Science Grade 4

Average Science Achievement

Average Achievement and Scale Score Distributions

The TIMSS 2019 fourth grade science assessment was based on a comprehensive assessment framework developed collaboratively with the participating countries to reflect their curricular goals. The fourth grade science assessment included three content areas—life science, physical science, and Earth science. In accordance with the framework, the majority of the TIMSS 2019 science items assessed students' applying and reasoning skills. To cover the framework at the fourth grade, the TIMSS 2019 science assessment comprised 175 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 58 countries are reported on the same TIMSS fourth grade science scale.

Exhibit 2.1 presents the average achievement at the fourth grade for each participating country (from highest to lowest) together with the scale score distribution underlying the scale score average. Exhibit 2.2 shows whether relatively small differences in average achievement between one country and the next are statistically significant.

Singapore and Korea performed similarly and had higher average achievement than all of the other countries, followed by the Russian Federation and Japan, whose students had similar achievement. However, the Russian Federation's performance was higher than all the remaining countries, while Japan performed higher than all the remaining countries except Chinese Taipei. Next, fourth grade students in Chinese Taipei performed similarly to students in Japan and Finland and had higher achievement than students in all of the other countries except the four top performing countries and Finland. In turn, Finland performed similarly to Chinese Taipei and had higher achievement than all of the other remaining countries. Latvia, Norway (fifth grade), the United States, Lithuania, Sweden, and England also performed very well. Essentially, Exhibit 2.2 shows clusters of several similarly performing countries, followed by the next highest achieving clusters of similarly performing countries, and so on.

A number of fourth grade TIMSS 2019 participants performed well. Thirty-two countries (including those discussed above) had higher average achievement than the centerpoint of 500 (Exhibit 2.1), which is a point of reference on the TIMSS fourth grade science scale that remains constant from TIMSS assessment to TIMSS assessment. However, although there was little difference between countries from one to the next, there was a considerable difference between the highest

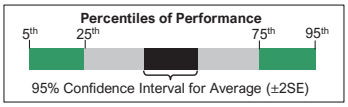
Exhibit 2.1: Average Science Achievement and Scale Score Distributions

Country	Average Scale Score	
[3] Singapore	595 (3.4)	▲
Korea, Rep. of	588 (2.1)	▲
[2] Russian Federation	567 (3.0)	▲
Japan	562 (1.8)	▲
Chinese Taipei	558 (1.8)	▲
Finland	555 (2.6)	▲
[2] Latvia	542 (2.4)	▲
† Norway (5)	539 (2.2)	▲
[2] † United States	539 (2.7)	▲
[2] Lithuania	538 (2.5)	▲
Sweden	537 (3.3)	▲
[2] England	537 (2.7)	▲
Czech Republic	534 (2.6)	▲
Australia	533 (2.4)	▲
† Hong Kong SAR	531 (3.3)	▲
Poland	531 (2.6)	▲
Hungary	529 (2.7)	▲
Ireland	528 (3.2)	▲
[2] Turkey (5)	526 (4.2)	▲
Croatia	524 (2.2)	▲
[1 2] Canada	523 (1.9)	▲
† Denmark	522 (2.4)	▲
Austria	522 (2.6)	▲
Bulgaria	521 (4.9)	▲
[2] Slovak Republic	521 (3.7)	▲
† Northern Ireland	518 (2.3)	▲
≡ Netherlands	518 (2.9)	▲
Germany	518 (2.2)	▲
[2] Serbia	517 (3.5)	▲
Cyprus	511 (3.0)	▲
Spain	511 (2.0)	▲
Italy	510 (3.0)	▲
[2] Portugal	504 (2.6)	
[2] New Zealand	503 (2.3)	
† Belgium (Flemish)	501 (2.1)	
TIMSS Scale Centerpoint	**500**	
Malta	496 (1.3)	▽
[2] Kazakhstan	494 (3.1)	
Bahrain	493 (3.4)	▽
Albania	489 (3.5)	▽
France	488 (3.0)	▽
United Arab Emirates	473 (2.1)	▽
Chile	469 (2.6)	▽
Armenia	466 (3.4)	▽
Bosnia and Herzegovina	459 (2.9)	▽
[1] Georgia	454 (3.9)	▽
Montenegro	453 (2.5)	▽
Qatar	449 (3.9)	▽
Iran, Islamic Rep. of	441 (4.1)	▽
Oman	435 (4.1)	▽
Azerbaijan	427 (3.3)	▽
North Macedonia	426 (6.2)	▽
[2] Kosovo	413 (3.7)	▽
[2] Saudi Arabia	402 (4.1)	▽
Kuwait	392 (6.1)	▽
Ψ Morocco	374 (5.8)	▽
Ж South Africa (5)	324 (4.9)	▽
[2 Ж] Pakistan	290 (13.4)	▽
[2 Ж] Philippines	249 (7.5)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	595 (2.2)	▲
[2] Dubai, UAE	545 (1.7)	▲
[2] Ontario, Canada	524 (3.2)	▲
Madrid, Spain	523 (2.0)	▲
Quebec, Canada	522 (2.5)	▲
Abu Dhabi, UAE	418 (2.8)	▽

Science Achievement Distribution

▲ Average significantly higher than the centerpoint of the TIMSS scale

▽ Average significantly lower than the centerpoint of the TIMSS scale



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%.

Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 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 2.2: 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	Korea, Rep. of	Russian Federation	Japan	Chinese Taipei	Finland	Latvia	Norway (5)	United States	Lithuania	Sweden	England	Czech Republic	Australia	Hong Kong SAR	Poland	Hungary	Ireland	Turkey (5)	Croatia	Canada	Denmark	Austria	Bulgaria	Slovak Republic	Northern Ireland	Netherlands	Germany	Serbia	Cyprus	Spain	Italy	Portugal	New Zealand
Singapore	595 (3.4)			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	588 (2.1)			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	567 (3.0)	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	562 (1.8)	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	558 (1.8)	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	555 (2.6)	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	542 (2.4)	▽	▽	▽	▽	▽	▽							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway (5)	539 (2.2)	▽	▽	▽	▽	▽	▽								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	539 (2.7)	▽	▽	▽	▽	▽	▽										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	538 (2.5)	▽	▽	▽	▽	▽	▽										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	537 (3.3)	▽	▽	▽	▽	▽	▽												▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	537 (2.7)	▽	▽	▽	▽	▽	▽											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	534 (2.6)	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	533 (2.4)	▽	▽	▽	▽	▽	▽	▽	▽												▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong SAR	531 (3.3)	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Poland	531 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽										▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	529 (2.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▽									▲	▲	▲			▲	▲	▲	▲	▲	▲	▲	▲	▲
Ireland	528 (3.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽														▲	▲	▲	▲	▲	▲	▲	▲	▲
Turkey (5)	526 (4.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽																		▲	▲	▲	▲	▲
Croatia	524 (2.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▽														▲	▲	▲	▲	▲
Canada	523 (1.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲
Denmark	522 (2.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲
Austria	522 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲
Bulgaria	521 (4.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽																		▲	▲	▲
Slovak Republic	521 (3.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽															▲	▲	▲	▲
Northern Ireland	518 (2.3)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲
Netherlands	518 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲
Germany	518 (2.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲
Serbia	517 (3.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽															▲	▲
Cyprus	511 (3.0)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽										▲
Spain	511 (2.0)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▽	▽	▽	▽				▲	▲
Italy	510 (3.0)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						
Portugal	504 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▽			
New Zealand	503 (2.3)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			
Belgium (Flemish)	501 (2.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		
Malta	496 (1.3)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Kazakhstan	494 (3.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Bahrain	493 (3.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Albania	489 (3.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
France	488 (3.0)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
United Arab Emirates	473 (2.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Chile	469 (2.6)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Armenia	466 (3.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Bosnia and Herzegovina	459 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Georgia	454 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Montenegro	453 (2.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Qatar	449 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Iran, Islamic Rep. of	441 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Oman	435 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Azerbaijan	427 (3.3)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
North Macedonia	426 (6.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Kosovo	413 (3.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Saudi Arabia	402 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Kuwait	392 (6.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Morocco	374 (5.8)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
South Africa (5)	324 (4.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Pakistan	290 (13.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Philippines	249 (7.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
Benchmarking Participants																																			
Moscow City, Russian Fed.	595 (2.2)		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Dubai, UAE	545 (1.7)	▽	▽	▽	▽	▽	▽				▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario, Canada	524 (3.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽																▲	▲	▲	▲	▲
Madrid, Spain	523 (2.0)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲
Quebec, Canada	522 (2.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽													▲	▲	▲	▲	▲
Abu Dhabi, UAE	418 (2.8)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽

▲ 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 2.2: Significance of Differences Between Countries' Average Science Achievement

(Continued)

Country	Average Scale Score	Belgium (Flemish)	Malta	Kazakhstan	Bahrain	Albania	France	United Arab Emirates	Chile	Armenia	Bosnia and Herzegovina	Georgia	Montenegro	Qatar	Iran, Islamic Rep. of	Oman	Azerbaijan	North Macedonia	Kosovo	Saudi Arabia	Kuwait	Morocco	South Africa (5)	Pakistan	Philippines	Benchmarking Participants	Moscow City, Russian Fed.	Dubai, UAE	Ontario, Canada	Madrid, Spain	Quebec, Canada	Abu Dhabi, UAE
Singapore	595 (3.4)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲	▲	▲
Korea, Rep. of	588 (2.1)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▲	▲	▲	▲	▲
Russian Federation	567 (3.0)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▲	▲	▲	▲	▲
Japan	562 (1.8)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▲	▲	▲	▲	▲
Chinese Taipei	558 (1.8)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▲	▲	▲	▲	▲
Finland	555 (2.6)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▲	▲	▲	▲	▲
Latvia	542 (2.4)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲
Norway (5)	539 (2.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲
United States	539 (2.7)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲
Lithuania	538 (2.5)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▲	▲	▲	▲
Sweden	537 (3.3)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲
England	537 (2.7)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▲	▲	▲	▲
Czech Republic	534 (2.6)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▲	▲	▲	▲
Australia	533 (2.4)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▲	▲	▲	▲
Hong Kong SAR	531 (3.3)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲
Poland	531 (2.6)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲
Hungary	529 (2.7)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽		▲	▲	▲
Ireland	528 (3.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Turkey (5)	526 (4.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Croatia	524 (2.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Canada	523 (1.9)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Denmark	522 (2.4)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Austria	522 (2.6)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Bulgaria	521 (4.9)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Slovak Republic	521 (3.7)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Northern Ireland	518 (2.3)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Netherlands	518 (2.9)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Germany	518 (2.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Serbia	517 (3.5)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Cyprus	511 (3.0)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Spain	511 (2.0)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Italy	510 (3.0)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Portugal	504 (2.6)		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
New Zealand	503 (2.3)		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Belgium (Flemish)	501 (2.1)		▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Malta	496 (1.3)	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Kazakhstan	494 (3.1)							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Bahrain	493 (3.4)	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Albania	489 (3.5)	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
France	488 (3.0)	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
United Arab Emirates	473 (2.1)	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Chile	469 (2.6)	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Armenia	466 (3.4)	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Bosnia and Herzegovina	459 (2.9)	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Georgia	454 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Montenegro	453 (2.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Qatar	449 (3.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Iran, Islamic Rep. of	441 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Oman	435 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
Azerbaijan	427 (3.3)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	▲
North Macedonia	426 (6.2)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽				▲	▲	▲	▲	▲	▲			▽	▽	▽	▽	▽	
Kosovo	413 (3.7)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	
Saudi Arabia	402 (4.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▲	▲	▲	▲		▽	▽	▽	▽	▽	▽
Kuwait	392 (6.1)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▲	▲	▲	▲		▽	▽	▽	▽	▽	▽
Morocco	374 (5.8)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▲	▲	▲		▽	▽	▽	▽	▽	▽
South Africa (5)	324 (4.9)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▲	▲		▽	▽	▽	▽	▽	▽
Pakistan	290 (13.4)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽		▲		▽	▽	▽	▽	▽	▽
Philippines	249 (7.5)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▽	▽	▽	▽	▽	▽
Benchmarking Participants																																
Moscow City, Russian Fed.	595 (2.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲
Dubai, UAE	545 (1.7)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽		▲	▲	▲	▲
Ontario, Canada	524 (3.2)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Madrid, Spain	523 (2.0)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Quebec, Canada	522 (2.5)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▽	▽				▲
Abu Dhabi, UAE	418 (2.8)	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▲	▲	▲	▲	▲	▲		▽	▽	▽	▽	▽	

▲ 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

average achievement and the lowest. Also, the scale score distributions show that there is wide variation in achievement in every country. Every country has some higher achieving and some lower achieving students.

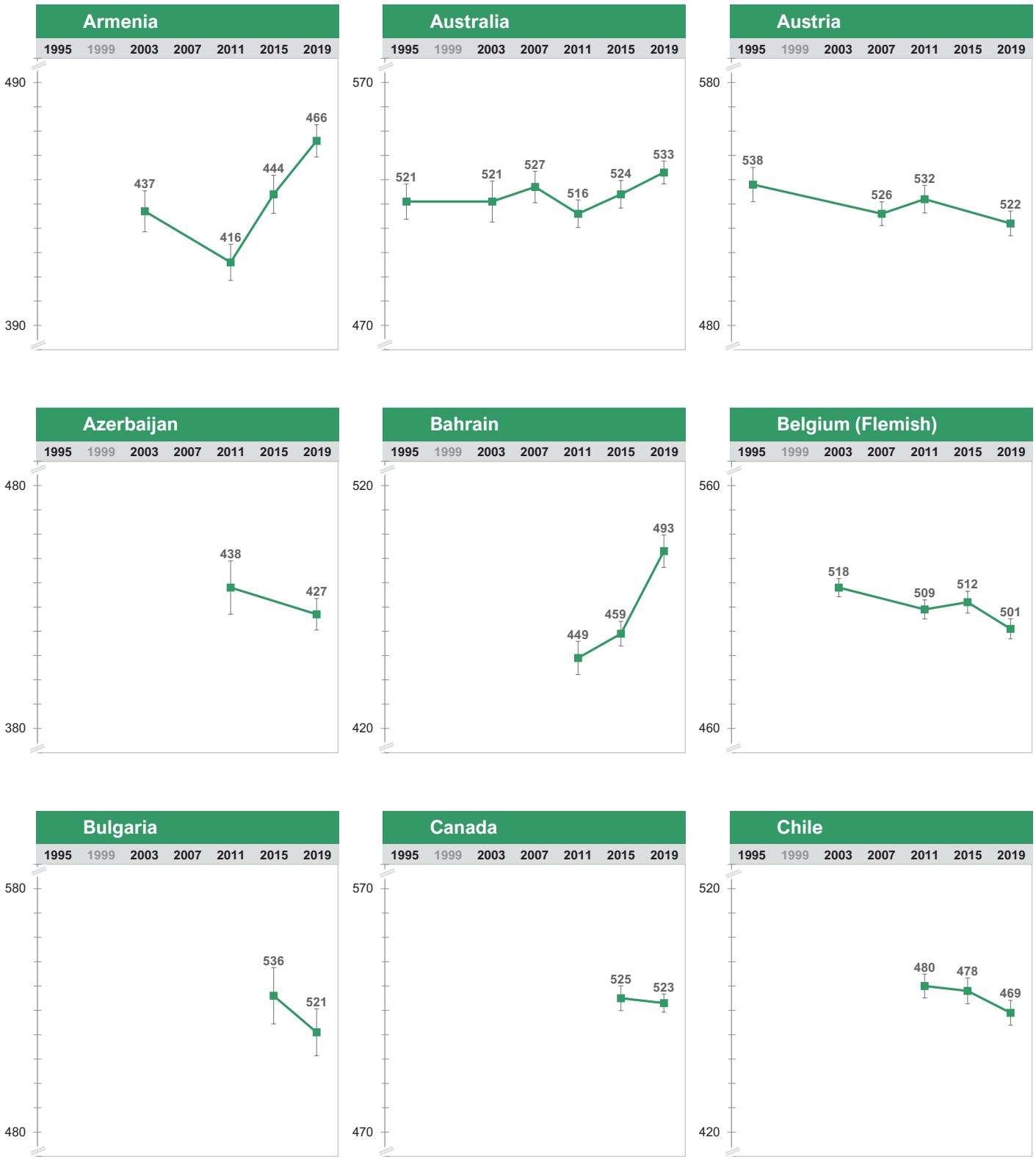
Trends in Average Achievement

Exhibit 2.3 graphs the differences in average science achievement between the assessments for TIMSS 2019 countries that have comparable data from previous assessments, while Exhibit 2.4 provides more detailed results. The countries are presented in alphabetical order in both exhibits. The trends in science achievement at the fourth grade signal more improvements than downturns across the assessment cycles internationally. However, since the inception of TIMSS in 1995, most countries have had some periods of increases and some of decreases in average achievement, as well as periods of stability.

Most recently, for the 44 countries that participated in both TIMSS 2015 and 2019, 10 had increases in average achievement and 10 had declines, but the majority stayed the same. As a midway point, 21 countries participated in both TIMSS 2007 and 2019, with 6 showing increases and 3 declines. For the 16 countries that participated in both 1995 and 2019, most showed improvement—11 with higher average achievement in 2019 and only 2 with lower average achievement.

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



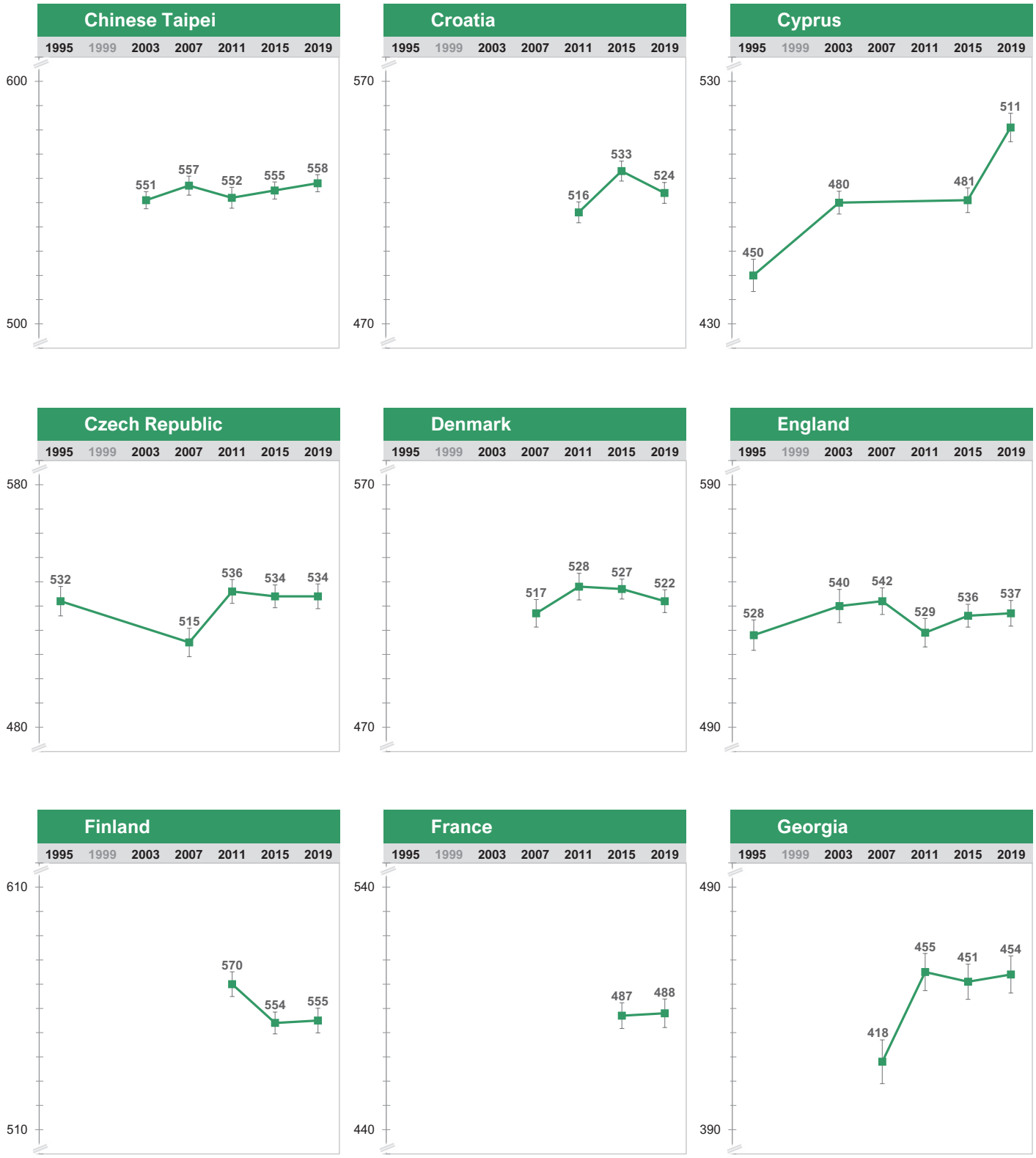
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

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

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



◊ There was no TIMSS fourth grade assessment in 1999. 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.

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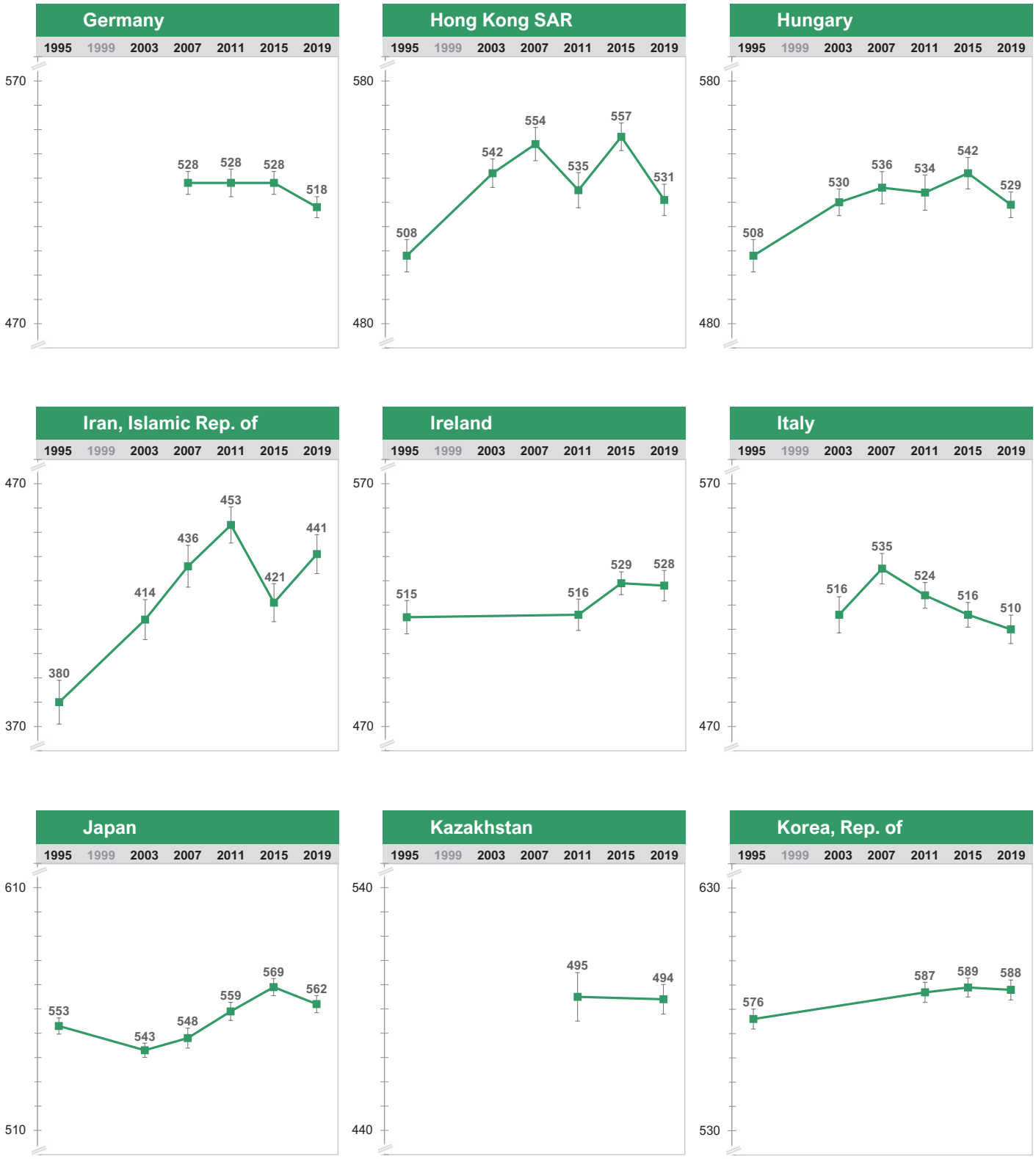
Downloaded from http://timss2019.org/download

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



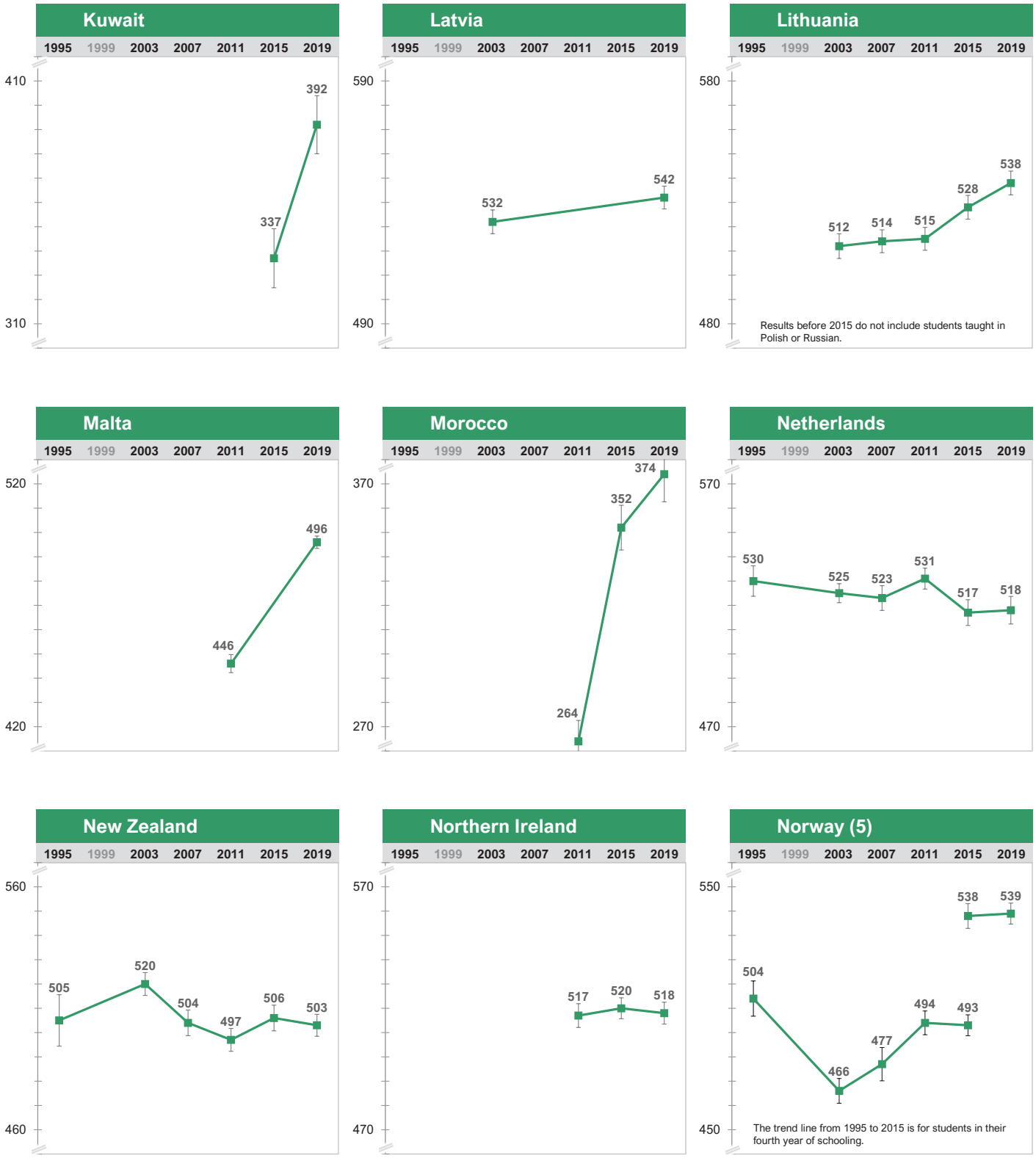
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

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

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



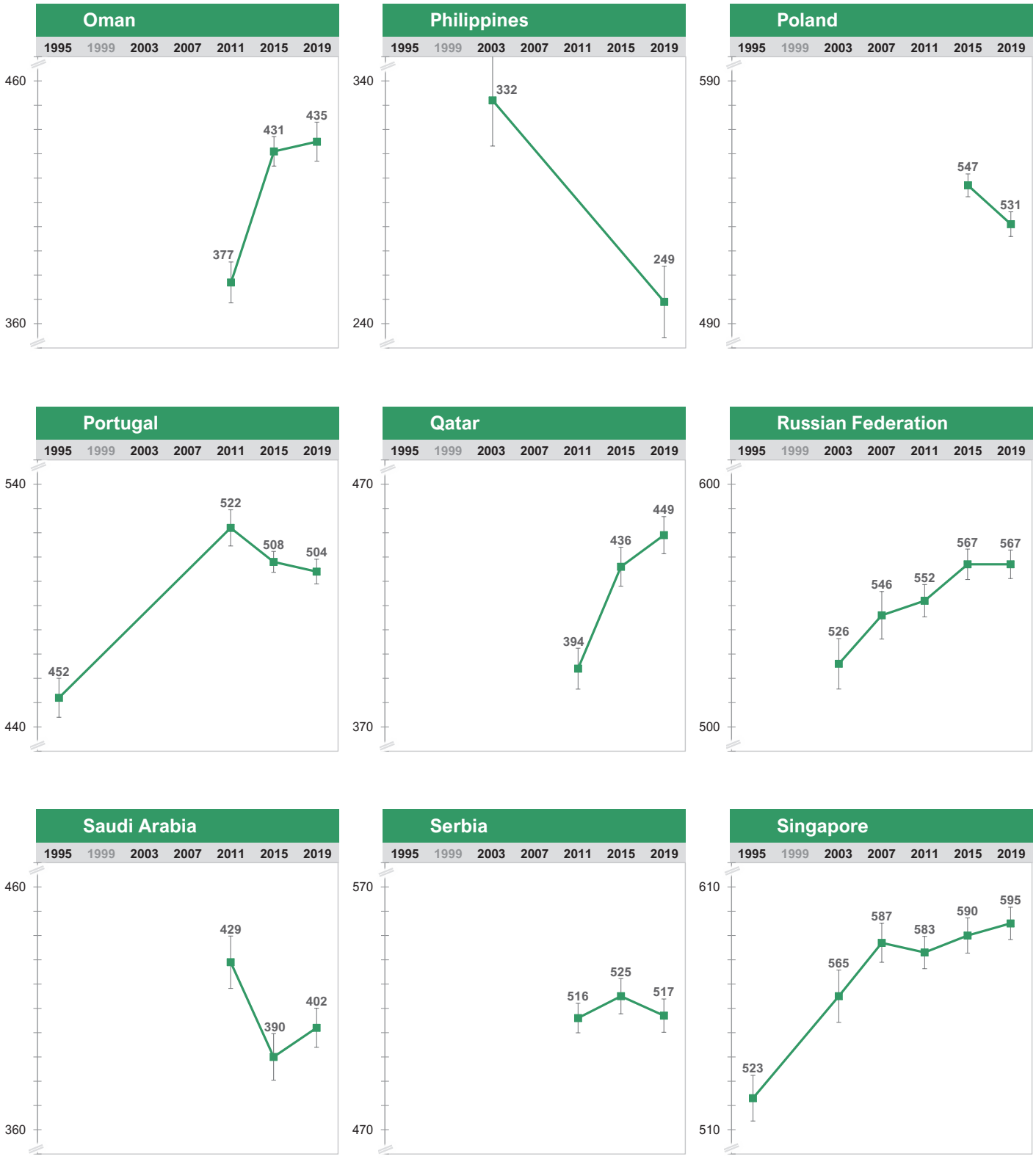
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

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

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



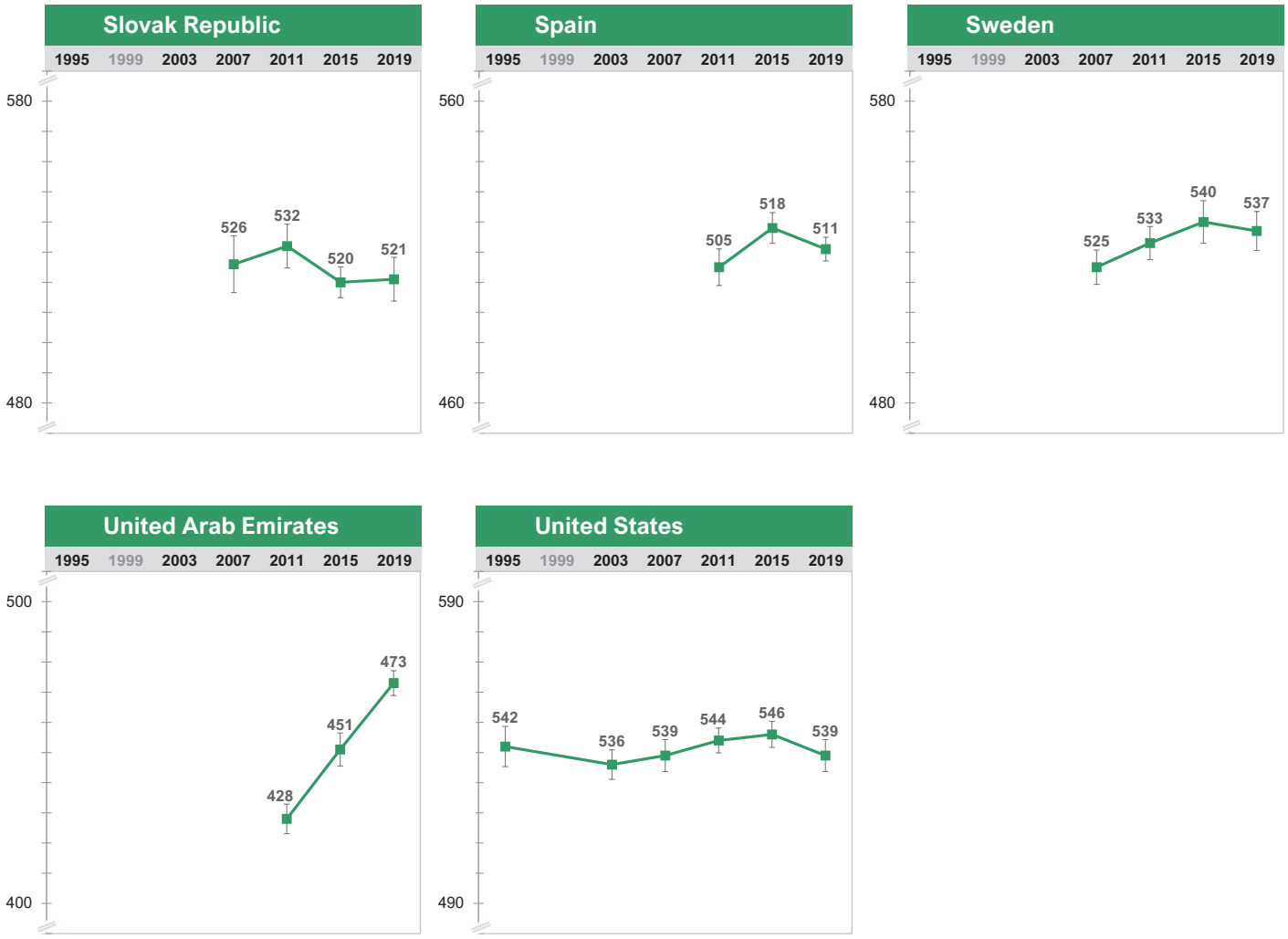
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

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

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



◊ There was no TIMSS fourth grade assessment in 1999. 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.

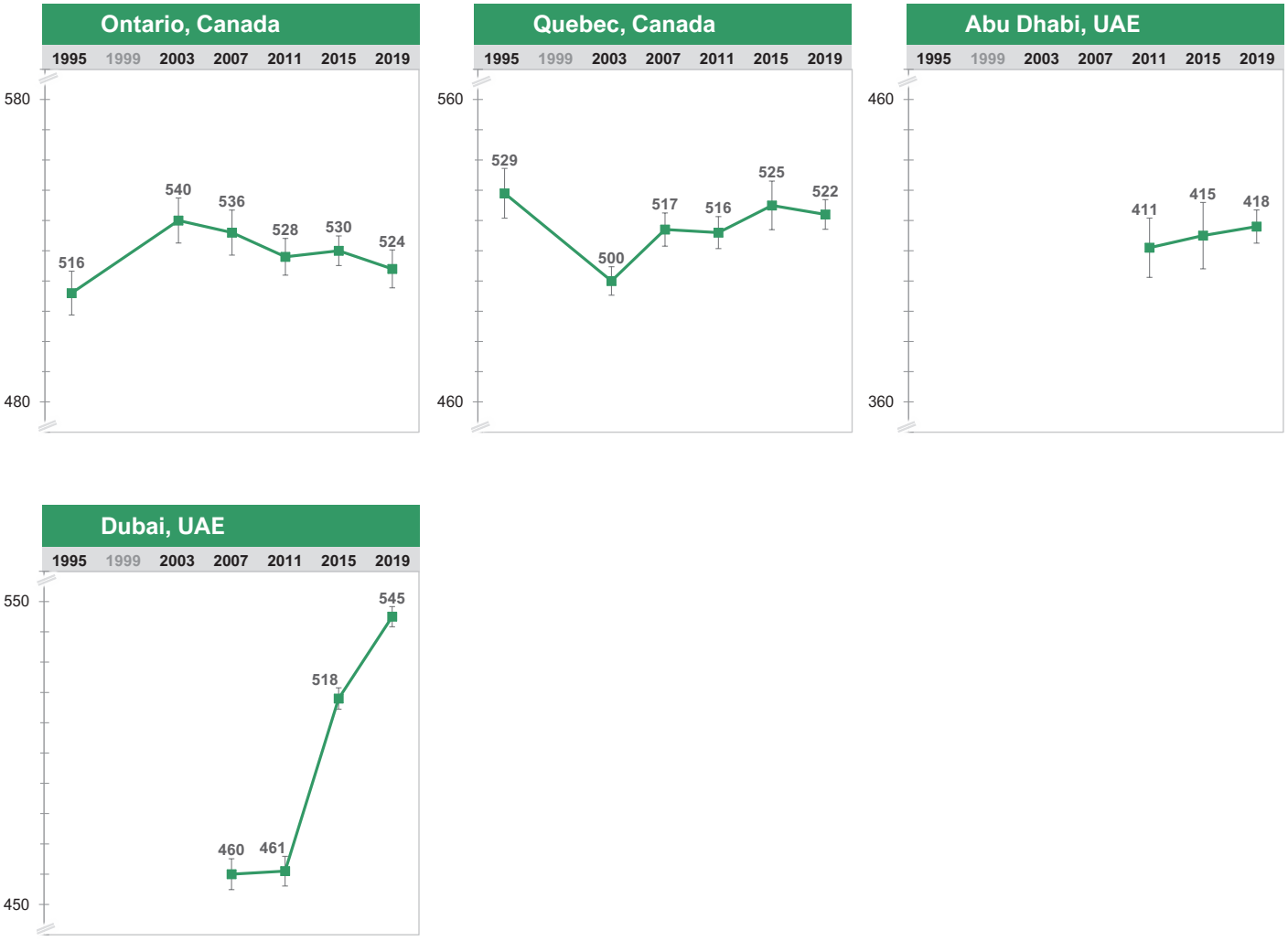
SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 2.3: 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 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

Benchmarking Participants



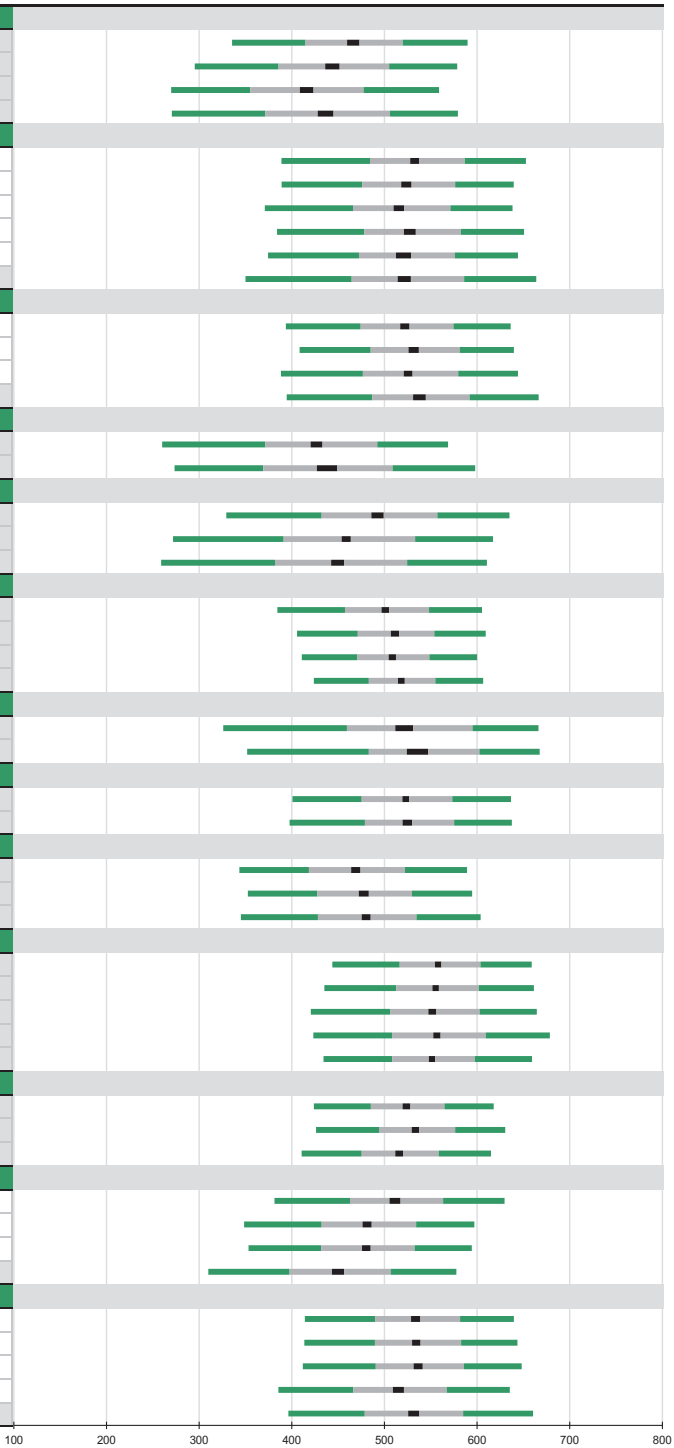
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
I The black bars represent the 95% confidence interval.

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

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

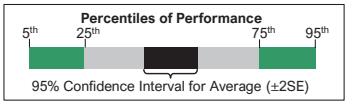
Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▽) than the performance in the column year.

Country	Average Scale Score	Differences Between Years					Science Achievement Distribution
		2015	2011	2007	2003	1995	
Armenia							
2019	466 (3.4)	23 ▲	50 ▲		30 ▲		
2015	444 (4.0)		28 ▲		7		
2011	416 (3.8)				-20 ▽		
2003	437 (4.3)						
Australia							
2019	533 (2.4)	9 ▲	17 ▲	5	12 ▲	11 ▲	
2015	524 (2.9)		8 ▲	-4	3	2	
2011	516 (2.9)			-12 ▽	-5	-6	
2007	527 (3.3)				7	6	
† 2003	521 (4.3)					-1	
≡ 1995	521 (3.7)						
Austria							
2019	522 (2.6)		-9 ▽	-4		-16 ▽	
2011	532 (2.9)			6		-6	
2007	526 (2.5)					-12 ▽	
≡ 1995	538 (3.6)						
Azerbaijan							
2019	427 (3.3)		-11				
2 2011	438 (5.6)						
Bahrain							
2019	493 (3.4)	34 ▲	43 ▲				
2 2015	459 (2.6)		9 ▲				
2011	449 (3.5)						
Belgium (Flemish)							
† 2019	501 (2.1)	-10 ▽	-8 ▽		-17 ▽		
† 2015	512 (2.3)		3		-7 ▽		
2011	509 (2.0)				-10 ▽		
2 2003	518 (1.9)						
Bulgaria							
2019	521 (4.9)	-14					
2015	536 (5.9)						
Canada							
1 2 2019	523 (1.9)	-2					
1 2 † 2015	525 (2.6)						
Chile							
2019	469 (2.6)	-9 ▽	-11 ▽				
2015	478 (2.7)		-3				
2011	480 (2.5)						
Chinese Taipei							
2019	558 (1.8)	3	6 ▲	1	7 ▲		
2015	555 (1.8)		4	-1	4		
2011	552 (2.2)			-5	0		
2007	557 (2.0)				5 ▲		
2003	551 (1.8)						
Croatia							
2019	524 (2.2)	-10 ▽	8 ▲				
2015	533 (2.1)		17 ▲				
2 2011	516 (2.2)						
Cyprus							
2019	511 (3.0)	30 ▲			31 ▲	61 ▲	
2015	481 (2.6)				1	31 ▲	
2003	480 (2.4)					30 ▲	
1995	450 (3.4)						
Czech Republic							
2019	534 (2.6)	-1	-3	19 ▲		2	
2015	534 (2.4)		-2	19 ▲		3	
2011	536 (2.5)			21 ▲		5	
2007	515 (3.0)					-17 ▽	
1995	532 (3.1)						



▲ 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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 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

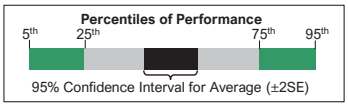
Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years					Science Achievement Distribution
		2015	2011	2007	2003	1995	
Denmark							
† 2019	522 (2.4)	-5	-6	5			
2 † 2015	527 (2.1)		-1	10 ▲			
2 2011	528 (2.8)			11 ▲			
† 2007	517 (2.9)						
England							
2 2019	537 (2.7)	1	8 ▲	-5	-3	9 ▲	
2015	536 (2.4)		7	-6	-4	8 ▲	
2011	529 (3.0)			-13 ▽	-11 ▽	1	
2007	542 (2.8)				1	14 ▲	
† 2003	540 (3.5)					13 ▲	
3 † 1995	528 (3.2)						
Finland							
2019	555 (2.6)	1	-16 ▽				
2015	554 (2.3)		-16 ▽				
2011	570 (2.6)						
France							
2019	488 (3.0)	0					
2015	487 (2.7)						
Georgia							
1 2019	454 (3.9)	3	-1	37 ▲			
1 2015	451 (3.7)		-4	34 ▲			
1 2011	455 (3.9)			37 ▲			
1 2007	418 (4.6)						
Germany							
2019	518 (2.2)	-10 ▽	-9 ▽	-9 ▽			
2015	528 (2.4)		1	1			
2011	528 (2.9)			0			
2007	528 (2.4)						
Hong Kong SAR							
† 2019	531 (3.3)	-25 ▽	-4	-23 ▽	-11 ▽	23 ▲	
† 2015	557 (2.9)		22 ▲	2	14 ▲	49 ▲	
2 2011	535 (3.7)			-19 ▽	-8	27 ▲	
2007	554 (3.5)				12 ▲	46 ▲	
† 2003	542 (3.0)					35 ▲	
1995	508 (3.4)						
Hungary							
2019	529 (2.7)	-13 ▽	-5	-7	0	22 ▲	
2015	542 (3.3)		8	6	12 ▲	34 ▲	
2011	534 (3.7)			-2	5	27 ▲	
2007	536 (3.4)				6	28 ▲	
2 2003	530 (2.8)					22 ▲	
1995	508 (3.4)						
Iran, Islamic Rep. of							
2019	441 (4.1)	20 ▲	-12 ▽	5	27 ▲	61 ▲	
2015	421 (4.0)		-32 ▽	-15 ▽	7	41 ▲	
2011	453 (3.8)			17 ▲	39 ▲	73 ▲	
2007	436 (4.4)				22 ▲	55 ▲	
2 2003	414 (4.2)					34 ▲	
1995	380 (4.6)						
Ireland							
2019	528 (3.2)	-1	12 ▲			13 ▲	
2015	529 (2.4)		13 ▲			14 ▲	
2011	516 (3.3)					1	
2 1995	515 (3.5)						
Italy							
2019	510 (3.0)	-7	-14 ▽	-25 ▽	-6		
2 2015	516 (2.6)		-7 ▽	-19 ▽	1		
2011	524 (2.7)			-11 ▽	8		
2007	535 (3.2)				20 ▲		
2003	516 (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
Downloaded from http://timss2019.org/download

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years 2015	2011	2007	2003	1995
Japan						
2019	562 (1.8)	-7 ▽	3	14 ▲	18 ▲	8 ▲
2015	569 (1.8)		10 ▲	21 ▲	26 ▲	16 ▲
2011	559 (1.9)			11 ▲	15 ▲	5 ▲
2007	548 (2.1)				4	-5
2003	543 (1.5)					-10 ▽
1995	553 (1.7)					
Kazakhstan						
[2] 2019	494 (3.1)		0			
[2] 2011	495 (5.1)					
Korea, Rep. of						
2019	588 (2.1)	-2	1			12 ▲
2015	589 (2.0)		3			14 ▲
2011	587 (2.1)					11 ▲
[2] 1995	576 (2.1)					
Kuwait						
2019	392 (6.1)	55 ▲				
Ψ 2015	337 (6.2)					
Latvia						
[2] 2019	542 (2.4)				10 ▲	
2003	532 (2.5)					
Lithuania						
[2] 2019	538 (2.5)	10 ▲	23 ▲	24 ▲	26 ▲	
[2] 2015	528 (2.5)		13 ▲	13 ▲	16 ▲	
[1 2] 2011	515 (2.4)			0	3	
[1] 2007	514 (2.4)				2	
[1] 2003	512 (2.6)					
Malta						
2019	496 (1.3)		50 ▲			
2011	446 (1.9)					
Morocco						
Ψ 2019	374 (5.8)	22 ▲	110 ▲			
Ψ 2015	352 (4.7)		89 ▲			
Ж 2011	264 (4.4)					
Netherlands						
≡ 2019	518 (2.9)	1	-13 ▽	-5	-7	-12 ▽
† 2015	517 (2.7)		-14 ▽	-6	-8 ▽	-13 ▽
† 2011	531 (2.2)			8 ▲	6 ▲	1
‡ 2007	523 (2.6)				-2	-7
† 2003	525 (2.0)					-5
≡ 1995	530 (3.2)					
New Zealand						
[2] 2019	503 (2.3)	-3	6	-2	-17 ▽	-3
2015	506 (2.7)		9 ▲	1	-14 ▽	0
2011	497 (2.4)			-7 ▽	-23 ▽	-8
2007	504 (2.7)				-16 ▽	-1
2003	520 (2.4)					15 ▲
1995	505 (5.4)					
Northern Ireland						
† 2019	518 (2.3)	-1	2			
‡ 2015	520 (2.2)		3			
† 2011	517 (2.5)					
Norway (5)						
† 2019	539 (2.2)	2				
2015	538 (2.6)					
Oman						
2019	435 (4.1)	4	58 ▲			
2015	431 (3.1)		54 ▲			
2011	377 (4.3)					
Philippines						
[2] Ж 2019	249 (7.5)				-83 ▽	
2003	332 (9.6)					
Poland						
2019	531 (2.6)	-16 ▽				
2015	547 (2.4)					

Science Achievement Distribution

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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

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

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years 2015	2011	2007	2003	1995
Portugal						
[2] 2019	504 (2.6)	-4	-18 ▽			52 ▲
[2] 2015	508 (2.2)		-14 ▽			56 ▲
2011	522 (3.8)					70 ▲
[2] 1995	452 (4.1)					
Qatar						
2019	449 (3.9)	13 ▲	55 ▲			
2015	436 (4.1)		42 ▲			
[2] 2011	394 (4.3)					
Russian Federation						
[2] 2019	567 (3.0)	0	15 ▲	21 ▲	41 ▲	
2015	567 (3.2)		15 ▲	21 ▲	41 ▲	
2011	552 (3.4)			6	26 ▲	
2007	546 (5.0)				20 ▲	
[2] 2003	526 (5.3)					
Saudi Arabia						
[2] 2019	402 (4.1)	12	-27 ▽			
2015	390 (4.9)		-39 ▽			
2011	429 (5.5)					
Serbia						
[2] 2019	517 (3.5)	-8	1			
[3] 2015	525 (3.7)		9			
[2] 2011	516 (3.1)					
Singapore						
[3] 2019	595 (3.4)	4	11 ▲	8	29 ▲	71 ▲
[2] 2015	590 (3.7)		7	4	25 ▲	67 ▲
[2] 2011	583 (3.4)			-3	18 ▲	60 ▲
2007	587 (4.1)				22 ▲	63 ▲
2003	565 (5.5)					42 ▲
1995	523 (4.8)					
Slovak Republic						
[2] 2019	521 (3.7)	0	-11 ▽	-5		
2015	520 (2.6)		-11 ▽	-5		
2011	532 (3.7)			6		
2007	526 (4.8)					
Spain						
2019	511 (2.0)	-7 ▽	6			
[2] 2015	518 (2.6)		13 ▲			
2011	505 (3.1)					
Sweden						
2019	537 (3.3)	-3	4	12 ▲		
[2] 2015	540 (3.6)		7	15 ▲		
2011	533 (2.8)			9 ▲		
2007	525 (2.9)					
United Arab Emirates						
2019	473 (2.1)	21 ▲	45 ▲			
2015	451 (2.8)		23 ▲			
2011	428 (2.5)					
United States						
[2†] 2019	539 (2.7)	-7 ▽	-5	0	3	-3
[2†] 2015	546 (2.2)		2	7 ▲	10 ▲	4
[2] 2011	544 (2.1)			5	8 ▲	2
[2†] 2007	539 (2.7)				3	-3
[†] 2003	536 (2.5)					-6
1995	542 (3.4)					

Science Achievement Distribution

▲ Average from more recent year significantly higher

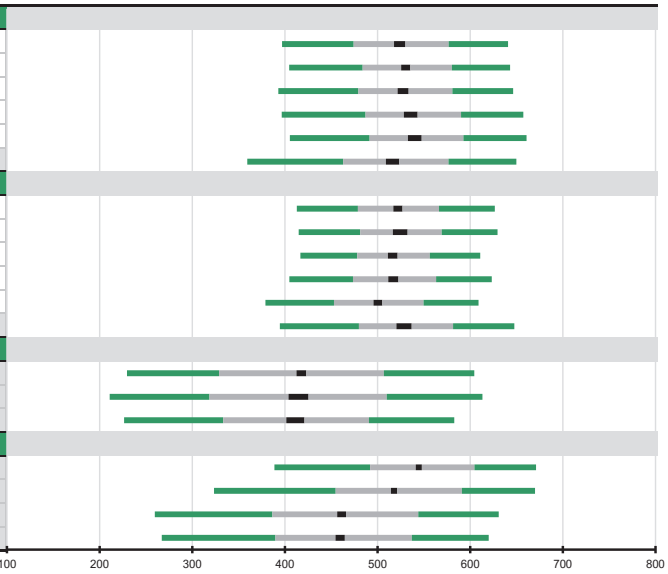
▽ Average from more recent year significantly lower

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

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years 2015	2011	2007	2003	1995	Science Achievement Distribution
Benchmarking Participants							
Ontario, Canada							
[2] 2019	524 (3.2)	-6	-4	-12 ▽	-16 ▽	8	
2015	530 (2.5)		3	-5	-10 ▽	14 ▲	
2011	528 (3.1)			-8	-13 ▽	11 ▲	
[2] 2007	536 (3.8)				-4	20 ▲	
2003	540 (3.8)					24 ▲	
[2] 1995	516 (3.7)						
Quebec, Canada							
2019	522 (2.5)	-3	6	5	22 ▲	-7	
[≡] 2015	525 (4.1)		8	7	24 ▲	-4	
2011	516 (2.7)			-1	16 ▲	-12 ▽	
[2] 2007	517 (2.8)				17 ▲	-11 ▽	
2003	500 (2.4)					-28 ▽	
1995	529 (4.2)						
Abu Dhabi, UAE							
2019	418 (2.8)	3	6				
[2] 2015	415 (5.6)		3				
2011	411 (5.0)						
Dubai, UAE							
[2] 2019	545 (1.7)	27 ▲	83 ▲	85 ▲			
2015	518 (1.8)		57 ▲	58 ▲			
2011	461 (2.5)			2			
[‡] 2007	460 (2.6)						



▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

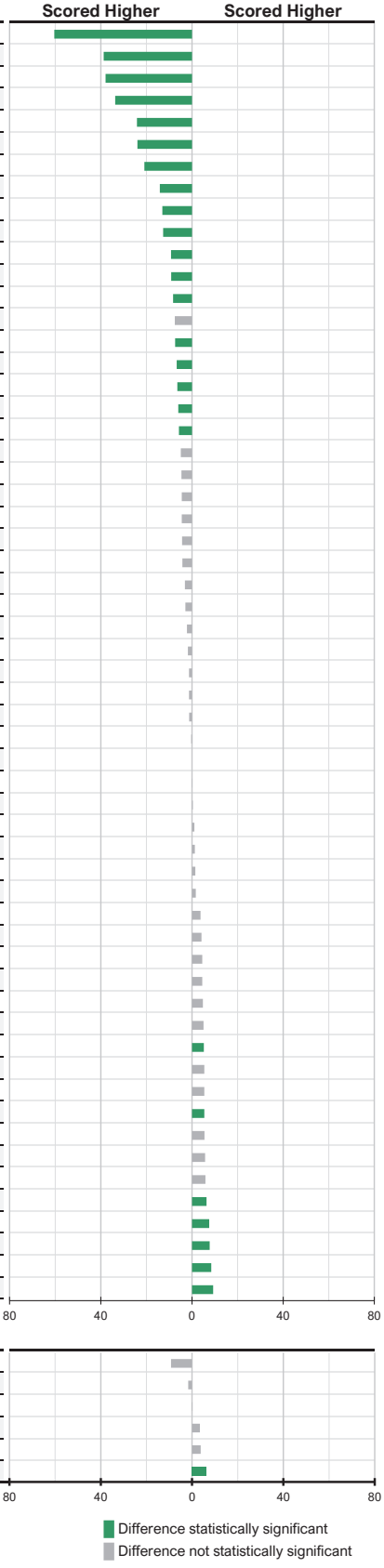
SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Average Achievement by Gender

Exhibit 2.5 shows the differences in average science achievement between girls and boys. In TIMSS 2019, fourth grade girls had higher average achievement than boys in 18 countries, there was gender equity in average science achievement in 33 countries, and boys had higher average achievement than girls in 7 countries.

Exhibit 2.5: 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
2 Saudi Arabia	48 (0.8)	434 (4.8)	52 (0.8)	373 (6.5)	60 (8.3)	
Kuwait	47 (2.6)	413 (6.9)	53 (2.6)	374 (8.7)	39 (10.3)	
2 Ж Pakistan	45 (4.7)	311 (15.4)	55 (4.7)	273 (14.5)	38 (15.8)	
Bahrain	49 (1.2)	510 (3.8)	51 (1.2)	476 (5.1)	34 (6.1)	
Oman	50 (0.7)	447 (3.8)	50 (0.7)	423 (5.0)	24 (3.6)	
2 Ж Philippines	48 (0.7)	261 (7.8)	52 (0.7)	238 (7.8)	24 (4.9)	
Ж South Africa (5)	50 (0.6)	335 (5.4)	50 (0.6)	314 (5.2)	21 (3.9)	
North Macedonia	48 (0.6)	433 (6.5)	52 (0.6)	419 (6.7)	14 (4.3)	
2 Kosovo	49 (1.0)	420 (4.2)	51 (1.0)	407 (4.0)	13 (3.6)	
Qatar	50 (1.5)	456 (6.0)	50 (1.5)	443 (3.7)	13 (6.1)	
Armenia	48 (0.8)	471 (3.5)	52 (0.8)	462 (4.0)	9 (3.1)	
Ψ Morocco	49 (0.7)	379 (6.4)	51 (0.7)	370 (5.8)	9 (3.7)	
Albania	49 (0.9)	494 (3.9)	51 (0.9)	485 (3.9)	8 (3.4)	
Bulgaria	48 (0.9)	525 (5.3)	52 (0.9)	518 (5.4)	7 (4.3)	
2 Serbia	50 (0.9)	521 (3.5)	50 (0.9)	513 (4.3)	7 (3.5)	
Bosnia and Herzegovina	49 (0.7)	462 (3.1)	51 (0.7)	455 (3.5)	7 (2.9)	
2 Kazakhstan	49 (0.7)	497 (3.6)	51 (0.7)	491 (3.1)	6 (2.8)	
Montenegro	47 (0.6)	457 (2.9)	53 (0.6)	451 (2.8)	6 (2.8)	
Japan	48 (0.5)	565 (2.0)	52 (0.5)	559 (2.1)	6 (2.0)	
Finland	49 (0.9)	557 (3.5)	51 (0.9)	552 (2.4)	5 (3.1)	
2 Latvia	50 (0.9)	544 (2.6)	50 (0.9)	540 (3.0)	5 (2.9)	
2 New Zealand	48 (1.3)	505 (3.2)	52 (1.3)	500 (2.8)	5 (3.9)	
2 Lithuania	49 (0.9)	540 (2.8)	51 (0.9)	536 (3.3)	4 (3.4)	
United Arab Emirates	50 (1.1)	475 (3.1)	50 (1.1)	471 (2.6)	4 (4.0)	
Azerbaijan	47 (0.9)	429 (3.9)	53 (0.9)	425 (3.5)	4 (3.2)	
† Norway (5)	48 (0.9)	541 (2.4)	52 (0.9)	538 (3.1)	3 (3.5)	
Poland	49 (0.8)	532 (2.8)	51 (0.8)	529 (3.2)	3 (3.0)	
Sweden	50 (1.1)	538 (3.6)	50 (1.1)	536 (3.8)	2 (3.3)	
France	49 (1.0)	489 (3.2)	51 (1.0)	487 (3.4)	2 (2.8)	
† Northern Ireland	50 (1.0)	519 (2.9)	50 (1.0)	518 (2.8)	1 (3.4)	
† Denmark	50 (0.8)	523 (2.7)	50 (0.8)	522 (2.8)	1 (2.8)	
Australia	49 (0.8)	533 (2.9)	51 (0.8)	532 (2.7)	1 (2.9)	
≡ Netherlands	49 (1.0)	519 (3.1)	51 (1.0)	518 (3.3)	0 (2.8)	
Croatia	50 (1.2)	524 (2.6)	50 (1.2)	524 (2.7)	0 (3.1)	
† Hong Kong SAR	46 (1.3)	531 (3.1)	54 (1.3)	531 (4.3)	0 (3.6)	
2 England	50 (1.0)	537 (3.6)	50 (1.0)	537 (2.7)	0 (3.5)	
2 Russian Federation	51 (1.1)	567 (3.5)	49 (1.1)	568 (3.3)	1 (3.0)	
Spain	47 (0.8)	511 (2.4)	53 (0.8)	512 (2.5)	1 (2.9)	
Iran, Islamic Rep. of	49 (2.1)	440 (6.6)	51 (2.1)	442 (5.4)	2 (8.7)	
Chinese Taipei	48 (0.6)	557 (2.0)	52 (0.6)	559 (2.2)	2 (2.3)	
† Belgium (Flemish)	51 (0.8)	499 (2.3)	49 (0.8)	503 (2.8)	4 (2.9)	
Cyprus	52 (0.7)	509 (2.8)	48 (0.7)	514 (4.1)	4 (3.3)	
Ireland	50 (1.1)	526 (3.8)	50 (1.1)	530 (3.4)	4 (3.5)	
Germany	50 (0.8)	516 (2.8)	50 (0.8)	520 (2.4)	4 (2.8)	
Malta	49 (0.7)	493 (2.1)	51 (0.7)	498 (2.4)	5 (3.7)	
1 Georgia	49 (0.9)	452 (4.7)	51 (0.9)	457 (4.2)	5 (4.1)	
1 2 Canada	49 (0.8)	520 (2.1)	51 (0.8)	526 (2.2)	5 (2.1)	
2 Turkey (5)	52 (1.4)	524 (4.4)	48 (1.4)	529 (5.2)	5 (4.6)	
2 Slovak Republic	49 (1.0)	518 (3.8)	51 (1.0)	523 (4.4)	5 (3.8)	
2 † United States	49 (0.8)	536 (3.0)	51 (0.8)	541 (3.2)	5 (2.7)	
2 Portugal	48 (0.9)	501 (3.1)	52 (0.9)	506 (2.7)	6 (2.9)	
Austria	49 (1.0)	519 (3.1)	51 (1.0)	525 (3.0)	6 (3.3)	
Chile	50 (1.3)	466 (3.1)	50 (1.3)	472 (3.3)	6 (3.7)	
Hungary	48 (1.0)	526 (3.2)	52 (1.0)	533 (3.1)	6 (3.3)	
Italy	50 (0.8)	506 (3.3)	50 (0.8)	514 (3.3)	8 (2.8)	
3 Singapore	49 (0.5)	591 (3.6)	51 (0.5)	598 (3.8)	8 (2.8)	
Czech Republic	49 (0.9)	529 (3.0)	51 (0.9)	538 (3.0)	8 (3.1)	
Korea, Rep. of	47 (0.7)	583 (2.4)	53 (0.7)	592 (2.5)	9 (2.5)	
International Average	**49 (0.2)**	**493 (0.6)**	**51 (0.2)**	**489 (0.6)**		
Benchmarking Participants						
Abu Dhabi, UAE	50 (1.5)	422 (3.8)	50 (1.5)	413 (3.9)	9 (5.3)	
2 Dubai, UAE	49 (2.4)	545 (3.6)	51 (2.4)	544 (2.4)	2 (5.0)	
Moscow City, Russian Fed.	49 (1.0)	595 (2.5)	51 (1.0)	595 (2.6)	0 (2.5)	
Madrid, Spain	49 (1.0)	521 (2.5)	51 (1.0)	524 (2.3)	3 (2.6)	
2 Ontario, Canada	49 (1.6)	522 (4.0)	51 (1.6)	526 (3.3)	4 (3.7)	
Quebec, Canada	48 (0.8)	519 (2.7)	52 (0.8)	525 (3.0)	6 (2.5)	



Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

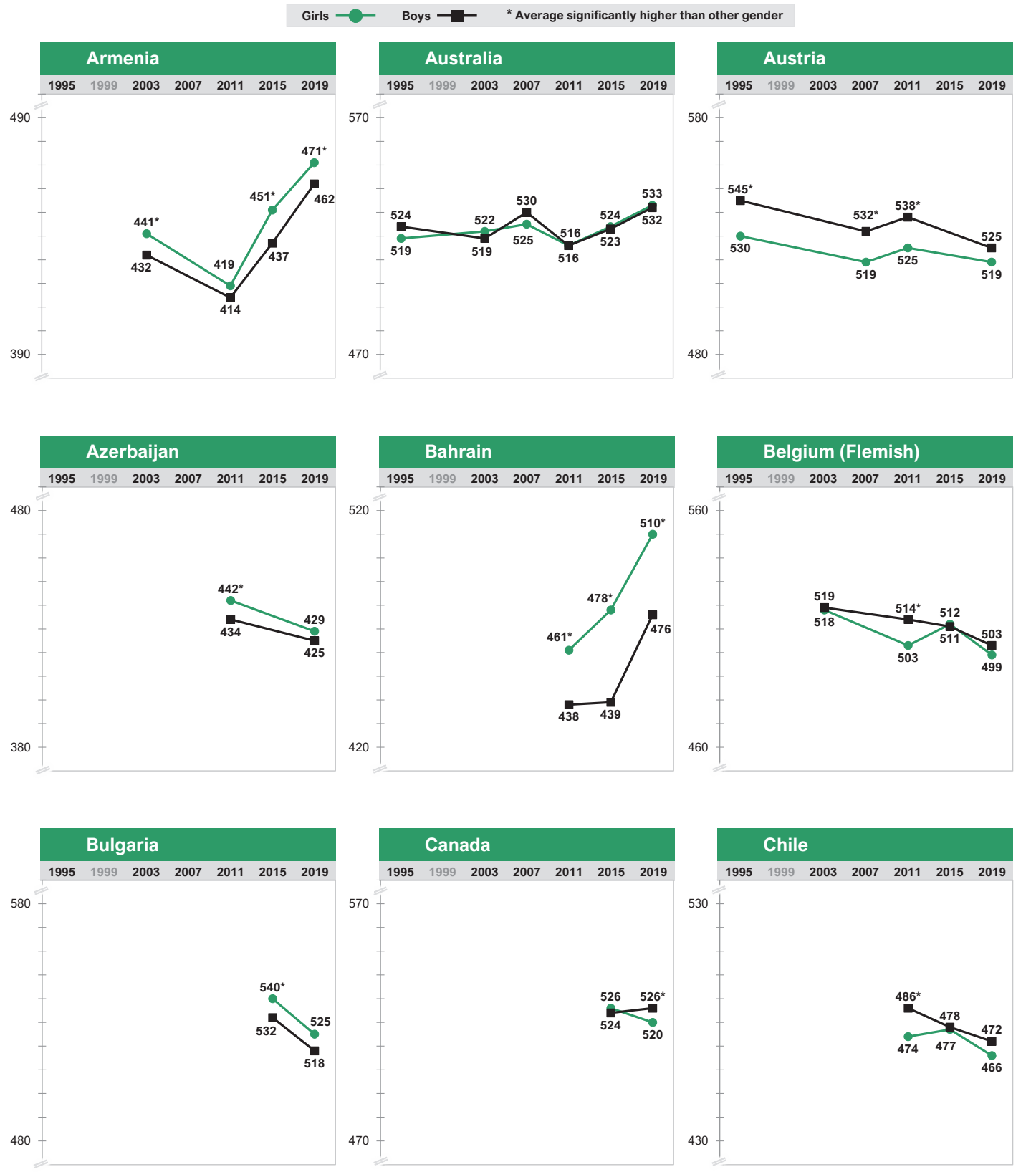
SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Trends in Average Achievement by Gender

For the TIMSS 2019 countries with comparable data from previous TIMSS assessments, Exhibit 2.6 contains graphs of average science achievement across assessments by gender. The countries are presented in alphabetical order. Most recently between 2015 and 2019, there were not a lot of changes, and the changes that did occur were varied. In Chinese Taipei, Hong Kong SAR, Portugal, Slovak Republic, and Spain, the gender gap favoring boys in 2015 closed in 2019. In Bulgaria, Finland, Sweden, and the United Arab Emirates, the gender gap favoring girls in 2015 closed in 2019. In Canada and Singapore, boys had higher average achievement than girls in 2019, whereas there was no gender gap in 2015. In Japan and Serbia, girls had higher achievement than boys in 2019, whereas that was not the situation in 2015.

Exhibit 2.6: 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.



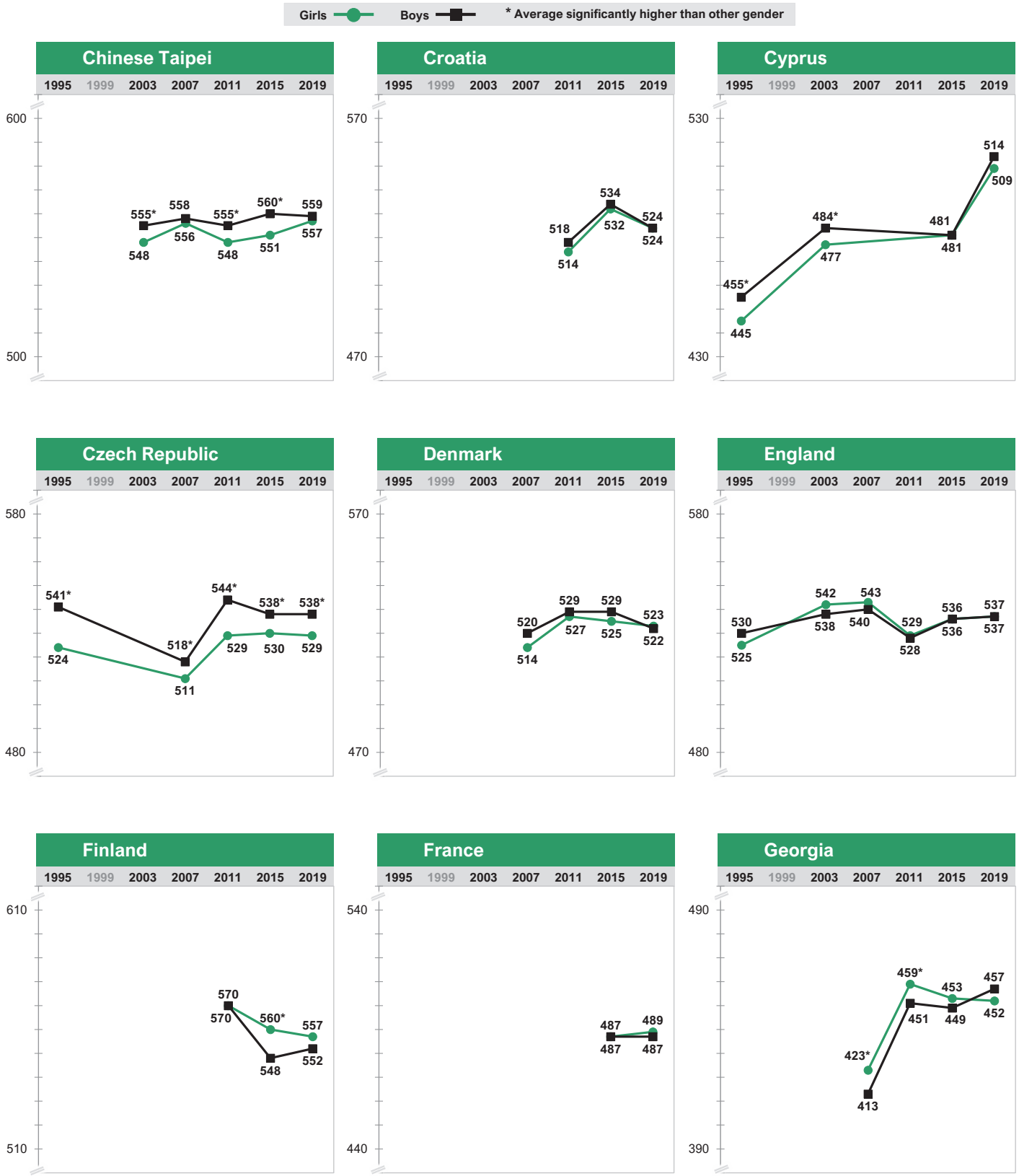
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

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

Exhibit 2.6: 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.



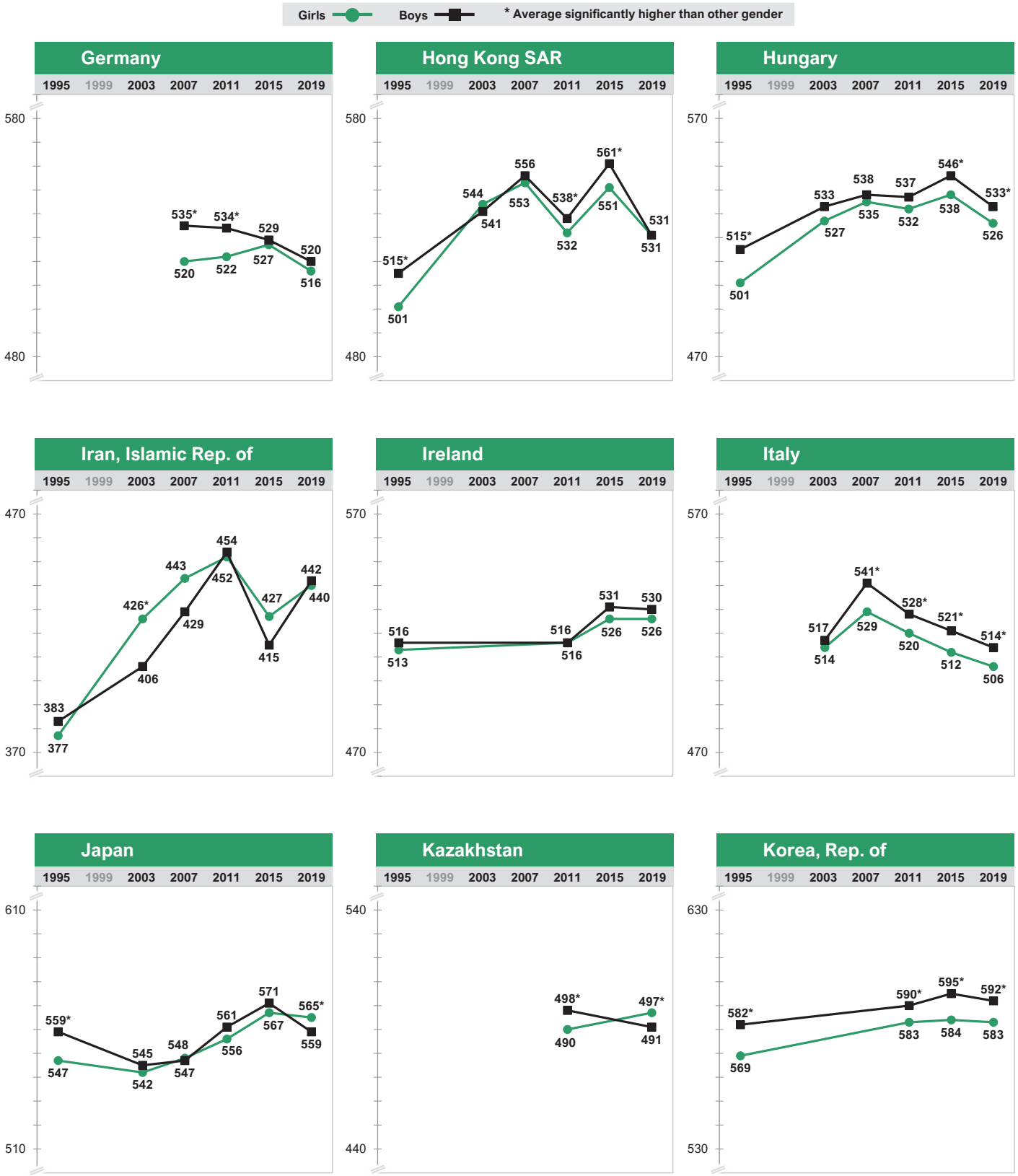
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

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

Exhibit 2.6: Trends 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.



◊ There was no TIMSS fourth grade assessment in 1999. 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.

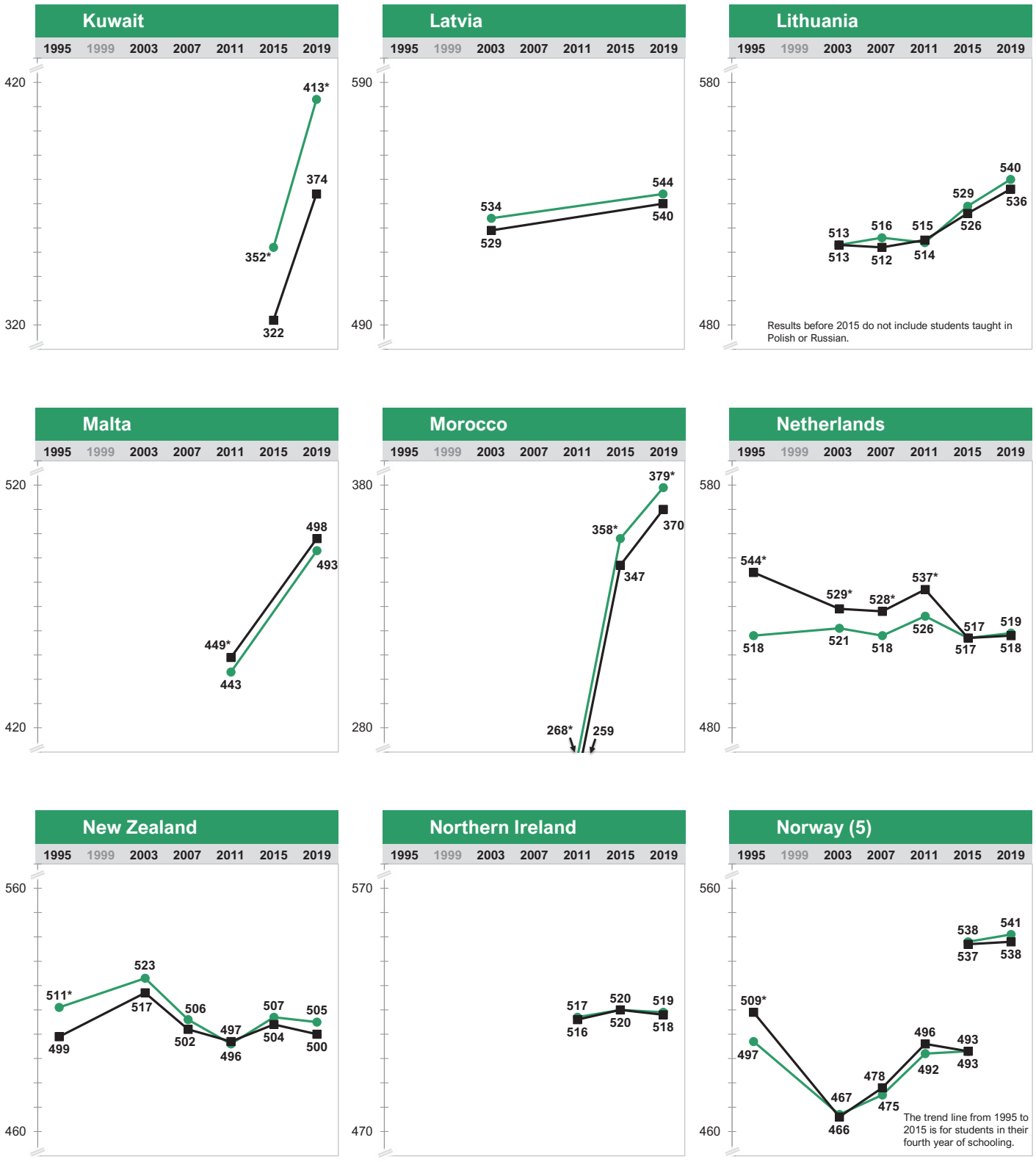
SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Exhibit 2.6: 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.

Girls — Boys — * Average significantly higher than other gender



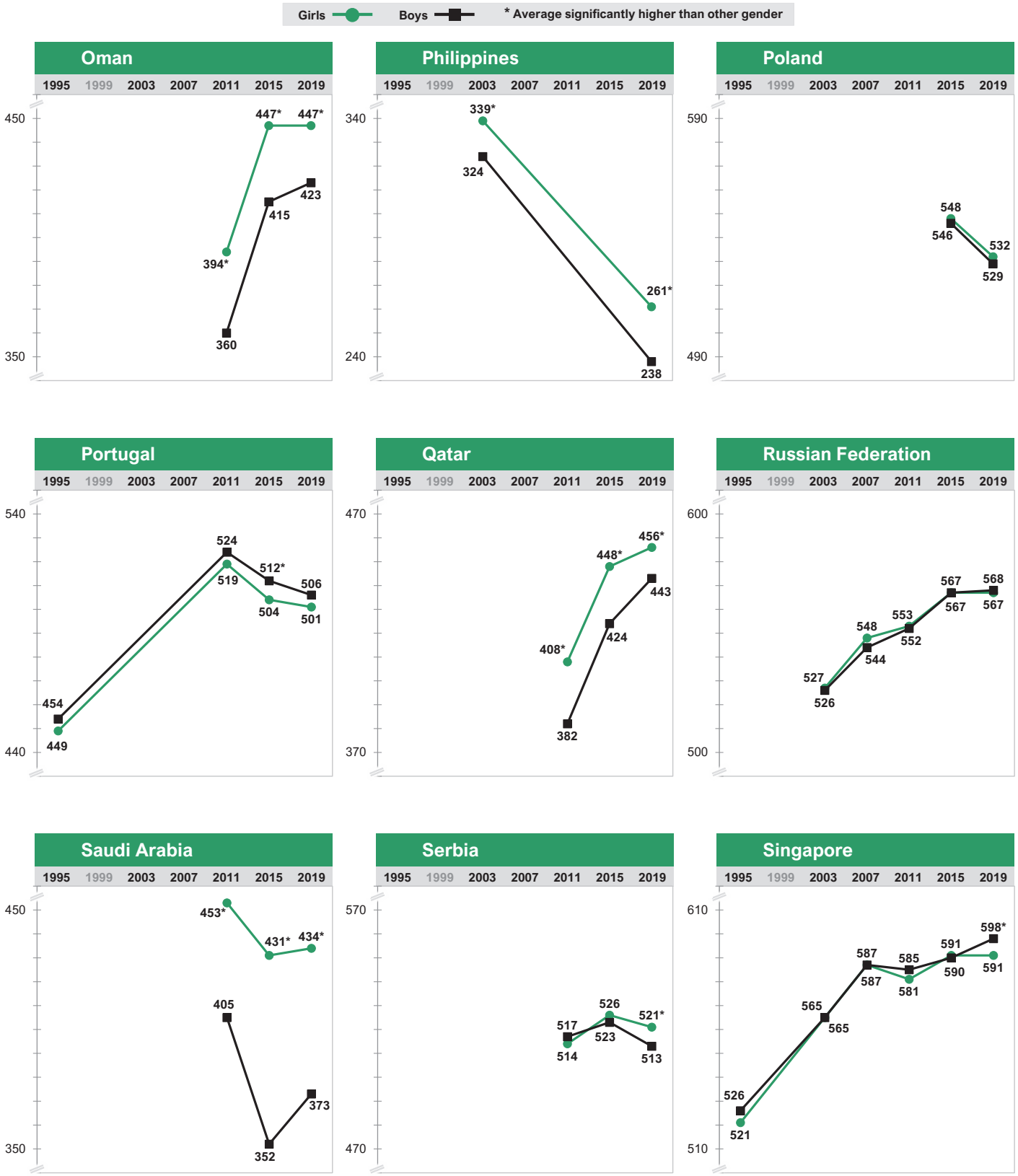
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

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

Exhibit 2.6: 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.



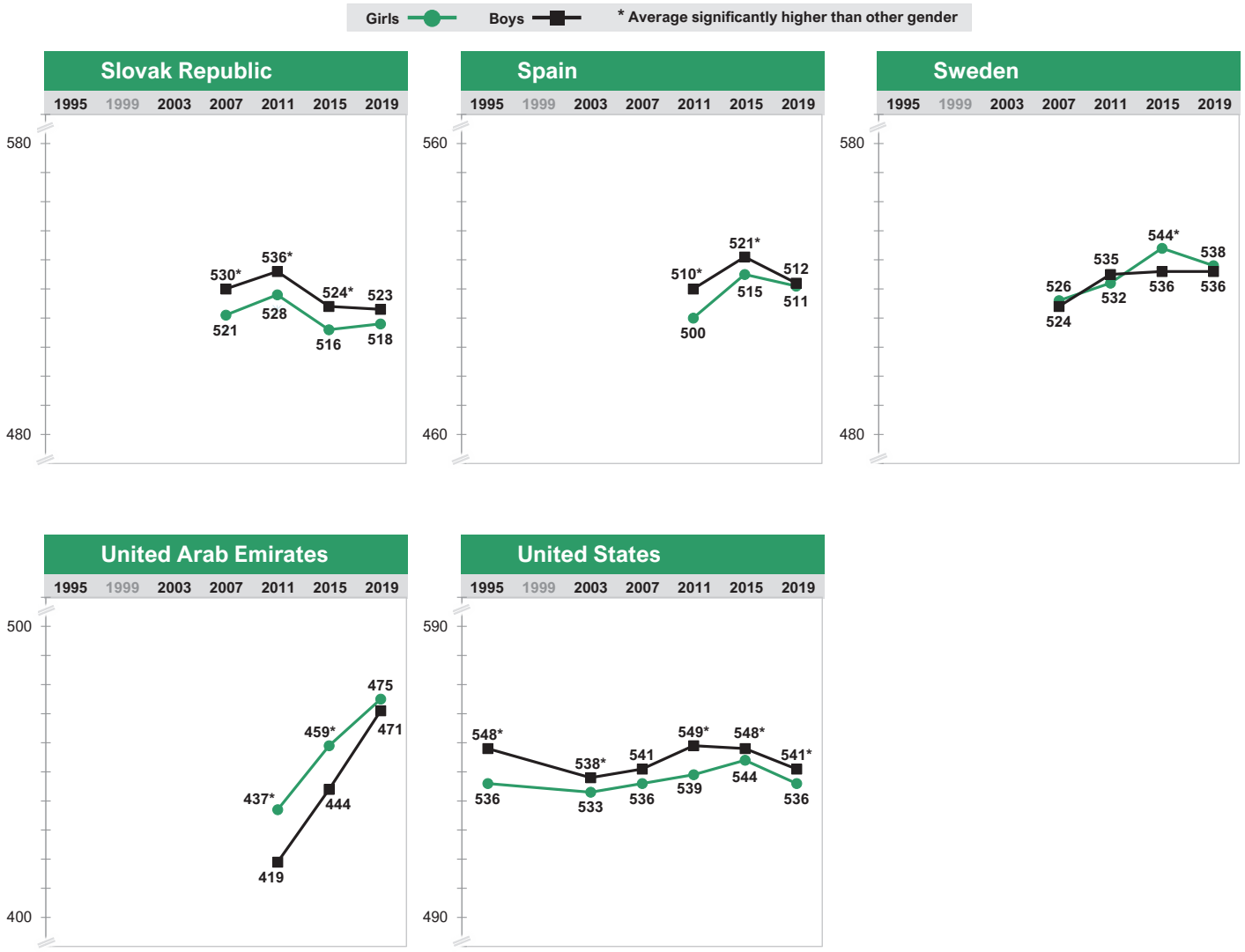
◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.

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

Exhibit 2.6: 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.



◊ There was no TIMSS fourth grade assessment in 1999. 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

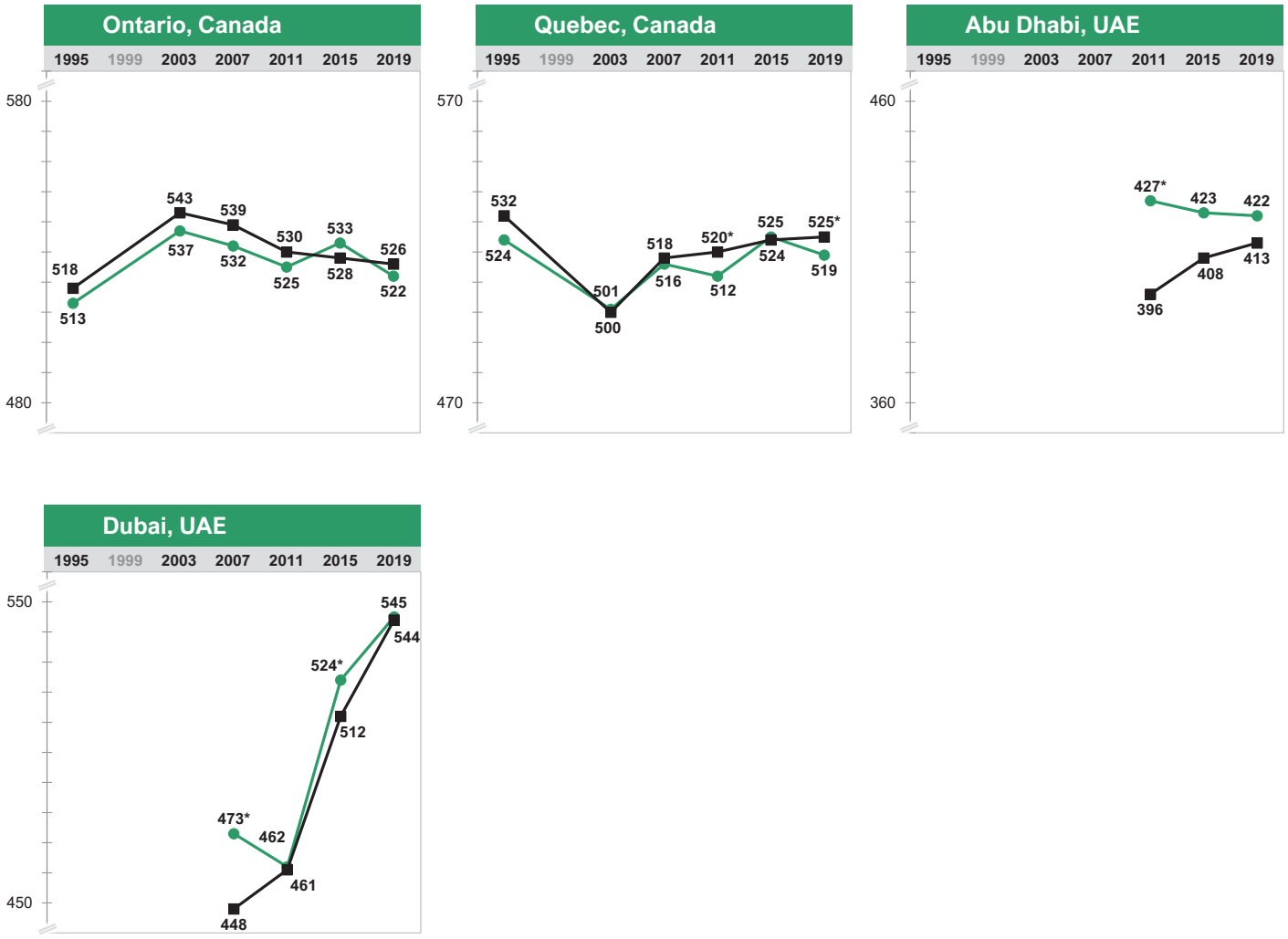
Exhibit 2.6: Trend Plots of Average Science Achievement Across Assessment Years by Gender◊

(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.

Girls — Boys — * Average significantly higher than other gender

Benchmarking Participants



◊ There was no TIMSS fourth grade assessment in 1999. 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

Performance at TIMSS International Benchmarks in Science

TIMSS 2019 International Benchmarks

To provide an interpretation of the results on the TIMSS fourth 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 2.7 summarizes what fourth 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 showing limited knowledge of science facts at the Low International Benchmark to communicating their science understanding about a variety of topics in life science, physical science, and Earth science at the Advanced International Benchmark. As much as possible, each description references achievement in the three content areas covered in the assessment at the fourth grade, 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 Fourth Grade Science

Content Domain	Percentage
Life Science	45%
Physical Science	35%
Earth Science	20%

Cognitive Domain	Percentage
Knowing	40%
Applying	40%
Reasoning	20%

The interactive map of the benchmark descriptions links to example items. It provides an overview of the science understanding demonstrated by the fourth 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 2.7: Summary of TIMSS 2019 International Benchmarks of Science Achievement

Advanced International Benchmark	
625	*Students communicate their understanding of life, physical, and Earth sciences and demonstrate some knowledge of the process of scientific inquiry.* Students demonstrate knowledge of characteristics and life processes of a variety of organisms. They can communicate understanding of relationships in ecosystems and interactions between organisms and their environment. They communicate understanding of properties and states of matter and physical and chemical changes. Students communicate understanding of Earth's physical characteristics, processes, and history and show knowledge of Earth's revolution and rotation.
High International Benchmark	
550	*Students communicate and apply knowledge of life, physical, and Earth sciences.* Students communicate knowledge of characteristics of plants, animals, and their life cycles, and apply knowledge of ecosystems and of humans' and organisms' interactions with their environment. Students demonstrate knowledge of states and properties of matter and of energy transfer in practical contexts, and show some understanding of forces and motion. Students know various facts about the Earth's physical characteristics and show basic understanding of the Earth-Moon-Sun system.
Intermediate International Benchmark	
475	*Students show knowledge and understanding of some aspects of science.* Students demonstrate some basic knowledge of plants and animals. They demonstrate knowledge about some properties of matter and some facts related to electricity, and can apply elementary knowledge of forces and motion. They show some understanding of Earth's physical characteristics.
Low International Benchmark	
400	*Students show limited understanding of scientific concepts and limited knowledge of foundational science facts.*

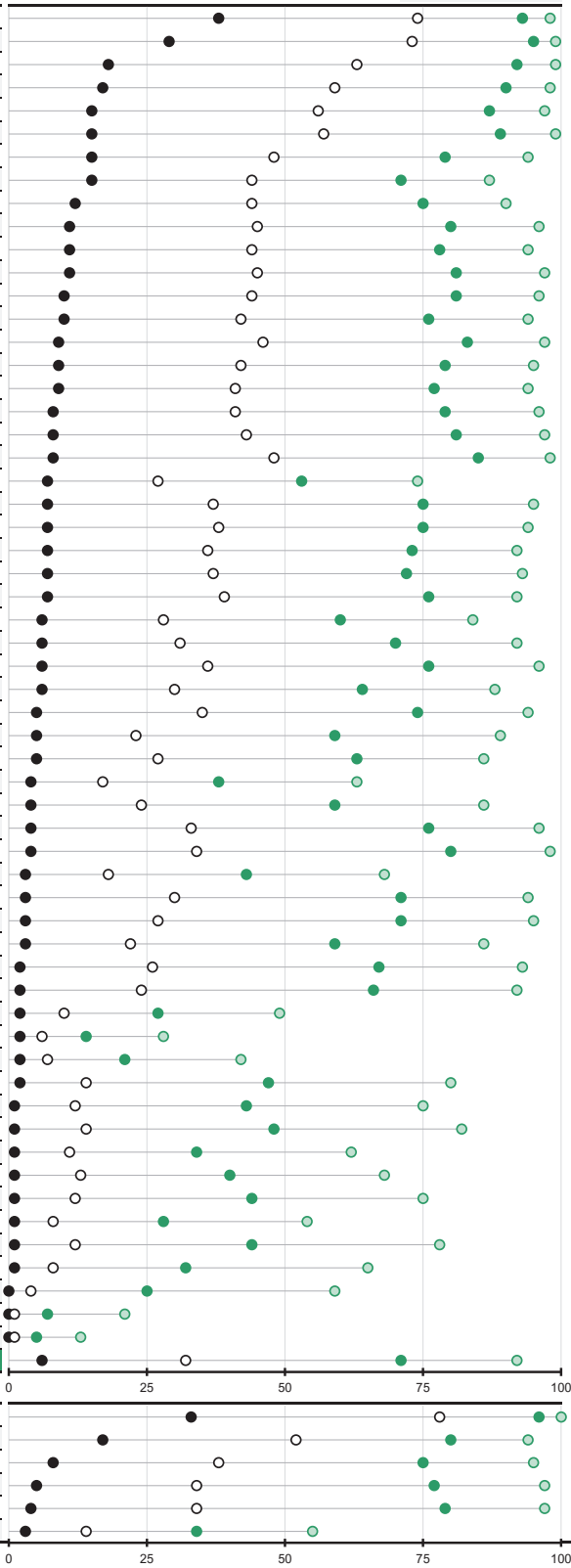
SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019
Downloaded from http://timss2019.org/download

Percentages of Students Reaching International Benchmarks

Exhibit 2.8 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, which is 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. The two highest-performing countries had the highest percentages of students reaching the Advanced International Benchmark—38 percent in Singapore and 29 percent in Korea. The Russian Federation and Japan were next with 17–18 percent.

Most countries had fewer than 10 percent of their fourth grade students performing at the Advanced Benchmark. In general, more countries are having success in educating their fourth grade students to a minimal level of proficiency in science than to an advanced level. As a point of reference, Exhibit 2.8 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—6 percent, High—32 percent, Intermediate—71 percent, and Low—92 percent. Many TIMSS 2019 countries had more than 90 percent of their fourth grade students reaching the Low Benchmark, and in three countries—Korea, the Russian Federation, and Chinese Taipei—essentially all the students (99%) reached this benchmark.

Exhibit 2.8: Percentages of Students Reaching International Benchmarks of Science Achievement



Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[3] Singapore	38 (1.9)	74 (1.7)	93 (0.9)	98 (0.4)
Korea, Rep. of	29 (1.2)	73 (1.3)	95 (0.6)	99 (0.2)
[2] Russian Federation	18 (1.3)	63 (1.9)	92 (1.0)	99 (0.3)
Japan	17 (0.8)	59 (1.2)	90 (0.7)	98 (0.4)
Finland	15 (1.1)	56 (1.4)	87 (1.0)	97 (0.5)
Chinese Taipei	15 (0.9)	57 (1.1)	89 (0.9)	99 (0.3)
[2] † United States	15 (0.8)	48 (1.3)	79 (1.1)	94 (0.6)
Bulgaria	15 (1.0)	44 (2.0)	71 (2.1)	87 (1.4)
[2] Turkey (5)	12 (1.0)	44 (1.9)	75 (1.7)	90 (1.1)
Sweden	11 (1.0)	45 (1.8)	80 (1.5)	96 (0.6)
Australia	11 (0.9)	44 (1.5)	78 (1.2)	94 (0.7)
[2] Lithuania	11 (0.9)	45 (1.5)	81 (1.4)	97 (0.4)
[2] England	10 (1.1)	44 (1.7)	81 (1.2)	96 (0.6)
Hungary	10 (0.6)	42 (1.3)	76 (1.4)	94 (0.7)
† Norway (5)	9 (0.7)	46 (1.6)	83 (1.2)	97 (0.5)
Poland	9 (0.8)	42 (1.6)	79 (1.3)	95 (0.5)
Ireland	9 (0.6)	41 (1.6)	77 (1.7)	94 (0.8)
† Hong Kong SAR	8 (0.9)	41 (1.8)	79 (1.6)	96 (0.6)
Czech Republic	8 (0.9)	43 (2.2)	81 (1.2)	97 (0.5)
[2] Latvia	8 (0.9)	48 (1.6)	85 (1.2)	98 (0.5)
United Arab Emirates	7 (0.4)	27 (0.7)	53 (0.9)	74 (0.7)
[1 2] Canada	7 (0.6)	37 (1.1)	75 (1.0)	95 (0.4)
Austria	7 (0.7)	38 (1.4)	75 (1.4)	94 (0.8)
[2] Serbia	7 (0.7)	36 (1.7)	73 (1.5)	92 (1.0)
Germany	7 (0.9)	37 (1.3)	72 (1.2)	93 (0.7)
[2] Slovak Republic	7 (0.8)	39 (1.5)	76 (1.6)	92 (1.2)
Bahrain	6 (0.7)	28 (1.3)	60 (1.5)	84 (1.1)
Cyprus	6 (0.8)	31 (1.6)	70 (1.5)	92 (0.8)
† Denmark	6 (0.7)	36 (1.3)	76 (1.3)	96 (0.5)
[2] New Zealand	6 (0.5)	30 (1.3)	64 (1.2)	88 (0.8)
† Northern Ireland	5 (0.7)	35 (1.4)	74 (1.5)	94 (0.7)
[2] Kazakhstan	5 (0.8)	23 (1.5)	59 (1.7)	89 (1.0)
Malta	5 (0.4)	27 (0.8)	63 (0.8)	86 (0.7)
Oman	4 (0.8)	17 (1.3)	38 (1.4)	63 (1.2)
Albania	4 (0.5)	24 (1.5)	59 (1.8)	86 (1.4)
≡ Netherlands	4 (0.9)	33 (1.7)	76 (1.7)	96 (0.6)
Croatia	4 (0.5)	34 (1.4)	80 (1.3)	98 (0.4)
Qatar	3 (0.6)	18 (1.2)	43 (1.7)	68 (1.5)
Spain	3 (0.5)	30 (1.1)	71 (1.3)	94 (0.7)
Italy	3 (0.7)	27 (1.8)	71 (1.6)	95 (0.8)
France	3 (0.4)	22 (1.3)	59 (1.6)	86 (1.0)
[2] Portugal	2 (0.4)	26 (1.4)	67 (1.5)	93 (0.6)
† Belgium (Flemish)	2 (0.3)	24 (1.1)	66 (1.5)	92 (0.6)
Kuwait	2 (0.4)	10 (1.3)	27 (2.0)	49 (2.1)
Ж South Africa (5)	2 (0.3)	6 (0.6)	14 (1.2)	28 (1.5)
Ψ Morocco	2 (0.7)	7 (1.1)	21 (1.6)	42 (2.0)
Armenia	2 (0.4)	14 (1.2)	47 (1.7)	80 (1.5)
[1] Georgia	1 (0.4)	12 (1.1)	43 (2.1)	75 (1.8)
Chile	1 (0.2)	14 (0.9)	48 (1.8)	82 (1.3)
North Macedonia	1 (0.4)	11 (1.3)	34 (2.5)	62 (2.6)
Iran, Islamic Rep. of	1 (0.3)	13 (1.0)	40 (1.7)	68 (1.8)
Montenegro	1 (0.2)	12 (0.9)	44 (1.6)	75 (0.9)
[2] Saudi Arabia	1 (0.2)	8 (0.6)	28 (1.1)	54 (1.5)
Bosnia and Herzegovina	1 (0.2)	12 (0.9)	44 (1.5)	78 (1.4)
Azerbaijan	1 (0.2)	8 (0.6)	32 (1.3)	65 (1.5)
[2] Kosovo	0 (0.1)	4 (0.6)	25 (1.6)	59 (1.7)
[2] Ж Pakistan	0 (0.1)	1 (0.4)	7 (1.4)	21 (3.2)
[2] Ж Philippines	0 (0.0)	1 (0.3)	5 (0.7)	13 (1.4)
International Median	**6**	**32**	**71**	**92**
Benchmarking Participants				
Moscow City, Russian Fed.	33 (1.4)	78 (1.2)	96 (0.5)	100 (0.1)
[2] Dubai, UAE	17 (0.8)	52 (0.8)	80 (0.7)	94 (0.5)
[2] Ontario, Canada	8 (1.0)	38 (1.8)	75 (1.7)	95 (0.8)
Quebec, Canada	5 (0.7)	34 (1.5)	77 (1.7)	97 (0.5)
Madrid, Spain	4 (0.7)	34 (1.2)	79 (1.3)	97 (0.4)
Abu Dhabi, UAE	3 (0.3)	14 (0.8)	34 (0.9)	55 (1.0)

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Trends in Percentages of Students Reaching International Benchmarks

Exhibit 2.9 shows the changes in percentages of students reaching the benchmarks for countries that have comparable data from previous assessments. Most recently, there were about as many decreases as increases at each level across the distribution. Of the 44 countries participating in both 2015 and 2019, 5 increased and 5 decreased at the Advanced International Benchmark, 8 increased and 7 decreased at the High Benchmark, 7 increased and 9 decreased at the Intermediate Benchmark, and 9 increased and 6 decreased at the Low Benchmark.

The recent trends from 2015 differ from previous assessments, when the countries made progress at all but the Advanced Benchmark. The pattern across the benchmarks between 2007 and 2019 shows decreases at the Advanced Benchmark but increases at the other three levels. Of the 21 countries that also participated in TIMSS 2007, 4 increased and 8 decreased at the Advanced International Benchmark, 7 increased and 4 decreased at the High Benchmark, 9 increased and 3 decreased at the Intermediate Benchmark, and 6 increased and only 1 decreased at the Low Benchmark. For the 16 countries with data for 1995 and 2019, although the Advanced International Benchmark had 7 increases and 5 decreases, there were substantial gains at the other three levels—High International Benchmark with 9 increases and 2 decreases, Intermediate International Benchmark with 11 increases and 2 decreases, and Low International Benchmark with 10 increases and 1 decrease.

Exhibit 2.9: Percentages of Students Reaching International Benchmarks of Science Achievement Across Assessment Years

Country	Advanced International Benchmark (625)						High International Benchmark (550)					
	Percent of Students						Percent of Students					
	2019	2015	2011	2007	2003	1995	2019	2015	2011	2007	2003	1995
Singapore	38	37	33	36	25 ▲	14 ▲	74	71	68 ▲	68 ▲	61 ▲	42 ▲
Korea, Rep. of	29	29	29			22 ▲	73	75	73			67 ▲
Russian Federation	18	20	16	16	11 ▲		63	62	52 ▲	49 ▲	39 ▲	
Japan	17	19	14 ▲	12 ▲	12 ▲	15 ▲	59	63 ▽	58	51 ▲	49 ▲	54 ▲
Finland	15	13	20 ▽				56	54	65 ▽			
Chinese Taipei	15	14	15	19 ▽	14		57	56	53 ▲	55	52 ▲	
United States	15	16	15	15	13	19 ▽	48	51	49	47	45	50
Bulgaria	15	16					44	50				
Sweden	11	11	10	8 ▲			45	47	44	37 ▲		
Australia	11	8 ▲	7 ▲	10	9	13	44	39 ▲	35 ▲	41	38 ▲	40
Lithuania	11	7 ▲	4 ▲	3 ▲	3 ▲		45	39 ▲	31 ▲	30 ▲	30 ▲	
England	10	10	11	14 ▽	15 ▽	15 ▽	44	43	42	48	47	42
Hungary	10	14 ▽	13 ▽	13 ▽	10	7 ▲	42	50 ▽	46	47 ▽	42	32 ▲
Norway (5)	9	7					46	44				
Poland	9	12 ▽					42	51 ▽				
Ireland	9	7	7			8	41	40	35 ▲			36 ▲
Hong Kong SAR	8	16 ▽	9	14 ▽	7	5 ▲	41	55 ▽	45	55 ▽	47 ▽	30 ▲
Czech Republic	8	9	10	7		12 ▽	43	43	44	33 ▲		42
Latvia	8				8		48				41 ▲	
United Arab Emirates	7	6	3 ▲				27	22 ▲	14 ▲			
Canada	7	7					37	38				
Austria	7		8	9		13 ▽	38		42 ▽	39		45 ▽
Serbia	7	8	8				36	40 ▽	35			
Germany	7	8	7	10 ▽			37	40	39	41 ▽		
Slovak Republic	7	9	10 ▽	11 ▽			39	40	44 ▽	42		
Bahrain	6	4 ▲	4 ▲				28	19 ▲	17 ▲			
Cyprus	6	2 ▲			2 ▲	1 ▲	31	18 ▲			17 ▲	11 ▲
Denmark	6	7	8 ▽	7			36	39	39	35		
New Zealand	6	6	5	8 ▽	9 ▽	11 ▽	30	32	28	32	38 ▽	35 ▽
Northern Ireland	5	5	5				35	34	33			
Kazakhstan	5		7				23		28 ▽			
Malta	5		2 ▲				27		14 ▲			
Oman	4	4	1 ▲				17	16	7 ▲			
Netherlands	4	3	3	4	3	6	33	30	37	34	32	38
Croatia	4	6 ▽	3				34	41 ▽	30 ▲			
Qatar	3	3	2				18	15	11 ▲			
Spain	3	5 ▽	4				30	34 ▽	28			
Italy	3	4	8 ▽	13 ▽	9 ▽		27	32	37 ▽	44 ▽	35 ▽	
France	3	2					22	20				
Portugal	2	2	7 ▽			2	26	25	35 ▽			13 ▲
Belgium (Flemish)	2	3	2		2		24	27	24		28 ▽	
Kuwait	2	1 ▲					10	4 ▲				
Morocco	2	1	0 ▲				7	5	1 ▲			
Armenia	2	1	1 ▲		2		14	10 ▲	6 ▲		10 ▲	
Georgia	1	1	1	1 ▲			12	12	13	5 ▲		
Chile	1	2	2 ▽				14	16	19 ▽			
Iran, Islamic Rep. of	1	1	3 ▽	2	1 ▲	0 ▲	13	9 ▲	16 ▽	12	7 ▲	3 ▲
Saudi Arabia	1	1	3 ▽				8	8	12 ▽			
Azerbaijan	1		2 ▽				8		13 ▽			
Philippines	0				2		1				6 ▽	
Benchmarking Participants												
Dubai, UAE	17	14 ▲	6 ▲	4 ▲			52	42 ▲	23 ▲	21 ▲		
Ontario, Canada	8	9	9	12 ▽	13 ▽	10	38	41	40	45 ▽	47 ▽	37
Quebec, Canada	5	6	3 ▲	5	3 ▲	9 ▽	34	35	29 ▲	32	25 ▲	40
Abu Dhabi, UAE	3	4	2 ▲				14	15	10 ▲			

▲ 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 2.9: 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	1995	2019	2015	2011	2007	2003	1995
Singapore	93	90	89 ▲	88 ▲	86 ▲	71 ▲	98	97	97 ▲	96 ▲	95 ▲	89 ▲
Korea, Rep. of	95	96	95			93	99	100	99			99
Russian Federation	92	91	86 ▲	82 ▲	74 ▲		99	99	98 ▲	96 ▲	93 ▲	
Japan	90	93 ▽	90	86 ▲	84 ▲	87 ▲	98	99	99	97	96 ▲	97
Finland	87	89	92 ▽				97	99	99 ▽			
Chinese Taipei	89	88	85 ▲	86 ▲	87		99	98	97 ▲	97 ▲	98	
United States	79	81 ▽	81 ▽	78	78	78	94	95 ▽	96 ▽	94	94	92
Bulgaria	71	77 ▽					87	90				
Sweden	80	82	79	76 ▲			96	96	95	95		
Australia	78	75	72 ▲	76	74	72 ▲	94	94	91 ▲	93	92	89 ▲
Lithuania	81	78	73 ▲	74 ▲	73 ▲		97	96	95 ▲	95	95 ▲	
England	81	81	76 ▲	81	79	72 ▲	96	97	93 ▲	95	94 ▲	90 ▲
Hungary	76	81	78	78	76	67 ▲	94	94	93	93	94	90 ▲
Norway (5)	83	85					97	98				
Poland	79	85 ▽					95	97 ▽				
Ireland	77	79	72 ▲			70 ▲	94	96	92			91 ▲
Hong Kong SAR	79	88 ▽	82	88 ▽	87 ▽	69 ▲	96	98 ▽	96	98 ▽	98 ▽	91 ▲
Czech Republic	81	81	81	72 ▲		77 ▲	97	96	97	93 ▲		95 ▲
Latvia	85				80 ▲		98				96 ▲	
United Arab Emirates	53	46 ▲	36 ▲				74	67 ▲	61 ▲			
Canada	75	77					95	95				
Austria	75		79 ▽	76		79 ▽	94		96	93		94
Serbia	73	77	72				92	93	91			
Germany	72	78 ▽	78 ▽	76 ▽			93	96 ▽	96 ▽	94		
Slovak Republic	76	74	79	75			92	91	94	92		
Bahrain	60	47 ▲	43 ▲				84	72 ▲	70 ▲			
Cyprus	70	56 ▲			55 ▲	39 ▲	92	86 ▲			86 ▲	74 ▲
Denmark	76	78	78	72 ▲			96	96	95	93 ▲		
New Zealand	64	67	63	65	73 ▽	66	88	88	86	87	91 ▽	85
Northern Ireland	74	76	74				94	95	94			
Kazakhstan	59		58				89		84 ▲			
Malta	63		41 ▲				86		70 ▲			
Oman	38	38	23 ▲				63	61	45 ▲			
Netherlands	76	76	86 ▽	79	83 ▽	82 ▽	96	97	99 ▽	97	99 ▽	98 ▽
Croatia	80	83	75 ▲				98	98	96 ▲			
Qatar	43	39	29 ▲				68	64 ▲	50 ▲			
Spain	71	74	67				94	95	92			
Italy	71	75	76 ▽	78 ▽	70		95	95	95	94	91 ▲	
France	59	58					86	88				
Portugal	67	72 ▽	75 ▽			43 ▲	93	96 ▽	95			73 ▲
Belgium (Flemish)	66	73 ▽	73 ▽		79 ▽		92	96 ▽	96 ▽		98 ▽	
Kuwait	27	15 ▲					49	33 ▲				
Morocco	21	17	6 ▲				42	35 ▲	16 ▲			
Armenia	47	38 ▲	26 ▲		38 ▲		80	70 ▲	58 ▲		66 ▲	
Georgia	43	41	44	26 ▲			75	74	75	59 ▲		
Chile	48	53 ▽	54 ▽				82	85	85			
Iran, Islamic Rep. of	40	33 ▲	44 ▽	36	28 ▲	15 ▲	68	61 ▲	72	65	58 ▲	42 ▲
Saudi Arabia	28	25 ▲	35 ▽				54	48 ▲	63 ▽			
Azerbaijan	32		37				65		65			
Philippines	5				19 ▽		13				34 ▽	
Benchmarking Participants												
Dubai, UAE	80	70 ▲	48 ▲	48 ▲			94	86 ▲	72 ▲	72 ▲		
Ontario, Canada	75	79	77	79	81 ▽	71	95	96	94	95	96	90 ▲
Quebec, Canada	77	78	76	74	66 ▲	77	97	97	97	96	91 ▲	94 ▲
Abu Dhabi, UAE	34	35	30				55	55	55			

▲ 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 and Example Items

Exhibit 2.10 provides the description of fourth grade students' achievement at the Low International Benchmark. Students demonstrated limited understanding of scientific concepts and limited knowledge of foundational science facts in life science, physical science, and Earth science.

Exhibit 2.10.1 shows an example item from the life science domain. On average, 74 percent of the students were able to recognize that the frog was the animal with a backbone. The top performing students on this item were in Hungary and Latvia with 88–89 percent correct.

Exhibit 2.10: Description of the TIMSS 2019 Low International Benchmark (400) of Science Achievement

Low International Benchmark

400

Summary

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

Students at this level can recognize that some animals have backbones, that some materials conduct heat better than others, and that water and soil are natural resources.

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

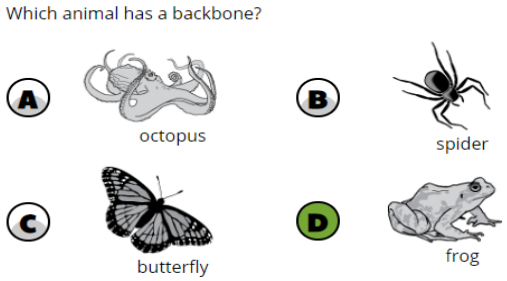
Exhibit 2.10.1: Low International Benchmark of Science Achievement – Example Item 1

Country	Percent Correct	
Hungary	89 (1.6)	▲
2 Latvia	88 (1.6)	▲
Croatia	87 (1.6)	▲
Korea, Rep. of	87 (1.6)	▲
Albania	86 (2.5)	▲
Armenia	85 (1.7)	▲
Chinese Taipei	85 (1.4)	▲
2 Slovak Republic	84 (1.7)	▲
† Norway (5)	83 (2.0)	▲
1 Georgia	83 (1.8)	▲
Bulgaria	83 (2.1)	▲
2† United States	82 (1.2)	▲
2 Serbia	82 (1.9)	▲
Poland	81 (1.6)	▲
Bosnia and Herzegovina	81 (1.7)	▲
2 Turkey (5)	81 (1.8)	▲
Czech Republic	81 (1.9)	▲
North Macedonia	81 (2.1)	▲
2 Russian Federation	80 (1.9)	▲
Japan	80 (1.5)	▲
† Denmark	79 (2.0)	▲
Malta	79 (1.7)	▲
Finland	79 (1.7)	▲
Sweden	79 (1.9)	▲
Australia	78 (1.7)	▲
2 New Zealand	78 (1.8)	▲
1 2 Canada	78 (1.5)	▲
2 Kazakhstan	77 (1.8)	
2 England	77 (2.4)	
France	76 (2.0)	
Azerbaijan	76 (2.0)	
† Northern Ireland	76 (2.0)	
Ireland	76 (2.1)	
Montenegro	75 (1.7)	
Cyprus	75 (1.8)	
2 Lithuania	74 (2.0)	
International Average	**74 (0.3)**	
Morocco	74 (1.7)	
2 Kosovo	74 (1.8)	
† Hong Kong SAR	74 (2.3)	
Germany	73 (2.0)	
Italy	73 (2.2)	
Oman	73 (2.0)	
Austria	72 (2.2)	
United Arab Emirates	72 (1.0)	▽
3 Singapore	72 (1.5)	
Spain	71 (2.7)	
Qatar	70 (2.2)	▽
Chile	67 (2.1)	▽
Bahrain	67 (1.8)	▽
Iran, Islamic Rep. of	64 (2.1)	▽
Kuwait	61 (2.6)	▽
2 Pakistan	61 (3.2)	▽
2 Saudi Arabia	61 (1.8)	▽
2 Portugal	60 (2.3)	▽
South Africa (5)	58 (1.6)	▽
2 Philippines	56 (2.5)	▽
† Belgium (Flemish)	35 (2.1)	▽
≡ Netherlands	27 (2.4)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	79 (1.7)	▲
2 Ontario, Canada	79 (2.1)	▲
2 Dubai, UAE	78 (1.9)	▲
Quebec, Canada	73 (2.6)	
Madrid, Spain	69 (2.4)	▽
Abu Dhabi, UAE	66 (1.6)	▽

Content Domain: Life Science

Cognitive Domain: Knowing

Description: Recognizes an animal that has a backbone



▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Intermediate Benchmark: Full Description and Example Items

Exhibit 2.11 provides the description of student achievement at the Intermediate International Benchmark. At this level, students showed knowledge and understanding of some aspects of science across the three content domains.

Exhibit 2.11.1 presents an item from the life science domain. It illustrates that students reaching the Intermediate Benchmark understood why plastic objects in the ocean are dangerous for sea animals. Sweden, Finland, and Norway (fifth grade) had best achievement on this item, 85–86 percent correct. The international average was 57 percent.

Exhibit 2.11.2 shows an item from the physical science domain. On average, internationally, 66 percent of fourth grade students recognized why wheels on a wagon make it easier to pull. Finland and Korea had the highest percentage correct—87–88 percent.

Exhibit 2.11: Description of the TIMSS 2019 Intermediate International Benchmark (475) of Science Achievement

Intermediate International Benchmark

475

Summary

Students show knowledge and understanding of some aspects of science. Students demonstrate some basic knowledge of plants and animals. They demonstrate knowledge about some properties of matter and some facts related to electricity, and can apply elementary knowledge of forces and motion. They show some understanding of Earth's physical characteristics.

Students show basic knowledge of what plants and animals need to survive as well as some knowledge of the characteristics of animals.

Students can recognize different properties of matter, demonstrate understanding of simple electrical circuits, and apply elementary knowledge of forces and motion, such as the force between a magnet and different materials.

Students show some understanding of Earth's physical characteristics.

Students can relate information in diagrams to some basic science concepts.

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

Exhibit 2.11.1: Intermediate International Benchmark of Science Achievement – Example Item 1

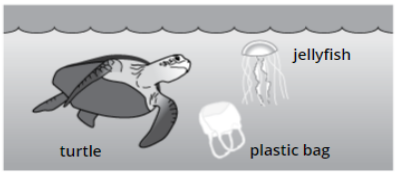
Country	Percent Full Credit	
Sweden	86 (1.8)	▲
Finland	85 (1.4)	▲
† Norway (5)	85 (1.9)	▲
Australia	84 (1.6)	▲
Japan	83 (1.6)	▲
≡ Netherlands	83 (1.8)	▲
3 Singapore	83 (1.2)	▲
Cyprus	83 (1.7)	▲
2 England	81 (2.1)	▲
Ireland	81 (1.9)	▲
2† United States	79 (1.2)	▲
† Denmark	78 (2.2)	▲
† Belgium (Flemish)	78 (2.1)	▲
† Northern Ireland	76 (2.5)	▲
Malta	76 (1.8)	▲
Chinese Taipei	75 (2.2)	▲
1 2 Canada	75 (1.6)	▲
2 Russian Federation	74 (2.3)	▲
Czech Republic	73 (1.9)	▲
Germany	73 (2.1)	▲
Korea, Rep. of	73 (2.1)	▲
2 Lithuania	71 (1.9)	▲
Spain	70 (2.0)	▲
2 New Zealand	70 (1.7)	▲
2 Portugal	70 (2.2)	▲
Austria	70 (2.2)	▲
Hungary	68 (2.0)	▲
Poland	67 (1.9)	▲
Italy	65 (2.1)	▲
2 Slovak Republic	63 (2.4)	▲
France	62 (2.6)	▲
† Hong Kong SAR	62 (3.0)	
Chile	61 (2.1)	
2 Latvia	60 (2.2)	
2 Turkey (5)	58 (2.4)	
International Average	**57 (0.3)**	
2 Serbia	54 (2.7)	
Croatia	51 (2.3)	▽
Bahrain	48 (2.2)	▽
Armenia	45 (2.4)	▽
Qatar	45 (2.6)	▽
United Arab Emirates	44 (1.0)	▽
Bulgaria	42 (3.1)	▽
Albania	40 (2.9)	▽
Bosnia and Herzegovina	39 (2.5)	▽
1 Georgia	36 (2.8)	▽
Montenegro	35 (2.1)	▽
Oman	34 (2.1)	▽
2 Kazakhstan	33 (2.0)	▽
South Africa (5)	28 (1.5)	▽
Kuwait	28 (2.0)	▽
Iran, Islamic Rep. of	21 (1.8)	▽
Morocco	21 (1.9)	▽
Azerbaijan	20 (1.9)	▽
North Macedonia	19 (2.3)	▽
2 Kosovo	17 (1.9)	▽
2 Saudi Arabia	14 (1.4)	▽
2 Philippines	11 (1.5)	▽
2 Pakistan	7 (1.9)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	78 (2.0)	▲
Madrid, Spain	76 (2.6)	▲
2 Ontario, Canada	76 (2.7)	▲
Quebec, Canada	73 (2.4)	▲
2 Dubai, UAE	60 (2.1)	
Abu Dhabi, UAE	34 (1.4)	▽

Content Domain: Life Science

Cognitive Domain: Knowing

Description: States one reason why plastic objects in the ocean are dangerous for sea animals

The picture shows a turtle and jellyfish swimming in the ocean. A plastic bag is floating nearby.



Write down one reason why plastic objects in the ocean are dangerous for animals such as turtles.

The turtle's flippers could get tangled up in the bag and make it hard for it to swim.

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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.11.2: Intermediate International Benchmark of Science Achievement – Example Item 2

Country	Percent Correct	
Finland	88 (1.4)	▲
Korea, Rep. of	87 (1.6)	▲
3 Singapore	85 (1.2)	▲
Chinese Taipei	85 (1.5)	▲
† Hong Kong SAR	83 (2.1)	▲
2 Russian Federation	82 (2.1)	▲
2 Lithuania	82 (1.9)	▲
Sweden	81 (1.7)	▲
Ireland	80 (1.9)	▲
2 Latvia	80 (2.0)	▲
2 England	77 (2.1)	▲
† Northern Ireland	76 (2.0)	▲
2 Serbia	76 (2.3)	▲
Australia	76 (2.1)	▲
Hungary	75 (1.9)	▲
† Belgium (Flemish)	74 (2.2)	▲
† Denmark	73 (2.0)	▲
Poland	72 (1.8)	▲
Italy	72 (2.6)	▲
Germany	72 (2.2)	▲
2 New Zealand	72 (2.0)	▲
1 2 Canada	72 (2.1)	▲
2† United States	71 (1.4)	▲
† Norway (5)	71 (2.2)	▲
2 Slovak Republic	70 (2.1)	▲
Croatia	70 (2.8)	
≡ Netherlands	70 (2.4)	
Czech Republic	69 (2.2)	
2 Kazakhstan	68 (1.9)	
Cyprus	68 (1.8)	
Austria	67 (2.2)	
Spain	67 (2.1)	
International Average	**66 (0.3)**	
Malta	66 (2.2)	
Japan	66 (2.2)	
Bulgaria	65 (2.8)	
Albania	64 (2.3)	
Bahrain	63 (1.8)	
2 Portugal	62 (1.9)	▽
Iran, Islamic Rep. of	61 (2.3)	▽
United Arab Emirates	61 (0.8)	▽
2 Turkey (5)	60 (2.6)	▽
Azerbaijan	60 (2.2)	▽
Bosnia and Herzegovina	58 (2.1)	▽
France	58 (2.1)	▽
1 Georgia	55 (2.7)	▽
Qatar	54 (2.2)	▽
2 Kosovo	54 (2.2)	▽
Montenegro	53 (2.1)	▽
Oman	53 (1.8)	▽
North Macedonia	51 (3.0)	▽
Chile	50 (2.1)	▽
2 Saudi Arabia	49 (2.3)	▽
Armenia	48 (2.4)	▽
South Africa (5)	47 (1.5)	▽
Kuwait	45 (2.1)	▽
Morocco	41 (2.0)	▽
2 Pakistan	39 (4.7)	▽
2 Philippines	36 (2.0)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	88 (1.7)	▲
2 Dubai, UAE	77 (1.6)	▲
Madrid, Spain	73 (2.6)	▲
2 Ontario, Canada	72 (3.7)	
Quebec, Canada	68 (2.4)	
Abu Dhabi, UAE	52 (1.4)	▽

Content Domain: Physical Science

Cognitive Domain: Applying

Description: Recognizes the best explanation for why a box on a cart is easier to pull than a box resting directly on the floor

Tina and Mary need to move identical heavy boxes. Tina has to pull harder on her box to move it than Mary does.

Why is it easier for Mary to move her box?

A. Gravity acting on Tina's box is much stronger.

B. Air resistance acting on Tina's box is much greater.

C. The cart increases the magnetic force acting on Mary's box.

D. The cart's wheels decrease the force needed to move Mary's box.

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

High Benchmark: Full Description and Example Items

Exhibit 2.12 presents the description of achievement at the High International Benchmark. Fourth grade students reaching this level could communicate and apply knowledge about various topics in life science, physical science, and Earth science.

Exhibit 2.12.1 provides an example from the life science domain. When shown a picture of a desert, 45 percent of students, on average, identified two living things and two non-living things. Eighty-four percent of the Singaporean fourth grade students successfully completed this task.

Exhibit 2.12.2 shows an example from the physical science domain. On average, internationally, 64 percent of the fourth grade students recognized that a flashlight changed electrical energy into light energy. The highest achievement was posted by Chinese Taipei, Korea, and Hong Kong SAR—80–82 percent.

Exhibit 2.12.3 shows an example from the Earth science domain. Sixty-one percent of Finnish students could explain that the shape of the Moon changes during the month. The average across countries was 37 percent.

Exhibit 2.12: Description of the TIMSS 2019 High International Benchmark (550) of Science Achievement

High International Benchmark

550

Summary

Students communicate and apply knowledge of life, physical, and Earth sciences. Students communicate knowledge of characteristics of plants, animals, and their life cycles, and apply knowledge of ecosystems and of humans' and organisms' interactions with their environment. Students demonstrate knowledge of states and properties of matter and of energy transfer in practical contexts, and show some understanding of forces and motion. Students know various facts about the Earth's physical characteristics and show basic understanding of the Earth-Moon-Sun system.

Students communicate knowledge of characteristics of plants and animals. For example, they can distinguish living things from nonliving things and demonstrate some knowledge of life cycles of plants and animals. Students can apply knowledge of ecosystems and of organisms' interactions with their environment. They can complete food chains and recognize some plant and animal features that provide advantages in a given environment. Students demonstrate an understanding of how germs spread.

Students demonstrate knowledge of states and properties of matter. They understand basic properties of magnets, including the forces between two magnets. Students show some elementary knowledge about how shadows are formed. They apply knowledge of energy transfer in practical contexts and show some understanding of forces and motion, including gravity and air resistance.

Students know various facts about the Earth's physical characteristics and climates, and show basic understanding of the Earth-Moon-Sun system.

Students can make simple inferences using models, tables, and diagrams.

Exhibit 2.12.1: High International Benchmark of Science Achievement – Example Item 1

Country	Percent Full Credit	
[3] Singapore	84 (1.4)	▲
Armenia	79 (1.8)	▲
[2] Kazakhstan	71 (2.6)	▲
Cyprus	67 (2.4)	▲
[2] Russian Federation	67 (2.2)	▲
[2] Turkey (5)	67 (2.6)	▲
[2] Serbia	66 (2.7)	▲
Czech Republic	64 (1.7)	▲
Italy	63 (2.6)	▲
[2] Slovak Republic	62 (2.3)	▲
Hungary	62 (2.3)	▲
Croatia	62 (2.6)	▲
Bahrain	60 (1.5)	▲
United Arab Emirates	58 (1.1)	▲
Bulgaria	57 (2.6)	▲
Oman	56 (2.1)	▲
Montenegro	55 (1.9)	▲
† Norway (5)	55 (3.0)	▲
[2] Kosovo	55 (2.6)	▲
Malta	52 (2.2)	▲
[2†] United States	52 (1.6)	▲
Australia	51 (2.2)	▲
Qatar	51 (3.0)	▲
Sweden	50 (2.4)	
Poland	50 (2.6)	
Finland	49 (2.0)	▲
[2] Portugal	48 (2.3)	
[2] Latvia	47 (2.3)	
[2] Lithuania	47 (2.7)	
[2] Saudi Arabia	46 (2.0)	
[1 2] Canada	46 (1.3)	
Kuwait	46 (2.3)	
International Average	**45 (0.3)**	
Albania	39 (2.8)	▽
[2] England	38 (2.6)	▽
North Macedonia	38 (3.3)	▽
Bosnia and Herzegovina	38 (2.4)	▽
France	37 (2.2)	▽
Japan	37 (2.3)	▽
Korea, Rep. of	37 (2.4)	▽
Iran, Islamic Rep. of	35 (2.5)	▽
Ireland	34 (2.1)	▽
† Denmark	34 (2.4)	▽
[2] Pakistan	34 (3.6)	▽
Azerbaijan	33 (2.0)	▽
[2] New Zealand	32 (2.0)	▽
Spain	32 (2.2)	▽
[1] Georgia	31 (2.7)	▽
≡ Netherlands	30 (2.3)	▽
† Northern Ireland	29 (2.4)	▽
Austria	27 (2.4)	▽
South Africa (5)	27 (1.6)	▽
Morocco	27 (2.0)	▽
Germany	23 (1.9)	▽
† Hong Kong SAR	23 (2.3)	▽
Chile	20 (2.0)	▽
† Belgium (Flemish)	18 (1.7)	▽
[2] Philippines	15 (1.5)	▽
Chinese Taipei	10 (1.2)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	76 (1.9)	▲
[2] Dubai, UAE	72 (1.5)	▲
[2] Ontario, Canada	52 (2.1)	▲
Abu Dhabi, UAE	42 (1.3)	▽
Quebec, Canada	31 (2.0)	▽
Madrid, Spain	23 (1.9)	▽

Content Domain: Life Science

Cognitive Domain: Knowing

Description: Lists two living things and two nonliving things shown in a picture of a desert ecosystem

The picture below shows a desert.

What are two **living things** shown in the picture?

1. Camel
2. Cactus

What are two **non-living things** shown in the picture?

1. Rock
2. Sand

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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.12.2: High International Benchmark of Science Achievement – Example Item 2

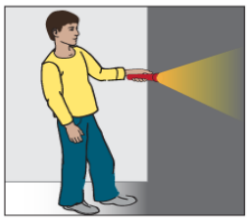
Country	Percent Correct	
Chinese Taipei	82 (1.8)	▲
Korea, Rep. of	81 (2.0)	▲
† Hong Kong SAR	80 (1.9)	▲
Sweden	77 (2.1)	▲
Croatia	75 (2.8)	▲
Finland	74 (2.0)	▲
Japan	74 (1.9)	▲
2 Lithuania	74 (2.1)	▲
Iran, Islamic Rep. of	73 (1.8)	▲
Poland	73 (2.0)	▲
Bulgaria	72 (2.5)	▲
3 Singapore	72 (1.6)	▲
† Belgium (Flemish)	71 (1.7)	▲
2 Slovak Republic	70 (2.3)	▲
2 Serbia	69 (2.1)	▲
† Norway (5)	69 (2.4)	▲
2 Russian Federation	69 (2.0)	▲
Spain	68 (2.0)	▲
Czech Republic	68 (2.2)	▲
† Denmark	67 (2.2)	
Australia	67 (2.0)	
2 Latvia	67 (2.6)	
France	66 (2.3)	
Bahrain	66 (1.8)	
Germany	66 (2.0)	
2 England	66 (2.3)	
Bosnia and Herzegovina	66 (1.8)	
Italy	65 (2.5)	
1 2 Canada	65 (1.4)	
2† United States	65 (1.6)	
Austria	64 (2.1)	
2 New Zealand	64 (2.1)	
International Average	**64 (0.3)**	
Hungary	64 (2.0)	
† Northern Ireland	63 (2.6)	
Ireland	62 (2.5)	
≡ Netherlands	62 (2.3)	
United Arab Emirates	62 (1.1)	
1 Georgia	62 (2.8)	
Qatar	61 (2.4)	
2 Turkey (5)	60 (2.4)	
2 Portugal	60 (2.1)	▽
Cyprus	59 (1.8)	▽
North Macedonia	59 (2.9)	
Malta	59 (2.0)	▽
2 Saudi Arabia	58 (2.1)	▽
Oman	57 (2.0)	▽
Kuwait	57 (2.2)	▽
Albania	56 (2.8)	▽
2 Kazakhstan	56 (2.1)	▽
Montenegro	56 (1.6)	▽
2 Kosovo	54 (2.5)	▽
Chile	52 (2.3)	▽
Azerbaijan	51 (2.4)	▽
Morocco	50 (1.9)	▽
South Africa (5)	50 (1.6)	▽
Armenia	49 (2.3)	▽
2 Philippines	42 (2.1)	▽
2 Pakistan	32 (3.3)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	88 (1.4)	▲
2 Dubai, UAE	73 (1.5)	▲
Quebec, Canada	72 (2.2)	▲
Madrid, Spain	66 (2.5)	
2 Ontario, Canada	61 (2.3)	
Abu Dhabi, UAE	51 (1.7)	▽

Content Domain: Physical Science

Cognitive Domain: Knowing

Description: Recognizes the energy change that occurs when a flashlight is turned on

Jake switches on a flashlight.



One kind of energy changes into another kind of energy in the flashlight.

Which statement describes this change?

A. Electrical energy changes into light energy.

B. Motion energy changes into light energy.

C. Light energy changes into electrical energy.

D. Light energy changes into motion energy.

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.12.3: High International Benchmark of Science Achievement – Example Item 3

Country	Percent Full Credit	
Finland	61 (2.0)	▲
† Norway (5)	58 (2.5)	▲
Australia	58 (2.0)	▲
2 Lithuania	56 (2.4)	▲
2† United States	55 (1.7)	▲
Korea, Rep. of	54 (2.1)	▲
2 Turkey (5)	53 (2.4)	▲
2 Russian Federation	53 (2.4)	▲
2 Portugal	52 (2.3)	▲
Sweden	52 (2.5)	▲
Japan	51 (2.1)	▲
3 Singapore	51 (1.8)	▲
Austria	50 (2.3)	▲
Germany	50 (2.3)	▲
Hungary	49 (2.4)	▲
Malta	49 (2.3)	▲
† Belgium (Flemish)	48 (2.1)	▲
Croatia	46 (3.3)	▲
Spain	46 (2.2)	▲
Chinese Taipei	44 (2.3)	▲
2 New Zealand	44 (2.5)	▲
2 Latvia	43 (2.2)	▲
2 Kazakhstan	43 (2.5)	▲
1 2 Canada	43 (1.6)	▲
2 Slovak Republic	42 (2.3)	▲
≡ Netherlands	41 (2.6)	
2 Serbia	41 (2.2)	
Bahrain	40 (1.7)	
Ireland	40 (2.4)	
Cyprus	40 (2.2)	
† Northern Ireland	39 (2.2)	
France	37 (2.4)	
Italy	37 (2.4)	
Czech Republic	37 (2.5)	
International Average	**37 (0.3)**	
2 England	36 (2.6)	
Poland	34 (2.2)	
† Denmark	34 (2.4)	
Armenia	33 (2.2)	
United Arab Emirates	30 (1.0)	▽
Bulgaria	30 (2.4)	▽
Chile	30 (1.8)	▽
Montenegro	28 (1.8)	▽
Albania	28 (2.3)	▽
1 Georgia	27 (2.1)	▽
Bosnia and Herzegovina	26 (1.8)	▽
Qatar	25 (2.0)	▽
† Hong Kong SAR	24 (2.0)	▽
2 Saudi Arabia	20 (1.7)	▽
Oman	19 (1.5)	▽
Azerbaijan	18 (1.6)	▽
South Africa (5)	17 (1.3)	▽
North Macedonia	17 (2.4)	▽
2 Kosovo	15 (1.4)	▽
Morocco	15 (1.8)	▽
Kuwait	15 (1.6)	▽
Iran, Islamic Rep. of	15 (1.6)	▽
2 Pakistan	8 (1.7)	▽
2 Philippines	4 (1.1)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	58 (2.1)	▲
Madrid, Spain	53 (2.5)	▲
Quebec, Canada	48 (2.5)	▲
2 Dubai, UAE	46 (1.8)	▲
2 Ontario, Canada	40 (3.0)	
Abu Dhabi, UAE	23 (1.5)	▽

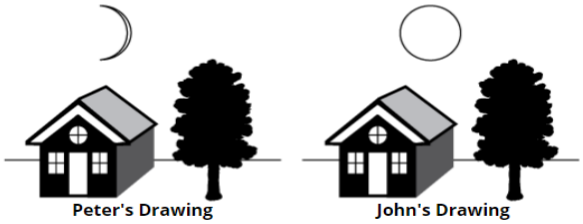
Content Domain: Earth Science

Cognitive Domain: Applying

Description: Using two pictures of the same location, explains that the Moon can look different at different times

One evening Peter went outside and made a drawing of a house, a tree, and the Moon. About 2 weeks later, Peter's brother, John, went outside and made a drawing of the same house, the same tree, and the Moon.

When they compared their drawings, they saw that they drew the Moon differently.



Peter's Drawing | John's Drawing

Whose drawing of the moon is correct?

(Click one box.)

- ☐ Only Peter's drawing of the moon can be correct.
- ☐ Only John's drawing of the moon can be correct.
- ☑ Both drawings of the moon can be correct.

Explain your answer.

The shape of the moon in the sky changes during the month. It looks different on different days.

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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Advanced Benchmark: Full Description and Example Items

Exhibit 2.13 presents the description of fourth grade performance at the Advanced International Benchmark. Students reaching the Advanced level could communicate their understanding of science concepts in the three content areas and demonstrate familiarity with the process of scientific inquiry.

Exhibit 2.13.1 shows an item from the life science domain that asks students to identify two competitors in a food web. Bulgaria was by far the highest achieving country, with 69 percent correct. The international average was 30 percent.

Exhibits 2.13.2 and 2.13.3 present a two-part item from the physical science domain about an experiment involving dissolving sugar in water. Part A asked students to recognize three situations that would dissolve the sugar faster—higher water temperature, stirring the water, and smaller sugar cubes. Latvia had the highest percentage correct—74 percent. The international average was 37 percent. Part B asked why the amount of water in each beaker had to be same. The international average was only 21 percent. However, 66 percent of the Singaporean fourth grade students provided the correct explanation.

Exhibit 2.13.4 shows the example from the Earth science domain. Students at the Advanced level demonstrated they understood that Earth's seasons are related to the tilt of its axis and its orbit around the Sun. Chinese Taipei had the highest percentage correct (59%), and the international average was 36 percent.

Exhibit 2.13: Description of the TIMSS 2019 Advanced International Benchmark (625) of Science Achievement

Advanced International Benchmark

625

Summary

Students communicate their understanding of life, physical, and Earth sciences and demonstrate some knowledge of the process of scientific inquiry. Students demonstrate knowledge of characteristics and life processes of a variety of organisms. They can communicate understanding of relationships in ecosystems and interactions between organisms and their environment. They communicate understanding of properties and states of matter and physical and chemical changes. Students communicate understanding of Earth's physical characteristics, processes, and history and show knowledge of Earth's revolution and rotation.

Students demonstrate knowledge of characteristics and life processes of a variety of organisms. Students communicate understanding of relationships in ecosystems and interactions between organisms and their environment, such as explaining adaptations and identifying animals that compete for food. They can evaluate experimental designs to test how light and water affect the growth of plants.

Students communicate understanding of properties and states of matter and of physical and chemical changes. In the context of investigations, students can explain what makes a solid dissolve faster in water, can evaluate methods for separating mixtures of solids, and understand what is important when designing a fair test.

Students communicate understanding of Earth's physical characteristics, processes, and history. For example, they can relate two different environments to the weathering of rocks and recognize how fish fossils are formed. Students show knowledge of Earth's revolution and can describe how the Earth's rotation causes day and night.

Students demonstrate basic knowledge and skills related to scientific inquiry and can recognize how to set up a simple experiment. They can draw conclusions from descriptions and diagrams and from results of experiments.

Exhibit 2.13.1: Advanced International Benchmark of Science Achievement – Example Item 1

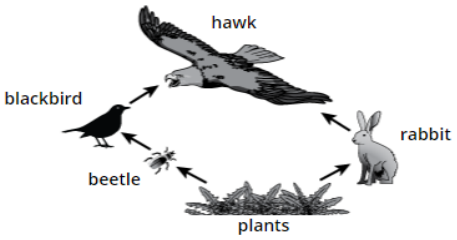
Country	Percent Full Credit	
Bulgaria	69 (2.3)	▲
Korea, Rep. of	56 (2.3)	▲
3 Singapore	54 (2.0)	▲
Chinese Taipei	45 (2.2)	▲
Sweden	45 (2.6)	▲
† Norway (5)	44 (2.2)	▲
Finland	43 (1.7)	▲
2 Slovak Republic	42 (2.3)	▲
2 Serbia	40 (2.7)	▲
2† United States	40 (1.8)	▲
† Hong Kong SAR	40 (2.6)	▲
† Denmark	40 (2.4)	▲
† Northern Ireland	39 (2.8)	▲
Austria	38 (2.9)	▲
Germany	38 (2.3)	▲
Australia	37 (2.3)	▲
2 England	37 (2.7)	▲
Japan	37 (1.9)	▲
2 Russian Federation	37 (2.4)	▲
Poland	37 (2.2)	▲
France	36 (2.8)	▲
Bahrain	35 (1.8)	▲
Ireland	35 (2.1)	▲
Czech Republic	34 (2.2)	
Spain	34 (1.7)	▲
Malta	33 (2.1)	
Italy	31 (2.6)	
Hungary	31 (2.0)	
2 New Zealand	31 (1.6)	
2 Portugal	31 (2.2)	
1 2 Canada	31 (1.9)	
International Average	**30 (0.3)**	
Cyprus	30 (2.5)	
† Belgium (Flemish)	29 (2.2)	
United Arab Emirates	28 (1.1)	▽
≡ Netherlands	27 (2.1)	
2 Latvia	27 (2.1)	
Montenegro	26 (2.1)	▽
Croatia	26 (2.0)	▽
2 Lithuania	26 (2.3)	▽
Chile	24 (2.0)	▽
Albania	22 (2.4)	▽
Armenia	22 (1.8)	▽
Oman	22 (2.0)	▽
Iran, Islamic Rep. of	22 (1.8)	▽
2 Turkey (5)	20 (1.7)	▽
2 Saudi Arabia	20 (1.4)	▽
Qatar	19 (2.1)	▽
Morocco	16 (2.0)	▽
1 Georgia	16 (2.2)	▽
Bosnia and Herzegovina	15 (1.5)	▽
Kuwait	15 (1.9)	▽
South Africa (5)	15 (1.1)	▽
Azerbaijan	14 (1.4)	▽
2 Kazakhstan	13 (1.6)	▽
North Macedonia	13 (1.8)	▽
2 Pakistan	10 (2.3)	▽
2 Philippines	6 (0.9)	▽
2 Kosovo	5 (1.3)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	52 (2.7)	▲
2 Dubai, UAE	41 (2.0)	▲
Madrid, Spain	36 (2.3)	▲
2 Ontario, Canada	32 (3.6)	
Quebec, Canada	30 (2.2)	
Abu Dhabi, UAE	19 (1.3)	▽

Content Domain: Life Science

Cognitive Domain: Applying

Description: Uses a food web to determine which animals are competitors

The picture below shows a food web in a forest ecosystem.



Based on what you see in the food web above, which two animals compete with each other for food?

1. beetle
2. rabbit

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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.13.2: Advanced International Benchmark of Science Achievement – Example Item 2

Country	Percent Full Credit	
[2] Latvia	74 (2.0)	▲
Chinese Taipei	69 (2.0)	▲
Poland	61 (2.1)	▲
Japan	59 (1.9)	▲
Korea, Rep. of	57 (2.1)	▲
[2] Serbia	55 (2.6)	▲
Finland	54 (2.2)	▲
[2] Russian Federation	52 (2.0)	▲
[2] Lithuania	52 (2.5)	▲
† Belgium (Flemish)	50 (2.0)	▲
[2] Slovak Republic	49 (2.7)	▲
[3] Singapore	48 (1.8)	▲
Sweden	46 (2.6)	▲
† Hong Kong SAR	45 (2.6)	▲
Czech Republic	44 (2.3)	▲
Ireland	44 (2.5)	▲
Hungary	44 (2.3)	▲
≡ Netherlands	43 (2.6)	▲
Bulgaria	43 (2.4)	▲
† Norway (5)	43 (2.6)	▲
† Denmark	42 (2.4)	▲
[1 2] Canada	42 (1.6)	▲
Croatia	41 (2.2)	
Germany	41 (2.0)	▲
Australia	41 (1.8)	▲
† Northern Ireland	41 (2.6)	
Italy	40 (2.3)	
Cyprus	40 (2.3)	
[2] Portugal	38 (2.2)	
[2] New Zealand	37 (1.9)	
International Average	**37 (0.3)**	
Austria	37 (2.1)	
Albania	36 (2.6)	
[2] England	36 (2.6)	
Malta	34 (2.2)	
France	32 (2.5)	▽
Spain	32 (2.4)	▽
Armenia	32 (2.0)	▽
[2†] United States	31 (1.6)	▽
[2] Turkey (5)	30 (1.8)	▽
Bahrain	30 (2.1)	▽
Chile	29 (2.0)	▽
Azerbaijan	28 (2.1)	▽
North Macedonia	28 (2.9)	▽
[2] Kazakhstan	28 (2.0)	▽
United Arab Emirates	27 (0.8)	▽
Bosnia and Herzegovina	27 (1.8)	▽
Montenegro	26 (1.9)	▽
[1] Georgia	25 (2.5)	▽
Qatar	24 (1.7)	▽
Oman	22 (1.8)	▽
Kuwait	21 (1.7)	▽
[2] Philippines	19 (1.6)	▽
[2] Saudi Arabia	18 (1.4)	▽
[2] Kosovo	17 (1.7)	▽
Morocco	15 (2.2)	▽
South Africa (5)	14 (1.2)	▽
Iran, Islamic Rep. of	13 (1.5)	▽
[2] Pakistan	9 (1.9)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	58 (2.2)	▲
Quebec, Canada	43 (2.5)	▲
Madrid, Spain	43 (2.8)	▲
[2] Ontario, Canada	42 (2.9)	
[2] Dubai, UAE	36 (1.8)	
Abu Dhabi, UAE	21 (1.4)	▽

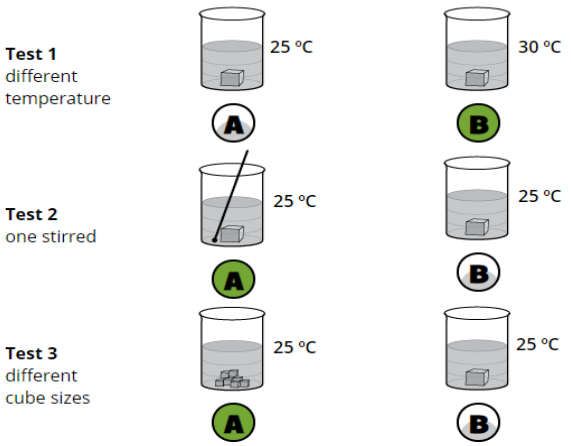
Content Domain: Physical Science

Cognitive Domain: Reasoning

Description: Part A - Recognizes set-ups that will more quickly dissolve a solid in water

Karl is investigating ways to make the same amount of sugar dissolve quickly in water. He sets up three tests.

A. For each of the tests, click the circle under the set-up that will dissolve the sugar faster.



B. Why is it important that the amount of water in each beaker is the same?

To make sure the amount of water did not change the test. Different amounts of water would not make the test fair.

The answer shown for part A 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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.13.3: Advanced International Benchmark of Science Achievement – Example Item 3

Country	Percent Full Credit	
[3] Singapore	66 (1.7)	▲
[2] England	53 (3.3)	▲
Japan	49 (2.0)	▲
Korea, Rep. of	48 (2.3)	▲
[2] Russian Federation	40 (2.5)	▲
Australia	38 (1.5)	▲
Ireland	35 (2.5)	▲
Finland	34 (2.1)	▲
† Northern Ireland	32 (2.3)	▲
Chinese Taipei	30 (2.5)	▲
Cyprus	30 (1.9)	▲
Armenia	29 (2.3)	▲
≡ Netherlands	28 (2.4)	▲
Oman	28 (2.0)	▲
[2] Serbia	27 (2.4)	▲
[2] Turkey (5)	27 (1.8)	▲
Poland	25 (1.7)	▲
Albania	25 (2.2)	
† Belgium (Flemish)	24 (1.7)	
[1 2] Canada	24 (1.5)	
Czech Republic	23 (1.7)	
Malta	23 (1.7)	
[2] Lithuania	23 (1.9)	
Germany	22 (1.9)	
Bahrain	22 (1.8)	
Spain	21 (2.2)	
Croatia	21 (1.9)	
International Average	**21 (0.2)**	
Hungary	21 (1.7)	
† Hong Kong SAR	20 (2.6)	
[2] Latvia	20 (1.8)	
France	20 (1.7)	
[2] Kazakhstan	20 (1.9)	
[2] Slovak Republic	19 (1.6)	
[2†] United States	19 (1.2)	
† Denmark	18 (1.9)	
Bulgaria	18 (1.6)	
Austria	18 (1.9)	
[2] New Zealand	16 (1.5)	▽
United Arab Emirates	16 (0.6)	▽
[2] Portugal	14 (1.6)	▽
Sweden	14 (1.8)	▽
Iran, Islamic Rep. of	13 (1.7)	▽
Qatar	12 (1.6)	▽
† Norway (5)	11 (1.6)	▽
Italy	10 (1.5)	▽
Bosnia and Herzegovina	10 (1.3)	▽
Azerbaijan	9 (1.1)	▽
North Macedonia	8 (1.4)	▽
Chile	8 (1.0)	▽
Kuwait	6 (1.1)	▽
Montenegro	6 (0.9)	▽
[2] Pakistan	5 (1.6)	▽
[1] Georgia	5 (1.2)	▽
South Africa (5)	5 (1.0)	▽
[2] Saudi Arabia	4 (0.8)	▽
[2] Kosovo	4 (0.9)	▽
Morocco	4 (0.8)	▽
[2] Philippines	1 (0.3)	▽
Benchmarking Participants		
[2] Dubai, UAE	35 (1.9)	▲
Madrid, Spain	27 (2.1)	▲
[2] Ontario, Canada	24 (2.5)	
Moscow City, Russian Fed.	20 (2.2)	
Quebec, Canada	19 (2.0)	
Abu Dhabi, UAE	7 (0.7)	▽

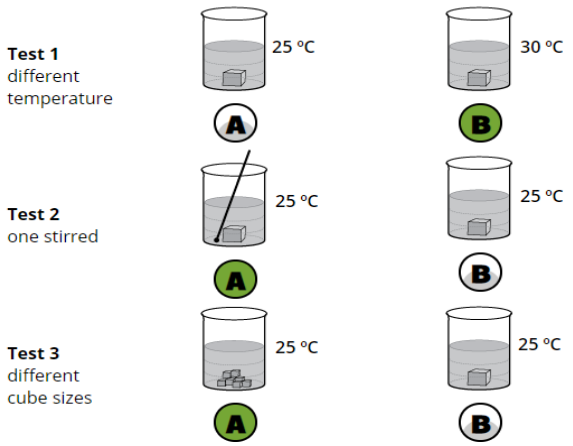
Content Domain: Physical Science

Cognitive Domain: Reasoning

Description: Part B - Explains the importance of controlling a variable in an experiment

Karl is investigating ways to make the same amount of sugar dissolve quickly in water. He sets up three tests.

A. For each of the tests, click the circle under the set-up that will dissolve the sugar faster.



B. Why is it important that the amount of water in each beaker is the same?

To make sure the amount of water did not change the test. Different amounts of water would not make the test fair.

The answer shown for part B 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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.13.4: Advanced International Benchmark of Science Achievement – Example Item 4

Country	Percent Full Credit	
Chinese Taipei	59 (2.6)	▲
Sweden	55 (2.7)	▲
2 Russian Federation	54 (2.4)	▲
3 Singapore	53 (2.3)	▲
† Norway (5)	52 (2.4)	▲
2 England	48 (2.4)	▲
2 Latvia	47 (2.2)	▲
Finland	47 (2.5)	▲
2 Lithuania	47 (2.1)	▲
Korea, Rep. of	46 (2.4)	▲
2 Slovak Republic	45 (2.4)	▲
Ireland	44 (2.5)	▲
2† United States	44 (1.5)	▲
Germany	43 (2.2)	▲
Australia	43 (2.7)	▲
† Denmark	42 (2.6)	▲
Poland	41 (2.4)	▲
Croatia	41 (3.2)	
United Arab Emirates	41 (1.1)	▲
Hungary	40 (2.5)	
† Hong Kong SAR	40 (2.1)	
Czech Republic	40 (2.6)	
2 Turkey (5)	40 (2.4)	
Bulgaria	40 (2.3)	
France	39 (2.2)	
1 2 Canada	39 (1.4)	
Austria	39 (2.4)	
† Belgium (Flemish)	38 (2.5)	
2 New Zealand	38 (1.8)	
† Northern Ireland	37 (2.6)	
≡ Netherlands	37 (2.5)	
Japan	37 (2.0)	
2 Portugal	36 (2.2)	
International Average	**36 (0.3)**	
2 Kazakhstan	36 (2.3)	
2 Serbia	35 (2.3)	
1 Georgia	35 (2.6)	
Italy	33 (2.3)	
Qatar	32 (2.3)	
Malta	31 (2.2)	▽
Spain	30 (2.0)	▽
Chile	28 (2.0)	▽
Albania	27 (2.7)	▽
Armenia	27 (2.1)	▽
Oman	27 (1.8)	▽
2 Saudi Arabia	27 (1.7)	▽
Bahrain	27 (1.7)	▽
Kuwait	26 (2.1)	▽
Bosnia and Herzegovina	26 (1.6)	▽
Azerbaijan	26 (1.8)	▽
Cyprus	26 (2.2)	▽
South Africa (5)	26 (1.3)	▽
Morocco	24 (2.0)	▽
2 Kosovo	23 (2.3)	▽
2 Pakistan	22 (2.4)	▽
North Macedonia	21 (2.2)	▽
2 Philippines	21 (1.9)	▽
Montenegro	18 (1.6)	▽
Iran, Islamic Rep. of	15 (1.7)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	69 (2.6)	▲
2 Dubai, UAE	53 (1.8)	▲
Quebec, Canada	42 (2.5)	▲
2 Ontario, Canada	36 (2.6)	
Madrid, Spain	35 (2.3)	
Abu Dhabi, UAE	33 (2.0)	

Content Domain: Earth Science

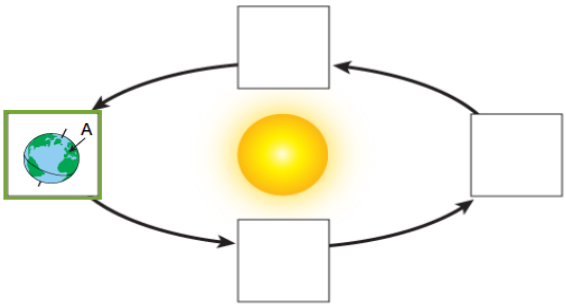
Cognitive Domain: Applying

Description: Places the Earth in a model to show its position relative to the Sun when a labeled city is experiencing summer

Earth's seasons are caused by the tilt of its axis.

It is summer in City A. In what position is the Earth when it is summer in City A?

Drag the Earth to the position that shows it is summer in City A.



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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Average Achievement in Science Content and Cognitive Domains

TIMSS 2019 Science Content and Cognitive Domains

TIMSS 2019 assessed three content areas in science at the fourth grade: life science, physical science, and Earth science.

Forty-five percent of the fourth grade science assessment was devoted to life science topics, including characteristics and life processes of organisms; life cycles, reproduction, and heredity; organisms, environment, and their interactions; ecosystems; and human health. Students were expected to have some knowledge about general characteristics of organisms, how they function, and how they interact with other organisms and with their environment, as well as to be familiar with fundamental science concepts related to life cycles, heredity, and human health.

The topic areas for the physical science content domain made up 35 percent of the assessment, including classification and properties of matter and changes in matter; forms of energy and energy transfer; and forces and motion. Students were asked about physical states of matter (solid, liquid, and gas), as well as common changes in the state and form of matter; common forms and sources of energy and their practical uses; and basic concepts about light, sound, electricity, and magnetism, as well as forces and motion.

The Earth science domain (20% of the assessment) included three topic areas: Earth's physical characteristics, resources, and history; Earth's weather and climates; and Earth in the Solar System. Students were asked about the structure and physical characteristics of Earth's surface and about the use of Earth's most important resources, and were asked to describe some of Earth's processes in terms of observable changes and recognize the time frame over which such changes have occurred. They also were asked about Earth's place in the Solar System based on observations of patterns of change on Earth and in the sky.

Fourth grade students also needed to draw on a range of cognitive skills across the content domains described above. The cognitive skills were categorized into three broad domains—knowing, applying, and reasoning. Forty percent of the fourth grade assessment was devoted to the knowing domain, 40 percent to applying, and 20 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 2.14 shows countries' average science achievement in each of the three content domains relative to their overall average achievement (presented from highest to lowest overall average achievement). Based on countries' relative strengths and weaknesses, the TIMSS 2019 countries appear to be placing relatively less instructional emphasis on the Earth science content domain than the other two science content domains. Of the 53 participating countries with scores in the science content domains, 21 had a relative strength in life science and 13 had a relative weakness; 17 had a relative strength in physical science and 21 had a relative weakness, and 10 had a relative strength in Earth science, and 26 had a relative weakness. All countries except Austria had at least one relative strength or relative weakness compared with their overall achievement.

Exhibit 2.14: Average Achievement in Science Content Domains

Country	Overall Science Average Scale Score	Life Science (73 Items)		Physical Science (61 Items)		Earth Science (35 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
[3] Singapore	595 (3.4)	603 (3.6)	8 (0.9) ▲	613 (3.7)	19 (1.1) ▲	557 (3.9)	-38 (2.0) ▽
Korea, Rep. of	588 (2.1)	574 (2.5)	-13 (1.4) ▽	607 (2.7)	19 (2.7) ▲	587 (2.9)	-1 (1.9)
[2] Russian Federation	567 (3.0)	570 (3.1)	3 (1.2) ▲	572 (2.9)	5 (1.7) ▲	554 (4.4)	-13 (2.5) ▽
Japan	562 (1.8)	550 (2.0)	-11 (1.1) ▽	579 (1.9)	17 (1.1) ▲	559 (1.9)	-2 (1.3)
Chinese Taipei	558 (1.8)	540 (2.0)	-18 (1.5) ▽	573 (1.9)	15 (1.0) ▲	568 (1.8)	10 (1.6) ▲
Finland	555 (2.6)	558 (2.9)	4 (1.5) ▲	544 (3.2)	-10 (2.1) ▽	563 (3.5)	9 (2.2) ▲
[2] Latvia	542 (2.4)	535 (2.7)	-7 (1.5) ▽	553 (3.6)	12 (2.7) ▲	535 (3.7)	-7 (2.8) ▽
† Norway (5)	539 (2.2)	547 (3.0)	8 (2.2) ▲	525 (3.0)	-14 (2.2) ▽	547 (2.9)	7 (1.7) ▲
[2] † United States	539 (2.7)	546 (2.5)	8 (0.8) ▲	527 (2.8)	-12 (0.7) ▽	539 (3.2)	0 (1.6)
[2] Lithuania	538 (2.5)	537 (2.8)	-1 (1.2)	547 (3.0)	9 (1.7) ▲	525 (3.0)	-13 (1.6) ▽
Sweden	537 (3.3)	541 (3.3)	4 (2.4)	525 (3.3)	-12 (1.2) ▽	547 (3.8)	9 (3.2) ▲
[2] England	537 (2.7)	537 (2.6)	0 (1.5)	537 (3.2)	0 (1.9)	533 (2.9)	-4 (1.4) ▽
Czech Republic	534 (2.6)	535 (2.2)	2 (1.6)	528 (2.5)	-6 (1.5) ▽	536 (3.0)	2 (2.6)
Australia	533 (2.4)	539 (2.8)	7 (1.1) ▲	526 (2.7)	-7 (1.2) ▽	527 (2.8)	-6 (1.2) ▽
† Hong Kong SAR	531 (3.3)	523 (3.6)	-8 (1.5) ▽	529 (3.5)	-2 (2.0)	549 (4.5)	18 (2.7) ▲
Poland	531 (2.6)	534 (3.1)	3 (1.7)	526 (2.9)	-5 (1.8) ▽	529 (3.3)	-2 (2.4)
Hungary	529 (2.7)	533 (3.4)	4 (2.1)	524 (2.8)	-6 (1.5) ▽	531 (3.2)	2 (2.0)
Ireland	528 (3.2)	528 (3.5)	0 (1.2)	523 (3.2)	-5 (1.3) ▽	536 (3.8)	8 (2.9) ▲
[2] Turkey (5)	526 (4.2)	519 (4.6)	-8 (1.5) ▽	538 (4.6)	12 (2.2) ▲	524 (4.0)	-2 (1.8)
Croatia	524 (2.2)	520 (2.3)	-4 (1.6) ▽	528 (2.4)	4 (2.3)	523 (3.0)	-1 (2.6)
[1 2] Canada	523 (1.9)	532 (1.9)	9 (0.8) ▲	513 (1.8)	-10 (0.9) ▽	519 (2.2)	-4 (0.9) ▽
† Denmark	522 (2.4)	526 (2.2)	4 (1.9) ▲	507 (2.3)	-15 (2.1) ▽	535 (2.7)	13 (2.4) ▲
Austria	522 (2.6)	523 (2.3)	1 (1.5)	519 (2.6)	-3 (1.5)	524 (3.5)	2 (2.7)
Bulgaria	521 (4.9)	525 (5.2)	4 (1.7) ▲	518 (6.4)	-3 (2.5)	514 (4.8)	-7 (1.9) ▽
[2] Slovak Republic	521 (3.7)	520 (3.9)	-1 (1.3)	525 (3.9)	5 (1.8) ▲	513 (4.4)	-8 (2.5) ▽
† Northern Ireland	518 (2.3)	520 (2.8)	2 (2.1)	511 (2.2)	-8 (1.4) ▽	525 (2.6)	6 (2.5) ▲
≡ Netherlands	518 (2.9)	518 (3.3)	-1 (2.5)	516 (2.8)	-3 (2.0)	521 (3.5)	2 (1.2) ▲
Germany	518 (2.2)	521 (2.3)	3 (1.2) ▲	518 (3.0)	0 (2.1)	509 (4.0)	-9 (3.6) ▽
[2] Serbia	517 (3.5)	521 (3.8)	4 (1.7) ▲	524 (4.2)	7 (2.2) ▲	494 (4.5)	-23 (2.1) ▽
Cyprus	511 (3.0)	515 (3.3)	3 (2.1)	511 (3.2)	0 (1.7)	500 (2.7)	-12 (1.9) ▽
Spain	511 (2.0)	514 (2.2)	3 (0.9) ▲	503 (2.3)	-8 (1.4) ▽	518 (2.4)	7 (1.5) ▲
Italy	510 (3.0)	514 (3.3)	4 (1.2) ▲	502 (3.4)	-8 (1.8) ▽	507 (3.7)	-3 (1.5)
[2] Portugal	504 (2.6)	509 (1.9)	5 (1.7) ▲	496 (2.4)	-7 (1.7) ▽	501 (3.0)	-3 (2.5)
[2] New Zealand	503 (2.3)	510 (2.3)	8 (1.6) ▲	492 (2.1)	-10 (1.4) ▽	503 (3.1)	1 (2.1)
† Belgium (Flemish)	501 (2.1)	500 (2.5)	-1 (1.4)	502 (2.3)	1 (1.4)	496 (2.2)	-5 (1.6) ▽
Malta	496 (1.3)	499 (2.5)	4 (1.9)	492 (2.9)	-4 (2.4)	491 (2.1)	-4 (1.7) ▽
[2] Kazakhstan	494 (3.1)	486 (3.5)	-8 (1.4) ▽	506 (3.3)	12 (1.4) ▲	488 (3.2)	-7 (1.5) ▽
Bahrain	493 (3.4)	492 (3.6)	-1 (1.4)	496 (3.8)	4 (1.4) ▲	478 (4.0)	-15 (1.7) ▽
Albania	489 (3.5)	488 (3.7)	-1 (1.6)	493 (4.1)	4 (1.5) ▲	475 (4.2)	-15 (1.8) ▽
France	488 (3.0)	494 (3.1)	6 (1.2) ▲	477 (3.1)	-10 (1.5) ▽	488 (3.2)	1 (1.5)
United Arab Emirates	473 (2.1)	467 (2.0)	-6 (0.5) ▽	477 (2.2)	5 (0.9) ▲	474 (1.6)	1 (1.0)
Chile	469 (2.6)	478 (2.5)	9 (1.1) ▲	458 (3.8)	-11 (2.3) ▽	460 (4.3)	-9 (3.4) ▽
Armenia	466 (3.4)	476 (3.2)	9 (1.7) ▲	454 (3.4)	-13 (1.2) ▽	451 (3.8)	-15 (2.3) ▽
Bosnia and Herzegovina	459 (2.9)	471 (3.3)	13 (1.3) ▲	450 (3.3)	-8 (1.3) ▽	437 (3.2)	-22 (1.6) ▽
[1] Georgia	454 (3.9)	457 (4.0)	3 (1.2) ▲	452 (4.6)	-2 (2.4)	435 (4.2)	-20 (3.2) ▽
Montenegro	453 (2.5)	464 (2.2)	11 (1.4) ▲	446 (2.8)	-7 (2.0) ▽	434 (3.1)	-20 (1.9) ▽
Qatar	449 (3.9)	448 (4.6)	-1 (1.7)	451 (4.0)	2 (1.3)	442 (5.7)	-7 (3.2) ▽
Iran, Islamic Rep. of	441 (4.1)	430 (4.5)	-11 (2.1) ▽	453 (4.7)	12 (1.9) ▲	438 (4.2)	-3 (1.7)
Oman	435 (4.1)	434 (4.6)	0 (1.8)	437 (4.7)	2 (1.4)	416 (4.5)	-19 (1.9) ▽
Azerbaijan	427 (3.3)	423 (3.4)	-4 (1.3) ▽	427 (3.3)	0 (1.5)	424 (4.7)	-3 (3.3)
North Macedonia	426 (6.2)	422 (5.9)	-4 (2.5)	432 (7.2)	6 (2.8) ▲	409 (7.2)	-17 (2.6) ▽
[2] Kosovo	413 (3.7)	408 (4.3)	-5 (2.5) ▽	415 (4.2)	2 (2.0)	410 (3.9)	-3 (2.0)
[2] Saudi Arabia	402 (4.1)	- -	- -	- -	- -	- -	- -
Kuwait	392 (6.1)	- -	- -	- -	- -	- -	- -
Ψ Morocco	374 (5.8)	364 (5.9)	-10 (1.6) ▽	379 (6.2)	4 (1.9) ▲	350 (6.6)	-24 (2.1) ▽
Ж South Africa (5)	324 (4.9)	- -	- -	- -	- -	- -	- -
[2 Ж] Pakistan	290 (13.4)	- -	- -	- -	- -	- -	- -
[2 Ж] Philippines	249 (7.5)	- -	- -	- -	- -	- -	- -
Benchmarking Participants							
Moscow City, Russian Fed.	595 (2.2)	595 (2.7)	0 (1.9)	598 (2.7)	4 (2.3)	589 (3.0)	-6 (1.8) ▽
[2] Dubai, UAE	545 (1.7)	537 (1.9)	-7 (1.1) ▽	556 (2.1)	11 (1.1) ▲	542 (2.3)	-3 (1.3) ▽
[2] Ontario, Canada	524 (3.2)	535 (2.9)	11 (1.3) ▲	512 (2.9)	-12 (1.4) ▽	518 (3.4)	-6 (1.2) ▽
Madrid, Spain	523 (2.0)	525 (3.4)	2 (2.5)	514 (2.5)	-9 (2.2) ▽	533 (2.0)	10 (0.8) ▲
Quebec, Canada	522 (2.5)	530 (2.4)	8 (1.3) ▲	514 (2.8)	-8 (1.6) ▽	519 (3.2)	-3 (1.7)
Abu Dhabi, UAE	418 (2.8)	413 (2.5)	-5 (1.1) ▽	418 (2.6)	0 (1.2)	422 (2.1)	4 (2.4)

▲ 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 fourth 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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 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 2.15 presents trends in average achievement for the three science content domains assessed by TIMSS 2019—life science, physical science, and Earth science. Of the 53 TIMSS 2019 countries for which science content domain scores were estimated, 42 had comparable data from TIMSS 2015, with each of three content areas showing no recent changes in average achievement for about half the countries. However, in the life science content area, 6 showed improvement and 12 declined; in physical science, 12 showed improvement and 9 declined; and in Earth science, 9 showed improvement and 6 declined.

TIMSS began providing scaled results in the content domains in 2007, with 21 countries having trends between 2007 and 2019. Compared with 2007, in TIMSS 2019 across the content domains in these countries, 7 had higher average achievement in life science and 6 had lower average achievement, 11 had higher average achievement in physical science and 2 had lower average achievement, and in Earth science, 7 had higher average achievement and 7 had lower average achievement.

Exhibit 2.15: 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	Life Science				Physical Science				Earth Science			
	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
Armenia												
2019	476 (3.2)	31 ▲	51 ▲		454 (3.4)	18 ▲	55 ▲		451 (3.8)	16 ▲	53 ▲	
2015	444 (3.9)		20 ▲		436 (4.3)		37 ▲		435 (4.1)		37 ▲	
2011	424 (3.9)				399 (3.9)				398 (4.1)			
Australia												
2019	539 (2.8)	8	23 ▲	10 ▲	526 (2.7)	10 ▲	12 ▲	5	527 (2.8)	7	7	-9
2015	531 (3.0)		15 ▲	2	516 (2.7)		2	-5	520 (3.3)		0	-16 ▽
2011	516 (3.1)			-14 ▽	514 (3.1)			-7	520 (3.6)			-17 ▽
2007	529 (3.6)				521 (3.8)				536 (4.2)			
Austria												
2019	523 (2.3)		-3	-4	519 (2.6)		-16 ▽	3	524 (3.5)		-15 ▽	-11 ▽
2011	526 (2.8)			-2	535 (2.8)			18 ▲	539 (3.5)			4
2007	528 (2.4)				517 (3.0)				535 (2.6)			
Azerbaijan												
2019	423 (3.4)		-17 ▽		427 (3.3)		-9		424 (4.7)		16	
[2] 2011	440 (5.3)				436 (6.0)				408 (7.3)			
Bahrain												
2019	492 (3.6)	37 ▲	48 ▲		496 (3.8)	31 ▲	44 ▲		478 (4.0)	30 ▲	33 ▲	
[2] 2015	455 (2.9)		11 ▲		465 (3.2)		12 ▲		448 (3.2)		3	
2011	444 (4.2)				453 (4.6)				445 (3.7)			
Belgium (Flemish)												
† 2019	500 (2.5)	-13 ▽	-10 ▽		502 (2.3)	-4	-5		496 (2.2)	-16 ▽	-8 ▽	
† 2015	513 (2.4)		3		506 (3.2)		-1		513 (2.8)		8	
2011	510 (2.5)				507 (2.1)				505 (2.9)			
Bulgaria												
2019	525 (5.2)	-17 ▽			518 (6.4)	-11			514 (4.8)	-18 ▽		
2015	542 (6.3)				529 (6.5)				532 (6.9)			
Canada												
[1 2] 2019	532 (1.9)	-4			513 (1.8)	-5			519 (2.2)	6		
[1 2] † 2015	536 (2.8)				518 (2.7)				513 (3.1)			
Chile												
2019	478 (2.5)	-9 ▽	-12 ▽		458 (3.8)	-8	-13 ▽		460 (4.3)	-5	-15 ▽	
2015	487 (2.6)		-2		466 (2.9)		-5		465 (3.4)		-10 ▽	
2011	490 (2.2)				471 (2.5)				475 (2.8)			
Chinese Taipei												
2019	540 (2.0)	-4	2	-7	573 (1.9)	5	5	9 ▲	568 (1.8)	13 ▲	15 ▲	5
2015	545 (2.0)		7 ▲	-2	568 (2.0)		0	5	555 (2.5)		3	-8 ▽
2011	538 (2.5)			-9 ▽	569 (2.1)			5	553 (2.6)			-10 ▽
2007	547 (2.7)				564 (2.4)				563 (2.9)			
Croatia												
2019	520 (2.3)	-11 ▽	-5		528 (2.4)	-8 ▽	26 ▲		523 (3.0)	-12 ▽	2	
2015	531 (2.6)		6		535 (2.9)		33 ▲		535 (3.4)		14 ▲	
[2] 2011	525 (2.0)				502 (2.7)				521 (2.7)			
Cyprus												
2019	515 (3.3)	34 ▲			511 (3.2)	25 ▲			500 (2.7)	37 ▲		
2015	481 (2.8)				486 (2.7)				463 (3.5)			
Czech Republic												
2019	535 (2.2)	-3	-14 ▽	13 ▲	528 (2.5)	-3	9 ▲	19 ▲	536 (3.0)	4	-2	22 ▲
2015	538 (2.0)		-12 ▽	16 ▲	531 (2.4)		11 ▲	22 ▲	531 (3.0)		-6	18 ▲
2011	550 (3.0)			27 ▲	519 (3.1)			10 ▲	537 (3.2)			24 ▲
2007	522 (3.4)				509 (3.5)				514 (3.6)			
Denmark												
† 2019	526 (2.2)	-8 ▽	-4	0	507 (2.3)	-9 ▽	-19 ▽	5	535 (2.7)	4	8 ▲	16 ▲
[2] † 2015	534 (2.4)		4	7	516 (2.7)		-10 ▽	14 ▲	531 (3.0)		4	12 ▲
[2] 2011	530 (2.7)			3	526 (2.4)			24 ▲	527 (3.0)			8
† 2007	527 (3.4)				502 (3.1)				519 (3.3)			
England												
[2] 2019	537 (2.6)	1	7	2	537 (3.2)	-3	2	-9	533 (2.9)	5	11 ▲	-9 ▽
2015	536 (2.5)		6	0	540 (2.7)		5	-6	527 (3.3)		5	-14 ▽
2011	530 (3.0)			-6	535 (3.4)			-10 ▽	522 (3.8)			-19 ▽
2007	536 (3.1)				546 (3.2)				542 (3.4)			

▲ 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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 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 2.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

(Continued)

Country	Life Science				Physical Science				Earth Science			
	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
Finland												
2019	558 (2.9)	2	-16 ▽		544 (3.2)	-3	-24 ▽		563 (3.5)	3	-2	
2015	556 (2.6)		-18 ▽		547 (2.3)		-21 ▽		560 (2.6)		-5	
2011	574 (2.8)				568 (2.9)				566 (2.8)			
France												
2019	494 (3.1)	4			477 (3.1)	-4			488 (3.2)	4		
2015	490 (3.1)				482 (2.7)				485 (4.7)			
Georgia												
[1] 2019	457 (4.0)	-2	-4	36 ▲	452 (4.6)	15 ▲	12 ▲	50 ▲	435 (4.2)	-6	-23 ▽	18 ▲
[1] 2015	459 (4.1)		-2	37 ▲	438 (4.7)		-2	35 ▲	441 (4.3)		-17 ▽	25 ▲
[1] 2011	461 (3.7)			39 ▲	440 (4.2)			37 ▲	458 (4.2)			42 ▲
[1] 2007	421 (4.2)				403 (4.9)				416 (5.6)			
Germany												
2019	521 (2.3)	-7 ▽	-4	-9 ▽	518 (3.0)	-14 ▽	-17 ▽	-8	509 (4.0)	-10	-11 ▽	-15 ▽
2015	528 (2.0)		3	-3	532 (2.5)		-3	6	519 (4.0)		-1	-5
2011	525 (2.7)			-6	535 (3.1)			8	520 (3.8)			-4
2007	531 (2.2)				527 (3.2)				524 (2.8)			
Hong Kong SAR												
[†] 2019	523 (3.6)	-27 ▽	-1	-17 ▽	529 (3.5)	-26 ▽	-10	-33 ▽	549 (4.5)	-25 ▽	1	-19 ▽
[†] 2015	550 (3.7)		26 ▲	10	555 (3.5)		16 ▲	-7	574 (3.1)		26 ▲	6
[2] 2011	524 (3.9)			-16 ▽	539 (4.5)			-23 ▽	548 (3.4)			-20 ▽
2007	540 (3.8)				562 (3.9)				568 (4.2)			
Hungary												
2019	533 (3.4)	-17 ▽	-18 ▽	-19 ▽	524 (2.8)	-10 ▽	3	-5	531 (3.2)	-4	8	14 ▲
2015	550 (3.4)		-1	-2	534 (3.5)		13 ▲	5	535 (4.0)		11	18 ▲
2011	552 (3.4)			-1	520 (3.7)			-8	524 (4.4)			7
2007	553 (3.3)				529 (3.7)				517 (4.4)			
Iran, Islamic Rep. of												
2019	430 (4.5)	13 ▲	-19 ▽	-7	453 (4.7)	29 ▲	0	13 ▲	438 (4.2)	30 ▲	-19 ▽	22 ▲
2015	417 (4.5)		-31 ▽	-20 ▽	423 (5.0)		-30 ▽	-16 ▽	408 (4.8)		-49 ▽	-8
2011	449 (4.0)			11	453 (3.9)			13 ▲	457 (3.6)			40 ▲
2007	437 (5.1)				440 (4.8)				416 (5.0)			
Ireland												
2019	528 (3.5)	-3	15 ▲		523 (3.2)	-1	6		536 (3.8)	2	16 ▲	
2015	531 (2.4)		18 ▲		524 (2.8)		7		535 (3.0)		15 ▲	
2011	513 (3.5)				517 (3.0)				520 (3.8)			
Italy												
2019	514 (3.3)	-5	-21 ▽	-41 ▽	502 (3.4)	-11 ▽	-7	-18 ▽	507 (3.7)	-3	-16 ▽	-20 ▽
[2] 2015	519 (2.7)		-16 ▽	-36 ▽	513 (2.9)		4	-7	510 (3.5)		-13 ▽	-16 ▽
2011	535 (2.8)			-20 ▽	509 (3.1)			-11 ▽	523 (3.7)			-3
2007	555 (3.7)				520 (3.6)				527 (4.2)			
Japan												
2019	550 (2.0)	-6	10 ▲	14 ▲	579 (1.9)	-8 ▽	-11 ▽	7 ▲	559 (1.9)	-4	8 ▲	28 ▲
2015	556 (2.2)		16 ▲	20 ▲	587 (2.6)		-2	16 ▲	563 (2.5)		12 ▲	31 ▲
2011	540 (1.9)			4	589 (2.0)			18 ▲	551 (1.8)			20 ▲
2007	536 (2.3)				571 (2.8)				532 (3.5)			
Kazakhstan												
[2] 2019	486 (3.5)		-14 ▽		506 (3.3)		20 ▲		488 (3.2)		-3	
[2] 2011	500 (5.2)				486 (5.3)				491 (5.9)			
Korea, Rep. of												
2019	574 (2.5)	-7 ▽	3		607 (2.7)	9 ▲	10 ▲		587 (2.9)	-4	-16 ▽	
2015	581 (1.9)		11 ▲		597 (2.0)		1		591 (4.1)		-12 ▽	
2011	571 (2.2)				597 (2.6)				603 (2.0)			
Lithuania												
[2] 2019	537 (2.8)	10 ▲	16 ▲	18 ▲	547 (3.0)	12 ▲	33 ▲	36 ▲	525 (3.0)	9 ▲	24 ▲	16 ▲
[2] 2015	527 (3.0)		7	9 ▲	535 (2.5)		21 ▲	24 ▲	515 (3.7)		15 ▲	7
[1 2] 2011	520 (3.0)			2	514 (3.1)			3	501 (3.0)			-8
[1] 2007	518 (2.2)				511 (2.1)				508 (2.8)			
Malta												
2019	499 (2.5)		61 ▲		492 (2.9)		39 ▲		491 (2.1)		45 ▲	
2011	439 (2.4)				453 (2.4)				447 (2.3)			

▲ 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
Downloaded from http://timss2019.org/download

Exhibit 2.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

(Continued)

Country	Life Science				Physical Science				Earth Science			
	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
Morocco												
Ψ 2019	364 (5.9)	13	119 ▲		379 (6.2)	22 ▲	122 ▲		350 (6.6)	60 ▲	141 ▲	
Ψ 2015	350 (4.3)		106 ▲		357 (5.9)		101 ▲		289 (6.6)		81 ▲	
Ж 2011	245 (4.6)				256 (5.4)				208 (4.9)			
Netherlands												
≡ 2019	518 (3.3)	-7	-19 ▽	-21 ▽	516 (2.8)	12 ▲	-10 ▽	12 ▲	521 (3.5)	1	-4	-3
† 2015	525 (2.7)		-11 ▽	-14 ▽	504 (2.6)		-22 ▽	0	520 (3.0)		-5	-4
† 2011	537 (1.9)			-3	526 (2.0)			22 ▲	525 (2.8)			1
‡ 2007	539 (2.6)				503 (3.2)				524 (3.5)			
New Zealand												
2 2019	510 (2.3)	-1	13 ▲	4	492 (2.1)	-5	-1	-2	503 (3.1)	-2	5	-9 ▽
2015	511 (2.7)		14 ▲	5	497 (2.5)		4	3	506 (3.4)		7	-7
2011	497 (2.5)			-8 ▽	493 (2.7)			-1	499 (3.1)			-14 ▽
2007	506 (2.7)				494 (3.3)				513 (3.5)			
Northern Ireland												
† 2019	520 (2.8)	-1	1		511 (2.2)	-3	-9 ▽		525 (2.6)	3	17 ▲	
‡ 2015	521 (2.7)		3		514 (2.6)		-6		522 (3.0)		15 ▲	
† 2011	519 (2.9)				520 (3.2)				507 (2.7)			
Norway (5)												
† 2019	547 (3.0)	1			525 (3.0)	3			547 (2.9)	-2		
2015	546 (2.6)				522 (2.8)				549 (3.8)			
Oman												
2019	434 (4.6)	8	65 ▲		437 (4.7)	2	67 ▲		416 (4.5)	-7	45 ▲	
2015	426 (3.2)		56 ▲		435 (3.4)		65 ▲		423 (3.5)		53 ▲	
2011	370 (3.9)				370 (4.8)				371 (4.7)			
Poland												
2019	534 (3.1)	-23 ▽			526 (2.9)	-14 ▽			529 (3.3)	-11 ▽		
2015	557 (2.5)				540 (2.1)				540 (2.6)			
Portugal												
2 2019	509 (1.9)	1	-12 ▽		496 (2.4)	-5	-20 ▽		501 (3.0)	-12 ▽	-30 ▽	
2 2015	508 (2.1)		-13 ▽		502 (2.9)		-15 ▽		513 (2.5)		-18 ▽	
2011	520 (4.2)				517 (4.1)				531 (4.3)			
Qatar												
2019	448 (4.6)	12	65 ▲		451 (4.0)	16 ▲	54 ▲		442 (5.7)	15 ▲	42 ▲	
2015	436 (4.4)		53 ▲		435 (4.7)		39 ▲		427 (5.0)		26 ▲	
2 2011	383 (5.1)				397 (5.0)				401 (4.7)			
Russian Federation												
2 2019	570 (3.1)	2	14 ▲	26 ▲	572 (2.9)	5	24 ▲	20 ▲	554 (4.4)	-8	2	13
2015	569 (3.1)		13 ▲	24 ▲	567 (3.6)		19 ▲	15 ▲	562 (4.7)		10	21 ▲
2011	556 (3.7)			12	548 (4.0)			-4	552 (4.0)			11
2007	545 (4.7)				552 (5.6)				541 (5.6)			
Serbia												
2 2019	521 (3.8)	-10	3		524 (4.2)	-5	2		494 (4.5)	-1	-3	
3 2015	531 (3.8)		13 ▲		529 (3.8)		6		496 (4.8)		-1	
2 2011	518 (3.0)				523 (3.8)				497 (3.6)			
Singapore												
3 2019	603 (3.6)	-4	6	8	613 (3.7)	10	15 ▲	16 ▲	557 (3.9)	10	16 ▲	-8
2 2015	607 (4.4)		9	12	603 (3.7)		5	6	546 (3.7)		5	-18 ▽
2 2011	597 (4.4)			3	598 (3.6)			2	541 (3.1)			-24 ▽
2007	595 (4.8)				597 (4.3)				565 (4.1)			
Slovak Republic												
2 2019	520 (3.9)	3	-14 ▽	-15 ▽	525 (3.9)	0	-2	13 ▲	513 (4.4)	-1	-22 ▽	-19 ▽
2015	517 (2.9)		-16 ▽	-18 ▽	526 (3.4)		-2	14 ▲	514 (3.0)		-22 ▽	-18 ▽
2011	534 (3.7)			-1	527 (4.1)			15 ▲	535 (4.0)			3
2007	535 (4.7)				512 (4.9)				532 (6.5)			
Spain												
2019	514 (2.2)	-9 ▽	1		503 (2.3)	-3	7		518 (2.4)	-2	19 ▲	
2 2015	523 (2.6)		10 ▲		507 (2.9)		10 ▲		520 (3.0)		21 ▲	
2011	513 (3.0)				497 (2.9)				499 (3.7)			
Sweden												
2019	541 (3.3)	2	8	9 ▲	525 (3.3)	-9	-3	17 ▲	547 (3.8)	-5	8	7
2 2015	540 (3.3)		6	8	534 (3.6)		6	26 ▲	552 (4.1)		13 ▲	13 ▲
2011	534 (2.8)			2	528 (2.5)			19 ▲	538 (3.2)			-1
2007	532 (2.7)				509 (3.2)				539 (3.9)			

▲ 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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

Exhibit 2.15: Differences in Achievement for Science Content Domains Across Assessment Years◊

(Continued)

Country	Life Science				Physical Science				Earth Science			
	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
United Arab Emirates												
2019	467 (2.0)	18 ▲	47 ▲		477 (2.2)	24 ▲	49 ▲		474 (1.6)	26 ▲	39 ▲	
2015	449 (3.3)		29 ▲		453 (3.0)		25 ▲		448 (3.5)		13 ▲	
2011	420 (2.7)				429 (2.7)				435 (2.4)			
United States												
2† 2019	546 (2.5)	-9 ▽	-1	3	527 (2.8)	-10 ▽	-17 ▽	-8	539 (3.2)	-1	0	2
2† 2015	555 (2.3)		8 ▲	12 ▲	537 (2.6)		-6	3	539 (2.4)		0	2
2 2011	547 (2.0)			3	544 (2.0)			9 ▲	539 (2.2)			2
2† 2007	544 (2.8)				535 (3.1)				537 (3.2)			
Benchmarking Participants												
Ontario, Canada												
2 2019	535 (2.9)	-9 ▽	0	-4	512 (2.9)	-10 ▽	-15 ▽	-23 ▽	518 (3.4)	3	4	-15 ▽
2015	544 (2.6)		9 ▲	5	522 (2.5)		-6	-13 ▽	515 (3.7)		1	-18 ▽
2011	535 (3.4)			-4	528 (3.2)			-7	514 (3.7)			-19 ▽
2 2007	539 (3.9)				535 (3.4)				533 (4.2)			
Quebec, Canada												
2019	530 (2.4)	-3	5	5	514 (2.8)	-6	7	4	519 (3.2)	4	3	-3
≡ 2015	533 (4.3)		9	9	519 (4.9)		12 ▲	10	515 (4.4)		-1	-7
2011	524 (2.6)			0	507 (3.3)			-2	516 (3.4)			-6
2 2007	524 (3.0)				509 (3.3)				522 (2.9)			
Abu Dhabi, UAE												
2019	413 (2.5)	0	10		418 (2.6)	5	3		422 (2.1)	14	4	
2 2015	413 (6.0)		10		413 (5.9)		-2		408 (6.9)		-10	
2011	403 (5.6)				415 (5.2)				418 (5.1)			
Dubai, UAE												
2 2019	537 (1.9)	20 ▲	82 ▲	81 ▲	556 (2.1)	35 ▲	96 ▲	100 ▲	542 (2.3)	31 ▲	73 ▲	81 ▲
2015	518 (2.6)		62 ▲	62 ▲	521 (2.2)		61 ▲	64 ▲	510 (2.9)		41 ▲	49 ▲
2011	455 (3.0)			-1	460 (3.1)			4	469 (3.0)			8
‡ 2007	456 (2.7)				456 (3.5)				461 (3.7)			

▲ 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
Downloaded from http://timss2019.org/download

Average Achievement in Content Domains by Gender

Exhibit 2.16 shows differences in average achievement between girls and boys in the three science content domains. The differences in average achievement between girls and boys are very different from content domain to content domain across the TIMSS 2019 countries, with girls having higher achievement in life science than boys in many countries, and boys having higher achievement in physical and Earth science. In the life science content domain, girls had higher average achievement than boys in 26 countries, and boys did not have higher average achievement in any country. In physical science, girls had higher average achievement than boys in 4 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 16 countries.

Exhibit 2.16: Average Achievement in Science Content Domains by Gender

Country	Life Science (73 Items)		Physical Science (61 Items)		Earth Science (35 Items)	
	Girls	Boys	Girls	Boys	Girls	Boys
Albania	495 (4.2) ▲	482 (4.1)	497 (4.6)	490 (5.3)	476 (5.0)	473 (4.5)
Armenia	482 (3.7) ▲	471 (3.5)	459 (4.0) ▲	449 (3.9)	458 (4.3) ▲	445 (4.9)
Australia	543 (2.9) ▲	535 (3.4)	524 (3.4)	528 (3.3)	524 (3.0)	530 (3.5)
Austria	523 (3.2)	523 (3.5)	514 (3.3)	524 (3.0) ▲	518 (3.8)	529 (4.0) ▲
Azerbaijan	427 (4.1)	420 (3.9)	429 (4.0)	425 (3.9)	425 (6.1)	422 (4.8)
Bahrain	512 (4.5) ▲	473 (5.0)	515 (4.3) ▲	479 (5.7)	494 (4.2) ▲	462 (5.9)
† Belgium (Flemish)	500 (2.4)	500 (3.4)	500 (2.7)	504 (2.5)	489 (2.9)	504 (3.3) ▲
Bosnia and Herzegovina	478 (3.6) ▲	465 (3.7)	452 (4.0)	449 (3.5)	434 (3.6)	439 (4.0)
Bulgaria	533 (5.6) ▲	518 (5.9)	518 (6.7)	518 (7.4)	518 (5.5)	510 (5.8)
1 2 Canada	533 (2.4)	531 (2.0)	508 (2.2)	518 (2.2) ▲	513 (2.5)	524 (2.9) ▲
Chile	477 (2.9)	478 (3.0)	452 (4.7)	463 (4.0) ▲	454 (5.1)	466 (5.0) ▲
Chinese Taipei	542 (3.6)	539 (2.3)	570 (1.9)	576 (2.8)	565 (2.7)	571 (2.0)
Croatia	524 (2.8) ▲	517 (2.5)	526 (3.8)	529 (2.6)	520 (3.7)	527 (3.6)
Cyprus	515 (3.6)	514 (4.0)	507 (3.3)	515 (4.1) ▲	495 (3.1)	505 (3.7) ▲
Czech Republic	536 (2.5)	535 (2.8)	520 (3.2)	536 (2.9) ▲	529 (4.4)	542 (3.5) ▲
† Denmark	533 (2.7) ▲	520 (2.9)	504 (3.4)	510 (3.6)	531 (4.0)	539 (2.8)
2 England	540 (3.7)	535 (3.7)	534 (4.2)	540 (3.6)	532 (3.3)	534 (3.8)
Finland	565 (3.7) ▲	552 (3.3)	544 (3.8)	544 (4.3)	564 (3.7)	562 (5.1)
France	499 (3.5) ▲	489 (3.8)	475 (3.3)	480 (3.9)	488 (4.2)	489 (3.7)
† Georgia	459 (4.5)	455 (4.6)	446 (5.5)	458 (4.8) ▲	432 (4.9)	438 (6.0)
Germany	525 (3.0) ▲	518 (2.7)	513 (4.4)	524 (4.1)	502 (4.9)	515 (4.3) ▲
† Hong Kong SAR	529 (3.7) ▲	518 (4.4)	525 (3.7)	532 (4.4)	544 (3.9)	554 (5.8) ▲
Hungary	532 (3.7)	534 (4.0)	517 (3.2)	530 (3.6) ▲	527 (4.3)	535 (4.0)
Iran, Islamic Rep. of	432 (6.7)	428 (6.0)	449 (7.6)	457 (6.1)	435 (6.4)	441 (6.0)
Ireland	530 (4.3)	526 (3.6)	520 (4.1)	526 (3.3)	529 (4.8)	543 (3.9) ▲
Italy	514 (4.1)	514 (3.3)	495 (3.5)	508 (4.3) ▲	501 (4.5)	513 (3.7) ▲
Japan	554 (2.4) ▲	547 (2.4)	580 (2.2)	577 (2.2)	558 (2.9)	560 (3.2)
2 Kazakhstan	492 (3.7) ▲	481 (3.7)	509 (3.7)	504 (3.9)	490 (4.8)	485 (4.2)
Korea, Rep. of	572 (3.2)	576 (2.5)	600 (3.3)	613 (2.8) ▲	579 (3.5)	594 (3.7) ▲
2 Kosovo	416 (4.8) ▲	400 (4.8)	423 (4.7) ▲	408 (4.8)	414 (4.3)	406 (5.6)
Kuwait	- -	- -	- -	- -	- -	- -
2 Latvia	540 (2.9) ▲	529 (3.2)	551 (4.0)	556 (4.8)	537 (4.3)	534 (3.9)
2 Lithuania	543 (3.1) ▲	530 (3.7)	545 (3.8)	549 (4.2)	524 (3.7)	526 (3.8)
Malta	501 (3.8)	498 (2.3)	486 (4.8)	497 (3.1)	482 (2.8)	500 (2.8) ▲
Montenegro	469 (3.0) ▲	460 (2.8)	447 (3.1)	445 (3.6)	434 (4.2)	433 (3.8)
Ψ Morocco	371 (6.5) ▲	356 (6.0)	383 (7.0)	374 (6.4)	353 (7.2)	346 (7.7)
≡ Netherlands	520 (3.3)	516 (3.9)	515 (2.8)	516 (4.2)	518 (4.3)	524 (4.6)
2 New Zealand	516 (3.9) ▲	504 (2.8)	493 (2.9)	492 (2.9)	501 (5.4)	505 (3.6)
North Macedonia	431 (7.0) ▲	414 (6.0)	435 (7.5)	429 (7.9)	418 (8.0) ▲	401 (7.7)
† Northern Ireland	523 (3.9)	517 (4.2)	510 (2.7)	512 (2.9)	521 (3.2)	528 (3.9)
† Norway (5)	550 (3.7)	544 (3.6)	525 (3.4)	526 (4.1)	546 (4.5)	548 (3.0)
Oman	447 (5.1) ▲	422 (4.9)	450 (4.6) ▲	424 (5.8)	426 (4.7) ▲	406 (5.8)
2 ж Pakistan	- -	- -	- -	- -	- -	- -
2 ж Philippines	- -	- -	- -	- -	- -	- -
Poland	539 (3.2) ▲	529 (3.6)	525 (3.2)	527 (3.5)	524 (3.7)	534 (3.7) ▲
2 Portugal	508 (2.5)	509 (2.9)	493 (3.3)	499 (2.4) ▲	497 (3.4)	504 (4.1)
Qatar	456 (6.0) ▲	440 (5.2)	456 (6.5)	446 (3.9)	444 (8.0)	440 (5.1)
2 Russian Federation	572 (3.6)	569 (3.3)	570 (3.1)	574 (3.3)	552 (4.9)	557 (4.6)
2 Saudi Arabia	- -	- -	- -	- -	- -	- -
2 Serbia	526 (4.4) ▲	515 (4.4)	526 (4.4)	522 (4.9)	494 (5.6)	494 (4.9)
3 Singapore	601 (3.9)	605 (4.2)	607 (3.9)	619 (4.0) ▲	548 (3.9)	565 (4.5) ▲
2 Slovak Republic	520 (4.0)	520 (4.6)	520 (4.2)	530 (4.7) ▲	507 (5.0)	519 (5.2) ▲
ж South Africa (5)	- -	- -	- -	- -	- -	- -
Spain	515 (2.5)	513 (2.9)	499 (3.2)	507 (2.4) ▲	517 (3.0)	519 (3.3)
Sweden	546 (3.6) ▲	537 (4.0)	523 (4.0)	527 (3.7)	546 (3.6)	547 (4.9)
2 Turkey (5)	518 (4.8)	520 (5.7)	534 (4.9)	543 (5.9)	521 (5.0)	528 (5.0)
United Arab Emirates	471 (3.0)	463 (2.6)	479 (3.3)	476 (2.9)	475 (2.7)	474 (2.3)
2 † United States	547 (2.6)	546 (3.4)	523 (3.7)	531 (3.1)	533 (3.7)	543 (3.4) ▲
International Average	**510 (0.5) ▲**	**503 (0.5)**	**504 (0.6)**	**506 (0.6) ▲**	**499 (0.6)**	**503 (0.6) ▲**
Benchmarking Participants						
2 Ontario, Canada	537 (4.0)	533 (3.0)	508 (4.0)	516 (3.0) ▲	514 (4.6)	522 (3.6) ▲
Quebec, Canada	530 (2.9)	529 (2.9)	508 (3.0)	519 (3.5) ▲	513 (3.3)	524 (3.9) ▲
Moscow City, Russian Fed.	599 (2.7) ▲	592 (3.3)	594 (3.0)	603 (2.9) ▲	586 (4.1)	593 (4.1)
Madrid, Spain	525 (3.1)	524 (4.4)	510 (3.4)	518 (2.4) ▲	531 (2.9)	535 (2.8)
Abu Dhabi, UAE	418 (3.5) ▲	408 (3.6)	422 (3.9)	414 (3.9)	424 (3.0)	419 (3.4)
2 Dubai, UAE	540 (3.6)	535 (2.8)	556 (4.1)	555 (3.0)	541 (3.6)	542 (3.7)

▲ Average significantly higher than other gender

Numbers of items are based on the TIMSS 2019 fourth 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%.
ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 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.

Average Achievement in Cognitive Domains

Exhibit 2.17 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). Eighteen countries had a relative strength in the knowing cognitive domain and 11 had a relative weakness, only 9 countries had a relative strength in the applying cognitive domain and 22 had a relative weakness, and 17 had a relative strength in the reasoning cognitive domain, and 15 had a relative weakness. Five countries had no relative strengths or weaknesses in the cognitive domains: Croatia, Germany, Portugal, Malta, and Montenegro.

Exhibit 2.17: Average Achievement in Science Cognitive Domains

Country	Overall Science Average Scale Score	Knowing (69 Items)		Applying (64 Items)		Reasoning (36 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
[3] Singapore	595 (3.4)	588 (3.7)	-7 (0.9) ▽	595 (3.7)	1 (1.6)	604 (3.5)	9 (1.2) ▲
Korea, Rep. of	588 (2.1)	584 (2.5)	-3 (1.8)	596 (2.6)	8 (1.5) ▲	581 (2.4)	-6 (1.4) ▽
[2] Russian Federation	567 (3.0)	562 (3.3)	-5 (1.7) ▽	572 (3.4)	5 (1.3) ▲	569 (2.8)	2 (1.7)
Japan	562 (1.8)	535 (2.6)	-27 (1.6) ▽	576 (2.2)	15 (1.3) ▲	580 (2.4)	18 (2.2) ▲
Chinese Taipei	558 (1.8)	560 (1.9)	2 (1.3)	561 (2.0)	2 (0.9) ▲	552 (2.7)	-6 (2.0) ▽
Finland	555 (2.6)	553 (2.5)	-1 (1.4)	551 (2.5)	-4 (1.5) ▽	563 (2.4)	8 (1.6) ▲
[2] Latvia	542 (2.4)	539 (3.2)	-3 (2.0)	540 (2.6)	-2 (0.9) ▽	547 (2.5)	5 (1.2) ▲
† Norway (5)	539 (2.2)	540 (2.5)	1 (1.6)	537 (2.4)	-3 (1.1) ▽	540 (2.5)	0 (1.3)
[2] † United States	539 (2.7)	542 (2.7)	3 (1.7) ▲	535 (3.1)	-4 (0.9) ▽	538 (2.7)	0 (1.2)
[2] Lithuania	538 (2.5)	539 (3.1)	1 (1.7)	531 (2.3)	-7 (1.3) ▽	548 (2.9)	10 (2.6) ▲
Sweden	537 (3.3)	540 (3.4)	3 (2.2)	532 (3.1)	-5 (1.2) ▽	541 (3.2)	4 (1.1) ▲
[2] England	537 (2.7)	544 (3.3)	7 (1.5) ▲	526 (3.0)	-11 (1.4) ▽	544 (3.7)	6 (2.8) ▲
Czech Republic	534 (2.6)	538 (2.9)	5 (1.6) ▲	526 (2.5)	-7 (1.8) ▽	539 (3.2)	5 (3.2)
Australia	533 (2.4)	538 (3.0)	5 (1.9) ▲	524 (3.2)	-9 (1.9) ▽	538 (3.0)	5 (1.7) ▲
† Hong Kong SAR	531 (3.3)	537 (3.2)	6 (1.6) ▲	526 (3.1)	-5 (1.8) ▽	531 (3.6)	-1 (2.2)
Poland	531 (2.6)	524 (2.6)	-6 (0.9) ▽	538 (2.5)	7 (1.1) ▲	525 (2.6)	-5 (1.9) ▽
Hungary	529 (2.7)	533 (2.7)	4 (1.4) ▲	526 (3.1)	-4 (2.1)	532 (2.6)	2 (1.2) ▲
Ireland	528 (3.2)	532 (3.4)	4 (1.6) ▲	525 (3.0)	-3 (1.4)	525 (3.8)	-3 (2.1)
[2] Turkey (5)	526 (4.2)	531 (4.5)	4 (1.5) ▲	528 (4.3)	2 (1.1)	521 (4.1)	-6 (1.7) ▽
Croatia	524 (2.2)	526 (2.4)	3 (1.6)	521 (2.3)	-3 (1.6)	522 (2.5)	-2 (2.0)
[1 2] Canada	523 (1.9)	524 (1.9)	1 (1.5)	520 (2.0)	-3 (1.0) ▽	526 (1.8)	2 (1.8)
† Denmark	522 (2.4)	521 (2.0)	-1 (2.3)	519 (2.5)	-3 (1.1) ▽	527 (2.7)	5 (1.7) ▲
Austria	522 (2.6)	523 (3.1)	1 (1.4)	523 (2.4)	1 (1.4)	518 (3.3)	-4 (1.9) ▽
Bulgaria	521 (4.9)	526 (5.4)	5 (1.9) ▲	523 (5.4)	1 (1.6)	508 (5.5)	-14 (1.7) ▽
[2] Slovak Republic	521 (3.7)	527 (3.9)	6 (1.4) ▲	515 (4.3)	-5 (1.9) ▽	516 (4.2)	-5 (2.1) ▽
† Northern Ireland	518 (2.3)	523 (2.9)	4 (2.7)	514 (2.3)	-4 (1.2) ▽	519 (3.2)	1 (2.1)
≡ Netherlands	518 (2.9)	515 (2.8)	-4 (1.9) ▽	517 (3.1)	-1 (2.2)	523 (3.2)	5 (2.0) ▲
Germany	518 (2.2)	520 (2.3)	1 (0.9)	516 (2.5)	-2 (1.7)	519 (2.9)	0 (1.8)
[2] Serbia	517 (3.5)	506 (3.3)	-11 (1.9) ▽	526 (3.9)	9 (1.4) ▲	518 (3.9)	1 (2.4)
Cyprus	511 (3.0)	503 (3.3)	-9 (1.1) ▽	519 (3.0)	8 (1.4) ▲	511 (3.2)	-1 (2.3)
Spain	511 (2.0)	514 (2.2)	3 (1.0) ▲	511 (2.0)	-1 (0.9)	507 (1.8)	-5 (1.5) ▽
Italy	510 (3.0)	515 (3.0)	5 (1.5) ▲	504 (2.7)	-6 (1.0) ▽	508 (2.7)	-2 (1.8)
[2] Portugal	504 (2.6)	502 (2.8)	-1 (2.5)	502 (3.1)	-2 (2.1)	504 (2.0)	0 (1.5)
[2] New Zealand	503 (2.3)	505 (2.7)	2 (1.2) ▲	497 (2.6)	-5 (1.0) ▽	505 (2.6)	2 (2.1)
† Belgium (Flemish)	501 (2.1)	493 (2.7)	-8 (1.7) ▽	501 (2.2)	0 (1.2)	511 (2.4)	10 (1.9) ▲
Malta	496 (1.3)	496 (1.6)	1 (1.4)	496 (2.7)	0 (2.2)	490 (3.8)	-6 (3.5)
[2] Kazakhstan	494 (3.1)	489 (2.9)	-6 (1.7) ▽	494 (3.4)	0 (1.6)	502 (3.4)	8 (2.7) ▲
Bahrain	493 (3.4)	496 (3.7)	4 (1.6) ▲	494 (3.4)	2 (1.6)	482 (3.6)	-11 (2.5) ▽
Albania	489 (3.5)	494 (3.9)	4 (1.5) ▲	485 (3.8)	-4 (2.3)	487 (3.6)	-2 (1.8)
France	488 (3.0)	485 (3.6)	-2 (1.9)	495 (3.0)	7 (1.1) ▲	475 (4.7)	-13 (4.0) ▽
United Arab Emirates	473 (2.1)	482 (2.2)	9 (0.7) ▲	470 (2.1)	-3 (0.9) ▽	462 (1.9)	-11 (1.2) ▽
Chile	469 (2.6)	473 (3.7)	4 (2.3)	461 (3.4)	-8 (1.7) ▽	472 (2.7)	3 (1.6)
Armenia	466 (3.4)	463 (3.4)	-3 (1.6)	453 (3.3)	-13 (1.4) ▽	486 (3.6)	19 (3.5) ▲
Bosnia and Herzegovina	459 (2.9)	451 (3.2)	-7 (1.3) ▽	459 (3.0)	0 (1.1)	469 (3.0)	10 (1.8) ▲
[1] Georgia	454 (3.9)	452 (3.9)	-3 (2.2)	445 (3.7)	-9 (2.1) ▽	465 (4.4)	11 (2.2) ▲
Montenegro	453 (2.5)	451 (3.2)	-2 (1.4)	454 (2.7)	0 (1.9)	451 (3.3)	-2 (1.7)
Qatar	449 (3.9)	455 (4.4)	5 (1.4) ▲	451 (4.2)	1 (1.5)	434 (4.3)	-16 (2.4) ▽
Iran, Islamic Rep. of	441 (4.1)	444 (4.6)	3 (1.7)	440 (4.3)	0 (2.1)	433 (4.9)	-8 (3.1) ▽
Oman	435 (4.1)	- -	- -	- -	- -	- -	- -
Azerbaijan	427 (3.3)	425 (4.0)	-2 (2.1)	419 (4.5)	-8 (2.7) ▽	430 (3.5)	3 (1.4) ▲
North Macedonia	426 (6.2)	- -	- -	- -	- -	- -	- -
[2] Kosovo	413 (3.7)	419 (4.5)	6 (2.2) ▲	406 (3.7)	-7 (1.3) ▽	402 (4.2)	-11 (2.3) ▽
[2] Saudi Arabia	402 (4.1)	- -	- -	- -	- -	- -	- -
Kuwait	392 (6.1)	- -	- -	- -	- -	- -	- -
Ψ Morocco	374 (5.8)	362 (6.1)	-12 (1.5) ▽	378 (6.2)	4 (1.7) ▲	366 (5.5)	-9 (2.0) ▽
Ж South Africa (5)	324 (4.9)	- -	- -	- -	- -	- -	- -
[2] Ж Pakistan	290 (13.4)	- -	- -	- -	- -	- -	- -
[2] Ж Philippines	249 (7.5)	- -	- -	- -	- -	- -	- -
Benchmarking Participants							
Moscow City, Russian Fed.	595 (2.2)	592 (2.1)	-3 (1.2) ▽	603 (2.4)	8 (1.0) ▲	592 (2.9)	-3 (2.1)
[2] Dubai, UAE	545 (1.7)	560 (2.1)	15 (0.8) ▲	541 (2.3)	-4 (1.5) ▽	531 (2.1)	-13 (1.5) ▽
[2] Ontario, Canada	524 (3.2)	525 (3.1)	1 (2.3)	520 (3.1)	-4 (1.2) ▽	528 (3.0)	4 (2.3)
Madrid, Spain	523 (2.0)	523 (3.7)	0 (3.3)	521 (3.8)	-1 (3.5)	520 (3.7)	-3 (3.2)
Quebec, Canada	522 (2.5)	523 (2.8)	1 (1.9)	520 (3.6)	-2 (2.6)	525 (3.0)	3 (3.2)
Abu Dhabi, UAE	418 (2.8)	422 (2.9)	4 (1.7) ▲	415 (3.0)	-3 (1.9)	411 (2.7)	-7 (2.6) ▽

▲ 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 fourth 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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 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 2.18 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. Forty-one countries for which cognitive domain scores were estimated participated in both the TIMSS 2015 and TIMSS 2019 assessments. The recent trends compared with 2015 in the knowing cognitive domain showed increases in 12 countries and decreases in 9 countries. In the applying domain, 8 countries showed increases and 12 showed decreases. In the reasoning domain, 9 showed increases, and 9 showed decreases. These recent increases in average achievement in the knowing cognitive domain together with the decreases in the applying domain may have contributed to more countries having a relative strength in knowing compared with applying in 2019.

Between 2007 and 2019, 6 countries had higher average achievement and 5 had lower average achievement in knowing; 6 had higher average achievement and 4 had lower average achievement in applying; and 7 had higher average achievement and 3 had lower average achievement in reasoning.

Exhibit 2.18: 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
Armenia												
2019	463 (3.4)	18 ▲	51 ▲		453 (3.3)	13 ▲	35 ▲		486 (3.6)	50 ▲	83 ▲	
2015	445 (4.1)		33 ▲		440 (4.8)		22 ▲		435 (4.2)		33 ▲	
2011	412 (4.3)				418 (3.9)				402 (5.1)			
Australia												
2019	538 (3.0)	15 ▲	20 ▲	6	524 (3.2)	1	10 ▲	2	538 (3.0)	10 ▲	20 ▲	9
2015	523 (3.3)		5	-9	522 (2.7)		9 ▲	0	527 (3.0)		10 ▲	-1
2011	517 (2.8)			-14 ▽	513 (3.0)			-9	518 (3.4)			-11 ▽
2007	532 (3.5)				522 (3.8)				528 (4.2)			
Austria												
2019	523 (3.1)		-9 ▽	-8 ▽	523 (2.4)		-10 ▽	-3	518 (3.3)		-7	4
2011	532 (3.0)			1	533 (2.9)			7	525 (3.1)			11 ▲
2007	531 (2.4)				527 (2.7)				514 (2.8)			
Azerbaijan												
2019	425 (4.0)		-20 ▽		419 (4.5)		-20 ▽		430 (3.5)		28 ▲	
[2] 2011	445 (6.4)				439 (5.3)				402 (5.9)			
Bahrain												
2019	496 (3.7)	41 ▲	43 ▲		494 (3.4)	33 ▲	51 ▲		481 (3.6)	26 ▲	39 ▲	
[2] 2015	456 (2.5)		2		462 (3.0)		18 ▲		455 (3.0)		13 ▲	
2011	454 (3.8)				443 (3.8)				442 (4.8)			
Belgium (Flemish)												
† 2019	493 (2.7)	-5	-14 ▽		501 (2.2)	-12 ▽	-10 ▽		511 (2.4)	-15 ▽	3	
† 2015	498 (2.7)		-9 ▽		513 (2.5)		2		526 (2.9)		17 ▲	
2011	507 (2.2)				511 (1.9)				508 (2.6)			
Bulgaria												
2019	526 (5.4)	-25 ▽			523 (5.4)	-14			507 (5.5)	1		
2015	551 (6.5)				536 (6.2)				507 (6.4)			
Canada												
[1 2] 2019	524 (1.9)	2			520 (2.0)	-8 ▽			525 (1.8)	1		
[1 2] † 2015	523 (3.1)				528 (2.6)				524 (2.6)			
Chile												
2019	473 (3.7)	-5	-10 ▽		461 (3.4)	-15 ▽	-19 ▽		472 (2.7)	-5	-5	
2015	477 (3.2)		-5		476 (3.0)		-4		477 (2.5)		0	
2011	483 (2.8)				479 (2.3)				477 (2.8)			
Chinese Taipei												
2019	560 (1.9)	4	18 ▲	17 ▲	561 (2.0)	7 ▲	8 ▲	1	552 (2.7)	-6	-15 ▽	-21 ▽
2015	557 (2.5)		15 ▲	13 ▲	553 (2.6)		1	-6	558 (3.1)		-10 ▽	-16 ▽
2011	542 (2.6)			-1	552 (3.2)			-7	568 (3.1)			-6
2007	544 (2.7)				560 (2.1)				574 (3.3)			
Croatia												
2019	526 (2.4)	-8 ▽	1		521 (2.3)	-9 ▽	11 ▲		522 (2.5)	-14 ▽	10 ▲	
2015	534 (2.9)		9 ▲		530 (2.2)		20 ▲		536 (2.4)		23 ▲	
[2] 2011	526 (2.0)				510 (2.4)				512 (3.5)			
Cyprus												
2019	503 (3.3)	35 ▲			519 (3.0)	30 ▲			511 (3.2)	21 ▲		
2015	467 (3.2)				489 (3.4)				490 (3.6)			
Czech Republic												
2019	538 (2.9)	-6	-12 ▽	18 ▲	526 (2.5)	-2	-8 ▽	11 ▲	539 (3.2)	10 ▲	22 ▲	31 ▲
2015	545 (3.0)		-6	24 ▲	528 (2.1)		-6	13 ▲	529 (2.4)		12 ▲	21 ▲
2011	551 (3.2)			30 ▲	534 (2.7)			19 ▲	516 (3.9)			9
2007	521 (3.0)				515 (3.3)				507 (3.6)			
Denmark												
† 2019	521 (2.0)	-3	-4	4	519 (2.5)	-10 ▽	-12 ▽	6	527 (2.7)	2	0	3
[2] † 2015	524 (2.6)		0	7	529 (2.4)		-2	16 ▲	526 (2.9)		-2	1
[2] 2011	524 (2.6)			7	532 (2.5)			19 ▲	527 (2.9)			3
† 2007	517 (3.3)				513 (3.4)				524 (4.4)			
England												
[2] 2019	544 (3.3)	10 ▲	15 ▲	-4	526 (3.0)	-12 ▽	-7	-11 ▽	544 (3.7)	5	17 ▲	3
2015	533 (2.6)		5	-14 ▽	538 (2.7)		5	1	539 (2.7)		12 ▲	-1
2011	529 (3.4)			-19 ▽	532 (3.2)			-4	526 (4.5)			-14 ▽
2007	547 (3.3)				537 (3.4)				540 (2.8)			

▲ 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.2 for population coverage notes 1, 2, and 3. See Appendix B.5 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 2.18: 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
Finland												
2019	553 (2.5)	-3	-26 ▽		551 (2.5)	-2	-17 ▽		563 (2.4)	11 ▲	3	
2015	556 (3.1)		-23 ▽		553 (2.4)		-15 ▽		552 (2.3)		-8 ▽	
2011	579 (2.5)				568 (2.4)				560 (3.0)			
France												
2019	485 (3.6)	4			495 (3.0)	1			475 (4.7)	-6		
2015	482 (3.8)				494 (3.1)				481 (2.8)			
Georgia												
[1] 2019	452 (3.9)	-8	-14 ▽	23 ▲	445 (3.7)	-4	-7	31 ▲	465 (4.4)	40 ▲	43 ▲	86 ▲
[1] 2015	460 (4.2)		-6	31 ▲	449 (4.8)		-3	35 ▲	426 (4.0)		3	46 ▲
[1] 2011	466 (3.8)			37 ▲	452 (4.3)			38 ▲	422 (4.8)			43 ▲
[1] 2007	429 (4.3)				415 (4.7)				379 (6.1)			
Germany												
2019	520 (2.3)	-8 ▽	-5	-9 ▽	516 (2.5)	-13 ▽	-17 ▽	-10 ▽	518 (2.9)	-13 ▽	-8	-7
2015	527 (2.8)		3	-1	529 (2.4)		-4	3	532 (2.3)		6	6
2011	524 (4.0)			-4	533 (2.5)			7 ▲	526 (3.7)			1
2007	529 (2.4)				526 (2.5)				525 (2.8)			
Hong Kong SAR												
[†] 2019	537 (3.2)	-25 ▽	0	-15 ▽	526 (3.1)	-28 ▽	-3	-26 ▽	531 (3.6)	-22 ▽	-11	-32 ▽
[†] 2015	562 (3.0)		25 ▲	9	554 (3.3)		25 ▲	1	552 (4.1)		11	-10
[2] 2011	537 (3.7)			-16 ▽	529 (3.5)			-24 ▽	541 (4.2)			-21 ▽
2007	553 (4.0)				552 (3.5)				563 (4.9)			
Hungary												
2019	533 (2.7)	-17 ▽	-13 ▽	-11 ▽	526 (3.1)	-13 ▽	-4	-6	532 (2.6)	-1	7	4
2015	550 (3.8)		4	6	539 (3.4)		9	7	533 (3.9)		8	5
2011	547 (3.7)			2	530 (3.5)			-2	525 (4.7)			-3
2007	544 (3.5)				532 (3.9)				528 (4.1)			
Iran, Islamic Rep. of												
2019	444 (4.6)	28 ▲	-4	13	440 (4.3)	23 ▲	-11	-2	432 (4.9)	10	-27 ▽	6
2015	416 (4.1)		-32 ▽	-15 ▽	417 (4.5)		-34 ▽	-25 ▽	422 (4.9)		-37 ▽	-5
2011	448 (4.2)			17 ▲	452 (3.8)			9	459 (3.8)			32 ▲
2007	431 (5.0)				443 (4.9)				427 (4.6)			
Ireland												
2019	532 (3.4)	3	14 ▲		525 (3.0)	-5	8		525 (3.8)	0	16 ▲	
2015	529 (2.5)		11 ▲		530 (2.5)		13 ▲		526 (2.9)		17 ▲	
2011	518 (3.8)				517 (3.6)				509 (3.3)			
Italy												
2019	515 (3.0)	-6	-17 ▽	-20 ▽	504 (2.7)	-10 ▽	-19 ▽	-37 ▽	508 (2.7)	-3	-2	-15 ▽
[2] 2015	521 (3.1)		-11 ▽	-14 ▽	513 (3.1)		-10 ▽	-28 ▽	511 (3.5)		2	-12 ▽
2011	532 (3.1)			-3	523 (2.8)			-18 ▽	510 (2.9)			-14 ▽
2007	535 (4.1)				541 (3.3)				523 (3.5)			
Japan												
2019	535 (2.6)	-9 ▽	-3	1	576 (2.2)	0	14 ▲	30 ▲	579 (2.4)	-15 ▽	-12 ▽	6 ▲
2015	544 (2.3)		6 ▲	9 ▲	576 (1.8)		14 ▲	31 ▲	594 (1.8)		3	21 ▲
2011	538 (1.8)			3	562 (1.6)			16 ▲	591 (1.9)			18 ▲
2007	534 (2.6)				546 (3.1)				573 (2.1)			
Kazakhstan												
[2] 2019	489 (2.9)		2		494 (3.4)		-5		502 (3.4)		6	
[2] 2011	486 (5.4)				499 (5.2)				496 (5.8)			
Korea, Rep. of												
2019	584 (2.5)	3	15 ▲		596 (2.6)	2	3		581 (2.4)	-13 ▽	-23 ▽	
2015	582 (2.2)		12 ▲		594 (1.9)		0		594 (2.2)		-11 ▽	
2011	570 (2.1)				593 (2.0)				605 (3.0)			
Lithuania												
[2] 2019	539 (3.1)	16 ▲	32 ▲	28 ▲	531 (2.3)	5	10 ▲	18 ▲	548 (2.9)	10 ▲	32 ▲	27 ▲
[2] 2015	524 (3.0)		16 ▲	12 ▲	526 (2.4)		6	13 ▲	538 (3.0)		22 ▲	17 ▲
[12] 2011	508 (2.8)			-4	521 (2.5)			7	515 (2.7)			-5
[1] 2007	511 (2.3)				513 (3.3)				521 (2.9)			
Malta												
2019	496 (1.6)		60 ▲		496 (2.7)		47 ▲		490 (3.8)		31 ▲	
2011	437 (3.1)				449 (1.7)				459 (4.2)			

▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower

Exhibit 2.18: 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
Morocco												
Ψ 2019	362 (6.1)	31 ▲	125 ▲		378 (6.2)	21 ▲	122 ▲		365 (5.5)	12	125 ▲	
Ψ 2015	331 (5.6)		94 ▲		357 (4.7)		101 ▲		354 (4.7)		114 ▲	
Ж 2011	237 (6.0)				256 (4.9)				240 (5.1)			
Netherlands												
≡ 2019	515 (2.8)	6	-13 ▽	-6	517 (3.1)	-2	-17 ▽	-7	523 (3.2)	-2	-9 ▽	-2
† 2015	508 (2.4)		-19 ▽	-12 ▽	519 (2.4)		-15 ▽	-6	526 (2.9)		-6	0
† 2011	528 (2.2)			7 ▲	534 (2.0)			10 ▲	532 (3.0)			6
‡ 2007	521 (2.7)				525 (2.4)				526 (2.7)			
New Zealand												
2 2019	505 (2.7)	1	9 ▲	-6	497 (2.6)	-5	0	1	505 (2.6)	-9 ▽	8 ▲	2
2015	504 (2.8)		8 ▲	-7	502 (3.1)		5	6	514 (2.4)		17 ▲	11 ▲
2011	496 (2.7)			-15 ▽	497 (2.8)			1	497 (3.0)			-6
2007	511 (3.4)				496 (2.8)				503 (4.2)			
Northern Ireland												
† 2019	523 (2.9)	5	6		514 (2.3)	-5	-7 ▽		519 (3.2)	-1	16 ▲	
‡ 2015	518 (2.9)		1		519 (2.9)		-3		520 (2.6)		17 ▲	
† 2011	517 (3.1)				521 (2.8)				503 (3.2)			
Norway (5)												
† 2019	540 (2.5)	8 ▲			537 (2.4)	-5			540 (2.5)	3		
2015	533 (3.0)				542 (2.9)				537 (3.8)			
Poland												
2019	524 (2.6)	-19 ▽			538 (2.5)	-16 ▽			525 (2.6)	-17 ▽		
2015	544 (2.5)				554 (2.8)				542 (3.2)			
Portugal												
2 2019	502 (2.8)	-4	-25 ▽		502 (3.1)	-6	-13 ▽		504 (2.0)	-2	-21 ▽	
2 2015	507 (2.9)		-21 ▽		508 (1.9)		-7		506 (1.9)		-19 ▽	
2011	528 (4.4)				515 (4.2)				524 (4.3)			
Qatar												
2019	455 (4.4)	18 ▲	67 ▲		451 (4.2)	20 ▲	62 ▲		434 (4.3)	0	29 ▲	
2015	437 (4.5)		49 ▲		430 (4.7)		41 ▲		433 (4.4)		29 ▲	
2 2011	388 (5.2)				389 (5.4)				404 (4.7)			
Russian Federation												
2 2019	562 (3.3)	-7	9	16 ▲	572 (3.4)	3	16 ▲	22 ▲	569 (2.8)	9	27 ▲	27 ▲
2015	569 (3.9)		15 ▲	23 ▲	568 (3.3)		12 ▲	19 ▲	561 (3.8)		19 ▲	18 ▲
2011	553 (3.8)			7	556 (3.5)			6	542 (4.3)			0
2007	546 (5.5)				550 (5.3)				542 (5.3)			
Serbia												
2 2019	506 (3.3)	-20 ▽	-18 ▽		526 (3.9)	4	20 ▲		518 (3.9)	-3	-2	
3 2015	527 (3.9)		3		522 (4.5)		16 ▲		521 (3.9)		1	
2 2011	524 (2.9)				506 (3.1)				519 (3.0)			
Singapore												
3 2019	588 (3.7)	13 ▲	18 ▲	-11	595 (3.7)	-4	6	8	604 (3.5)	-1	7	27 ▲
2 2015	574 (4.1)		4	-24 ▽	599 (4.0)		10	12 ▲	605 (3.6)		8	29 ▲
2 2011	570 (3.4)			-29 ▽	590 (4.0)			2	597 (3.8)			20 ▲
2007	599 (4.5)				587 (4.2)				576 (4.1)			
Slovak Republic												
2 2019	527 (3.9)	-2	-20 ▽	-4	515 (4.3)	-1	-12 ▽	-11	516 (4.2)	9	2	4
2015	530 (3.3)		-17 ▽	-2	517 (2.8)		-11 ▽	-10	507 (3.4)		-7	-4
2011	547 (3.9)			15 ▲	528 (3.9)			1	514 (4.0)			2
2007	531 (4.9)				527 (5.0)				512 (5.4)			
Spain												
2019	514 (2.2)	-8 ▽	-2		511 (2.0)	-3	12 ▲		507 (1.8)	-10 ▽	11 ▲	
2 2015	522 (3.3)		6		514 (3.3)		15 ▲		517 (2.6)		21 ▲	
2011	516 (3.2)				499 (3.1)				496 (3.0)			
Sweden												
2019	540 (3.4)	2	4	12 ▲	532 (3.1)	-8	2	12 ▲	541 (3.2)	-1	4	13 ▲
2 2015	538 (3.8)		3	10 ▲	540 (3.4)		9 ▲	20 ▲	542 (3.8)		5	14 ▲
2011	536 (2.8)			8	531 (3.0)			11 ▲	537 (3.0)			9
2007	528 (3.1)				520 (3.2)				528 (4.3)			

▲ 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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

Exhibit 2.18: 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
United Arab Emirates												
2019	482 (2.2)	28 ▲	49 ▲		470 (2.1)	18 ▲	49 ▲		461 (1.9)	17 ▲	36 ▲	
2015	453 (3.3)		21 ▲		452 (3.2)		31 ▲		444 (3.0)		19 ▲	
2011	433 (2.8)				421 (2.6)				426 (2.6)			
United States												
2† 2019	542 (2.7)	-6	-4	-4	535 (3.1)	-11 ▽	-9 ▽	1	538 (2.7)	-3	1	3
2† 2015	548 (2.5)		2	3	546 (2.2)		2	12 ▲	542 (2.7)		4	6
2 2011	546 (1.9)			1	544 (2.2)			10 ▲	537 (2.4)			2
2† 2007	546 (2.7)				534 (3.1)				535 (3.0)			
Benchmarking Participants												
Ontario, Canada												
2 2019	525 (3.1)	-3	-4	-18 ▽	520 (3.1)	-15 ▽	-6	-9	528 (3.0)	-1	-1	-13 ▽
2015	527 (2.8)		-1	-15 ▽	534 (2.5)		9 ▲	6	529 (2.8)		0	-11 ▽
2011	529 (3.0)			-14 ▽	526 (3.3)			-3	529 (3.6)			-11 ▽
2 2007	542 (3.6)				529 (3.7)				540 (3.4)			
Quebec, Canada												
2019	523 (2.8)	-1	4	6	520 (3.6)	-6	6	5	525 (3.0)	-1	5	-1
≡ 2015	524 (4.3)		5	7	525 (4.5)		12 ▲	11 ▲	526 (4.6)		7	0
2011	519 (2.7)			2	514 (2.5)			-1	520 (3.8)			-6
2 2007	517 (2.8)				515 (3.0)				526 (3.6)			
Abu Dhabi, UAE												
2019	422 (2.9)	12	7		415 (3.0)	-2	10		411 (2.7)	-1	-5	
2 2015	410 (6.6)		-4		417 (5.9)		11		412 (5.3)		-5	
2011	415 (5.7)				405 (5.3)				416 (5.2)			
Dubai, UAE												
2 2019	560 (2.1)	37 ▲	92 ▲	99 ▲	541 (2.3)	24 ▲	88 ▲	83 ▲	531 (2.1)	21 ▲	76 ▲	76 ▲
2015	523 (2.3)		55 ▲	62 ▲	517 (2.8)		64 ▲	59 ▲	510 (2.9)		55 ▲	54 ▲
2011	467 (2.5)			7	453 (2.2)			-5	455 (3.7)			-1
‡ 2007	461 (2.8)				458 (3.7)				456 (3.1)			

▲ 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
Downloaded from http://timss2019.org/download

Average Achievement in Cognitive Domains by Gender

Exhibit 2.19 shows the differences between girls' and boys' average achievement in the cognitive domains of knowing, applying, and reasoning. Interestingly, boys had higher average achievement in more countries than girls in the knowing cognitive domain, but the situation was reversed in the applying and reasoning domains. In the knowing domain, girls had higher average achievement than boys in 3 countries, and boys had higher average achievement than girls in 16 countries. However, in the applying domain, girls had higher average achievement than boys in 12 countries compared with only 3 countries where boys had higher achievement than girls, and in the reasoning domain, girls had higher average achievement than boys in 16 countries compared with no countries with higher average achievement for boys.

Exhibit 2.19: Average Achievement in Science Cognitive Domains by Gender

Country	Knowing (69 Items)		Applying (64 Items)		Reasoning (36 Items)	
	Girls	Boys	Girls	Boys	Girls	Boys
Albania	496 (5.0)	491 (4.7)	493 (4.8) ▲	477 (4.4)	492 (3.9) ▲	482 (4.5)
Armenia	469 (3.4) ▲	458 (4.5)	458 (3.8) ▲	449 (3.9)	492 (4.9) ▲	480 (3.7)
Australia	535 (3.0)	540 (3.7)	526 (4.0)	521 (3.5)	541 (3.2) ▲	534 (3.3)
Austria	517 (3.1)	528 (4.1) ▲	520 (3.4)	526 (2.9)	520 (4.3)	517 (3.1)
Azerbaijan	426 (4.5)	424 (4.4)	422 (4.3)	416 (6.5)	434 (5.4)	426 (3.9)
Bahrain	515 (4.5) ▲	479 (5.3)	513 (4.0) ▲	477 (5.0)	498 (4.0) ▲	465 (5.2)
† Belgium (Flemish)	490 (2.9)	497 (3.4) ▲	500 (2.4)	502 (2.6)	511 (2.3)	511 (4.1)
Bosnia and Herzegovina	450 (4.1)	453 (3.2)	463 (3.0) ▲	454 (4.0)	474 (3.5) ▲	464 (3.8)
Bulgaria	529 (5.8)	524 (6.0)	529 (6.5) ▲	517 (5.7)	512 (6.8)	503 (5.9)
1 2 Canada	519 (2.4)	529 (2.0) ▲	517 (2.3)	522 (2.2) ▲	527 (2.2)	524 (2.4)
Chile	468 (4.4)	477 (3.9) ▲	458 (4.1)	463 (3.5)	473 (3.1)	471 (3.8)
Chinese Taipei	556 (2.3)	565 (2.6) ▲	559 (2.5)	562 (2.4)	556 (4.1)	548 (3.0)
Croatia	525 (3.5)	528 (2.3)	521 (2.5)	521 (3.0)	524 (2.8)	519 (3.1)
Cyprus	498 (3.6)	508 (4.0) ▲	519 (3.3)	520 (3.6)	509 (3.9)	512 (4.7)
Czech Republic	532 (4.0)	545 (3.0) ▲	524 (3.0)	529 (3.4)	536 (3.9)	541 (3.2)
† Denmark	518 (2.8)	523 (2.9)	520 (3.0)	518 (2.9)	532 (4.0)	523 (3.1)
2 England	542 (3.9)	545 (4.0)	526 (4.1)	525 (3.4)	548 (3.9) ▲	539 (4.5)
Finland	553 (3.1)	553 (2.7)	554 (3.3)	548 (2.7)	568 (3.1) ▲	557 (3.2)
France	485 (4.0)	486 (4.2)	497 (3.6)	492 (4.0)	478 (4.8)	471 (5.3)
1 Georgia	448 (4.1)	455 (4.6)	445 (4.0)	446 (4.3)	463 (4.6)	467 (5.1)
Germany	517 (3.0)	522 (3.2)	515 (3.2)	517 (2.8)	519 (3.8)	518 (3.5)
† Hong Kong SAR	531 (3.7)	542 (4.1) ▲	528 (3.4)	525 (4.0)	534 (4.0)	528 (4.5)
Hungary	528 (3.5)	538 (3.1) ▲	522 (3.6)	529 (3.7)	531 (3.8)	532 (3.2)
Iran, Islamic Rep. of	441 (7.2)	447 (6.2)	441 (6.7)	440 (5.4)	434 (6.9)	431 (5.9)
Ireland	528 (4.8)	535 (3.5)	524 (4.0)	527 (3.1)	527 (4.7)	524 (4.1)
Italy	507 (3.6)	522 (3.7) ▲	501 (3.2)	506 (3.1)	507 (3.0)	508 (4.2)
Japan	533 (2.5)	537 (3.3)	581 (2.3) ▲	572 (2.9)	585 (3.1)	574 (4.3)
2 Kazakhstan	488 (3.8)	489 (3.4)	499 (3.9) ▲	489 (3.5)	509 (3.5) ▲	495 (4.4)
Korea, Rep. of	573 (2.3)	595 (3.2) ▲	594 (2.9)	598 (2.8)	580 (2.9)	583 (3.7)
2 Kosovo	426 (5.0) ▲	413 (4.8)	415 (4.6) ▲	398 (3.9)	407 (5.6)	398 (5.8)
Kuwait	- -	- -	- -	- -	- -	- -
2 Latvia	538 (3.7)	541 (3.6)	543 (2.8) ▲	537 (3.0)	553 (3.5) ▲	540 (3.4)
2 Lithuania	539 (4.2)	540 (3.8)	534 (2.7)	528 (3.2)	551 (3.6)	545 (3.5)
Malta	491 (2.1)	501 (2.8) ▲	493 (2.8)	499 (3.9)	491 (3.4)	489 (4.7)
Montenegro	451 (3.9)	451 (3.5)	459 (3.3) ▲	449 (2.9)	453 (3.8)	449 (4.0)
Ψ Morocco	365 (6.9)	359 (6.1)	386 (7.0) ▲	370 (6.2)	372 (6.1) ▲	359 (6.1)
≡ Netherlands	512 (3.1)	517 (3.3)	519 (3.6)	515 (3.6)	526 (4.3)	520 (4.1)
2 New Zealand	504 (3.8)	505 (3.6)	500 (3.6)	495 (3.5)	512 (3.5) ▲	498 (3.3)
North Macedonia	- -	- -	- -	- -	- -	- -
† Northern Ireland	521 (3.7)	525 (3.7)	514 (3.6)	514 (3.3)	525 (3.9) ▲	514 (4.0)
† Norway (5)	539 (2.5)	542 (3.6)	538 (2.8)	536 (3.2)	546 (3.5) ▲	535 (3.6)
Oman	- -	- -	- -	- -	- -	- -
2 Ж Pakistan	- -	- -	- -	- -	- -	- -
2 Ж Philippines	- -	- -	- -	- -	- -	- -
Poland	522 (3.3)	526 (3.0)	540 (2.9)	536 (2.9)	531 (3.4) ▲	520 (3.6)
2 Portugal	499 (3.5)	505 (3.2)	500 (3.9)	504 (3.2)	502 (2.9)	505 (2.5)
Qatar	459 (6.6)	450 (4.2)	457 (6.1)	444 (4.5)	442 (6.8) ▲	425 (4.2)
2 Russian Federation	559 (3.9)	566 (3.5) ▲	570 (4.4)	573 (3.2)	571 (4.8)	567 (3.6)
2 Saudi Arabia	- -	- -	- -	- -	- -	- -
2 Serbia	507 (3.7)	506 (4.3)	533 (4.4) ▲	518 (4.8)	522 (3.9)	514 (5.2)
3 Singapore	580 (3.9)	595 (4.2) ▲	591 (4.1)	599 (3.9) ▲	605 (4.0)	603 (3.8)
2 Slovak Republic	522 (3.9)	532 (4.7) ▲	511 (4.1)	519 (5.3) ▲	517 (5.5)	516 (4.8)
Ж South Africa (5)	- -	- -	- -	- -	- -	- -
Spain	511 (2.9)	517 (2.5)	511 (2.4)	511 (2.6)	506 (2.8)	507 (2.5)
Sweden	538 (3.6)	543 (4.3)	534 (3.2)	530 (4.5)	547 (3.2) ▲	535 (4.4)
2 Turkey (5)	527 (5.0)	536 (5.6)	526 (4.4)	530 (5.3)	519 (4.0)	523 (5.3)
United Arab Emirates	482 (3.3)	482 (3.0)	473 (3.2)	467 (2.6)	465 (3.2)	458 (2.3)
2 † United States	537 (3.4)	547 (3.1) ▲	534 (3.1)	536 (3.7)	538 (3.1)	539 (3.2)
International Average	**507 (0.6)**	**510 (0.5)** ▲	**509 (0.5)** ▲	**506 (0.5)**	**512 (0.6)** ▲	**506 (0.6)**
Benchmarking Participants						
2 Ontario, Canada	521 (4.1)	528 (3.2)	519 (3.9)	521 (3.2)	530 (3.9)	526 (3.5)
Quebec, Canada	517 (3.1)	529 (3.4) ▲	516 (4.1)	523 (3.7) ▲	526 (3.6)	524 (3.3)
Moscow City, Russian Fed.	588 (2.8)	595 (2.8)	601 (3.6)	604 (3.4)	593 (2.6)	590 (3.8)
Madrid, Spain	520 (4.5)	527 (3.4) ▲	520 (4.2)	522 (4.0)	519 (3.4)	520 (5.1)
Abu Dhabi, UAE	424 (4.1)	419 (4.3)	420 (4.2)	410 (3.8)	417 (4.1) ▲	405 (3.4)
2 Dubai, UAE	559 (4.2)	560 (3.1)	542 (3.9)	540 (2.7)	534 (4.0)	529 (2.5)

▲ Average significantly higher than other gender

Numbers of items are based on the TIMSS 2019 fourth 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%.
Ж Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.
See Appendix B.2 for target population coverage notes 1, 2, and 3. See Appendix B.5 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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