMSS eighth grade science achievement scale in relation to the students' performance on the assessment items, TIMSS describes achievement at four points along the scale as International Benchmarks: Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475), and Low International Benchmark (400). The descriptions of science achievement at the International Benchmarks were updated from TIMSS 2015 based on an analysis of the items that students with average achievement at each of the benchmarks answered successfully in TIMSS 2019.

Exhibit 4.7 summarizes what eighth grade students who reached each of the TIMSS International Benchmarks in 2019 could do in science. The progression in science achievement is evident from benchmark to benchmark, from limited knowledge of science facts at the Low International Benchmark to communicating conceptual understanding in a variety of science contexts at the Advanced International Benchmark. As much as possible, each description references achievement in the four content areas covered in the assessment at the eighth grade— biology, chemistry, physics, and Earth science—as well as science practices assessed by TIMSS. Science practices include skills from daily life and school studies that students use systematically to conduct scientific inquiry and investigation. The following tables show the target percentages for the content and cognitive domains.

Target Percentages of Assessment Devoted to Content and Cognitive Domains – TIMSS 2019 Eighth Grade Science

Content Domain	Percentage
Biology	35%
Chemistry	20%
Physics	25%
Earth Science	20%

Cognitive Domain	Percentage
Knowing	35%
Applying	35%
Reasoning	30%

The interactive map of the benchmark descriptions links to example items. It provides an overview of the science understanding demonstrated by the eighth grade students who performed at the four different levels on the achievement scale. The following sections provide more information about students' achievement in TIMSS 2019 at each International Benchmark as well as more detailed descriptions of each level together with example items.

Exhibit 4.7: Summary of TIMSS 2019 International Benchmarks of Science Achievement

Advanced International Benchmark	
625	*Students communicate understanding of concepts related to biology, chemistry, physics, and Earth science in a variety of contexts.* Students can classify animals into taxonomic groups. They can apply knowledge of cell structures and their functions. Students show some understanding of diversity, adaptation, and natural selection. They also recognize the interdependence of populations of organisms in an ecosystem. Students demonstrate knowledge of the composition of matter and the periodic table of the elements. Students use physical properties of matter to sort, classify, and compare substances and materials. They also recognize evidence that a chemical reaction has occurred. Students communicate understanding of particle spacing and motion in different physical states. Students apply knowledge of energy transfer and electrical circuits, can relate the properties of light and sound to common phenomena, and demonstrate understanding of forces in everyday contexts. Students communicate understanding of Earth's structure, physical features, and processes. They demonstrate knowledge of the Earth's resources and their conservation.
High International Benchmark	
550	*Students apply understanding of concepts from biology, chemistry, physics, and Earth science.* Students can apply knowledge of the characteristics of groups of animals, life processes in humans, cells and their functions, genetic inheritance, ecosystems, and nutrition. Students show some knowledge and understanding of the composition and properties of matter and chemical reactions. They can apply basic knowledge of energy transformation and transfer, electrical circuits, properties of magnets, light, sound, and forces. They can apply knowledge of Earth's physical features, processes, cycles, and history, and show some understanding of Earth's resources and their use.
Intermediate International Benchmark	
475	*Students show and apply some knowledge of biology and the physical sciences.* Students demonstrate some knowledge of characteristics of animals and apply knowledge of ecosystems. They show some knowledge of the properties of matter, chemical changes, and a few physics concepts.
Low International Benchmark	
400	*Students show limited understanding of scientific principles and concepts and limited knowledge of science facts.*

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Percentages of Students Reaching International Benchmarks

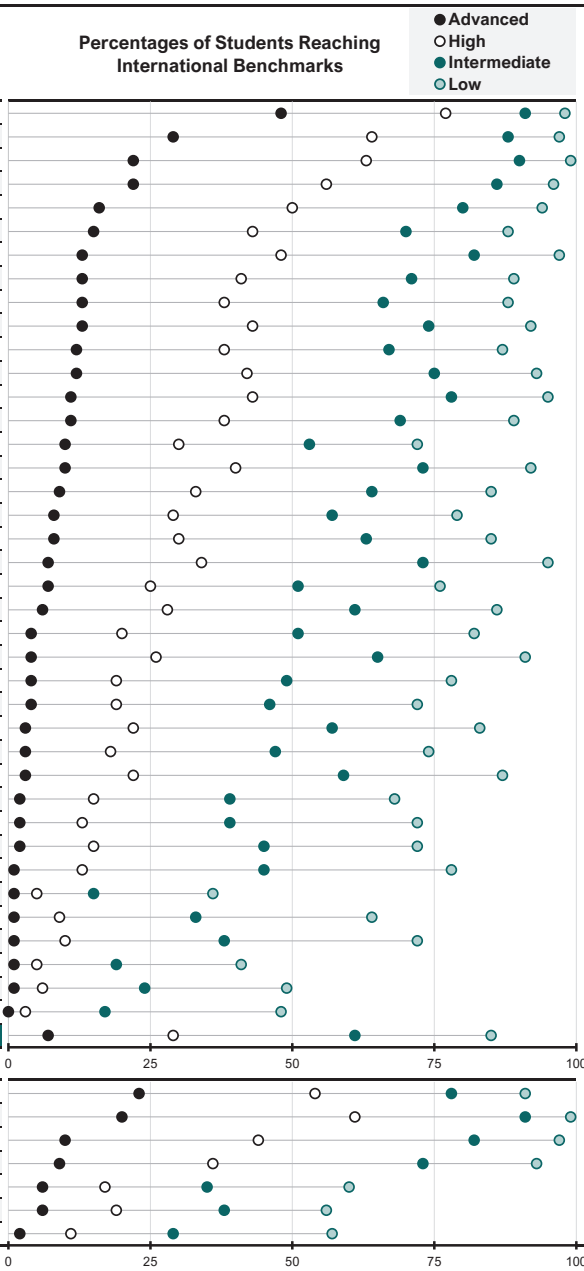
Exhibit 4.8 presents the percentage of students reaching each TIMSS 2019 International Benchmark. The results are presented in descending order according to the percentage of students reaching the Advanced International Benchmark and are indicated in the graph with black dots. Because students who reached the Advanced Benchmark also reached the other benchmarks, the percentages illustrated in the exhibit and shown in the columns to the right are cumulative.

Consistent with Singapore being the highest performing country, nearly half of their eighth grade students (48%) reached the Advanced International Benchmark. The next highest percentages reaching the Advanced level were in Chinese Taipei (29%), Japan (22%), and Korea (22%). Twelve countries had 10 to 16 percent, and the rest of the countries had fewer than 10 percent of their eighth grade students reaching the Advanced International Benchmark.

As a point of reference, Exhibit 4.8 provides the international median percentage of students reaching each benchmark at the bottom of the four right-hand columns. By definition, half the countries have a percentage in that column above the median and half below the median. The median percentages of students reaching the International Benchmarks were as follows: Advanced—7 percent, High—29 percent, Intermediate—61 percent, and Low—85 percent. The Low International Benchmark can be considered a level of minimum proficiency, with Japan (99%) and Singapore (98%) having nearly all of their students reaching this level.

Exhibit 4.8: Percentages of Students Reaching International Benchmarks of Science Achievement

Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[2] Singapore	48 (1.9)	77 (2.0)	91 (1.2)	98 (0.5)
Chinese Taipei	29 (1.0)	64 (1.0)	88 (0.7)	97 (0.3)
Japan	22 (1.4)	63 (1.1)	90 (0.6)	99 (0.3)
Korea, Rep. of	22 (0.9)	56 (1.1)	86 (0.8)	96 (0.4)
Finland	16 (1.0)	50 (1.5)	80 (1.4)	94 (0.7)
† United States	15 (1.1)	43 (1.8)	70 (1.8)	88 (1.4)
[2] Russian Federation	13 (1.4)	48 (2.3)	82 (1.7)	97 (0.8)
[2] Sweden	13 (1.1)	41 (1.5)	71 (1.5)	89 (0.9)
Turkey	13 (0.9)	38 (1.8)	66 (1.6)	88 (1.0)
Australia	13 (1.2)	43 (1.6)	74 (1.2)	92 (0.7)
[3] Israel	12 (1.3)	38 (1.9)	67 (1.9)	87 (1.2)
Hungary	12 (1.1)	42 (1.5)	75 (1.3)	93 (0.7)
Lithuania	11 (1.0)	43 (1.6)	78 (1.2)	95 (0.6)
England	11 (1.3)	38 (2.1)	69 (2.1)	89 (1.4)
United Arab Emirates	10 (0.4)	30 (0.8)	53 (0.9)	72 (0.7)
Ireland	10 (0.8)	40 (1.4)	73 (1.5)	92 (0.9)
† Hong Kong SAR	9 (1.2)	33 (2.1)	64 (2.3)	85 (1.9)
Bahrain	8 (0.5)	29 (0.8)	57 (0.9)	79 (0.9)
† New Zealand	8 (0.6)	30 (1.4)	63 (1.6)	85 (1.2)
Portugal	7 (0.7)	34 (1.5)	73 (1.7)	95 (1.0)
Qatar	7 (0.9)	25 (1.8)	51 (1.8)	76 (1.4)
† Norway (9)	6 (0.6)	28 (1.4)	61 (1.5)	86 (1.0)
[2] Kazakhstan	4 (0.6)	20 (1.3)	51 (1.7)	82 (1.3)
Italy	4 (0.5)	26 (1.2)	65 (1.5)	91 (0.9)
Romania	4 (0.6)	19 (1.6)	49 (2.1)	78 (1.5)
Oman	4 (0.5)	19 (0.9)	46 (1.1)	72 (1.1)
Cyprus	3 (0.4)	22 (1.1)	57 (1.2)	83 (0.9)
Malaysia	3 (0.4)	18 (0.8)	47 (1.6)	74 (1.7)
France	3 (0.5)	22 (1.4)	59 (1.4)	87 (0.9)
Kuwait	2 (0.5)	15 (1.5)	39 (2.2)	68 (2.2)
Iran, Islamic Rep. of	2 (0.5)	13 (1.4)	39 (1.7)	72 (1.3)
Jordan	2 (0.3)	15 (1.1)	45 (2.0)	72 (1.9)
Chile	1 (0.2)	13 (1.2)	45 (1.5)	78 (1.4)
Ψ South Africa (9)	1 (0.1)	5 (0.4)	15 (0.8)	36 (1.2)
[2] Saudi Arabia	1 (0.2)	9 (0.6)	33 (1.2)	64 (1.2)
[1] Georgia	1 (0.3)	10 (1.4)	38 (1.8)	72 (2.1)
Lebanon	1 (0.2)	5 (0.7)	19 (1.3)	41 (1.9)
[2] Egypt	1 (0.2)	6 (0.7)	24 (1.6)	49 (2.1)
Morocco	0 (0.1)	3 (0.4)	17 (0.9)	48 (1.4)
International Median	**7**	**29**	**61**	**85**
Benchmarking Participants				
[2] Dubai, UAE	23 (0.9)	54 (1.0)	78 (0.7)	91 (0.6)
Moscow City, Russian Fed.	20 (1.5)	61 (1.9)	91 (0.8)	99 (0.3)
‡ Quebec, Canada	10 (1.2)	44 (2.2)	82 (1.5)	97 (0.7)
Ontario, Canada	9 (1.0)	36 (1.5)	73 (1.4)	93 (0.7)
Western Cape, RSA (9)	6 (1.0)	17 (1.9)	35 (1.9)	60 (1.7)
Abu Dhabi, UAE	6 (0.5)	19 (0.9)	38 (1.3)	56 (1.4)
Gauteng, RSA (9)	2 (0.4)	11 (1.0)	29 (1.6)	57 (1.5)



Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Trends in Percentages of Students Reaching International Benchmarks

Exhibit 4.9 shows the changes in percentages of students reaching the benchmarks for countries that have comparable data from previous assessments. The trends indicate more improvement at the two higher benchmarks than declines, in contrast to similar improvements but more declines at lower benchmarks. Of the 33 countries participating in both 2015 and 2019, 10 increased and only 1 decreased at the Advanced International Benchmark, 9 increased and 4 decreased at the High Benchmark, 10 increased and 8 decreased at the Intermediate Benchmark, and 8 increased and 8 decreased at the Low Benchmark.

The longer-term trends also show a similar pattern. Between 2007 and 2019, the 23 countries participating in those two assessments had 13 increases and 2 decreases at the Advanced level, 12 increases and 4 decreases at the High level, 10 increases and 5 decreases at the Intermediate level, and 8 increases and 9 decreases at the Low level. Between 1995 and 2019, the 18 countries participating in both assessments had 7 increases and 2 decreases at the Advanced level, 8 increases and 2 decreases at the High level, and 7 increases and 3 decreases at the Intermediate level, as well as 5 increases and 6 decreases at the Low level.

Exhibit 4.9: Percentages of Students Reaching International Benchmarks of Science Achievement Across Assessment Years

Country	Advanced International Benchmark (625) — Percent of Students							High International Benchmark (550) — Percent of Students						
	2019	2015	2011	2007	2003	1999	1995	2019	2015	2011	2007	2003	1999	1995
Singapore	48	42 ▲	40 ▲	32 ▲	33 ▲	29 ▲	29 ▲	77	74	69 ▲	61 ▲	66 ▲	60 ▲	64 ▲
Chinese Taipei	29	27	24 ▲	25 ▲	26	27		64	63	60 ▲	60 ▲	63	61	
Japan	22	24	18 ▲	17 ▲	15 ▲	16 ▲	18 ▲	63	63	57 ▲	55 ▲	53 ▲	52 ▲	54 ▲
Korea, Rep. of	22	19 ▲	20	17 ▲	17 ▲	19 ▲	17 ▲	56	54	57	54	57	50 ▲	50 ▲
Finland	16		13 ▲					50		53				
United States	15	12 ▲	10 ▲	10 ▲	11 ▲	12	11 ▲	43	43	40	38 ▲	41	37 ▲	38
Russian Federation	13	14	14	11	6 ▲	15	11	48	49	48	41 ▲	32 ▲	41	38 ▲
Sweden	13	10 ▲	6 ▲	6 ▲	8 ▲		19 ▽	41	40	33 ▲	32 ▲	38		52 ▽
Turkey	13	8 ▲	8 ▲					38	29 ▲	26 ▲				
Australia	13	7 ▲	11	8 ▲	9 ▲		10	43	34 ▲	35 ▲	33 ▲	40		36 ▲
Israel	12	12	11					38	37	39				
Hungary	12	12	9 ▲	13	14	19 ▽	12	42	42	39	46	46	53 ▽	44
Lithuania	11	8 ▲	6 ▲	8 ▲	6 ▲	5 ▲	2 ▲	43	36 ▲	33 ▲	36 ▲	34 ▲	22 ▲	14 ▲
England	11	14	14	17 ▽	15	17 ▽	15 ▽	38	45 ▽	44	48 ▽	48 ▽	45 ▽	43 ▽
United Arab Emirates	10	7 ▲	4 ▲					30	26 ▲	19 ▲				
Ireland	10	10					11	40	43					38
Hong Kong SAR	9	12	9	10	13 ▽	7	7	33	51 ▽	47 ▽	45 ▽	58 ▽	40 ▽	33
Bahrain	8	6 ▲	3 ▲	2 ▲	0 ▲			29	22 ▲	17 ▲	17 ▲	6 ▲		
New Zealand	8	10 ▽	9		7	10	9	30	36 ▽	34		35	35	34
Portugal	7						2 ▲	34						15 ▲
Qatar	7	6	3 ▲					25	21	14 ▲				
Norway (9)	6	6						28	31					
Kazakhstan	4		4					20		23				
Italy	4	4	4	4	4	6		26	26	27	24	23	26	
Romania	4		3 ▲	2 ▲	4	5	5	19		16	16	20	21	22
Oman	4	3 ▲	2 ▲	1 ▲				19	17 ▲	11 ▲	8 ▲			
Cyprus	3			1 ▲	0 ▲	2 ▲	2 ▲	22			12 ▲	8 ▲	14 ▲	15 ▲
Malaysia	3	3	1 ▲	3	4	5 ▽		18	21 ▽	11 ▲	18	28 ▽	24 ▽	
France	3						2	22						19
Kuwait	2	2						15	10 ▲					
Iran, Islamic Rep. of	2	3	5 ▽	2	1 ▲	1	1	13	15	21 ▽	14	9 ▲	11	11
Jordan	2	1	2	5 ▽	3 ▽	4 ▽		15	9 ▲	15	26 ▽	21 ▽	17	
Chile	1	1	1		1 ▲	1		13	12	12		5 ▲	7 ▲	
South Africa (9)	1	1	1					5	5	4				
Saudi Arabia	1	1	1					9	6 ▲	8				
Georgia	1	1	0	0 ▲				10	10	6 ▲	5 ▲			
Lebanon	1	1	1	1	0			5	7	7	8 ▽	4		
Egypt	1	0		1	1 ▽			6	5		7	10 ▽		
Morocco	0	0	0					3	3	2 ▲				
Benchmarking Participants														
Dubai, UAE	23	14 ▲	7 ▲	6 ▲				54	43 ▲	28 ▲	27 ▲			
Quebec, Canada	10	7	5 ▲	4 ▲	6 ▲	10	7	44	39	34 ▲	27 ▲	39	43	30 ▲
Ontario, Canada	9	7	6 ▲	7	7	7	5 ▲	36	37	35	37	41	34	26 ▲
Abu Dhabi, UAE	6	5	4 ▲					19	20	17				

▲ 2019 percent significantly higher

▽ 2019 percent significantly lower

An empty cell indicates a country did not participate in that year's assessment or did not have comparable data.
See Appendix A for country participation in previous TIMSS assessments.
Results for Lithuania before 2015 do not include students taught in Polish or Russian.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.9: Percentages of Students Reaching International Benchmarks of Science Achievement Across Assessment Years

(Continued)

Country	Intermediate International Benchmark (475) — Percent of Students							Low International Benchmark (400) — Percent of Students						
	2019	2015	2011	2007	2003	1999	1995	2019	2015	2011	2007	2003	1999	1995
Singapore	91	90	87 ▲	80 ▲	85 ▲	84 ▲	91	98	97	96 ▲	93 ▲	95 ▲	95 ▲	99 ▽
Chinese Taipei	88	86	85 ▲	83 ▲	88	86		97	96	96	95 ▲	98	96	
Japan	90	89	86 ▲	85 ▲	86 ▲	84 ▲	85 ▲	99	98	97 ▲	96 ▲	98 ▲	97 ▲	97 ▲
Korea, Rep. of	86	85	86	85	88 ▽	81 ▲	81 ▲	96	97	97	97	98 ▽	96	95
Finland	80		88 ▽					94		99 ▽				
United States	70	75 ▽	73	71	75	67	68	88	93 ▽	93 ▽	92 ▽	93 ▽	87	87
Russian Federation	82	81	81	76 ▲	70 ▲	73 ▲	71 ▲	97	96	96	95 ▲	93 ▲	92 ▲	92 ▲
Sweden	71	73	68	69	75 ▽		83 ▽	89	92 ▽	91	91	95 ▽		97 ▽
Turkey	66	59 ▲	54 ▲					88	83 ▲	79 ▲				
Australia	74	69 ▲	70	70 ▲	76		69 ▲	92	91	92	92	95 ▽		89
Israel	67	64	69					87	84	88				
Hungary	75	74	75	80 ▽	82 ▽	83 ▽	80 ▽	93	92	92	96 ▽	97 ▽	96 ▽	95 ▽
Lithuania	78	72 ▲	71 ▲	72 ▲	74 ▲	57 ▲	45 ▲	95	93 ▲	92 ▲	93 ▲	95	86 ▲	79 ▲
England	69	77 ▽	76 ▽	79 ▽	81 ▽	76 ▽	75 ▽	89	95 ▽	93 ▽	94 ▽	96 ▽	94 ▽	93 ▽
United Arab Emirates	53	53	47 ▲					72	76 ▽	75				
Ireland	73	77 ▽					70	92	94					90
Hong Kong SAR	64	85 ▽	80 ▽	77 ▽	89 ▽	80 ▽	70	85	96 ▽	95 ▽	92 ▽	98 ▽	96 ▽	90
Bahrain	57	49 ▲	44 ▲	49 ▲	33 ▲			79	73 ▲	70 ▲	78	70 ▲		
New Zealand	63	67 ▽	67		73 ▽	66	67	85	88 ▽	90 ▽		94 ▽	88	89 ▽
Portugal	73						49 ▲	95						84 ▲
Qatar	51	46 ▲	34 ▲					76	70 ▲	58 ▲				
Norway (9)	61	68 ▽						86	91 ▽					
Kazakhstan	51		58 ▽					82		86 ▽				
Italy	65	64	65	62	59 ▲	59 ▲		91	89	90	88	87 ▲	86 ▲	
Romania	49		47	46	49	50	51	78		78	77	78	78	77
Oman	46	45	34 ▲	32 ▲				72	72	59 ▲	61 ▲			
Cyprus	57			42 ▲	35 ▲	45 ▲	43 ▲	83			74 ▲	71 ▲	77 ▲	72 ▲
Malaysia	47	52 ▽	34 ▲	50	71 ▽	59 ▽		74	77	62 ▲	80 ▽	95 ▽	87 ▽	
France	59						58	87						89
Kuwait	39	29 ▲						68	55 ▲					
Iran, Islamic Rep. of	39	42	50 ▽	41	38	38	43	72	73	79 ▽	76 ▽	77 ▽	72	81 ▽
Jordan	45	34 ▲	45	56 ▽	53 ▽	42		72	63 ▲	72	79 ▽	80 ▽	69	
Chile	45	40 ▲	43		24 ▲	27 ▲		78	75	79		56 ▲	60 ▲	
South Africa (9)	15	14	11 ▲					36	32	25 ▲				
Saudi Arabia	33	22 ▲	33					64	49 ▲	68				
Georgia	38	38	28 ▲	27 ▲				72	70	62 ▲	61 ▲			
Lebanon	19	24 ▽	25 ▽	28 ▽	20			41	50 ▽	54 ▽	55 ▽	48 ▽		
Egypt	24	20 ▲		27	33 ▽			49	42 ▲		55 ▽	59 ▽		
Morocco	17	17	13 ▲					48	47	39 ▲				
Benchmarking Participants														
Dubai, UAE	78	72 ▲	57 ▲	58 ▲				91	89 ▲	79 ▲	82 ▲			
Quebec, Canada	82	79	76 ▲	68 ▲	82	83	69 ▲	97	97	96	94 ▲	98	98	92
Ontario, Canada	73	77	76	77	81 ▽	72	61 ▲	93	95	96 ▽	96 ▽	97 ▽	95	88 ▲
Abu Dhabi, UAE	38	44 ▽	45 ▽					56	69 ▽	74 ▽				

▲ 2019 percent significantly higher

▽ 2019 percent significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Low Benchmark: Full Description

Exhibit 4.10 presents the description of eighth grade students' achievement at the Low International Benchmark. The very few items that anchored at the Low level indicated students had limited understanding of scientific principles and concepts and limited knowledge of science facts.

Exhibit 4.10: Description of the TIMSS 2019 Low International Benchmark (400) of Science Achievement

Low International Benchmark

400

Summary

Students show limited understanding of scientific principles and concepts and limited knowledge of science facts.

Students at this level can read a food web, identify some materials that are attracted to magnets, and know that salt must be removed from clean ocean water to make it safe to drink.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Intermediate Benchmark: Full Description and Example Items

Exhibit 4.11 provides the description of students' achievement at the Intermediate International Benchmark. At this level, the eighth grade students showed and applied some knowledge of biology and physical science.

Exhibit 4.11.1 presents an item from the biology content domain about the advantages of a crocodile's field of vision. On average, 55 percent of the eighth grade students could provide an explanation. The highest achievement was in Japan and Singapore with 84–85 percent correct.

Exhibit 4.11.2 presents an item from the chemistry content domain asking students to distinguish between elements and compounds. Finland and Lithuania had the highest performance—88–89 percent correct. The international average was 61 percent.

Exhibit 4.11.3 shows an example item from physics. Students were able to identify the difference in gravitational attraction as the reason why a rover weighs a different amount on Mars than it does on Earth. With 90 percent correct, the Singaporean eighth graders had the highest achievement. The international average was 69 percent.

Exhibit 4.11: Description of the TIMSS 2019 Intermediate International Benchmark (475) of Science Achievement

Intermediate International Benchmark

475

Summary

Students show and apply some knowledge of biology and the physical sciences. Students demonstrate some knowledge of characteristics of animals and apply knowledge of ecosystems. They show some knowledge of the properties of matter, chemical changes, and a few physics concepts.

Students demonstrate limited knowledge of characteristics of animals and of animals' adaptations to their environment. They can apply knowledge of ecosystems and the interaction of living things with their environment.

Students show some knowledge of the structure and properties of matter and chemical changes.

Students can separate conductors from insulators based on differences in electric current, recognize energy change in an everyday object moving downhill, and recognize that the gravity on Earth is different than on another planet.

Students can interpret information from graphs and pictorial diagrams.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.11.1: Intermediate International Benchmark of Science Achievement – Example Item 1

Country	Percent Full Credit	
Japan	85 (1.6)	▲
[2] Singapore	84 (1.5)	▲
Portugal	79 (1.9)	▲
Ireland	76 (2.2)	▲
Korea, Rep. of	75 (2.1)	▲
Turkey	75 (2.0)	▲
[3] Israel	72 (1.9)	▲
Finland	72 (1.8)	▲
France	69 (2.2)	▲
Australia	68 (1.9)	▲
Lithuania	68 (2.4)	▲
[2] Sweden	68 (2.2)	▲
England	67 (2.7)	▲
† United States	66 (1.5)	▲
[2] Russian Federation	65 (2.3)	▲
Hungary	63 (2.4)	▲
Chinese Taipei	63 (1.8)	▲
† New Zealand	62 (2.5)	▲
Italy	62 (2.1)	▲
† Norway (9)	62 (2.7)	▲
Cyprus	56 (2.3)	
International Average	**55 (0.3)**	
[2] Kazakhstan	54 (2.9)	
Bahrain	54 (1.6)	
Romania	49 (2.8)	▽
Chile	48 (2.5)	▽
Qatar	44 (1.8)	▽
Jordan	44 (2.3)	▽
United Arab Emirates	44 (1.0)	▽
Iran, Islamic Rep. of	44 (2.1)	▽
† Hong Kong SAR	40 (2.7)	▽
Oman	38 (2.0)	▽
Kuwait	36 (2.0)	▽
[1] Georgia	35 (3.1)	▽
[2] Saudi Arabia	35 (1.9)	▽
Malaysia	27 (1.5)	▽
Morocco	24 (1.5)	▽
Lebanon	22 (2.2)	▽
[2] Egypt	18 (1.5)	▽
South Africa (9)	14 (0.8)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	80 (2.2)	▲
Ontario, Canada	73 (2.0)	▲
‡ Quebec, Canada	73 (2.6)	▲
[2] Dubai, UAE	65 (1.6)	▲
Western Cape, RSA (9)	36 (2.3)	▽
Abu Dhabi, UAE	34 (1.8)	▽
Gauteng, RSA (9)	24 (1.8)	▽

Content Domain: Biology

Cognitive Domain: Reasoning

Description: Reasons how a crocodile's angle of vision helps it to survive in the environment

Dixon read a fact sheet about crocodiles.

Crocodile Facts

1. Crocodiles have a lifespan of up to 75 years.

2. Crocodiles today look like ancient crocodiles found in fossils.

3. Crocodiles have an angle of vision of 290° as shown in the diagram.

How can a crocodile's angle of vision help it to survive in its environment?

Give one reason.

The crocodile can see predators and prey almost all of the way around its body without moving its head.

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.11.2: Intermediate International Benchmark of Science Achievement – Example Item 2

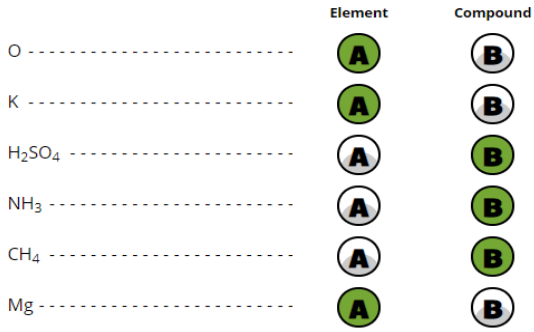
Country	Percent Full Credit	
Finland	89 (1.6)	▲
Lithuania	88 (1.7)	▲
[2] Russian Federation	83 (1.9)	▲
[2] Singapore	78 (1.8)	▲
Chinese Taipei	78 (1.5)	▲
Japan	77 (1.9)	▲
[2] Kazakhstan	75 (2.1)	▲
[1] Georgia	74 (2.9)	▲
England	74 (2.5)	▲
Korea, Rep. of	73 (2.2)	▲
[3] Israel	73 (2.2)	▲
Hungary	72 (1.8)	▲
Portugal	71 (2.2)	▲
† Norway (9)	71 (2.9)	▲
Cyprus	70 (2.3)	▲
Romania	67 (2.3)	▲
Turkey	65 (2.1)	
Italy	64 (3.0)	
Qatar	64 (2.6)	
† United States	63 (2.0)	
International Average	**61 (0.4)**	
Australia	61 (2.3)	
Lebanon	61 (2.8)	
Jordan	60 (2.5)	
[2] Sweden	59 (2.1)	
Ireland	58 (2.6)	
United Arab Emirates	58 (1.0)	▽
Bahrain	56 (2.0)	▽
Oman	54 (1.8)	▽
Chile	49 (2.5)	▽
† New Zealand	48 (3.0)	▽
Kuwait	47 (2.4)	▽
Morocco	45 (1.9)	▽
France	45 (2.6)	▽
[2] Egypt	42 (2.3)	▽
South Africa (9)	41 (1.2)	▽
Malaysia	40 (1.7)	▽
† Hong Kong SAR	39 (2.9)	▽
[2] Saudi Arabia	31 (1.6)	▽
Iran, Islamic Rep. of	29 (1.8)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	90 (1.5)	▲
‡ Quebec, Canada	79 (2.1)	▲
[2] Dubai, UAE	73 (1.7)	▲
Western Cape, RSA (9)	56 (2.5)	▽
Gauteng, RSA (9)	50 (1.8)	▽
Abu Dhabi, UAE	47 (1.7)	▽
Ontario, Canada	32 (2.6)	▽

Content Domain: Chemistry

Cognitive Domain: Applying

Description: From a list of symbols and formulas, recognizes which are elements and which are compounds

Click the circle to show whether each symbol or formula represents an element or compound.



The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.11.3: Intermediate International Benchmark of Science Achievement – Example Item 3

Country	Percent Correct	
[2] Singapore	90 (1.2)	▲
Korea, Rep. of	86 (1.5)	▲
Hungary	84 (1.4)	▲
Ireland	84 (1.7)	▲
[2] Russian Federation	81 (2.1)	▲
Australia	80 (1.6)	▲
Italy	80 (2.0)	▲
England	80 (2.0)	▲
† Norway (9)	79 (1.9)	▲
Cyprus	77 (1.9)	▲
Lithuania	77 (2.1)	▲
† New Zealand	76 (1.8)	▲
† United States	74 (2.4)	▲
Chinese Taipei	74 (1.7)	▲
Finland	73 (1.8)	▲
Portugal	73 (2.6)	
[2] Sweden	72 (2.1)	
Malaysia	72 (1.9)	
[3] Israel	71 (2.1)	
Oman	71 (1.9)	
Bahrain	70 (1.9)	
Romania	69 (2.2)	
International Average	**69 (0.3)**	
Japan	68 (1.7)	
Iran, Islamic Rep. of	67 (1.9)	
Chile	67 (2.6)	
France	67 (2.3)	
Turkey	67 (2.1)	
Qatar	66 (2.2)	
Jordan	65 (2.1)	
Kuwait	65 (2.5)	
United Arab Emirates	65 (1.1)	▽
† Hong Kong SAR	61 (2.7)	▽
[2] Saudi Arabia	59 (1.8)	▽
[2] Egypt	54 (1.8)	▽
South Africa (9)	53 (1.5)	▽
[2] Kazakhstan	48 (2.2)	▽
Morocco	47 (1.9)	▽
[1] Georgia	46 (2.7)	▽
Lebanon	39 (2.6)	▽
Benchmarking Participants		
‡ Quebec, Canada	85 (2.1)	▲
Moscow City, Russian Fed.	84 (2.0)	▲
Ontario, Canada	84 (1.8)	▲
[2] Dubai, UAE	81 (1.7)	▲
Western Cape, RSA (9)	69 (1.6)	
Gauteng, RSA (9)	68 (1.5)	
Abu Dhabi, UAE	53 (1.8)	▽

Content Domain: Physics

Cognitive Domain: Knowing

Description: Recognizes why a vehicle has a different weight on Mars than it does on Earth

Scientists sent a special vehicle to Mars to make a map of the surface of the planet. A diagram of the vehicle is shown.

The vehicle has a different weight on Mars than it has on the Earth.

Why does the vehicle have different weights on the two planets?

A. The vehicle lost mass when it was transported from Earth to Mars.

B. The vehicle gained mass when it began moving on Mars.

C. The magnetic attraction on Earth is different from Mars.

D. The gravitational attraction on Earth is different from Mars.

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

High Benchmark: Full Description and Example Items

Exhibit 4.12 presents the description of science achievement at the High International Benchmark. Eighth grade students reaching this level demonstrated conceptual understanding of topics related to biology, chemistry, physics, and Earth science.

Exhibit 4.12.1 provides an example from the biology domain. Forty-eight percent of the eighth grade students, on average, were able to explain why increasing the number of gardens reduces the amount of carbon dioxide in the air. With 85 percent success, Singapore had the highest percentage correct.

Exhibit 4.12.2 provides an example from the chemistry domain. In this item, students were asked to interpret the results of a science experiment shown in a diagram and provide evidence. Students in the Russian Federation were the most successful—69 percent correct. The international average was 39 percent.

A physics example is shown in Exhibit 4.12.3. Seventy-eight percent of the students in Chinese Taipei—by far the highest percentage correct—explained that you cannot hear a phone ring in a vacuum because there is no air. The international average was 38 percent.

Exhibit 4.12.4 provides an example from Earth science asking students to identify the shrinking size of polar ice caps as evidence that the Earth is becoming warmer. Chinese Taipei had the highest achievement with 87 percent correct, and 57 percent of eighth grade students internationally answered correctly, on average.

Exhibit 4.12: Description of the TIMSS 2019 High International Benchmark (550) of Science Achievement

High International Benchmark

550

Summary

Students apply understanding of concepts from biology, chemistry, physics, and Earth science. Students can apply knowledge of the characteristics of groups of animals, life processes in humans, cells and their functions, genetic inheritance, ecosystems, and nutrition. Students show some knowledge and understanding of the composition and properties of matter and chemical reactions. They can apply basic knowledge of energy transformation and transfer, electrical circuits, properties of magnets, light, sound, and forces. They can apply knowledge of Earth's physical features, processes, cycles, and history, and show some understanding of Earth's resources and their use.

Students apply knowledge of the characteristics of groups of animals and life processes in humans. They apply knowledge of cells and their functions, recognizing, for example, what happens to an animal's cells as it grows, and distinguishing between plant and animal cells. Students have a basic understanding of genetic inheritance in plants and animals. They can communicate understanding of ecosystems and the interaction of organisms with their environment. Students can apply some knowledge of human health related to nutrition.

Students show some knowledge and understanding of the composition and properties of matter, including identifying structural models of simple substances. Students show some knowledge of chemical reactions.

Students apply basic knowledge of energy transformation and transfer. They demonstrate understanding of parallel electrical circuits as well as properties of magnets. Students demonstrate understanding of light and sound in practical situations. They can identify the forces acting on objects at rest, predict whether an object will float or sink, and analyze force diagrams.

Students apply knowledge of Earth's physical features, processes, cycles, and history. They can interpret weather pattern data to identify climate types and have some understanding of Earth's resources and their use. They can recognize that the planets are visible because they reflect the Sun's light.

Students can combine and interpret information from various types of diagrams, graphs, and tables to draw conclusions.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.12.1: High International Benchmark of Science Achievement – Example Item 1

Country	Percent Full Credit	
[2] Singapore	85 (1.5)	▲
Chinese Taipei	69 (2.0)	▲
[2] Kazakhstan	68 (2.3)	▲
Turkey	67 (2.4)	▲
[2] Russian Federation	65 (2.5)	▲
[2] Sweden	63 (2.6)	▲
† Hong Kong SAR	60 (2.9)	▲
Korea, Rep. of	58 (2.5)	▲
Australia	57 (2.0)	▲
Qatar	57 (2.0)	▲
[3] Israel	57 (2.2)	▲
Ireland	56 (2.3)	▲
Lithuania	53 (2.7)	
Cyprus	52 (2.3)	
† United States	51 (2.5)	
Bahrain	50 (2.1)	
Romania	49 (2.5)	
United Arab Emirates	49 (1.2)	
Finland	49 (1.8)	
Kuwait	49 (2.8)	
International Average	**48 (0.4)**	
Jordan	48 (2.6)	
Portugal	47 (3.0)	
Italy	44 (2.4)	
England	44 (2.7)	
Hungary	43 (3.0)	
Oman	42 (2.2)	▽
Japan	42 (1.9)	▽
[2] Saudi Arabia	40 (2.0)	▽
Iran, Islamic Rep. of	40 (2.1)	▽
France	39 (2.2)	▽
[2] Egypt	37 (1.9)	▽
† Norway (9)	37 (2.3)	▽
[1] Georgia	36 (2.7)	▽
Morocco	34 (1.6)	▽
Malaysia	33 (1.7)	▽
† New Zealand	30 (1.9)	▽
Lebanon	29 (2.0)	▽
Chile	24 (1.8)	▽
South Africa (9)	20 (1.1)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	79 (1.7)	▲
[2] Dubai, UAE	66 (2.0)	▲
Ontario, Canada	49 (2.5)	
‡ Quebec, Canada	42 (2.7)	▽
Abu Dhabi, UAE	37 (1.5)	▽
Western Cape, RSA (9)	33 (1.8)	▽
Gauteng, RSA (9)	32 (1.7)	▽

Content Domain: Biology

Cognitive Domain: Reasoning

Description: Explains how roof gardens in cities help reduce the amount of carbon dioxide in the air

In some large cities, owners of large buildings and houses have installed gardens on the roofs. Having more gardens helps reduce the amount of carbon dioxide in the air.

How does increasing the number of gardens help reduce the amount of carbon dioxide in the air?

The trees and plants in the gardens take carbon dioxide out of the air during photosynthesis and give off oxygen.

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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Exhibit 4.12.2: High International Benchmark of Science Achievement – Example Item 2

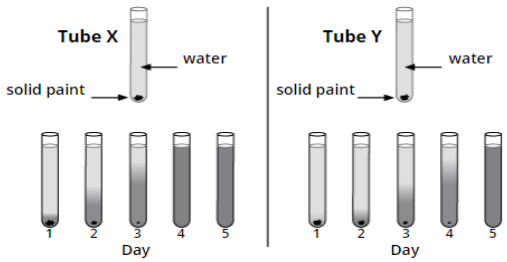
Country	Percent Full Credit	
[2] Russian Federation	69 (1.8)	▲
Japan	67 (2.0)	▲
[2] Singapore	64 (1.9)	▲
Korea, Rep. of	63 (2.4)	▲
Lithuania	59 (2.4)	▲
† United States	55 (1.9)	▲
† New Zealand	52 (1.8)	▲
Chinese Taipei	52 (2.0)	▲
Portugal	51 (2.8)	▲
Hungary	51 (2.2)	▲
Australia	49 (2.0)	▲
Turkey	49 (2.4)	▲
Ireland	49 (2.4)	▲
[3] Israel	48 (2.5)	▲
Finland	48 (1.7)	▲
[2] Sweden	45 (2.6)	▲
† Hong Kong SAR	40 (2.4)	
[2] Kazakhstan	40 (2.8)	
Bahrain	39 (1.9)	
International Average	**39 (0.3)**	
France	38 (2.3)	
Chile	35 (2.3)	
Qatar	35 (2.6)	
Cyprus	34 (2.4)	
Italy	33 (2.4)	▽
Romania	32 (2.4)	▽
† Norway (9)	32 (2.1)	▽
England	31 (2.5)	▽
Morocco	29 (1.6)	▽
Malaysia	27 (1.5)	▽
Iran, Islamic Rep. of	27 (2.1)	▽
[1] Georgia	27 (2.9)	▽
Oman	26 (1.7)	▽
Kuwait	23 (1.7)	▽
United Arab Emirates	21 (0.9)	▽
[2] Saudi Arabia	20 (1.4)	▽
South Africa (9)	20 (0.9)	▽
Jordan	15 (1.4)	▽
Lebanon	13 (1.5)	▽
[2] Egypt	5 (0.7)	▽
Benchmarking Participants		
‡ Quebec, Canada	63 (2.5)	▲
Moscow City, Russian Fed.	59 (2.3)	▲
Ontario, Canada	56 (2.5)	▲
Western Cape, RSA (9)	37 (1.8)	
Gauteng, RSA (9)	36 (1.7)	
[2] Dubai, UAE	35 (2.0)	
Abu Dhabi, UAE	15 (1.1)	▽

Content Domain: Chemistry

Cognitive Domain: Reasoning

Description: Explains the effect of temperature on diffusion in the context of an investigation

Maria placed two identical pieces of solid paint at the bottom of two identical tubes, X and Y, filled with water. On Day 1 she put one tube in a refrigerator and left the other in the warm room. Maria took a picture of each tube at the same time for five days. The diagram shows Maria's pictures from each day.



Which tube was in the refrigerator?

(Click one box.)

☐ Tube X

☑ Tube Y

Explain your answer.

The paint in Tube X spread through the water faster. The test tube is fully dark on day 4 for Tube X. The test tube is not fully dark until day 5 for Tube Y. The cold water made the mixing go more slowly in Tube Y.

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.12.3: High International Benchmark of Science Achievement – Example Item 3

Country	Percent Full Credit	
Chinese Taipei	78 (1.8)	▲
Turkey	61 (2.1)	▲
[2] Singapore	59 (2.5)	▲
Japan	56 (2.2)	▲
Lithuania	56 (2.8)	▲
Korea, Rep. of	53 (2.6)	▲
Malaysia	52 (2.0)	▲
† Hong Kong SAR	51 (3.3)	▲
Qatar	50 (2.8)	▲
Jordan	46 (2.3)	▲
[2] Sweden	46 (2.3)	▲
France	44 (2.5)	▲
Finland	44 (2.1)	▲
Hungary	43 (2.2)	▲
[2] Russian Federation	42 (2.8)	
[2] Kazakhstan	42 (2.0)	
[2] Saudi Arabia	41 (2.2)	
[1] Georgia	40 (2.8)	
United Arab Emirates	39 (1.1)	
International Average	**38 (0.4)**	
Portugal	38 (2.7)	
† United States	37 (2.3)	
Cyprus	36 (2.4)	
England	35 (2.8)	
Oman	33 (1.9)	▽
Australia	33 (2.1)	▽
Kuwait	33 (2.8)	▽
Ireland	33 (2.3)	▽
[2] Egypt	32 (2.0)	▽
† New Zealand	31 (2.1)	▽
Romania	30 (2.3)	▽
Morocco	29 (1.7)	▽
Bahrain	29 (1.8)	▽
[3] Israel	26 (2.1)	▽
† Norway (9)	26 (2.0)	▽
Italy	22 (2.3)	▽
Lebanon	19 (1.7)	▽
Iran, Islamic Rep. of	15 (1.4)	▽
South Africa (9)	11 (0.7)	▽
Chile	7 (1.3)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	73 (2.2)	▲
[2] Dubai, UAE	52 (2.0)	▲
Abu Dhabi, UAE	32 (1.7)	▽
‡ Quebec, Canada	28 (2.7)	▽
Ontario, Canada	23 (2.0)	▽
Western Cape, RSA (9)	22 (1.6)	▽
Gauteng, RSA (9)	17 (1.9)	▽

Content Domain: Physics

Cognitive Domain: Applying

Description: Applies knowledge of sound transmission to explain whether a ringing cell phone in a vacuum can be heard outside the vacuum chamber

Nada hangs her cell phone under a glass bowl as shown. The ringer on the phone is turned on. She removes the air from under the bowl so that her phone is in a vacuum.

Nada asks her friend to call her phone. Will they hear it ring?

(Click one box.)

☐ Yes

☑ No

Explain your answer.

There is no air under the bowl for the sound waves to travel through.

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.12.4: High International Benchmark of Science Achievement – Example Item 4

Country	Percent Correct	
Chinese Taipei	87 (1.3)	▲
Finland	82 (1.8)	▲
Ireland	79 (1.9)	▲
Hungary	77 (2.1)	▲
Lithuania	76 (2.1)	▲
[2] Singapore	76 (1.9)	▲
Japan	75 (1.8)	▲
Turkey	74 (2.0)	▲
† Norway (9)	70 (2.0)	▲
[2] Sweden	70 (2.0)	▲
England	69 (2.8)	▲
† New Zealand	68 (2.0)	▲
Korea, Rep. of	67 (2.6)	▲
Australia	67 (1.5)	▲
Italy	65 (2.4)	▲
† United States	65 (2.4)	▲
[2] Russian Federation	63 (2.7)	▲
† Hong Kong SAR	63 (2.8)	▲
Cyprus	63 (2.3)	▲
Chile	60 (2.2)	
[3] Israel	58 (2.8)	
France	57 (2.5)	
International Average	**57 (0.4)**	
Portugal	54 (2.8)	
[2] Kazakhstan	52 (2.5)	▽
Romania	52 (2.7)	
Qatar	48 (2.5)	▽
United Arab Emirates	47 (1.1)	▽
Kuwait	45 (2.5)	▽
Bahrain	44 (2.6)	▽
[1] Georgia	44 (2.9)	▽
Oman	43 (2.0)	▽
Malaysia	43 (1.7)	▽
[2] Egypt	40 (1.9)	▽
[2] Saudi Arabia	39 (2.3)	▽
Jordan	36 (1.8)	▽
Iran, Islamic Rep. of	28 (1.5)	▽
Morocco	28 (1.6)	▽
South Africa (9)	24 (1.1)	▽
Lebanon	24 (2.1)	▽
Benchmarking Participants		
‡ Quebec, Canada	78 (2.1)	▲
Ontario, Canada	75 (2.4)	▲
Moscow City, Russian Fed.	72 (2.1)	▲
[2] Dubai, UAE	65 (2.1)	▲
Abu Dhabi, UAE	39 (1.6)	▽
Western Cape, RSA (9)	35 (2.1)	▽
Gauteng, RSA (9)	25 (1.6)	▽

Content Domain: Earth Science

Cognitive Domain: Reasoning

Description: Identifies evidence that the Earth is becoming warmer over time

Scientists have evidence of changes in Earth's climate over the last 650,000 years.

Which of the following statements would be evidence that the Earth is becoming warmer?

A. a decrease in the size of Earth's polar ice caps

B. a decrease in the average depth of Earth's oceans

C. an increase in the number of volcanoes erupting

D. an increase in the number of sunspots

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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Advanced Benchmark: Full Description and Example Items

Exhibit 4.13 presents the description of eighth grade performance at the Advanced International Benchmark. Students reaching the Advanced level communicated conceptual understanding of concepts related to biology, chemistry, physics, and Earth science in a variety of contexts.

Exhibit 4.13.1 shows an item from the biology domain asking students to correctly classify seven animals as mammals or non-mammals. On average, 30 percent of the eighth grade students were successful. Japan was the highest achieving country with 75 percent correct.

Exhibit 4.13.2 presents an item from the chemistry domain about the periodic table of elements. The international average was 29 percent correct, and top-achieving Singapore had 60 percent on this item.

Exhibit 4.13.3 shows a physics item that asked what happens to gas molecules inside a balloon when the balloon is heated. Singapore and Israel had the highest performance on this item with 68–69 percent correct. The international average was 41 percent.

The last example item is shown in Exhibit 4.13.4. From the Earth science content domain, the item asked students to recognize what causes a weather balloon to expand as it rises above the ground. On average, 42 percent of the eighth grade students correctly answered that the atmospheric pressure decreases. The highest percentage correct, 68 percent, was posted by Japan.

Exhibit 4.13: Description of the TIMSS 2019 Advanced International Benchmark (625) of Science Achievement

Advanced International Benchmark

625

Summary

Students communicate understanding of concepts related to biology, chemistry, physics, and Earth science in a variety of contexts. Students can classify animals into taxonomic groups. They can apply knowledge of cell structures and their functions. Students show some understanding of diversity, adaptation, and natural selection. They also recognize the interdependence of populations of organisms in an ecosystem. Students demonstrate knowledge of the composition of matter and the periodic table of the elements. Students use physical properties of matter to sort, classify, and compare substances and materials. They also recognize evidence that a chemical reaction has occurred. Students communicate understanding of particle spacing and motion in different physical states. Students apply knowledge of energy transfer and electrical circuits, can relate the properties of light and sound to common phenomena, and demonstrate understanding of forces in everyday contexts. Students communicate understanding of Earth's structure, physical features, and processes. They demonstrate knowledge of the Earth's resources and their conservation.

Students can classify animals into taxonomic groups. They can apply knowledge of cell structures and their functions. Students show some understanding of diversity, adaptation, and natural selection among organisms. They also recognize the interdependence of populations of organisms in an ecosystem.

Students demonstrate knowledge of the composition of matter. They demonstrate understanding of how the elements are arranged in the periodic table. Students use physical properties of matter to sort, classify, and compare substances and materials. They also recognize evidence that a chemical reaction has occurred.

Students communicate understanding of particle spacing and motion in different physical states. They can apply knowledge of energy transfer in practical and abstract contexts. Students can relate the properties of light and sound to common phenomena. They can apply knowledge of electricity. For example, they can recognize components in a circuit, indicate whether parts of a lightbulb are electrical conductors or insulators, and evaluate statements about battery life and bulb brightness in two circuits. Students demonstrate understanding of forces and motion and pressure in everyday contexts.

Students communicate understanding of Earth's structure, physical features, and processes. They also demonstrate knowledge of the Earth's resources and their conservation.

Students can combine and compare information from several sources to draw conclusions. They can interpret information in diagrams, graphs, and tables to identify and explain science concepts.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.13.1: Advanced International Benchmark of Science Achievement – Example Item 1

Country	Percent Full Credit	
Japan	75 (1.9)	▲
Chinese Taipei	63 (1.9)	▲
[2] Singapore	62 (2.0)	▲
Hungary	53 (2.8)	▲
† Hong Kong SAR	46 (2.6)	▲
[2] Russian Federation	44 (2.5)	▲
[1] Georgia	42 (3.2)	▲
Italy	41 (2.6)	▲
Romania	40 (2.4)	▲
Finland	37 (1.7)	▲
Lithuania	37 (2.7)	▲
[2] Kazakhstan	35 (2.6)	▲
Australia	35 (1.6)	▲
Portugal	35 (2.6)	▲
[3] Israel	33 (2.5)	
Korea, Rep. of	31 (2.1)	
† New Zealand	30 (2.0)	
† United States	30 (1.9)	
International Average	**30 (0.3)**	
England	27 (2.5)	
Cyprus	27 (2.0)	
United Arab Emirates	27 (1.2)	▽
Lebanon	26 (2.3)	
Bahrain	24 (2.3)	▽
Qatar	22 (1.7)	▽
Malaysia	21 (1.5)	▽
France	21 (1.8)	▽
Turkey	20 (2.0)	▽
Ireland	20 (1.9)	▽
Oman	20 (1.5)	▽
Jordan	18 (1.8)	▽
[2] Sweden	17 (1.7)	▽
† Norway (9)	16 (2.0)	▽
Chile	16 (1.7)	▽
Kuwait	16 (2.3)	▽
Morocco	16 (1.5)	▽
Iran, Islamic Rep. of	12 (1.4)	▽
[2] Saudi Arabia	10 (1.3)	▽
[2] Egypt	7 (1.2)	▽
South Africa (9)	5 (0.4)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	55 (2.5)	▲
[2] Dubai, UAE	37 (2.0)	▲
Ontario, Canada	37 (3.0)	▲
‡ Quebec, Canada	27 (2.2)	
Abu Dhabi, UAE	23 (1.5)	▽
Western Cape, RSA (9)	14 (1.4)	▽
Gauteng, RSA (9)	10 (1.6)	▽

Content Domain: Biology

Cognitive Domain: Applying

Description: Classifies 7 of 7 animals as mammals or non-mammals

Here is a list of animals.

ant	**cat**	**dolphin**	**earthworm**
fish	**frog**	**jellyfish**	

Classify the animals into two groups based on whether or not the animal is a mammal. List the animals in each group in the table.

Mammal	Not a mammal
cat dolphin	ant earthworm fish frog jellyfish

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.13.2: Advanced International Benchmark of Science Achievement – Example Item 2

Country	Percent Full Credit	
[2] Singapore	60 (2.1)	▲
Korea, Rep. of	56 (2.0)	▲
Turkey	49 (2.2)	▲
[2] Russian Federation	46 (2.4)	▲
Japan	44 (2.3)	▲
† Norway (9)	44 (2.5)	▲
Chinese Taipei	43 (2.2)	▲
Lithuania	42 (2.8)	▲
Hungary	41 (2.7)	▲
[2] Kazakhstan	40 (2.7)	▲
Australia	40 (2.1)	▲
† New Zealand	38 (2.2)	▲
Finland	36 (2.0)	▲
† United States	35 (1.8)	▲
Ireland	35 (2.3)	▲
[1] Georgia	32 (3.2)	
England	31 (2.7)	
[3] Israel	31 (2.4)	
[2] Sweden	29 (2.6)	
International Average	**29 (0.3)**	
United Arab Emirates	27 (1.1)	
Romania	26 (2.7)	
Bahrain	23 (2.0)	▽
Kuwait	23 (2.3)	▽
Lebanon	23 (2.2)	▽
Italy	21 (2.1)	▽
South Africa (9)	21 (1.1)	▽
Chile	21 (1.9)	▽
† Hong Kong SAR	21 (2.1)	▽
Iran, Islamic Rep. of	19 (2.3)	▽
Jordan	19 (2.1)	▽
[2] Egypt	18 (1.9)	▽
Portugal	17 (1.6)	▽
Qatar	15 (2.3)	▽
Cyprus	15 (1.8)	▽
France	15 (1.5)	▽
Malaysia	11 (1.1)	▽
Oman	8 (1.0)	▽
[2] Saudi Arabia	7 (1.3)	▽
Morocco	6 (1.1)	▽
Benchmarking Participants		
‡ Quebec, Canada	56 (2.7)	▲
Moscow City, Russian Fed.	55 (2.3)	▲
[2] Dubai, UAE	41 (2.0)	▲
Western Cape, RSA (9)	32 (2.1)	
Gauteng, RSA (9)	31 (2.3)	
Abu Dhabi, UAE	23 (1.4)	▽
Ontario, Canada	23 (2.4)	▽

Content Domain: Chemistry

Cognitive Domain: Applying

Description: Uses a portion of the periodic table to order four elements from the smallest atomic number to the largest atomic number

This is a portion of the periodic table of elements.

[1]H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

Hydrogen (H) is the first element of the periodic table. The nucleus of a hydrogen atom contains one proton. The atomic number of hydrogen is 1.

Four elements from the periodic table are shown below. The elements are not ordered by their atomic numbers.

Drag the four elements below to sort them by atomic number from smallest to largest.

Smallest **Largest**

Helium (He) | Carbon (C) | Fluorine (F) | Sodium (Na)

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.13.3: Advanced International Benchmark of Science Achievement – Example Item 3

Country	Percent Correct	
[2] Singapore	69 (2.2)	▲
[3] Israel	68 (2.1)	▲
Portugal	56 (2.6)	▲
Korea, Rep. of	56 (2.3)	▲
Bahrain	50 (2.1)	▲
Australia	50 (2.5)	▲
United Arab Emirates	50 (1.0)	▲
[2] Russian Federation	49 (2.5)	▲
England	49 (2.5)	▲
Turkey	49 (2.3)	▲
Chile	47 (2.6)	▲
Qatar	47 (2.4)	▲
† United States	47 (1.7)	▲
Japan	46 (2.6)	▲
Oman	45 (1.8)	▲
Lithuania	43 (2.4)	
[2] Sweden	41 (2.4)	
International Average	**41 (0.4)**	
Italy	40 (2.5)	
† New Zealand	40 (2.6)	
Chinese Taipei	38 (2.0)	
Kuwait	37 (2.3)	
Jordan	37 (2.5)	
France	36 (2.2)	▽
Malaysia	36 (2.1)	▽
[2] Saudi Arabia	36 (1.6)	▽
[1] Georgia	36 (3.0)	
† Hong Kong SAR	35 (3.1)	
[2] Kazakhstan	35 (2.1)	▽
Ireland	34 (2.4)	▽
Finland	34 (2.0)	▽
† Norway (9)	34 (2.1)	▽
Iran, Islamic Rep. of	31 (2.0)	▽
Cyprus	31 (2.2)	▽
Hungary	31 (2.0)	▽
Morocco	28 (1.8)	▽
Romania	27 (2.4)	▽
Lebanon	23 (2.4)	▽
[2] Egypt	22 (2.0)	▽
South Africa (9)	20 (0.9)	▽
Benchmarking Participants		
[2] Dubai, UAE	63 (1.9)	▲
Ontario, Canada	60 (2.6)	▲
Moscow City, Russian Fed.	59 (2.5)	▲
‡ Quebec, Canada	48 (2.8)	▲
Abu Dhabi, UAE	43 (1.9)	
Western Cape, RSA (9)	28 (2.0)	▽
Gauteng, RSA (9)	28 (2.0)	▽

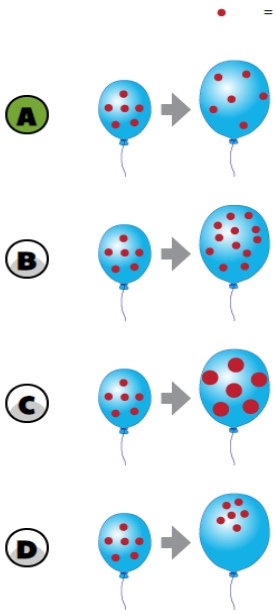
Content Domain: Physics

Cognitive Domain: Applying

Description: Recognizes a diagram of what happens to gas molecules inside a balloon when the balloon expands

Gas inside of a balloon expands when heated.

What happens to the gas molecules when the balloon expands?



▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.13.4: Advanced International Benchmark of Science Achievement – Example Item 4

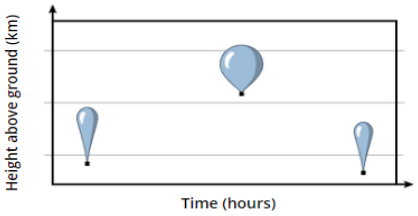
Country	Percent Correct	
Japan	68 (1.9)	▲
[2] Russian Federation	66 (2.6)	▲
Lithuania	65 (2.0)	▲
Korea, Rep. of	63 (2.2)	▲
Chinese Taipei	63 (2.0)	▲
Turkey	62 (2.4)	▲
[2] Kazakhstan	57 (2.4)	▲
Finland	55 (2.0)	▲
Hungary	52 (2.3)	▲
Bahrain	51 (2.0)	▲
† Hong Kong SAR	50 (2.5)	▲
France	49 (2.1)	▲
Italy	45 (2.8)	
[2] Singapore	45 (2.1)	
Romania	43 (2.3)	
England	42 (2.6)	
International Average	**42 (0.3)**	
[1] Georgia	42 (3.0)	
[2] Saudi Arabia	42 (2.0)	
Australia	41 (1.9)	
† United States	40 (1.8)	
Portugal	40 (2.1)	
United Arab Emirates	39 (1.0)	▽
† Norway (9)	39 (2.4)	
Qatar	37 (2.0)	▽
Ireland	36 (2.0)	▽
[2] Sweden	35 (2.2)	▽
[3] Israel	35 (2.7)	▽
† New Zealand	34 (2.5)	▽
Oman	34 (1.8)	▽
Cyprus	34 (2.2)	▽
Kuwait	33 (1.8)	▽
Chile	33 (2.2)	▽
Malaysia	32 (1.7)	▽
Morocco	30 (1.7)	▽
Jordan	29 (2.1)	▽
[2] Egypt	28 (1.8)	▽
Lebanon	25 (2.0)	▽
Iran, Islamic Rep. of	18 (1.5)	▽
South Africa (9)	12 (0.7)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	74 (2.3)	▲
‡ Quebec, Canada	51 (3.3)	▲
[2] Dubai, UAE	47 (1.9)	▲
Ontario, Canada	37 (2.9)	
Abu Dhabi, UAE	37 (1.5)	▽
Gauteng, RSA (9)	18 (1.4)	▽
Western Cape, RSA (9)	18 (1.5)	▽

Content Domain: Earth Science

Cognitive Domain: Knowing

Description: Recognizes why a balloon gets bigger as its height above the ground increases

The diagram shows the height above the ground of a helium-filled weather balloon during a period of several hours.



What causes the balloon to become bigger as its height above the ground increases?

A. Gravity decreases.

B. Atmospheric pressure decreases.

C. The balloon is heated by the Sun.

D. The balloon absorbs air.

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Average Achievement in Science Content and Cognitive Domains

TIMSS 2019 Science Content and Cognitive Domains

TIMSS 2019 assessed four content areas in science at the eighth grade: biology, chemistry, physics, and Earth science.

Thirty-five percent of the eighth grade science assessment was devoted to biology, including characteristics and life processes of organisms; cells and their functions; life cycles, reproduction, and heredity; diversity, adaptation, and natural selection; ecosystems; and human health. Eighth grade students were asked about how structure relates to function in organisms, cell structure and function, and the processes of photosynthesis and cellular respiration. Other areas assessed included reproduction and heredity, molecular biology and molecular genetics, adaptation and natural selection, and processes and interactions in ecosystems.

Twenty percent of the assessment covered three chemistry topics—composition of matter, properties of matter, and chemical change. Students were asked about elements, compounds, and mixtures; the use of the periodic table; physical and chemical properties of matter; as well as the properties of mixtures and solutions and the properties of acids and bases. The chemical change topic focused on the characteristics of chemical changes and the conservation of matter during chemical changes.

Twenty-five percent of the assessment was devoted to physics, which consisted of five topics: physical states and changes in matter, energy transformation and transfer, light and sound, electricity and magnetism, and motion and forces. For example, eighth grade students were asked to describe processes involved in changes in the state of matter, to identify different forms of energy and describe simple energy transformations, to apply the principle of conservation of total energy in practical situations, and to understand the difference between thermal energy (heat) and temperature.

The remaining 20 percent of the assessment was devoted to Earth science topics. Students were asked about the structure and physical features of Earth, including Earth's structural layers, and the atmosphere, as well as processes, cycles, and patterns, including geological processes that have occurred over Earth's history, the water cycle, and patterns of weather and climate. Earth's resources and their use and conservation also were covered. The area of Earth in the Solar System included identifying how observable phenomena relate to the movements of Earth and the Moon, and describing the features of Earth, the Moon, and other planets.

Eighth grade students also needed to draw on a range of cognitive skills across the content domains already described above. There are three cognitive domains. Thirty-five percent of the eighth grade assessment was devoted to the knowing cognitive domain, 35 percent to applying, and 30 percent to reasoning. The knowing domain covers the facts, concepts, and procedures students need to know, while the applying domain focuses on students' ability to apply knowledge and conceptual understanding to solve practical problems or answer questions. The reasoning domain goes beyond

the solution of familiar problems to encompass unfamiliar situations, complex contexts, and multistep problems. Also, five science practices fundamental to scientific inquiry were assessed within the content areas and cognitive domains.

Average Achievement in Content Domains

Exhibit 4.14 shows countries' average science achievement in each of the four content domains relative to their overall average achievement (presented from highest to lowest overall average achievement). Based on countries' strengths and weaknesses, the TIMSS 2019 countries appear to be placing relatively less instructional emphasis on the chemistry and physics domains. Of the 37 participating countries for which cognitive domain scores were estimated, 11 had a relative strength in biology and 8 had a relative weakness. In chemistry, 10 had a relative strength and 16 had a relative weakness; in physics, 9 had a relative strength and 14 had a relative weakness. In most countries, Earth science tended to be either a relative strength (12 countries) or a relative weakness (19 countries). England and Hungary were the only two countries without at least one relative strength or relative weakness compared with its overall achievement.

Exhibit 4.14: Average Achievement in Science Content Domains

Country	Overall Science Average Scale Score	Biology (75 Items)		Chemistry (42 Items)		Physics (52 Items)		Earth Science (42 Items)	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
[2] Singapore	608 (3.9)	622 (4.2)	14 (1.9) ▲	616 (5.0)	8 (1.8) ▲	619 (4.1)	12 (1.0) ▲	562 (4.1)	-46 (1.8) ▽
Chinese Taipei	574 (1.9)	576 (2.2)	2 (1.2)	594 (2.4)	20 (1.2) ▲	555 (2.7)	-19 (2.3) ▽	579 (2.5)	5 (2.0) ▲
Japan	570 (2.1)	574 (2.3)	4 (1.5) ▲	560 (2.7)	-9 (2.1) ▽	570 (2.5)	1 (1.7)	572 (3.2)	2 (2.1)
Korea, Rep. of	561 (2.1)	560 (2.2)	-1 (1.3)	551 (2.5)	-10 (1.6) ▽	569 (2.7)	9 (1.7) ▲	562 (3.2)	1 (2.3)
[2] Russian Federation	543 (4.2)	543 (4.5)	0 (1.4)	551 (4.2)	8 (1.5) ▲	540 (4.7)	-2 (2.6)	533 (4.4)	-10 (1.8) ▽
Finland	543 (3.1)	534 (3.3)	-9 (1.6) ▽	545 (3.8)	3 (2.0)	539 (3.9)	-3 (1.9)	558 (3.5)	16 (2.8) ▲
Lithuania	534 (3.0)	535 (3.0)	1 (1.4)	530 (3.2)	-4 (2.3)	529 (3.5)	-5 (2.0) ▽	534 (3.3)	0 (2.8)
Hungary	530 (2.6)	530 (2.7)	0 (1.2)	527 (3.5)	-2 (2.4)	528 (2.9)	-2 (1.5)	535 (3.9)	5 (2.7)
Australia	528 (3.2)	531 (3.3)	3 (1.4)	515 (3.8)	-14 (1.2) ▽	529 (3.6)	0 (1.1)	533 (3.3)	5 (1.9) ▲
Ireland	523 (2.9)	521 (3.2)	-2 (1.6)	512 (3.9)	-11 (2.4) ▽	519 (3.8)	-4 (1.9) ▽	536 (3.8)	13 (3.1) ▲
† United States	522 (4.7)	530 (4.8)	7 (0.9) ▲	509 (5.2)	-13 (1.8) ▽	515 (5.0)	-8 (1.1) ▽	530 (5.1)	7 (1.2) ▲
[2] Sweden	521 (3.2)	519 (3.4)	-3 (1.8)	509 (3.7)	-13 (1.5) ▽	520 (3.8)	-1 (2.1)	530 (3.2)	9 (1.4) ▲
Portugal	519 (2.9)	527 (3.0)	8 (1.6) ▲	512 (3.5)	-6 (1.8) ▽	497 (3.5)	-22 (1.9) ▽	531 (3.4)	12 (1.8) ▲
England	517 (4.8)	516 (5.2)	-1 (2.0)	512 (6.0)	-5 (3.1)	516 (5.1)	0 (1.2)	517 (5.5)	1 (2.6)
Turkey	515 (3.7)	513 (3.4)	-2 (1.2) ▽	516 (4.8)	0 (2.6)	518 (4.0)	3 (1.9)	509 (3.8)	-6 (1.8) ▽
[3] Israel	513 (4.2)	512 (4.2)	-1 (1.1)	518 (4.6)	5 (1.7) ▲	520 (4.9)	7 (1.6) ▲	495 (4.7)	-18 (2.4) ▽
† Hong Kong SAR	504 (5.2)	501 (5.7)	-3 (1.3) ▽	485 (5.5)	-19 (2.6) ▽	510 (5.6)	6 (2.7) ▲	512 (5.6)	8 (2.7) ▲
Italy	500 (2.6)	508 (2.7)	8 (1.0) ▲	484 (3.0)	-17 (1.9) ▽	487 (4.5)	-14 (3.6) ▽	512 (3.5)	11 (2.1) ▲
† New Zealand	499 (3.5)	498 (3.7)	-1 (1.5)	482 (3.8)	-17 (1.5) ▽	502 (3.8)	3 (1.3) ▲	510 (3.7)	11 (1.3) ▲
† Norway (9)	495 (3.1)	486 (2.8)	-10 (1.6) ▽	492 (3.7)	-3 (2.6)	493 (3.6)	-3 (2.1)	519 (3.9)	23 (2.9) ▲
France	489 (2.7)	488 (2.9)	0 (1.8)	465 (3.2)	-24 (2.0) ▽	491 (3.6)	2 (3.0)	502 (4.3)	14 (3.1) ▲
Bahrain	486 (1.9)	492 (1.9)	6 (1.4) ▲	480 (2.4)	-6 (1.7) ▽	480 (2.6)	-6 (2.1) ▽	475 (2.8)	-11 (2.1) ▽
Cyprus	484 (1.9)	489 (2.4)	5 (1.7) ▲	478 (2.1)	-5 (1.4) ▽	480 (3.6)	-4 (3.3)	473 (2.6)	-11 (2.3) ▽
[2] Kazakhstan	478 (3.1)	476 (3.2)	-2 (1.4)	494 (3.6)	16 (1.9) ▲	476 (3.9)	-3 (2.4)	448 (4.1)	-30 (2.6) ▽
Qatar	475 (4.4)	476 (4.4)	2 (1.2)	474 (4.4)	0 (1.5)	469 (4.4)	-5 (1.7) ▽	465 (5.0)	-10 (2.6) ▽
United Arab Emirates	473 (2.2)	474 (2.5)	1 (0.8)	475 (2.4)	2 (0.7) ▲	469 (2.3)	-4 (0.7) ▽	465 (2.4)	-8 (0.9) ▽
Romania	470 (4.2)	479 (4.4)	9 (1.4) ▲	466 (5.0)	-3 (2.6)	458 (4.3)	-12 (1.5) ▽	453 (4.7)	-16 (3.7) ▽
Chile	462 (2.9)	471 (3.0)	9 (1.2) ▲	442 (2.9)	-20 (1.6) ▽	450 (3.7)	-12 (1.8) ▽	464 (3.3)	2 (1.4)
Malaysia	460 (3.5)	463 (3.7)	2 (1.4)	434 (4.2)	-26 (1.5) ▽	475 (3.4)	15 (1.3) ▲	452 (4.3)	-9 (1.7) ▽
Oman	457 (2.9)	466 (3.3)	9 (1.1) ▲	443 (3.1)	-14 (1.2) ▽	449 (3.1)	-8 (1.1) ▽	449 (3.0)	-9 (1.8) ▽
Jordan	452 (4.7)	457 (5.2)	5 (1.3) ▲	454 (5.3)	2 (1.6)	449 (4.6)	-3 (1.4) ▽	428 (4.7)	-24 (2.5) ▽
Iran, Islamic Rep. of	449 (3.6)	448 (3.7)	-2 (1.2)	450 (4.5)	1 (2.0)	453 (4.2)	4 (2.5)	437 (4.0)	-13 (2.3) ▽
[1] Georgia	447 (3.9)	447 (3.5)	0 (2.1)	456 (4.3)	9 (2.1) ▲	436 (5.0)	-11 (3.3) ▽	431 (3.6)	-16 (2.0) ▽
Kuwait	444 (5.7)	- -	- -	- -	- -	- -	- -	- -	- -
[2] Saudi Arabia	431 (2.6)	- -	- -	- -	- -	- -	- -	- -	- -
Morocco	394 (2.7)	387 (3.0)	-7 (1.1) ▽	402 (3.0)	8 (1.7) ▲	402 (2.9)	8 (1.9) ▲	357 (3.3)	-37 (1.6) ▽
[2] Egypt	389 (5.4)	381 (5.6)	-8 (1.0) ▽	397 (5.9)	8 (1.6) ▲	394 (5.0)	5 (1.9) ▲	367 (5.5)	-22 (1.3) ▽
Lebanon	377 (4.6)	355 (5.1)	-22 (1.9) ▽	412 (4.6)	36 (2.4) ▲	378 (4.9)	1 (2.2)	337 (5.1)	-40 (3.4) ▽
Ψ South Africa (9)	370 (3.1)	359 (3.0)	-11 (1.4) ▽	372 (4.2)	2 (2.4)	381 (3.0)	11 (1.3) ▲	366 (3.2)	-4 (1.6) ▽
Benchmarking Participants									
Moscow City, Russian Fed.	567 (2.9)	565 (3.1)	-1 (1.2)	561 (2.9)	-5 (1.1) ▽	576 (3.6)	10 (2.1) ▲	565 (3.6)	-2 (1.9)
[2] Dubai, UAE	548 (2.0)	554 (2.2)	6 (0.9) ▲	554 (2.2)	6 (1.4) ▲	539 (2.6)	-8 (1.9) ▽	538 (2.3)	-9 (1.7) ▽
‡ Quebec, Canada	537 (3.6)	531 (3.8)	-6 (1.5) ▽	548 (4.1)	12 (1.8) ▲	521 (4.2)	-16 (2.5) ▽	553 (4.5)	16 (2.7) ▲
Ontario, Canada	522 (3.0)	534 (3.2)	13 (1.9) ▲	492 (3.9)	-30 (3.1) ▽	520 (3.5)	-2 (2.5)	520 (3.0)	-2 (1.7)
Western Cape, RSA (9)	439 (5.1)	432 (5.2)	-7 (2.6) ▽	442 (7.2)	2 (5.6)	442 (6.2)	3 (4.2)	442 (6.7)	3 (5.6)
Gauteng, RSA (9)	422 (3.9)	416 (3.9)	-6 (2.1) ▽	423 (4.2)	0 (1.8)	428 (4.5)	6 (2.6) ▲	419 (4.1)	-3 (2.5)
Abu Dhabi, UAE	420 (3.6)	417 (3.9)	-3 (1.2) ▽	421 (4.1)	1 (1.3)	420 (3.8)	0 (1.0)	413 (4.1)	-7 (2.0) ▽

▲ Subscale score significantly higher than overall science score
▽ Subscale score significantly lower than overall science score

Numbers of items are based on the TIMSS 2019 eighth grade science eAssessment items included in scaling.
Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available because average achievement could not be accurately estimated.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Trends in Average Achievement in Content Domains

Exhibit 4.15 presents trends in average achievement for the four science content domains assessed by TIMSS 2019—biology, chemistry, physics, and Earth science. The results are moderately positive, showing more increases than decreases in all four content areas, especially most recently in biology. Thirty-one TIMSS 2019 countries also participated in TIMSS 2015 and have comparable data in the content domains. In the biology content area, 13 showed improvement and 5 showed declines; in chemistry, 8 showed improvement and 8 showed declines; in physics, 9 showed improvement and 5 showed declines; and in Earth science, 10 showed improvement and 5 showed declines.

TIMSS began providing scaled results in the content domains in 2007, with 23 countries having trends between 2007 and 2019. Compared with 2007, in TIMSS 2019, 11 countries showed improvement and 5 showed declines in biology, 8 countries showed improvement and 6 showed declines in chemistry, 11 showed improvement and 6 showed declines in physics, and 12 showed improvement and 6 showed declines in Earth science.

Exhibit 4.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▽) than the performance in the column year.

Country	Biology				Chemistry				Physics				Earth Science			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007		2015	2011	2007
Australia																
2019	531 (3.3)	9 ▲	4	12 ▲	515 (3.8)	22 ▲	13 ▲	10	529 (3.6)	24 ▲	18 ▲	20 ▲	533 (3.3)	11 ▲	0	13 ▲
2015	522 (2.8)		-5	3	493 (3.3)		-8	-12 ▽	505 (2.7)		-6	-4	522 (2.9)		-11	1
2011	527 (4.8)			8	501 (5.0)			-3	511 (5.1)			2	533 (5.5)			13
2007	519 (3.8)				504 (4.0)				509 (4.3)				521 (4.4)			
Bahrain																
2019	492 (1.9)	24 ▲	44 ▲	22 ▲	480 (2.4)	18 ▲	33 ▲	14 ▲	480 (2.6)	19 ▲	23 ▲	17 ▲	475 (2.8)	15 ▲	24 ▲	15 ▲
2015	469 (2.6)		20 ▲	-1	462 (2.8)		15 ▲	-4	461 (2.6)		5	-2	461 (3.5)		9 ▲	0
2011	449 (2.0)			-22 ▽	448 (2.6)			-19 ▽	457 (1.7)			-7 ▽	451 (1.8)			-9 ▽
2007	470 (2.1)				467 (2.9)				463 (1.6)				460 (2.8)			
Chile																
2019	471 (3.0)	12 ▲	10 ▲		442 (2.9)	4	-5		450 (3.7)	11 ▲	-3		464 (3.3)	0	-12 ▽	
2015	459 (3.6)		-3		438 (3.6)		-9		439 (3.8)		-14 ▽		464 (3.2)		-12 ▽	
2011	462 (2.6)				447 (3.0)				453 (2.6)				476 (2.8)			
Chinese Taipei																
2019	576 (2.2)	11 ▲	19 ▲	22 ▲	594 (2.4)	16 ▲	9 ▲	10	555 (2.7)	-5	3	-4	579 (2.5)	-2	11 ▲	27 ▲
2015	565 (2.2)		8 ▲	11 ▲	579 (2.7)		-7	-6	560 (3.0)		8	1	581 (2.7)		12 ▲	29 ▲
2011	557 (2.5)			3	585 (3.8)			1	552 (3.3)			-6	568 (2.8)			16 ▲
2007	554 (3.7)				585 (4.7)				559 (4.2)				552 (3.4)			
Cyprus																
2019	489 (2.4)			45 ▲	478 (2.1)			30 ▲	480 (3.6)			25 ▲	473 (2.6)			20 ▲
2007	444 (2.3)				448 (3.1)				454 (3.6)				453 (2.6)			
Egypt																
[2] 2019	381 (5.6)	33 ▲		-19 ▽	397 (5.9)	2		-7	394 (5.0)	16 ▲		-12	367 (5.5)	16 ▲		-50 ▽
2015	348 (5.0)			-52 ▽	395 (5.0)			-9	378 (4.7)			-28 ▽	351 (4.6)			-65 ▽
2007	400 (3.7)				404 (4.7)				406 (3.8)				417 (4.4)			
England																
2019	516 (5.2)	-26 ▽	-17 ▽	-28 ▽	512 (6.0)	-17 ▽	-17 ▽	-27 ▽	516 (5.1)	-19 ▽	-17 ▽	-32 ▽	517 (5.5)	-18 ▽	-19 ▽	-14
2015	542 (4.0)		9	-2	529 (4.5)		0	-11	535 (3.9)		2	-14 ▽	536 (4.0)		-1	4
‡ 2011	533 (4.8)			-11	529 (5.2)			-11	533 (4.7)			-15 ▽	536 (5.3)			5
† 2007	544 (4.7)				539 (4.7)				549 (4.5)				531 (5.2)			
Finland																
2019	534 (3.3)		-14 ▽		545 (3.8)		-8		539 (3.9)		-1		558 (3.5)		-16 ▽	
2011	548 (2.8)				554 (2.6)				540 (2.9)				574 (3.0)			
Georgia																
[1] 2019	447 (3.5)	0	12 ▲	28 ▲	456 (4.3)	0	61 ▲	48 ▲	436 (5.0)	6	35 ▲	25 ▲	431 (3.6)	11 ▲	13 ▲	15 ▲
[1 2] 2015	447 (3.1)		12 ▲	28 ▲	456 (3.7)		61 ▲	48 ▲	429 (4.6)		28 ▲	19 ▲	420 (3.6)		2	4
[1] 2011	435 (3.2)			16 ▲	395 (3.2)			-13 ▽	401 (4.2)			-9	417 (3.5)			2
[1] 2007	419 (4.1)				408 (5.4)				411 (5.9)				416 (4.5)			
Hong Kong SAR																
† 2019	501 (5.7)	-48 ▽	-35 ▽	-29 ▽	485 (5.5)	-51 ▽	-41 ▽	-36 ▽	510 (5.6)	-30 ▽	-29 ▽	-20 ▽	512 (5.6)	-46 ▽	-28 ▽	-24 ▽
2015	549 (4.7)		13 ▲	19 ▲	536 (4.1)		10	15 ▲	540 (4.1)		2	10	558 (4.3)		19 ▲	23 ▲
2011	535 (3.6)			6	526 (3.6)			5	539 (3.6)			9	539 (3.6)			4
† 2007	529 (5.0)				521 (5.3)				530 (5.4)				535 (5.1)			
Hungary																
2019	530 (2.7)	9 ▲	11 ▲	-5	527 (3.5)	-7	-7	-13 ▽	528 (2.9)	-3	3	-16 ▽	535 (3.9)	13 ▲	24 ▲	0
2015	521 (3.3)		1	-14 ▽	534 (3.6)		0	-6	531 (4.0)		6	-13 ▽	521 (3.9)		10 ▲	-13 ▽
2011	520 (3.0)			-15 ▽	534 (3.3)			-6	525 (3.7)			-19 ▽	511 (3.3)			-24 ▽
2007	535 (2.9)				540 (4.0)				544 (3.7)				535 (3.3)			
Iran, Islamic Rep. of																
2019	448 (3.7)	-1	-18 ▽	3	450 (4.5)	-8	-19 ▽	-7	453 (4.2)	-22 ▽	-30 ▽	-14 ▽	437 (4.0)	-2	-40 ▽	-35 ▽
2015	448 (3.8)		-18 ▽	3	458 (4.6)		-12	1	475 (4.4)		-8	8	439 (4.5)		-38 ▽	-33 ▽
2011	466 (3.9)			21 ▲	469 (4.4)			12 ▲	483 (4.1)			16 ▲	477 (4.0)			5
2007	445 (3.7)				457 (4.1)				467 (4.1)				472 (4.3)			
Ireland																
2019	521 (3.2)	-13 ▽			512 (3.9)	-5			519 (3.8)	-6			536 (3.8)	-6		
2015	534 (2.9)				517 (3.6)				525 (3.2)				542 (3.1)			
Israel																
[3] 2019	512 (4.2)	8	-11		518 (4.6)	3	5		520 (4.9)	11	6		495 (4.7)	2	-9	
[3] 2015	504 (4.2)		-19 ▽		516 (4.6)		2		508 (4.0)		-5		493 (4.0)		-12 ▽	
[3] 2011	523 (4.2)				514 (5.0)				514 (4.1)				504 (4.3)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

◊ Trend reporting in content domains using current methodology began with TIMSS 2007.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

(Continued)

Country	Biology				Chemistry				Physics				Earth Science			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007		2015	2011	2007
Italy																
2019	508 (2.7)	13 ▲	5	6	484 (3.0)	-4	-8	6	487 (4.5)	-10	-4	-2	512 (3.5)	-2	-1	10 ▲
[2] 2015	496 (2.6)		-8 ▽	-6	487 (2.4)		-4	9 ▲	496 (2.5)		6	8	514 (2.8)		1	12 ▲
2011	503 (3.0)			1	491 (3.0)			13 ▲	490 (2.8)			2	513 (3.8)			11 ▲
2007	502 (3.2)				478 (3.5)				489 (3.5)				502 (3.5)			
Japan																
2019	574 (2.3)	3	13 ▲	19 ▲	560 (2.7)	-10 ▽	0	2	570 (2.5)	1	12 ▲	7 ▲	572 (3.2)	-2	23 ▲	36 ▲
2015	570 (2.9)		10 ▲	16 ▲	570 (2.4)		10 ▲	11 ▲	570 (2.3)		12 ▲	6 ▲	574 (2.0)		26 ▲	38 ▲
2011	561 (2.3)			6 ▲	560 (2.7)			1	558 (2.8)			-5	548 (2.8)			12 ▲
2007	554 (2.0)				559 (2.4)				563 (2.2)				536 (3.4)			
Jordan																
2019	457 (5.2)	38 ▲	10	-19 ▽	454 (5.3)	17 ▲	-8	-38 ▽	449 (4.6)	25 ▲	3	-28 ▽	428 (4.7)	12 ▲	-8	-54 ▽
2015	420 (3.9)		-28 ▽	-57 ▽	438 (3.8)		-25 ▽	-55 ▽	424 (3.6)		-22 ▽	-53 ▽	416 (3.0)		-20 ▽	-66 ▽
2011	447 (4.4)			-29 ▽	463 (4.4)			-30 ▽	446 (4.2)			-31 ▽	436 (4.3)			-46 ▽
2007	476 (4.2)				493 (4.7)				478 (4.3)				481 (4.2)			
Kazakhstan																
[2] 2019	476 (3.2)		-7		494 (3.6)		-15 ▽		476 (3.9)		-13 ▽		448 (4.1)		-24 ▽	
2011	483 (4.4)				508 (4.7)				489 (4.3)				472 (4.8)			
Korea, Rep. of																
2019	560 (2.2)	6	-1	8 ▲	551 (2.5)	0	0	12 ▲	569 (2.7)	5	-7	-7	562 (3.2)	7	14 ▲	19 ▲
2015	554 (2.2)		-7 ▽	2	550 (2.5)		-1	11 ▲	564 (2.8)		-12 ▽	-12 ▽	554 (2.7)		7	12 ▲
2011	561 (2.3)			9 ▲	551 (2.1)			12 ▲	577 (2.7)			0	548 (3.2)			5
2007	552 (2.0)				539 (3.0)				576 (2.6)				543 (2.4)			
Lebanon																
2019	355 (5.1)	-11	-40 ▽	-44 ▽	412 (4.6)	-25 ▽	-22 ▽	-27 ▽	378 (4.9)	-34 ▽	-27 ▽	-46 ▽	337 (5.1)	-28 ▽	-28 ▽	-41 ▽
2015	366 (6.2)		-29 ▽	-33 ▽	438 (6.2)		3	-2	412 (6.6)		7	-12	365 (6.4)		1	-13
2011	395 (5.2)			-4	435 (5.2)			-5	405 (5.4)			-19 ▽	365 (6.4)			-14
2007	399 (6.7)				440 (6.5)				424 (5.7)				378 (6.8)			
Lithuania																
2019	535 (3.0)	14 ▲	18 ▲	5	530 (3.2)	13 ▲	13 ▲	23 ▲	529 (3.5)	16 ▲	26 ▲	22 ▲	534 (3.3)	16 ▲	18 ▲	17 ▲
[2] 2015	521 (3.1)		4	-9 ▽	517 (3.2)		0	11 ▲	513 (3.6)		10 ▲	6	518 (3.3)		2	1
[1] 2011	517 (2.7)			-13 ▽	517 (2.3)			11 ▲	503 (3.2)			-4	517 (3.5)			0
[1] 2007	530 (2.7)				506 (2.6)				507 (3.1)				517 (3.0)			
Malaysia																
2019	463 (3.7)	-4	36 ▲	-3	434 (4.2)	-39 ▽	8	-41 ▽	475 (3.4)	-5	40 ▲	-7	452 (4.3)	-9	50 ▲	-5
2015	466 (4.4)		39 ▲	1	473 (4.0)		47 ▲	-2	480 (3.9)		45 ▲	-2	460 (4.5)		59 ▲	4
2011	427 (6.2)			-39 ▽	426 (6.5)			-49 ▽	435 (6.6)			-47 ▽	401 (6.5)			-56 ▽
2007	466 (6.2)				475 (5.9)				482 (6.4)				457 (6.1)			
Morocco																
2019	387 (3.0)	7	9 ▲		402 (3.0)	3	28 ▲		402 (2.9)	7	53 ▲		357 (3.3)	-38 ▽	-20 ▽	
2015	380 (2.5)		2		400 (3.0)		25 ▲		395 (2.9)		47 ▲		395 (2.2)		18 ▲	
2011	378 (3.1)				374 (2.3)				349 (2.6)				377 (3.3)			
New Zealand																
† 2019	498 (3.7)	-22 ▽	-16 ▽		482 (3.8)	-16 ▽	-19 ▽		502 (3.8)	-7	-7		510 (3.7)	-7	-13 ▽	
† 2015	520 (3.5)		5		498 (3.5)		-3		508 (3.2)		0		517 (3.6)		-6	
2011	514 (4.8)				501 (5.3)				509 (4.6)				523 (4.8)			
Norway (9)																
† 2019	486 (2.8)	-16 ▽			492 (3.7)	-10 ▽			493 (3.6)	-19 ▽			519 (3.9)	-4		
2015	502 (2.6)				503 (2.9)				512 (3.1)				523 (3.3)			
Oman																
2019	466 (3.3)	12 ▲	59 ▲	59 ▲	443 (3.1)	-9 ▽	35 ▲	35 ▲	449 (3.1)	1	23 ▲	11 ▲	449 (3.0)	-8	17 ▲	17 ▲
2015	454 (2.7)		47 ▲	47 ▲	452 (2.7)		44 ▲	44 ▲	449 (3.0)		22 ▲	10 ▲	456 (2.4)		25 ▲	24 ▲
2011	407 (3.5)			0	408 (3.5)			0	427 (3.3)			-12 ▽	431 (3.0)			-1
2007	408 (3.2)				408 (4.4)				439 (3.1)				432 (2.9)			
Qatar																
2019	476 (4.4)	22 ▲	65 ▲		474 (4.4)	19 ▲	59 ▲		469 (4.4)	10	43 ▲		465 (5.0)	19 ▲	57 ▲	
2015	454 (3.0)		43 ▲		455 (3.6)		39 ▲		459 (3.4)		33 ▲		446 (3.7)		38 ▲	
2011	411 (4.2)				416 (4.0)				426 (3.8)				408 (3.8)			
Romania																
2019	479 (4.4)		21 ▲	22 ▲	466 (5.0)		-2	9	458 (4.3)		2	3	453 (4.7)		-17 ▽	-13 ▽
2011	458 (3.7)			2	469 (4.3)			11	456 (3.9)			2	470 (3.6)			4
2007	457 (3.8)				458 (5.2)				454 (3.8)				466 (4.0)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

(Continued)

Country	Biology				Chemistry				Physics				Earth Science			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007		2015	2011	2007
Russian Federation																
2 2019	543 (4.5)	4	6	16 ▲	551 (4.2)	-7	-3	11	540 (4.7)	-7	-7	20 ▲	533 (4.4)	1	-2	5
2015	539 (4.4)		2	12 ▲	558 (4.9)		4	18 ▲	548 (4.2)		1	27 ▲	532 (4.7)		-3	4
2 2011	537 (3.3)			10	554 (3.5)			13 ▲	547 (3.6)			26 ▲	535 (3.6)			7
2007	527 (3.9)				540 (4.2)				521 (4.3)				528 (4.2)			
Singapore																
2 2019	622 (4.2)	13 ▲	27 ▲	55 ▲	616 (5.0)	22 ▲	25 ▲	49 ▲	619 (4.1)	11 ▲	17 ▲	37 ▲	562 (4.1)	-3	-4	15 ▲
2 2015	609 (3.5)		15 ▲	42 ▲	593 (3.6)		3	27 ▲	608 (3.1)		7	26 ▲	565 (3.6)		-1	17 ▲
2 2011	594 (4.8)			27 ▲	590 (4.7)			24 ▲	602 (4.2)			19 ▲	566 (4.5)			19 ▲
2007	567 (4.5)				566 (4.8)				582 (4.3)				547 (4.9)			
South Africa (9)																
Ψ 2019	359 (3.0)	3	41 ▲		372 (4.2)	3	36 ▲		381 (3.0)	22 ▲	30 ▲		366 (3.2)	36 ▲	72 ▲	
2015	356 (5.9)		38 ▲		369 (6.1)		33 ▲		359 (5.5)		8		330 (6.4)		36 ▲	
Ψ 2011	318 (3.5)				336 (3.8)				351 (3.6)				294 (3.7)			
Sweden																
2 2019	519 (3.4)	-1	6	3	509 (3.7)	-4	7	10 ▲	520 (3.8)	-4	22 ▲	13 ▲	530 (3.2)	-2	10 ▲	19 ▲
2015	520 (3.6)		7	5	512 (3.6)		10 ▲	13 ▲	524 (3.7)		26 ▲	17 ▲	532 (4.5)		12 ▲	20 ▲
2011	513 (2.9)			-3	502 (2.6)			3	498 (3.2)			-9 ▽	520 (2.7)			8
2007	515 (2.6)				499 (2.8)				507 (3.0)				511 (3.3)			
Turkey																
2019	513 (3.4)	22 ▲	29 ▲		516 (4.8)	22 ▲	39 ▲		518 (4.0)	13 ▲	24 ▲		509 (3.8)	32 ▲	41 ▲	
2015	491 (4.1)		7		493 (4.7)		16 ▲		506 (4.2)		12 ▲		477 (3.9)		9	
2011	484 (3.7)				477 (4.0)				494 (3.6)				468 (3.4)			
United Arab Emirates																
2019	474 (2.5)	0	11 ▲		475 (2.4)	-6	12 ▲		469 (2.3)	-5	8 ▲		465 (2.4)	-10 ▽	-1	
2015	475 (2.4)		12 ▲		481 (3.2)		17 ▲		475 (2.5)		13 ▲		475 (2.4)		8 ▲	
2011	463 (2.4)				464 (2.3)				461 (2.3)				466 (2.5)			
United States																
† 2019	530 (4.8)	-11	0	-1	509 (5.2)	-10	-11	-1	515 (5.0)	-1	1	11 ▲	530 (5.1)	-5	-4	3
† 2015	540 (2.9)		10 ▲	10 ▲	519 (3.2)		-1	9 ▲	516 (2.9)		3	13 ▲	535 (3.1)		2	9
2 2011	530 (2.5)			0	520 (2.6)			10 ▲	513 (2.5)			10 ▲	533 (2.7)			7
2 † 2007	531 (3.0)				510 (3.1)				503 (3.0)				526 (3.7)			
Benchmarking Participants																
Ontario, Canada																
2019	534 (3.2)	-3	3	-3	492 (3.9)	-11 ▽	-3	-12 ▽	520 (3.5)	-2	-2	-3	520 (3.0)	-6	-8	-13 ▽
2015	538 (2.9)		7	0	503 (2.7)		8 ▲	-1	521 (2.9)		0	-1	526 (3.2)		-2	-7
2 2011	531 (2.6)			-6	495 (2.4)			-9 ▽	521 (2.8)			-1	528 (3.4)			-5
2 2007	537 (4.1)				504 (4.1)				523 (4.6)				533 (4.8)			
Quebec, Canada																
‡ 2019	531 (3.8)	4	6	18 ▲	548 (4.1)	18 ▲	33 ▲	53 ▲	521 (4.2)	1	19 ▲	29 ▲	553 (4.5)	10	17 ▲	38 ▲
≡ 2015	527 (4.3)		2	15 ▲	531 (4.6)		15 ▲	35 ▲	520 (4.7)		18 ▲	28 ▲	542 (4.2)		7	28 ▲
2011	525 (2.8)			12 ▲	515 (3.0)			20 ▲	502 (3.1)			10 ▲	536 (2.9)			21 ▲
3 2007	512 (3.2)				495 (3.4)				492 (3.5)				514 (4.3)			
Abu Dhabi, UAE																
2019	417 (3.9)	-35 ▽	-43 ▽		421 (4.1)	-38 ▽	-40 ▽		420 (3.8)	-34 ▽	-39 ▽		413 (4.1)	-41 ▽	-48 ▽	
2015	452 (6.1)		-7		459 (6.7)		-2		454 (5.4)		-5		453 (5.8)		-8	
2011	459 (4.2)				461 (4.1)				459 (3.9)				461 (4.6)			
Dubai, UAE																
2 2019	554 (2.2)	29 ▲	69 ▲	71 ▲	554 (2.2)	26 ▲	67 ▲	62 ▲	539 (2.6)	15 ▲	58 ▲	50 ▲	538 (2.3)	20 ▲	52 ▲	50 ▲
2015	525 (2.4)		40 ▲	42 ▲	528 (2.5)		41 ▲	36 ▲	525 (2.4)		43 ▲	36 ▲	518 (2.3)		31 ▲	30 ▲
2011	485 (2.7)			2	487 (2.4)			-5	482 (2.1)			-7	487 (3.1)			-1
‡ 2007	483 (3.3)				492 (3.9)				489 (3.5)				488 (3.7)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Average Achievement in Content Domains by Gender

Exhibit 4.16 shows the differences in average achievement between girls and boys in the four science content domains. Across the TIMSS 2019 countries, girls had a substantial advantage in biology and chemistry whereas boys had the edge in physics and Earth science. In the biology content domain, girls had higher average achievement than boys in 17 countries, and boys had higher average achievement in 3 countries. In chemistry, girls had higher average achievement than boys in 21 countries, and boys had higher average achievement in only 1 country. In physics, girls had higher average achievement than boys in 6 countries, and boys had higher average achievement in 13 countries. In Earth science, girls had higher average achievement than boys in 4 countries, and boys had higher average achievement in 15 countries.

Exhibit 4.16: Average Achievement in Science Content Domains by Gender

Country	Biology (75 Items)		Chemistry (42 Items)		Physics (52 Items)		Earth Science (42 Items)	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Australia	533 (3.2)	529 (4.8)	519 (3.5)	510 (5.3)	524 (3.6)	533 (5.0)	531 (3.3)	536 (4.6)
Bahrain	522 (2.8) ▲	464 (2.7)	514 (3.0) ▲	448 (3.5)	500 (3.8) ▲	461 (2.8)	499 (3.2) ▲	453 (3.7)
Chile	468 (3.6)	475 (4.0)	440 (3.7)	443 (3.8)	442 (3.6)	458 (5.3) ▲	451 (4.6)	476 (4.8) ▲
Chinese Taipei	577 (3.1)	575 (2.7)	598 (3.3)	591 (3.1)	550 (3.3)	560 (3.3) ▲	572 (3.4)	586 (2.8) ▲
Cyprus	500 (3.3) ▲	479 (2.8)	491 (2.7) ▲	466 (3.3)	482 (4.9)	477 (3.7)	473 (3.4)	473 (3.1)
[2] Egypt	393 (6.3) ▲	366 (8.7)	415 (6.2) ▲	376 (9.1)	405 (5.8) ▲	380 (7.8)	375 (6.4)	357 (8.6)
England	518 (5.9)	513 (6.7)	521 (7.5)	502 (7.9)	517 (5.9)	515 (7.2)	513 (6.8)	523 (7.0)
Finland	549 (3.4) ▲	520 (4.1)	561 (4.0) ▲	530 (4.7)	542 (4.0)	537 (5.1)	562 (4.4)	555 (4.0)
France	488 (2.8)	488 (3.8)	467 (3.7)	463 (4.8)	486 (3.5)	495 (4.6) ▲	495 (5.9)	510 (4.5) ▲
[1] Georgia	451 (3.8)	444 (4.2)	462 (4.7)	451 (5.8)	431 (6.0)	441 (5.4)	425 (4.0)	436 (4.7) ▲
† Hong Kong SAR	502 (6.3)	499 (6.8)	492 (6.1)	479 (7.5)	511 (6.1)	509 (7.1)	506 (6.8)	516 (6.7)
Hungary	523 (3.3)	537 (3.2) ▲	521 (3.9)	534 (4.4) ▲	514 (3.4)	542 (3.5) ▲	517 (4.2)	552 (4.6) ▲
Iran, Islamic Rep. of	459 (4.4) ▲	438 (5.8)	467 (5.5) ▲	435 (6.8)	460 (5.2)	448 (6.0)	438 (5.7)	436 (6.0)
Ireland	523 (3.2)	520 (4.4)	525 (4.6) ▲	500 (5.0)	517 (4.1)	520 (4.7)	536 (4.5)	536 (4.2)
[3] Israel	511 (4.5)	513 (5.4)	527 (5.0) ▲	510 (5.6)	514 (5.3)	526 (5.9) ▲	487 (6.1)	503 (5.4) ▲
Italy	506 (3.2)	510 (3.2)	484 (3.4)	483 (3.4)	483 (4.8)	491 (4.8) ▲	503 (4.1)	521 (4.8) ▲
Japan	571 (2.2)	577 (3.2) ▲	560 (2.5)	560 (3.6)	563 (2.8)	578 (3.4) ▲	563 (3.5)	581 (4.9) ▲
Jordan	488 (4.4) ▲	429 (7.1)	488 (4.4) ▲	423 (7.5)	471 (4.3) ▲	429 (6.8)	450 (4.6) ▲	407 (6.7)
[2] Kazakhstan	482 (3.7) ▲	471 (3.7)	501 (4.0) ▲	487 (4.3)	479 (4.4)	472 (4.4)	449 (5.6)	447 (4.7)
Korea, Rep. of	554 (3.0)	565 (2.8) ▲	553 (4.0)	549 (3.7)	563 (3.7)	575 (3.2) ▲	549 (4.3)	574 (3.7) ▲
Kuwait	- -	- -	- -	- -	- -	- -	- -	- -
Lebanon	362 (6.2) ▲	348 (5.3)	420 (4.9) ▲	405 (5.9)	375 (6.0)	380 (5.4)	337 (6.2)	337 (5.9)
Lithuania	540 (3.1) ▲	529 (3.7)	536 (3.2) ▲	524 (3.9)	523 (2.9)	534 (4.6) ▲	530 (3.2)	539 (4.2) ▲
Malaysia	468 (3.9) ▲	457 (4.4)	440 (4.6) ▲	428 (5.1)	475 (4.1)	475 (4.4)	449 (4.7)	454 (4.9)
Morocco	387 (3.5)	386 (3.8)	408 (3.4) ▲	396 (3.6)	403 (3.0)	401 (3.3)	352 (4.1)	362 (4.1)
† New Zealand	500 (3.7)	496 (5.0)	483 (3.8)	481 (6.1)	496 (3.9)	507 (5.4) ▲	502 (3.5)	517 (5.4) ▲
† Norway (9)	489 (3.1)	482 (3.8)	499 (4.8) ▲	486 (4.7)	486 (3.5)	500 (4.6) ▲	513 (5.1)	525 (4.1) ▲
Oman	497 (3.6) ▲	437 (4.8)	480 (3.3) ▲	409 (4.9)	473 (3.6) ▲	427 (5.3)	472 (4.2) ▲	427 (5.4)
Portugal	524 (3.7)	530 (3.7)	514 (3.5)	511 (4.9)	493 (4.0)	500 (4.2)	523 (5.1)	539 (4.0) ▲
Qatar	491 (5.3) ▲	462 (6.4)	497 (5.8) ▲	452 (6.5)	480 (5.6) ▲	459 (5.7)	472 (5.7)	458 (7.2)
Romania	486 (5.0) ▲	472 (4.8)	476 (5.3) ▲	457 (5.8)	460 (4.6)	455 (4.9)	452 (4.6)	455 (5.8)
[2] Russian Federation	545 (4.7)	542 (4.9)	550 (4.6)	552 (4.6)	532 (5.0)	549 (5.1) ▲	522 (5.0)	543 (5.0) ▲
[2] Saudi Arabia	- -	- -	- -	- -	- -	- -	- -	- -
[2] Singapore	621 (4.7)	623 (5.2)	617 (5.8)	614 (5.7)	614 (5.0)	624 (4.8) ▲	551 (5.4)	572 (4.3) ▲
Ψ South Africa (9)	366 (3.2) ▲	352 (3.4)	383 (4.2) ▲	359 (4.9)	383 (3.3)	379 (3.6)	370 (3.6)	362 (4.2)
[2] Sweden	523 (3.9)	515 (4.1)	521 (4.4) ▲	497 (4.4)	524 (4.5)	516 (4.5)	533 (4.3)	528 (4.1)
Turkey	519 (3.9) ▲	507 (4.8)	530 (4.7) ▲	501 (6.7)	519 (4.3)	517 (5.7)	508 (4.3)	510 (5.4)
United Arab Emirates	489 (4.1) ▲	461 (4.3)	494 (4.1) ▲	458 (4.4)	479 (3.8) ▲	460 (3.9)	474 (4.0) ▲	458 (4.1)
† United States	536 (4.0) ▲	524 (6.2)	515 (4.6)	503 (7.0)	514 (4.2)	515 (6.6)	527 (4.5)	532 (6.8)
International Average	**499 (0.7) ▲**	**487 (0.8)**	**499 (0.7) ▲**	**480 (0.9)**	**491 (0.7)**	**490 (0.8)**	**486 (0.8)**	**489 (0.8) ▲**
Benchmarking Participants								
Ontario, Canada	536 (3.4)	533 (3.8)	493 (4.3)	490 (4.4)	516 (4.4)	523 (3.7)	513 (4.7)	527 (4.3) ▲
‡ Quebec, Canada	533 (4.6)	528 (4.1)	553 (4.6)	544 (4.7)	517 (5.1)	525 (4.7)	549 (5.0)	556 (5.1)
Moscow City, Russian Fed.	564 (3.8)	567 (3.5)	561 (3.7)	562 (4.2)	565 (4.3)	586 (4.7) ▲	550 (4.3)	578 (4.4) ▲
Gauteng, RSA (9)	421 (4.4) ▲	409 (4.4)	433 (4.8) ▲	410 (4.7)	429 (4.8)	426 (4.9)	422 (4.7)	414 (5.2)
Western Cape, RSA (9)	427 (6.1)	438 (6.6)	441 (7.2)	443 (9.4)	434 (7.0)	451 (7.2) ▲	435 (7.3)	450 (8.1) ▲
Abu Dhabi, UAE	434 (7.5) ▲	401 (6.0)	443 (7.0) ▲	401 (6.2)	433 (6.6) ▲	409 (5.6)	423 (7.1)	403 (6.3)
[2] Dubai, UAE	558 (5.5)	549 (7.0)	563 (5.8)	545 (7.2)	541 (5.6)	538 (6.7)	537 (5.4)	540 (6.7)

▲ Average significantly higher than other gender

Numbers of items are based on the TIMSS 2019 eighth grade science eAssessment items included in scaling.
Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available because average achievement could not be accurately estimated.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Average Achievement in Cognitive Domains

Exhibit 4.17 shows countries' average achievement in the knowing, applying, and reasoning cognitive domains relative to their overall average achievement (from highest to lowest overall average achievement). Interestingly, in the knowing and reasoning domains, about the same number of countries had relative strengths as had relative weaknesses, but in the applying domain, fewer countries had strengths than weaknesses. Eleven countries had a relative strength in the knowing cognitive domain, and 12 had a relative weakness. Only 6 countries had a relative strength in the applying domain, although 14 had a relative weakness. Thirteen countries had a relative strength in the reasoning cognitive domain, and 16 had a relative weakness. The Russian Federation and Hong Kong SAR were well balanced, with no relative strengths or weaknesses in the cognitive domains.

Exhibit 4.17: Average Achievement in Science Cognitive Domains

Country	Overall Science Average Scale Score	Knowing (75 Items)		Applying (80 Items)		Reasoning (56 Items)	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
[2] Singapore	608 (3.9)	621 (4.2)	13 (1.7) ▲	608 (4.1)	1 (1.6)	595 (4.0)	-13 (0.8) ▽
Chinese Taipei	574 (1.9)	600 (2.4)	26 (1.5) ▲	567 (2.1)	-8 (1.2) ▽	559 (2.1)	-16 (1.0) ▽
Japan	570 (2.1)	563 (2.4)	-7 (1.4) ▽	576 (2.3)	6 (0.8) ▲	570 (2.5)	1 (1.2)
Korea, Rep. of	561 (2.1)	558 (2.6)	-3 (1.5)	560 (2.4)	-1 (1.9)	564 (2.3)	3 (1.7) ▲
[2] Russian Federation	543 (4.2)	543 (4.7)	1 (2.4)	543 (4.5)	0 (1.2)	543 (4.5)	0 (2.9)
Finland	543 (3.1)	545 (3.2)	2 (1.4)	537 (3.3)	-6 (1.1) ▽	548 (3.4)	5 (1.4) ▲
Lithuania	534 (3.0)	527 (3.1)	-6 (1.3) ▽	530 (3.0)	-4 (1.3) ▽	541 (3.2)	7 (1.5) ▲
Hungary	530 (2.6)	537 (3.0)	8 (1.4) ▲	528 (3.1)	-2 (1.8)	524 (3.1)	-5 (1.4) ▽
Australia	528 (3.2)	515 (3.5)	-14 (1.4) ▽	532 (3.4)	4 (0.9) ▲	536 (3.1)	7 (1.0) ▲
Ireland	523 (2.9)	513 (3.0)	-10 (1.7) ▽	521 (3.4)	-2 (1.8)	534 (3.4)	11 (1.6) ▲
† United States	522 (4.7)	515 (4.6)	-8 (1.1) ▽	523 (4.8)	1 (0.9)	528 (4.7)	6 (1.4) ▲
[2] Sweden	521 (3.2)	521 (3.2)	0 (1.1)	518 (3.3)	-3 (1.2) ▽	524 (3.8)	2 (2.3)
Portugal	519 (2.9)	520 (3.1)	2 (1.7)	514 (3.1)	-4 (1.3) ▽	519 (3.5)	1 (2.2)
England	517 (4.8)	520 (5.0)	3 (1.5)	515 (5.1)	-2 (1.8)	513 (5.0)	-3 (1.1) ▽
Turkey	515 (3.7)	506 (4.2)	-9 (1.6) ▽	515 (3.9)	-1 (2.5)	524 (4.0)	8 (2.1) ▲
[3] Israel	513 (4.2)	514 (4.6)	0 (1.6)	509 (4.3)	-4 (1.5) ▽	518 (4.6)	5 (1.9) ▲
† Hong Kong SAR	504 (5.2)	501 (5.7)	-2 (1.8)	501 (5.2)	-2 (1.4)	504 (5.2)	0 (1.3)
Italy	500 (2.6)	507 (2.6)	7 (1.5) ▲	499 (3.4)	-2 (1.8)	495 (4.0)	-5 (2.7)
† New Zealand	499 (3.5)	480 (3.6)	-19 (1.6) ▽	503 (3.8)	4 (1.4) ▲	510 (3.5)	11 (1.1) ▲
† Norway (9)	495 (3.1)	497 (2.5)	2 (1.6)	493 (3.5)	-3 (1.3) ▽	494 (3.6)	-1 (1.3)
France	489 (2.7)	480 (2.9)	-8 (1.7) ▽	482 (2.8)	-7 (1.6) ▽	502 (3.0)	14 (2.2) ▲
Bahrain	486 (1.9)	493 (2.0)	7 (1.2) ▲	481 (2.6)	-5 (2.0) ▽	482 (2.4)	-4 (1.5) ▽
Cyprus	484 (1.9)	482 (3.0)	-1 (2.9)	477 (1.9)	-6 (1.1) ▽	488 (2.3)	4 (1.1) ▲
[2] Kazakhstan	478 (3.1)	463 (3.7)	-15 (1.6) ▽	481 (3.4)	3 (1.5)	482 (3.5)	4 (1.8) ▲
Qatar	475 (4.4)	487 (4.2)	12 (1.6) ▲	469 (4.5)	-5 (1.3) ▽	464 (4.6)	-11 (1.7) ▽
United Arab Emirates	473 (2.2)	482 (2.7)	9 (0.9) ▲	472 (2.2)	-1 (0.6)	461 (2.2)	-12 (0.8) ▽
Romania	470 (4.2)	475 (4.4)	5 (2.6)	467 (4.2)	-3 (1.4) ▽	464 (4.4)	-6 (1.9) ▽
Chile	462 (2.9)	463 (3.3)	1 (1.7)	462 (3.0)	0 (2.1)	458 (3.1)	-5 (2.0) ▽
Malaysia	460 (3.5)	442 (3.9)	-18 (1.1) ▽	473 (3.4)	13 (0.9) ▲	459 (3.7)	-2 (1.5)
Oman	457 (2.9)	461 (3.3)	4 (2.0) ▲	456 (3.4)	-1 (2.2)	450 (3.0)	-7 (1.1) ▽
Jordan	452 (4.7)	455 (5.3)	3 (1.7)	453 (4.9)	1 (1.4)	443 (4.8)	-9 (1.7) ▽
Iran, Islamic Rep. of	449 (3.6)	449 (4.1)	-1 (1.6)	452 (3.5)	2 (0.9) ▲	444 (4.4)	-5 (2.3) ▽
[1] Georgia	447 (3.9)	459 (4.1)	12 (1.7) ▲	440 (3.7)	-7 (2.8) ▽	436 (4.2)	-10 (2.8) ▽
Kuwait	444 (5.7)	- -	- -	- -	- -	- -	- -
[2] Saudi Arabia	431 (2.6)	- -	- -	- -	- -	- -	- -
Morocco	394 (2.7)	380 (3.1)	-14 (1.1) ▽	393 (2.9)	-1 (1.4)	398 (2.8)	4 (1.2) ▲
[2] Egypt	389 (5.4)	396 (5.9)	7 (1.5) ▲	384 (5.7)	-6 (2.0) ▽	378 (5.7)	-11 (1.7) ▽
Lebanon	377 (4.6)	388 (4.4)	11 (2.9) ▲	375 (5.2)	-1 (1.9)	346 (5.2)	-31 (3.1) ▽
Ψ South Africa (9)	370 (3.1)	361 (3.2)	-9 (1.1) ▽	377 (2.9)	7 (0.7) ▲	362 (3.0)	-8 (0.9) ▽
Benchmarking Participants							
Moscow City, Russian Fed.	567 (2.9)	570 (3.0)	4 (0.9) ▲	562 (3.7)	-5 (2.4) ▽	568 (3.1)	2 (1.0)
[2] Dubai, UAE	548 (2.0)	560 (2.3)	13 (1.0) ▲	545 (2.5)	-3 (1.2) ▽	538 (2.3)	-10 (1.6) ▽
‡ Quebec, Canada	537 (3.6)	529 (3.6)	-8 (2.0) ▽	538 (4.2)	1 (2.2)	540 (4.1)	4 (1.5) ▲
Ontario, Canada	522 (3.0)	505 (3.3)	-17 (1.1) ▽	523 (3.5)	1 (2.3)	533 (3.7)	11 (3.3) ▲
Western Cape, RSA (9)	439 (5.1)	427 (6.0)	-12 (2.6) ▽	446 (5.0)	7 (1.5) ▲	438 (5.8)	-1 (4.1)
Gauteng, RSA (9)	422 (3.9)	413 (4.9)	-9 (2.2) ▽	428 (3.7)	6 (2.3) ▲	417 (3.8)	-5 (1.3) ▽
Abu Dhabi, UAE	420 (3.6)	422 (4.3)	1 (1.2)	421 (3.5)	0 (1.4)	412 (3.6)	-8 (1.4) ▽

▲ Subscale score significantly higher than overall science score
▽ Subscale score significantly lower than overall science score

Numbers of items are based on the TIMSS 2019 eighth grade science eAssessment items included in scaling.
Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available because average achievement could not be accurately estimated.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Trends in Average Achievement in Cognitive Domains

Exhibit 4.18 presents differences in average achievement for the three cognitive domains across four assessment cycles back to 2007, when TIMSS first began providing scaled results in the cognitive domains. Trends show more countries have had increases than decreases in average achievement in each of cognitive domains, particularly in the knowing domain. Thirty-one countries participated in both the TIMSS 2015 and TIMSS 2019 assessments and have comparable data in the cognitive domains. The recent trends in the knowing cognitive domain showed increases in 10 countries and decreases in 8 countries. In the applying and reasoning domains, 7 countries showed increases, and 6 showed decreases.

Between 2007 and 2019, in the knowing domain, there were increases in 13 countries compared with declines in 6 countries. In the applying domain, there were increases in 11 countries and declines in 6 countries. In the reasoning domain, 9 countries had increases and 6 had decreases.

Exhibit 4.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years◊

Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▽) than the performance in the column year.

Country	Knowing				Applying				Reasoning			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Australia												
2019	515 (3.5)	4	1	10 ▲	532 (3.4)	20 ▲	15 ▲	21 ▲	536 (3.1)	23 ▲	9	5
2015	510 (2.7)		-4	6	512 (2.9)		-5	1	513 (2.8)		-14 ▽	-18 ▽
2011	514 (5.1)			9	517 (4.5)			6	526 (5.0)			-4
2007	505 (3.7)				511 (3.7)				530 (4.1)			
Bahrain												
2019	493 (2.0)	31 ▲	35 ▲	25 ▲	481 (2.6)	17 ▲	31 ▲	15 ▲	482 (2.4)	16 ▲	33 ▲	18 ▲
2015	462 (2.5)		4	-6	464 (2.4)		15 ▲	-1	466 (2.8)		18 ▲	3
2011	457 (3.7)			-10 ▽	450 (2.1)			-16 ▽	449 (2.0)			-15 ▽
2007	468 (2.2)				465 (2.2)				464 (2.4)			
Chile												
2019	463 (3.3)	-3	-12 ▽		462 (3.0)	16 ▲	8 ▲		458 (3.1)	9	-2	
2015	466 (3.2)		-10 ▽		446 (3.0)		-7		448 (3.6)		-11 ▽	
2011	476 (3.1)				454 (2.3)				459 (2.7)			
Chinese Taipei												
2019	600 (2.4)	11 ▲	31 ▲	26 ▲	567 (2.1)	1	-3	3	559 (2.1)	-2	8 ▲	15 ▲
2015	589 (2.3)		20 ▲	15 ▲	565 (2.0)		-5	2	560 (2.0)		9 ▲	16 ▲
2011	569 (2.6)			-5	570 (2.6)			6	551 (2.9)			7
2007	574 (3.9)				564 (3.7)				544 (4.0)			
Cyprus												
2019	482 (3.0)			44 ▲	477 (1.9)			24 ▲	488 (2.3)			35 ▲
2007	438 (3.1)				454 (2.4)				453 (2.7)			
Egypt												
[2] 2019	396 (5.9)	24 ▲		-33 ▽	384 (5.7)	13		-14 ▽	378 (5.7)	19 ▲		-7
2015	372 (5.2)			-57 ▽	371 (4.4)			-27 ▽	359 (4.8)			-26 ▽
2007	429 (4.1)				398 (3.8)				385 (3.7)			
England												
2019	520 (5.0)	-3	-14	-17 ▽	515 (5.1)	-24 ▽	-17 ▽	-25 ▽	513 (5.0)	-31 ▽	-24 ▽	-35 ▽
2015	523 (4.1)		-11	-14 ▽	538 (3.9)		7	-1	545 (4.0)		8	-4
‡ 2011	533 (5.1)			-3	531 (4.7)			-8	537 (4.9)			-12
† 2007	536 (5.2)				540 (4.3)				548 (4.6)			
Finland												
2019	545 (3.2)		-20 ▽		537 (3.3)		-12 ▽		548 (3.4)		0	
2011	564 (3.0)				549 (2.5)				547 (3.4)			
Georgia												
[1] 2019	459 (4.1)	6	31 ▲	21 ▲	440 (3.7)	-2	22 ▲	22 ▲	436 (4.2)	4	24 ▲	51 ▲
[1 2] 2015	452 (3.3)		25 ▲	15 ▲	442 (3.1)		24 ▲	24 ▲	432 (3.5)		20 ▲	47 ▲
[1] 2011	428 (3.9)			-10	418 (3.8)			0	412 (3.7)			27 ▲
[1] 2007	438 (5.3)				418 (4.6)				385 (5.0)			
Hong Kong SAR												
† 2019	501 (5.7)	-46 ▽	-43 ▽	-36 ▽	501 (5.2)	-39 ▽	-27 ▽	-21 ▽	504 (5.2)	-47 ▽	-34 ▽	-31 ▽
2015	547 (3.7)		3	10	541 (4.3)		12 ▲	18 ▲	550 (4.4)		12 ▲	15 ▲
2011	544 (3.2)			7	529 (3.4)			6	538 (4.0)			3
† 2007	537 (4.8)				522 (5.1)				535 (5.6)			
Hungary												
2019	537 (3.0)	12 ▲	27 ▲	8	528 (3.1)	0	-4	-23 ▽	524 (3.1)	0	6	-6
2015	525 (3.5)		14 ▲	-5	528 (3.4)		-4	-23 ▽	524 (3.8)		6	-6
2011	511 (3.2)			-19 ▽	532 (3.5)			-19 ▽	518 (3.3)			-12 ▽
2007	530 (3.2)				551 (3.2)				530 (3.4)			
Iran, Islamic Rep. of												
2019	449 (4.1)	-7	-30 ▽	-19 ▽	452 (3.5)	-6	-18 ▽	0	444 (4.4)	-10	-31 ▽	-12 ▽
2015	455 (4.8)		-24 ▽	-13 ▽	457 (4.0)		-13 ▽	6	454 (4.0)		-22 ▽	-2
2011	479 (4.6)			11	470 (3.9)			18 ▲	475 (3.8)			19 ▲
2007	468 (4.1)				452 (4.0)				456 (4.0)			
Ireland												
2019	513 (3.0)	-10 ▽			521 (3.4)	-12 ▽			534 (3.4)	2		
2015	523 (3.2)				533 (3.0)				532 (3.0)			
Israel												
[3] 2019	514 (4.6)	11	-4		509 (4.3)	5	-3		518 (4.6)	7	-1	
[3] 2015	503 (4.3)		-15 ▽		504 (3.8)		-8		511 (4.4)		-8	
[3] 2011	518 (4.2)				512 (4.0)				519 (4.4)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

◊ Trend reporting in cognitive domains using current methodology began with TIMSS 2007.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 4.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years◊

(Continued)

Country	Knowing				Applying				Reasoning			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Italy												
2019	507 (2.6)	3	-5	11 ▲	499 (3.4)	2	-1	2	495 (4.0)	2	7	6
[2] 2015	505 (2.6)		-8 ▽	8	496 (2.4)		-4	-1	493 (2.8)		4	4
2011	512 (2.7)			16 ▲	500 (2.3)			3	489 (2.6)			-1
2007	496 (3.6)				497 (2.9)				489 (3.1)			
Japan												
2019	563 (2.4)	-5	22 ▲	21 ▲	576 (2.3)	1	15 ▲	19 ▲	570 (2.5)	0	3	7 ▲
2015	567 (2.2)		27 ▲	26 ▲	575 (1.9)		14 ▲	18 ▲	570 (2.1)		3	7 ▲
2011	541 (2.7)			-1	561 (2.6)			4	568 (2.4)			4
2007	542 (2.4)				556 (2.1)				564 (2.3)			
Jordan												
2019	455 (5.3)	25 ▲	2	-36 ▽	453 (4.9)	28 ▲	2	-31 ▽	443 (4.8)	23 ▲	1	-24 ▽
2015	430 (3.3)		-23 ▽	-62 ▽	425 (3.3)		-26 ▽	-59 ▽	419 (3.6)		-22 ▽	-47 ▽
2011	453 (4.4)			-39 ▽	451 (4.0)			-33 ▽	441 (4.3)			-25 ▽
2007	492 (4.8)				484 (4.3)				466 (4.2)			
Kazakhstan												
[2] 2019	463 (3.7)		-19 ▽		481 (3.4)		-10		482 (3.5)		-5	
2011	483 (4.9)				491 (4.1)				487 (4.4)			
Korea, Rep. of												
2019	558 (2.6)	3	4	8 ▲	560 (2.4)	8 ▲	-1	10 ▲	564 (2.3)	4	0	3
2015	555 (2.9)		2	6	552 (2.2)		-9 ▽	2	560 (2.8)		-3	-1
2011	554 (3.0)			4	561 (2.1)			11 ▲	564 (2.3)			2
2007	550 (2.3)				550 (2.4)				561 (2.3)			
Lebanon												
2019	388 (4.4)	-15 ▽	7	-13	375 (5.2)	-23 ▽	-33 ▽	-43 ▽	346 (5.2)	-36 ▽	-62 ▽	-64 ▽
2015	403 (5.9)		22 ▲	2	398 (5.3)		-10	-20 ▽	381 (6.3)		-27 ▽	-29 ▽
2011	381 (5.7)			-20 ▽	408 (5.2)			-10	408 (5.7)			-2
2007	401 (6.3)				418 (6.1)				410 (6.6)			
Lithuania												
2019	527 (3.1)	14 ▲	12 ▲	10 ▲	530 (3.0)	14 ▲	18 ▲	17 ▲	541 (3.2)	15 ▲	28 ▲	14 ▲
[2] 2015	513 (3.1)		-2	-4	517 (3.4)		4	4	525 (3.2)		13 ▲	-2
[1] 2011	516 (2.4)			-1	512 (2.3)			-1	513 (2.8)			-14 ▽
[1] 2007	517 (2.5)				513 (2.4)				527 (2.7)			
Malaysia												
2019	442 (3.9)	-23 ▽	39 ▲	-16 ▽	473 (3.4)	-3	49 ▲	3	459 (3.7)	-8	20 ▲	-24 ▽
2015	466 (5.1)		63 ▲	8	476 (4.2)		52 ▲	6	467 (3.9)		28 ▲	-15 ▽
2011	403 (7.1)			-55 ▽	424 (6.2)			-46 ▽	439 (6.0)			-44 ▽
2007	458 (6.8)				470 (6.2)				483 (5.5)			
Morocco												
2019	380 (3.1)	-15 ▽	17 ▲		393 (2.9)	2	13 ▲		398 (2.8)	13 ▲	31 ▲	
2015	395 (2.3)		32 ▲		391 (2.8)		11 ▲		385 (2.6)		18 ▲	
2011	363 (2.8)				381 (2.0)				366 (2.3)			
New Zealand												
[†] 2019	480 (3.6)	-23 ▽	-32 ▽		503 (3.8)	-11 ▽	-7		510 (3.5)	-10 ▽	-6	
[†] 2015	503 (3.2)		-8		513 (3.5)		4		520 (3.3)		4	
2011	511 (5.0)				509 (4.4)				515 (4.7)			
Norway (9)												
[†] 2019	497 (2.5)	-3			493 (3.5)	-14 ▽			494 (3.6)	-24 ▽		
2015	500 (3.1)				507 (2.9)				518 (3.0)			
Oman												
2019	461 (3.3)	7	45 ▲	36 ▲	456 (3.4)	3	37 ▲	37 ▲	450 (3.0)	-4	33 ▲	31 ▲
2015	455 (2.9)		38 ▲	30 ▲	454 (2.9)		34 ▲	34 ▲	454 (2.4)		37 ▲	36 ▲
2011	416 (3.4)			-8	419 (3.4)			0	417 (3.0)			-2
2007	425 (3.5)				419 (3.6)				419 (3.8)			
Qatar												
2019	487 (4.2)	39 ▲	69 ▲		469 (4.5)	10	49 ▲		464 (4.6)	10	55 ▲	
2015	448 (3.6)		30 ▲		460 (3.6)		40 ▲		454 (3.2)		45 ▲	
2011	418 (4.5)				420 (3.7)				409 (4.6)			
Romania												
2019	475 (4.4)		18 ▲	24 ▲	467 (4.2)		-1	-1	464 (4.4)		4	11
2011	457 (4.3)			6	468 (3.6)			0	460 (3.7)			7
2007	451 (4.3)				468 (3.7)				453 (3.8)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Exhibit 4.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years◊

(Continued)

Country	Knowing				Applying				Reasoning			
	Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years			Average Scale Score	Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Russian Federation												
2 2019	543 (4.7)	-14 ▽	-14 ▽	3	543 (4.5)	4	4	15 ▲	543 (4.5)	5	10	24 ▲
2015	558 (5.2)		1	17 ▲	538 (4.6)		0	11	538 (3.9)		5	18 ▲
2 2011	557 (3.8)			16 ▲	539 (3.3)			12 ▲	533 (3.2)			13 ▲
2007	541 (4.4)				527 (4.0)				519 (4.0)			
Singapore												
2 2019	621 (4.2)	27 ▲	33 ▲	59 ▲	608 (4.1)	8	19 ▲	38 ▲	595 (4.0)	0	2	26 ▲
2 2015	594 (3.4)		6	32 ▲	600 (3.4)		11 ▲	30 ▲	595 (3.2)		2	26 ▲
2 2011	588 (4.9)			26 ▲	589 (4.4)			19 ▲	592 (4.4)			24 ▲
2007	561 (4.9)				570 (4.5)				568 (4.5)			
South Africa (9)												
Ψ 2019	361 (3.2)	24 ▲	79 ▲		377 (2.9)	9	42 ▲		362 (3.0)	11	23 ▲	
2015	337 (6.7)		55 ▲		368 (5.9)		33 ▲		350 (5.6)		12	
Ψ 2011	282 (4.1)				335 (3.5)				338 (5.0)			
Sweden												
2 2019	521 (3.2)	2	10 ▲	14 ▲	518 (3.3)	0	10 ▲	9 ▲	524 (3.8)	-3	14 ▲	7
2015	519 (3.2)		8	12 ▲	518 (3.5)		10 ▲	9 ▲	526 (4.0)		17 ▲	10 ▲
2011	512 (2.5)			4	508 (2.7)			-1	510 (3.0)			-6
2007	508 (2.6)				509 (2.8)				516 (2.9)			
Turkey												
2019	506 (4.2)	17 ▲	16 ▲		515 (3.9)	22 ▲	37 ▲		524 (4.0)	29 ▲	41 ▲	
2015	489 (4.5)		-1		492 (3.9)		15 ▲		495 (4.2)		12 ▲	
2011	490 (3.7)				478 (3.4)				483 (3.3)			
United Arab Emirates												
2019	482 (2.7)	4	11 ▲		472 (2.2)	-6	8 ▲		461 (2.2)	-12 ▽	5	
2015	478 (2.5)		7		478 (2.4)		14 ▲		473 (2.4)		17 ▲	
2011	471 (2.4)				464 (2.1)				456 (2.5)			
United States												
† 2019	515 (4.6)	-17 ▽	-12 ▽	-1	523 (4.8)	-8	1	6	528 (4.7)	2	5	0
† 2015	532 (3.4)		5	16 ▲	531 (2.8)		9 ▲	14 ▲	526 (2.8)		3	-2
2 2011	527 (2.8)			11 ▲	522 (2.3)			5	524 (2.5)			-5
2 † 2007	516 (3.2)				517 (2.9)				529 (3.0)			
Benchmarking Participants												
Ontario, Canada												
2019	505 (3.3)	-9 ▽	-8	-10 ▽	523 (3.5)	-2	5	-1	533 (3.7)	1	0	-10
2015	514 (2.6)		1	-1	525 (2.4)		7 ▲	1	532 (2.6)		0	-10 ▽
2 2011	513 (2.8)			-2	518 (2.4)			-6	532 (3.0)			-10
2 2007	515 (3.6)				524 (3.8)				542 (4.2)			
Quebec, Canada												
‡ 2019	529 (3.6)	2	9 ▲	30 ▲	538 (4.2)	13 ▲	20 ▲	37 ▲	540 (4.1)	5	19 ▲	18 ▲
≡ 2015	527 (5.1)		7	28 ▲	524 (4.6)		7	24 ▲	535 (4.5)		13 ▲	13 ▲
2011	519 (2.8)			20 ▲	518 (2.9)			17 ▲	522 (3.1)			-1
3 2007	499 (3.3)				500 (3.4)				523 (3.3)			
Abu Dhabi, UAE												
2019	422 (4.3)	-31 ▽	-44 ▽		421 (3.5)	-36 ▽	-40 ▽		412 (3.6)	-42 ▽	-43 ▽	
2015	453 (6.1)		-13		457 (5.9)		-4		454 (5.7)		-1	
2011	466 (4.2)				461 (3.9)				455 (4.3)			
Dubai, UAE												
2 2019	560 (2.3)	33 ▲	68 ▲	65 ▲	545 (2.5)	19 ▲	59 ▲	57 ▲	538 (2.3)	18 ▲	59 ▲	60 ▲
2015	527 (2.5)		35 ▲	32 ▲	525 (2.2)		39 ▲	37 ▲	521 (2.0)		41 ▲	43 ▲
2011	492 (2.9)			-4	486 (2.8)			-2	479 (2.6)			1
‡ 2007	496 (3.5)				488 (3.0)				478 (3.5)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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Average Achievement in Cognitive Domains by Gender

Exhibit 4.19 shows the differences between girls' and boys' average achievement in the cognitive domains of knowing, applying, and reasoning. Reflecting the overall results where girls had higher average achievement in more countries than the reverse, girls had higher average achievement than boys in more countries than the reverse in all three cognitive domains, especially applying and reasoning. In the knowing domain, girls had higher average achievement than boys in 10 countries, and boys had higher achievement than girls in 8 countries. In the applying domain, girls had higher average achievement than boys in 13 countries, and boys had higher average achievement than girls in 4 countries. In reasoning, girls had higher average achievement than boys in 13 countries, compared with 2 countries where boys had higher average achievement.

Exhibit 4.19: Average Achievement in Science Cognitive Domains by Gender

Country	Knowing (75 Items)		Applying (80 Items)		Reasoning (56 Items)	
	Girls	Boys	Girls	Boys	Girls	Boys
Australia	511 (3.3)	518 (5.3)	534 (3.2)	530 (4.9)	538 (3.1)	533 (4.7)
Bahrain	520 (2.8) ▲	466 (3.7)	508 (2.6) ▲	454 (3.9)	508 (3.6) ▲	457 (2.6)
Chile	457 (4.1)	469 (4.6) ▲	458 (3.7)	466 (3.9)	450 (4.0)	465 (3.8) ▲
Chinese Taipei	592 (2.9)	608 (2.9) ▲	567 (2.5)	567 (2.9)	560 (2.7)	558 (2.6)
Cyprus	487 (4.1) ▲	478 (3.1)	486 (2.5) ▲	469 (2.9)	497 (3.2) ▲	479 (2.9)
[2] Egypt	406 (6.3) ▲	384 (9.2)	397 (6.3) ▲	367 (8.7)	392 (6.4) ▲	361 (8.4)
England	519 (6.1)	521 (6.9)	517 (6.0)	512 (6.8)	516 (5.7)	510 (6.8)
Finland	553 (3.2) ▲	537 (4.2)	547 (3.4) ▲	527 (4.0)	559 (3.9) ▲	537 (4.1)
France	473 (2.9)	487 (4.7) ▲	480 (3.1)	484 (3.8)	504 (3.2)	501 (3.7)
[1] Georgia	460 (4.6)	457 (5.4)	441 (4.1)	439 (4.9)	434 (4.5)	438 (5.8)
† Hong Kong SAR	493 (6.2)	508 (6.9) ▲	505 (5.7)	499 (6.7)	510 (6.0)	498 (6.4)
Hungary	526 (3.1)	549 (4.3) ▲	516 (3.1)	540 (3.8) ▲	517 (3.4)	532 (3.9) ▲
Iran, Islamic Rep. of	457 (5.0)	442 (6.3)	462 (4.6) ▲	443 (5.3)	454 (4.9) ▲	435 (6.9)
Ireland	512 (3.6)	514 (4.1)	525 (4.1)	518 (4.2)	538 (3.6)	531 (4.6)
[3] Israel	513 (5.2)	514 (5.5)	507 (4.8)	511 (5.0)	516 (4.7)	520 (5.9)
Italy	502 (3.1)	512 (4.2)	495 (3.7)	503 (3.8) ▲	494 (4.5)	496 (4.6)
Japan	555 (3.3)	572 (2.7) ▲	571 (2.5)	581 (2.7) ▲	569 (2.5)	571 (3.0)
Jordan	484 (5.0) ▲	429 (7.4)	481 (4.6) ▲	428 (6.5)	470 (4.0) ▲	417 (6.7)
[2] Kazakhstan	468 (4.6) ▲	459 (4.2)	486 (4.0) ▲	476 (4.1)	486 (3.9) ▲	478 (4.1)
Korea, Rep. of	549 (3.8)	567 (3.0) ▲	554 (3.2)	566 (2.8) ▲	562 (3.4)	566 (2.5)
Kuwait	- -	- -	- -	- -	- -	- -
Lebanon	392 (5.9)	385 (4.4)	377 (6.2)	374 (5.4)	351 (6.1)	341 (6.0)
Lithuania	526 (3.1)	528 (4.0)	532 (3.0)	529 (3.6)	542 (3.2)	539 (3.8)
Malaysia	447 (4.4)	437 (5.0)	475 (3.6)	471 (4.2)	460 (3.9)	457 (4.3)
Morocco	379 (3.5)	381 (3.6)	393 (3.2)	393 (3.3)	401 (3.3)	394 (3.5)
† New Zealand	475 (3.7)	484 (5.3)	500 (4.2)	505 (5.2)	510 (3.6)	509 (5.0)
† Norway (9)	495 (2.7)	500 (3.4)	493 (3.8)	493 (4.3)	494 (4.3)	495 (4.1)
Oman	488 (3.5) ▲	436 (5.1)	485 (4.0) ▲	429 (4.8)	478 (3.4) ▲	424 (4.7)
Portugal	515 (3.5)	526 (3.6) ▲	512 (3.8)	516 (4.0)	517 (3.9)	522 (4.1)
Qatar	499 (4.9) ▲	474 (5.9)	485 (5.7) ▲	454 (6.2)	477 (5.8) ▲	451 (6.3)
Romania	477 (4.7)	473 (5.0)	471 (4.9)	462 (4.9)	469 (4.6) ▲	458 (5.5)
[2] Russian Federation	539 (5.3)	547 (5.0)	539 (4.9)	546 (4.9)	541 (5.2)	545 (4.6)
[2] Saudi Arabia	- -	- -	- -	- -	- -	- -
[2] Singapore	617 (4.9)	624 (4.9)	604 (4.6)	613 (5.0)	591 (4.8)	598 (4.5)
Ψ South Africa (9)	369 (3.2) ▲	352 (3.9)	383 (3.0) ▲	371 (3.5)	365 (3.3) ▲	358 (3.5)
[2] Sweden	522 (4.3)	521 (4.2)	526 (4.0) ▲	510 (4.3)	530 (4.6) ▲	517 (4.7)
Turkey	510 (4.7)	502 (5.6)	521 (4.3) ▲	508 (5.3)	529 (4.1)	519 (5.5)
United Arab Emirates	495 (4.4) ▲	470 (4.7)	486 (3.6) ▲	460 (4.1)	473 (4.0) ▲	450 (3.8)
† United States	515 (4.1)	514 (5.9)	525 (4.2)	521 (6.3)	530 (3.8)	526 (6.2)
International Average	**495 (0.7) ▲**	**490 (0.8)**	**496 (0.7) ▲**	**487 (0.8)**	**496 (0.7) ▲**	**486 (0.8)**
Benchmarking Participants						
Ontario, Canada	499 (3.4)	511 (4.1) ▲	522 (4.1)	524 (3.7)	534 (4.4)	531 (4.1)
‡ Quebec, Canada	527 (4.1)	531 (4.1)	537 (4.4)	538 (4.8)	543 (4.7)	538 (4.7)
Moscow City, Russian Fed.	564 (3.5)	576 (3.5) ▲	556 (4.2)	567 (4.0) ▲	563 (3.6)	573 (3.6) ▲
Gauteng, RSA (9)	421 (5.0) ▲	404 (5.4)	433 (3.9) ▲	423 (4.5)	419 (4.2)	414 (4.4)
Western Cape, RSA (9)	424 (6.9)	431 (7.1)	441 (5.8)	452 (6.4)	430 (6.8)	448 (7.0) ▲
Abu Dhabi, UAE	437 (7.6) ▲	408 (6.4)	437 (6.7) ▲	405 (5.7)	427 (6.6) ▲	398 (5.6)
[2] Dubai, UAE	564 (6.1)	557 (7.5)	549 (5.3)	541 (6.8)	541 (5.7)	535 (6.6)

▲ Average significantly higher than other gender

Numbers of items are based on the TIMSS 2019 eighth grade science eAssessment items included in scaling.
Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix B.7 for target population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available because average achievement could not be accurately estimated.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
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