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Changes Between 2011 and 2019 in Achievement Gaps Between High- and Low-Performing Students in Mathematics and Science: International Results From TIMSS

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Statistics in Brief publications present descriptive data in tabular formats to provide useful information to a broad audience, including members of the general public. They address simple and topical issues and questions. They do not investigate more complex hypotheses, account for interrelationships among variables, or support causal inferences. We encourage readers who are interested in more complex questions and in-depth analysis to explore other National Center for Education Statistics (NCES) resources, including publications, online data tools, and public- and restricted-use datasets. See **nces.ed.gov** and references noted in the body of the document for more information.

The findings of the 2019 Trends in International Mathematics and Science Study (TIMSS) provided insights regarding the equity of educational outcomes in the United States. The **U.S. results** showed that achievement gaps between high- and low-performing U.S. students increased from 2011 to 2019 in mathematics and science at both the 4th and 8th grades (NCES 2020). The results also showed that the increases were largely due to decreases in the scores of low performers. Such decreases were also observed in **NAEP in mathematics** (NCES 2019) over a similar time period (2009 to 2019).

This Statistics in Brief expands upon the national results and explores how achievement gaps between high and low performers, or differences in scores between students at the 90th and 10th percentiles, changed over this time period in all participating TIMSS education systems. The findings show that the widening achievement (or score) gaps observed in the United States in the past decade were mirrored in only a few other systems. In contrast, in some education systems, score gaps narrowed because the low-performing students' scores improved, and average performance often improved as well.

Background

Prior cross-national research on the equity of educational outcomes includes a small number of studies focused specifically on changes in the score gaps between high- and low-performing students over time. For example, in *Twenty Years of TIMSS,* Mullis, Martin, and Loveless (2016) analyzed long-term changes in TIMSS scores for 22 countries in the 4th grade and 25 countries in the 8th grade—most of which had baseline data from 1995 and others from 1999 or 2003. Their analysis showed that the international average score gap between the 90th and 10th percentiles in the 4th grade closed by 15 points in mathematics and 26 points in science from the baseline to 2015. However, the gaps in the 8th grade remained nearly unchanged in both subjects. Another previous study that examined score gaps using TIMSS mathematics data exclusively from 1995 and 2015 (Miller and Fonseca 2021) found that most countries followed these same patterns, although less consistently at the 8th grade.

The TIMSS 2019 results, however, signal a change from these patterns

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of static or shrinking score gaps in the United States. In the 2019 TIMSS international report (Mullis et al. 2020), the ranges in performance in 2019 for the middle group of U.S. students (those at the 25th to 75th percentiles) appeared to be wider than in previous years, although they were not tested for statistical significance. This was observed in both mathematics and science and at both the 4th and 8th grades. Exploring these results further, the 2019 U.S. highlights report (NCES 2020) found the following for both subjects and grades:

- In 2019, the U.S. score gap between high- and low-performing students (those at the 90th and 10th percentiles) was larger than in most other education systems; and
- The U.S. score gap had increased from 2011 to 2019.

Notably, the 59-point increase in the score gap in eighth-grade mathematics—from 198 points in 2011 to 256 points in 2019—represented more than half a standard deviation on the TIMSS scale.[1] This was due to a drop in the scores of low-performing students alongside a rise in the scores of high-performing students. Of concern, decreases in low performers' scores were a consistent factor in the widening score gaps observed and a key driver for widening gaps in the other grades and subjects.

Purpose

This brief examines how score gaps changed across education systems from 2011 to 2019, exploring the prevalence of widening score gaps—such as those observed in the United States in the past decade—as well as narrowing gaps. In doing so, this brief updates readers on the latest trends in score gaps in mathematics and science at grades 4 and 8 and also presents new analyses that focus on the *patterns* in score gap changes in the past decade.

Studying patterns in score gap changes sheds light on which part of the achievement distribution may be driving change. This context is important for evaluating equity in a nuanced way and for developing appropriate policy responses. For example, narrowing score gaps is an important goal, but some scenarios could be concerning, such as those due to decreases among high-performing students, either with relatively smaller decreases among low-performing students or without (see **NAEP's visual depictions of the various ways score gaps can narrow**). Analyses such as these may also offer a model for future international and national reporting, in addition to providing data on educational equity.

Data and Methods

This Statistics in Brief uses 4th- and 8th-grade mathematics and science data from TIMSS to explore trends in score gaps between high- and low-performing students in each education system. High- and low-performing students are defined as those at the 90th and 10th percentiles, in keeping with the TIMSS 2019 U.S. highlights report (NCES 2020). This brief compares data from 2019 with data from 2011 to expand upon the U.S. highlights report's findings that U.S. score gaps were relatively large in 2019 and had widened since 2011.

This brief uses data from 47 education systems at grade 4 and 36 education systems at grade 8 that have data for both 2011 and 2019. In some cases, it focuses only on the subset of 29 education systems that participated in both years and at both grades. It is possible that results would differ depending on the years chosen for analyses across all comparison countries.

For this analysis, all estimates (i.e., average scores and 10th and 90th percentile scores) and their standard errors were calculated using the **EdSurvey R Package** (NCES 2021), which was designed for the analysis of data from large-scale surveys, including international assessments such as TIMSS. EdSurvey takes into account the complex sample survey design of TIMSS, including the use of plausible values, replicate weights, and sampling weights. Covariance within a year is accounted for in the calculation of standard errors of the percentile gaps. Independent *t* tests were conducted to determine the significance of changes in average scores, 10th and 90th percentile scores, and 90th–10th percentile gaps between 2011 and 2019. All stated changes are significant at the $p < .05$ level. Score-point differences presented in the text were computed from unrounded numbers, and they may differ from those computed using the rounded whole numbers that appear in the tables and figures. For more information about the data and methods used in this brief, please see the **TIMSS 2019 U.S. Technical Notes** on the **TIMSS 2019 Results page**.

[1] At each grade, the TIMSS scale has a range of 0 to 1,000. A centerpoint of 500 was set to correspond to the mean of overall achievement in 1995, with 100 points set to correspond to the standard deviation. Score-point differences presented in the text were computed from unrounded numbers, and they may differ from those computed using the rounded whole numbers that appear in the tables and figures.

Study Questions and Key Findings

The key findings summarize the results, across grades 4 and 8, in both mathematics and science. See table A1 for the summary results *at-a-glance*.

1. In which education systems did score gaps between high- and low-performing students change (widen or narrow) between 2011 and 2019?

- Between 2011 and 2019, neither the widening nor narrowing of score gaps between high- and low-performing students was typical in any given TIMSS subject or grade. Across mathematics and science at the 4th and 8th grades, no more than a quarter of the participating education systems had a score gap that widened, and no more than one-third had a score gap that narrowed.

- Of the 29 education systems that participated in TIMSS 2011 and 2019 at both grades (see table A2), the United States was the only one where the score gap between high- and low-performing students widened in both mathematics and science at both grades. Qatar was the only education system where the score gap narrowed; and Australia, the Islamic Republic of Iran, Japan, and Lithuania were the only ones where the score gaps did not change.

2. Is the widening or narrowing of score gaps between 2011 and 2019 driven primarily by changes in the scores of high-performing students, low-performing students, or both?

Score gap changes and changes in the achievement distribution

- Between 2011 and 2019, score gaps generally widened because low-performing students' scores decreased. In contrast, score gaps generally narrowed because low-performing students' scores increased. In some education systems where score gaps narrowed, the scores of both low- and high-performing students increased, but the scores of the low-performing students increased more.

- In the United States, the score gap widened in both subjects and grades due to decreases in the scores of low-performing students—matching the prevailing international pattern. At the eighth grade, in addition to decreases in low-performing students' scores, high-performing students' scores increased, resulting in a pattern of divergence.

Score gap changes and changes in average scores

- Among education systems where score gaps narrowed from 2011 to 2019, the narrowing score gap was typically associated with increased average performance. In each grade and subject combination, about three-quarters or more of these education systems also had average score increases.

- Among education systems where score gaps widened from 2011 to 2019, there was no clear relationship between changes in score gaps and changes in average scores. In the United States, the score gap widened in both grades and subjects, although average scores did not change across this time period.

STUDY QUESTION 1: In which education systems did score gaps between high- and low-performing students change (widen or narrow) between 2011 and 2019?

Grade 4 Mathematics

Between 2011 and 2019, the score gap between high- and low-performing students in 4th-grade mathematics widened in 11 education systems and narrowed in 10 education systems (see figure 1). However, in most education systems (26 of 47), there was no change in the score gap over this time period.

The United States had one of the largest increases in score gaps across education systems at 24 points. Increases otherwise ranged from 16 points in Quebec-CAN to 29 points in Kuwait. Decreases in 4th-grade mathematics score gaps ranged from 14 points in Italy to 62 points in Azerbaijan.

There was no clear relationship between changes in score gap sizes and 2019 average scores in 4th-grade mathematics (see figure A1). Most education systems where score gaps widened were clustered in the middle range of performance. However, one education system (Hong Kong-CHN) had among the highest average scores in 2019 and one (Kuwait) had among the lowest. Education systems where score gaps narrowed were found across the distribution of performance, with Chinese Taipei and the Russian Federation having among the highest average scores and Qatar and Chile having among the lowest scores.

FIGURE 1. Changes in score gaps between high- and low-performing students on the TIMSS 4th-grade mathematics scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap
Widening score gap	
Kuwait	29 *
United States	**24 ***
Netherlands	23 *
Portugal	22 *
Belgium (Flemish)-BEL	22 *
Finland	21 *
New Zealand	19 *
Germany	18 *
Sweden	18 *
Hong Kong-CHN	17 *
Quebec-CAN	16 *
No change in score gap	
Saudi Arabia	14
Ontario-CAN	14
Poland	13
Czech Republic	12
Denmark	11
Austria	7
Northern Ireland-GBR	6
Iran, Islamic Rep. of	6
Spain	6
Abu Dhabi-UAE	5
Korea, Republic of	4
Lithuania	3
Australia	2
Singapore	1
United Arab Emirates	1
Croatia	#
Ireland	#
Malta	-2
Morocco	-4
Slovak Republic	-4
Serbia	-4
Bahrain	-4
Japan	-5
Oman	-5
England-GBR	-9
Georgia	-17
Narrowing score gap	
Italy	-14 *
Russian Federation	-15 *
Chile	-16 *
Chinese Taipei	-19 *
Hungary	-22 *
Qatar	-34 *
Kazakhstan	-44 *
Dubai-UAE	-52 *
Armenia	-54 *
Azerbaijan	-62 *

2019 score gap significantly wider than 2011 score gap
2019 score gap not significantly different from 2011 score gap
2019 score gap significantly narrower than 2011 score gap

Rounds to zero.
* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 1 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 4 Science

Between 2011 and 2019, the score gap between high- and low-performing students in 4th-grade science widened in only 6 of the 47 education systems, including in the United States (see figure 2). In 15 education systems, the score gap narrowed, and in 26 education systems there was no change in the size of the gap over this time period.

In the United States, the score gap in 4th-grade science widened by 14 points. Increases in gap size across other education systems ranged from 17 points in Quebec-CAN to 30 points in the Netherlands. Decreases in the score gap ranged from 14 points in Poland to 77 points in Dubai-UAE.

Compared to 4th-grade mathematics, in science the score gap widened in fewer education systems (6 compared to 11) and narrowed in more (15 compared to 10). About half (8 of 15) of the education systems where score gaps narrowed also had 2019 average scores above the TIMSS scale centerpoint of 500, including two education systems—Singapore and the Russian Federation—that were among the top three performers (see figure A2).

FIGURE 2. Changes in score gaps between high- and low-performing students on the TIMSS 4th-grade science scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap
Widening score gap	
Netherlands	30 *
Belgium (Flemish)-BEL	24 *
Abu Dhabi-UAE	19 *
Germany	18 *
Quebec-CAN	17 *
United States	**14 ***
No change in score gap	
Saudi Arabia	19
Lithuania	12
Japan	11
Finland	10
Austria	9
United Arab Emirates	6
Northern Ireland-GBR	4
Slovak Republic	3
Hong Kong-CHN	3
Korea, Republic of	#
Sweden	-1
Iran, Islamic Rep. of	-3
Ontario-CAN	-4
Australia	-5
Kuwait	-6
New Zealand	-7
Serbia	-7
Croatia	-7
Czech Republic	-7
Denmark	-9
Ireland	-9
Chile	-10
Portugal	-13
Georgia	-13
Spain	-15
Morocco	-25
Narrowing score gap	
Poland	-14 *
Hungary	-17 *
Italy	-18 *
Chinese Taipei	-18 *
Oman	-21 *
Russian Federation	-23 *
Azerbaijan	-24 *
England-GBR	-26 *
Singapore	-27 *
Armenia	-30 *
Malta	-35 *
Bahrain	-35 *
Kazakhstan	-37 *
Qatar	-58 *
Dubai-UAE	-77 *

2019 score gap significantly wider than 2011 score gap
2019 score gap not significantly different from 2011 score gap
2019 score gap significantly narrower than 2011 score gap

Rounds to zero.
* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 2 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 8 Mathematics

In the United States, the score gap between high- and low-performing students in 8th-grade mathematics widened by 59 points from 2011 to 2019 (see figure 3). Six other education systems saw their score gaps widen, with their increases ranging from 20 points in the Republic of Korea to 48 points in Abu Dhabi-UAE.

In 8 education systems, the score gap in 8th-grade mathematics narrowed, with the decreases ranging from 18 points in South Africa to 46 points in Georgia. However, most education systems (21 out of 36) showed no change in their score gap from 2011 to 2019.

All but one of the education systems where score gaps in 8th-grade mathematics narrowed were also relatively poor performers, with 2019 average scores below the TIMSS scale centerpoint of 500 (see figure A3). The exception was Chinese Taipei, which was one of the top-performing education systems in 2019 while also having a score gap that narrowed by 19 points from 2011. The Republic of Korea, in contrast, was a top-performing education system where score gaps widened.

FIGURE 3. Changes in score gaps between high- and low-performing students on the TIMSS 8th-grade mathematics scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap
Widening score gap	
United States	**59 ***
Abu Dhabi-UAE	48 *
United Arab Emirates	43 *
Sweden	26 *
Finland	23 *
Ontario-CAN	21 *
Korea, Republic of	20 *
No change in score gap	
Hong Kong-CHN	16
Singapore	12
Quebec-CAN	11
Australia	11
Kazakhstan	10
New Zealand	9
England-GBR	7
Lithuania	7
Hungary	4
Israel	4
Russian Federation	#
Japan	-1
Iran, Islamic Rep. of	-2
Italy	-5
Dubai-UAE	-5
Lebanon	-6
Malaysia	-7
Turkey	-10
Romania	-11
Bahrain	-12
Chile	-13
Narrowing score gap	
South Africa (9)	-18 *
Chinese Taipei	-19 *
Oman	-26 *
Jordan	-32 *
Morocco	-38 *
Qatar	-38 *
Saudi Arabia	-41 *
Georgia	-46 *

2019 score gap significantly wider than 2011 score gap
2019 score gap not significantly different from 2011 score gap
2019 score gap significantly narrower than 2011 score gap

Rounds to zero.
* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 3 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 8 Science

Between 2011 and 2019, the score gap between high- and low-performing students in 8th-grade science widened in 9 education systems and narrowed in 5 education systems (see figure 4). Eighth-grade science—in comparison to 4th- and 8th-grade mathematics and 4th-grade science—had the largest proportion of education systems in which score gaps widened (25 percent vs. 23, 19, and 13 percent, respectively) and the smallest proportion in which they narrowed (14 percent vs. 21, 22, and 32 percent, respectively).

The United States was one of the education systems where the score gap in 8th-grade science widened, with an increase of 45 points. It was in the middle of the 9 education systems, where increases ranged from 16 points in the Republic of Korea to 117 points in Abu Dhabi-UAE. Decreases in the score gap ranged from 17 points in Oman to 47 points in Qatar. In 22 of the 36 education systems, there were no changes in the score gap from 2011 to 2019.

All but one of the education systems where score gaps narrowed in 8th-grade science were also relatively poor performers, with 2019 average scores below the TIMSS scale centerpoint of 500 (see figure A4). The exception was Singapore, which was one of the top-performing education systems in 2019 while also having a score gap that narrowed by 28 points from 2011. The Republic of Korea, in contrast, was a top-performing education system where score gaps widened.

FIGURE 4. Changes in score gaps between high- and low-performing students on the TIMSS 8th-grade science scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap
Widening score gap	
Abu Dhabi-UAE	117 *
United Arab Emirates	80 *
Hong Kong-CHN	61 *
Finland	55 *
United States	**45 ***
Sweden	42 *
Ontario-CAN	28 *
Saudi Arabia	16 *
Korea, Republic of	16 *
No change in score gap	
Kazakhstan	17
Lebanon	17
New Zealand	16
England-GBR	16
Romania	14
Chile	11
Australia	9
Quebec-CAN	5
Israel	5
Bahrain	3
Lithuania	3
Hungary	2
Russian Federation	-2
Morocco	-3
Chinese Taipei	-4
Iran, Islamic Rep. of	-5
Italy	-5
Japan	-7
Dubai-UAE	-7
Jordan	-10
Turkey	-14
Malaysia	-15
Narrowing score gap	
Oman	-17 *
Georgia	-19 *
South Africa (9)	-26 *
Singapore	-28 *
Qatar	-47 *

2019 score gap significantly wider than 2011 score gap
2019 score gap not significantly different from 2011 score gap
2019 score gap significantly narrower than 2011 score gap

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 4 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

STUDY QUESTION 2: Is the widening or narrowing of score gaps between 2011 and 2019 driven primarily by changes in the scores of high-performing students, low-performing students, or both?

Grade 4 Mathematics

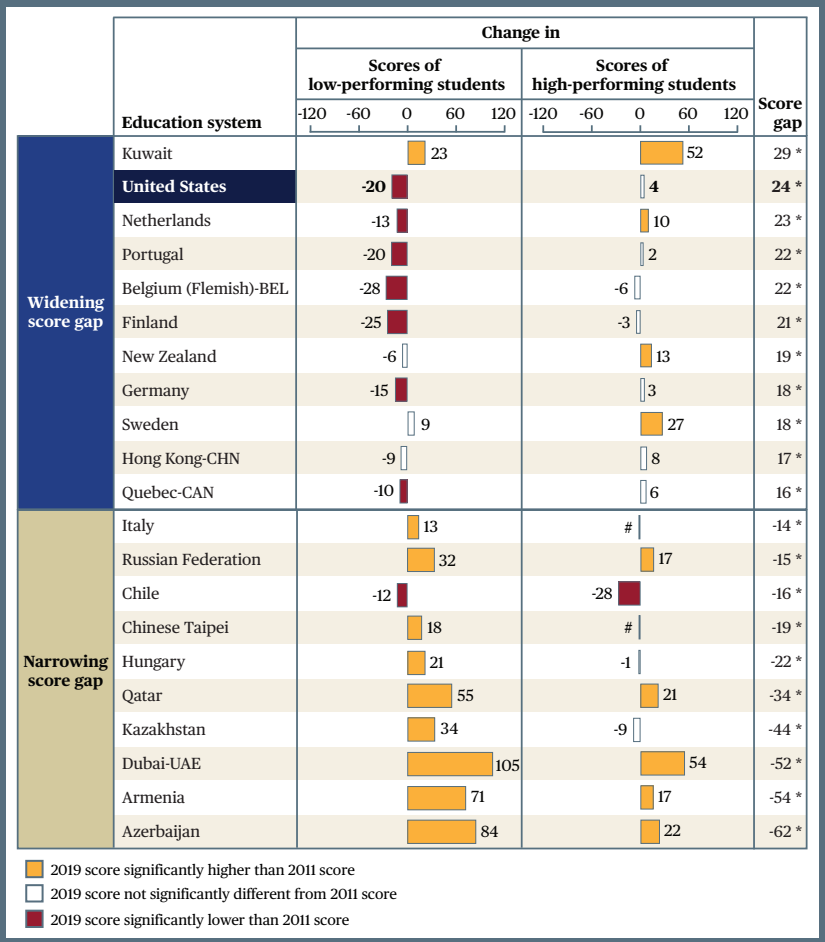
Score gaps in 4th-grade mathematics generally **widened** from 2011 to 2019 because the scores of low-performing students decreased, as was the case in 7 of 11 education systems (see figure 5). These decreases ranged from 10 points in Quebec-CAN to 28 points in Belgium (Flemish)-BEL. In the United States, the scores of low-performing students decreased by 20 points, while there was no change in the score of high-performing students. The United States shared the same pattern of change—that is, a decrease for low-performing students, but no change for high-performing students—with Portugal, Belgium (Flemish)-BEL, Finland, Germany, and Quebec-CAN. A notable exception to the overall pattern was in Kuwait, where low-performing students' scores *increased,* but the score gap still widened because of an even larger increase among high-performing students.

Score gaps in 4th-grade mathematics generally **narrowed** from 2011 to 2019 because low-performing students' scores increased, as was the case in 9 of 10 education systems. These increases ranged from 13 points in Italy to 105 points in Dubai-UAE. In 5 of these education systems, the scores of high-performing students also increased, although not as much as they did for their low-performing students. Among education systems where score gaps narrowed, Chile was an exception. Although the scores of both low and high performers decreased, a larger decrease among high-performing students led to the narrowed score gap.

Among the 26 education systems that showed **no change** in their 4th-grade mathematics score gap, most (21) did still experience changes in the scores of their low- and/or high-performing students (see figure A5). However, these changes were either too small to change the score gap size or, if they occurred for both groups, similar in size at both ends of the distribution. In 15 of these education systems, the scores of both low and high performers increased.

Among education systems where score gaps narrowed in 4th-grade mathematics, nearly all (8 of 10) also increased their **average score**—demonstrating both improved equity and improved achievement. The relationship between change in score gap and average score varied for the other groups of education systems.

FIGURE 5. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 4th-grade mathematics scale, by education system: 2011 and 2019



Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes education systems that participated in TIMSS at 4th grade in both 2011 and 2019 and that had a change in the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) over that time period. Education systems are grouped by whether the score gap widened or narrowed. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 1 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 4 Science

In 4 of 6 education systems, score gaps in 4th-grade science **widened** from 2011 to 2019 because the scores of low-performing students decreased (see figure 6). These decreases ranged from 14 points in the United States to 27 points in the Netherlands. In the other two of these education systems, the widening gaps were due to increases in high performers' scores.

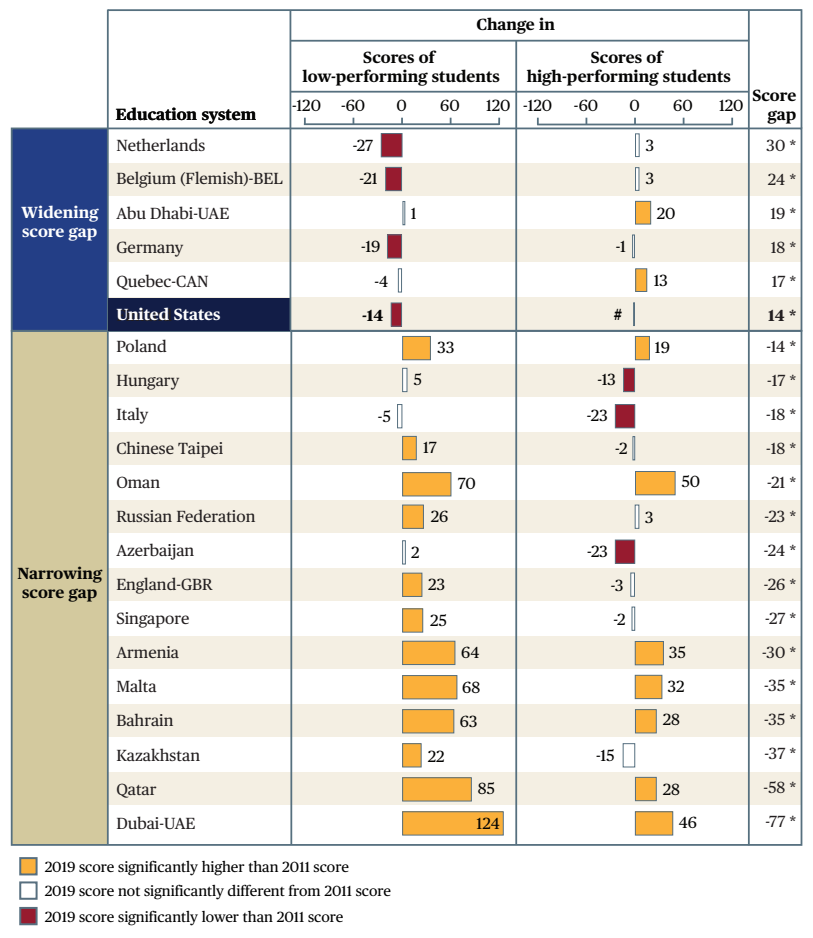
Among the 6 education systems where score gaps widened, the United States shared the same pattern of change with Germany, Belgium (Flemish)-BEL, and the Netherlands: a decrease for low-performing students, but no change for high-performing students. This was also the pattern of change found for the United States in 4th-grade mathematics.

Score gaps in 4th-grade science generally **narrowed** from 2011 to 2019 because of improvements among low-performing students, as was the case in 12 of 15 education systems. These students' score increases ranged from 17 points in Chinese Taipei to 124 points in Dubai-UAE. In 7 of these education systems, the scores of high-performing students also increased, although not as much as they did among low performers. Among education systems where score gaps narrowed, a less common pattern was a drop in high performers' scores with no change among low performers, which occurred in Hungary, Italy, and Azerbaijan.

Among the 26 education systems that showed **no change** in their 4th-grade science score gap, some (14) did still experience changes in the scores of their low- and/or high-performing students (see figure A6). In 5 education systems—Lithuania, United Arab Emirates, Australia, Kuwait, and Morocco—scores increased at both ends of the distribution.

Most education systems that narrowed their score gap in 4th-grade science also increased their **average score** (11 of 15)—demonstrating improved equity and achievement. The relationship between change in score gap and average score varied for the other groups of education systems. Among education systems where the score gap widened, average scores either dropped or remained unchanged (such as in the United States).

FIGURE 6. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 4th-grade science scale, by education system: 2011 and 2019



Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes education systems that participated in TIMSS at 4th grade in both 2011 and 2019 and that had a change in the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) over that time period. Education systems are grouped by whether the score gap widened or narrowed. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 2 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 8 Mathematics

In 3 of 7 education systems, score gaps in 8th-grade mathematics **widened** from 2011 to 2019 because the scores of high-performing students increased without any changes among low-performing students (see figure 7). These systems are the United Arab Emirates, Sweden, and Ontario-CAN. In the United States and Abu Dhabi-UAE, however, improvements among high-performing students were accompanied by declines among low-performing students, leading to among the largest score gaps across education systems in 2019. The scores of low performers in these two education systems decreased by 24 and 36 points, respectively.

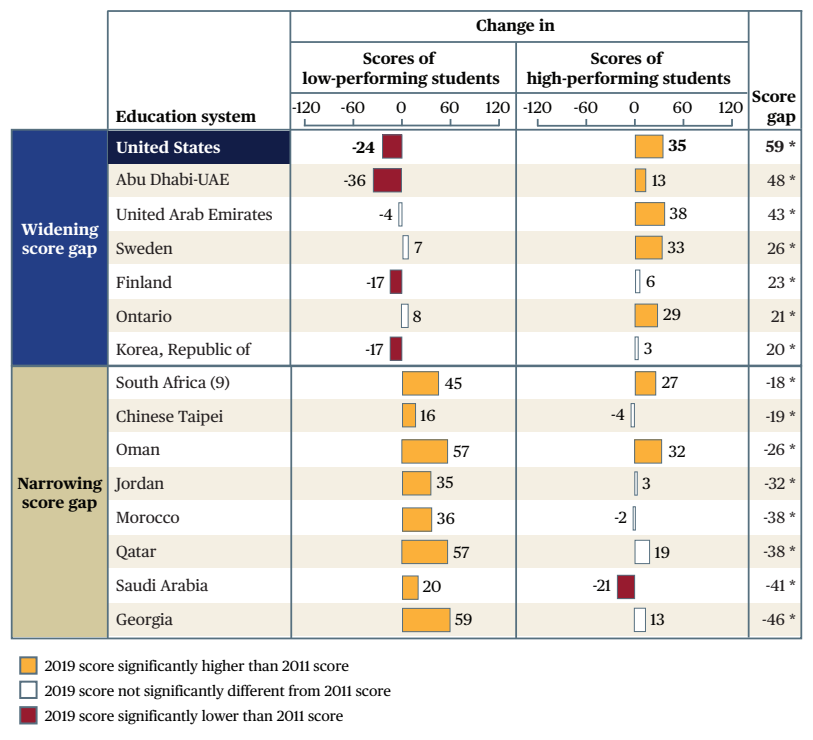
Score gaps in 8th-grade mathematics **narrowed** from 2011 to 2019 because of improvements among low-performing students, as was the case in all 8 education systems where gaps narrowed. These students' score increases ranged from 16 points in Chinese Taipei to 59 points in Georgia. In 2 of these education systems (South Africa and Oman), the scores of high-performing students also increased, although not as much as they did among low performers. Only one education system (Saudi Arabia) saw a score increase for low-performing students accompanied by a decline among high-performing students.

Among the 21 education systems that showed **no change** in their 8th-grade mathematics score gap, over half of these systems (12) still experienced changes in the scores of their low- and/or high-performing students (see figure A7). In 8 education systems, score increases among both high and low performers were similar enough that the overall gaps did not change. Only in Lebanon did the scores of both groups of students decline.

Most education systems (20 of 36) experienced an increase in their 8th-grade mathematics **average score** from 2011 to 2019—regardless of score gap change. Where score gaps widened, average score increases were due to increases in the scores of high-performing students. Where score gaps narrowed, this was typically due to increases in the scores of low-performing students. Among education systems with no score gap change, average score increases were typically due to score increases at both ends of the distribution.

Notably, in the six education systems where scores declined among low performers, high performers, or both groups, none saw improvements in their average scores (including the United States), and two education systems (Abu Dhabi-UAE and Lebanon) saw declines.

FIGURE 7. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 8th-grade mathematics scale, by education system: 2011 and 2019



* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes education systems that participated in TIMSS at 8th grade in both 2011 and 2019 and that had a change in the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) over that time period. Education systems are grouped by whether the score gap widened or narrowed. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 3 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

Grade 8 Science

In 5 of 9 education systems, score gaps in 8th-grade science **widened** from 2011 to 2019 because the scores of low-performing students decreased while the scores of high-performing students increased, which is a pattern that was not frequently seen in other grades and subjects (see figure 8). The United States was one of these 5 education systems, with a 27-point decrease among low performers and a 17-point increase among high performers. In Hong Kong-CHN, the widening of the score gap was due to a decrease in the scores of low-performing students, with no change in the scores of high-performing students. In contrast, the widening of the score gap in Sweden and the Republic of Korea was due to an increase in high-performing students' scores.

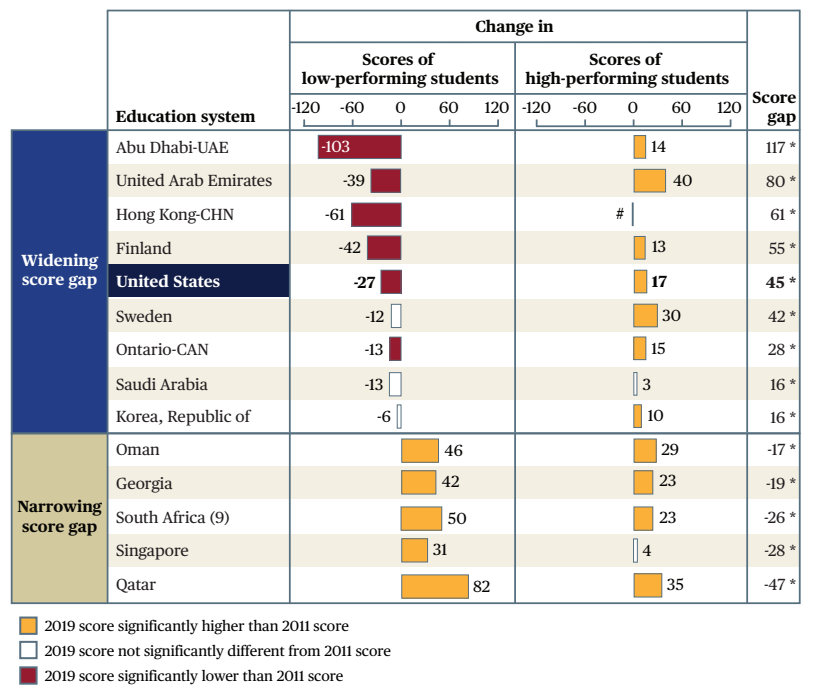
Score gaps in 8th-grade science **narrowed** from 2011 to 2019 because of increases in low performers' scores, as was the case in all 5 education systems where score gaps narrowed. These increases ranged from 31 points in Singapore to 82 points in Qatar. In 4 of these education systems, the scores of high-performing students also increased, although not as much as they did among low performers.

Among the 22 education systems that showed **no change** in their 8th-grade science score gap, most of these systems (15) still did experience changes in the scores of their low- and/or high-performing students (see figure A8). These changes were either too small to change the achievement gap size or, if they occurred for both groups, similar in size at both ends of the distribution. In 7 of the 15 education systems, the scores of both low and high performers increased.

All 5 education systems where score gaps narrowed in 8th-grade science also increased their **average score**, demonstrating both improved equity and improved achievement. In fact, all education systems (13) that saw an increase in the scores of low-performing students also saw an increase in average score, regardless of whether high performers' scores improved or gap sizes changed.

Most education systems that saw a drop in the scores of low-performing students (8 out of 11) also saw a drop in average scores, even when high performers' scores increased. The United States and Ontario-CAN were two of the exceptions, where diverging scores between low- and high-performing students resulted in a widening score gap but no change in average score.

FIGURE 8. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 8th-grade science scale, by education system: 2011 and 2019



Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes education systems that participated in TIMSS at 8th grade in both 2011 and 2019 and that had a change in the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) over that time period. Education systems are grouped by whether the score gap widened or narrowed. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 4 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

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To access and explore TIMSS data, visit the TIMSS International Data Explorer at **https://nces.ed.gov/surveys/international/ide/**.

Read the **NCES TIMSS 2019 U.S. Results**.

Visit the **IEA TIMSS website**.

Read the **International TIMSS 2019 Report**.

References

Miller, D.C., and Fonseca, F.T. (2021). An Average Is Just an Average: What Do We Know About Countries' Low- and High-Performing Students in Mathematics? In A. Wilmers and S. Jornitz (Eds.), *International Perspectives on School Settings, Education Policy and Digital Strategies: A Transatlantic Discourse in Education Research* (pp. 195–219). Opladen: Verlag Barbara Budrich. Retrieved August 31, 2022, from **https://shop.budrich.de/wp-content/uploads/2021/03/9783847416609-1.pdf**.

Mullis, I.V.S., Martin, M.O., Foy, P., Kelly, D.L., and Fishbein, B. (2020). *TIMSS 2019 International Results in Mathematics and Science*. Retrieved August 31, 2022, from **https://timssandpirls.bc.edu/timss2019/international-results/**.

Mullis, I.V.S., Martin, M.O., and Loveless, T. (2016). *20 Years of TIMSS: International Trends in Mathematics and Science Achievement, Curriculum, and Instruction*. Retrieved August 31, 2022, from **http://timssandpirls.bc.edu/timss2015/international-results/timss2015/wp-content/uploads/2016/T15-20-years-of-TIMSS.pdf**.

National Center for Education Statistics (NCES). (2019). *2019 NAEP Mathematics and Reading Assessments: Highlighted Results at Grades 4 and 8 for the Nation, States, and Districts* (NCES 2020-012). Retrieved August 31, 2022, from **https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020012**.

National Center for Education Statistics (NCES). (2020). *TIMSS 2019 U.S. Highlights Web Report* (NCES 2021-021). Retrieved August 31, 2022, from **https://nces.ed.gov/timss/results19/index.asp**.

National Center for Education Statistics (NCES). (2021). *EdSurvey* (Version 2.6.9). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved June 1, 2022, from **https://cran.r-project.org/package=EdSurvey**.

Appendix

TABLE A1. Changes in score gaps between high- and low-performing students on the TIMSS 4th- and 8th-grade mathematics and science scales, by education system: 2011 and 2019

GRADE 4 MATHEMATICS				
	2011–2019 change in:			
Education system	Average score	Scores of low-performing students	Scores of high-performing students	Score gap
Widening in score gap				
Kuwait	42 ▲	23 ▲	52 ▲	29
United States	**-6**	**-20 ▼**	**4**	**24**
Netherlands	-3	-13 ▼	10 ▲	23
Portugal	-7	-20 ▼	2	22
Belgium (Flemish)-BEL	-17 ▼	-28 ▼	-6	22
Finland	-13 ▼	-25 ▼	-3	21
New Zealand	1	-6	13 ▲	19
Germany	-7 ▼	-15 ▼	3	18
Sweden	17 ▲	9	27 ▲	18
Hong Kong-CHN	#	-9	8	17
Quebec-CAN	-1	-10 ▼	6	16
Narrowing score gap				
Italy	7 ▲	13 ▲	#	-14
Russian Federation	25 ▲	32 ▲	17 ▲	-15
Chile	-21 ▼	-12 ▼	-28 ▼	-16
Chinese Taipei	8 ▲	18 ▲	#	-19
Hungary	8	21 ▲	-1	-22
Qatar	36 ▲	55 ▲	21 ▲	-34
Kazakhstan	11 ▲	34 ▲	-9	-44
Dubai-UAE	76 ▲	105 ▲	54 ▲	-52
Armenia	46 ▲	71 ▲	17 ▲	-54
Azerbaijan	53 ▲	84 ▲	22 ▲	-62

GRADE 4 SCIENCE				
	2011–2019 change in:			
Education system	Average score	Scores of low-performing students	Scores of high-performing students	Score gap
Widening in score gap				
Netherlands	-13 ▼	-27 ▼	3	30
Belgium (Flemish)-BEL	-8 ▼	-21 ▼	3	24
Abu Dhabi-UAE	6	1	20 ▲	19
Germany	-9 ▼	-19 ▼	-1	18
Quebec-CAN	6	-4	13 ▲	17
United States	**-5**	**-14 ▼**	#	**14**
Narrowing score gap				
Poland	26 ▲	33 ▲	19 ▲	-14
Hungary	-5	5	-13 ▼	-17
Italy	-14 ▼	-5	-23 ▼	-18
Chinese Taipei	6 ▲	17 ▲	-2	-18
Oman	58 ▲	70 ▲	50 ▲	-21
Russian Federation	15 ▲	26 ▲	3	-23
Azerbaijan	-11	2	-23 ▼	-24
England-GBR	8 ▲	23 ▲	-3	-26
Singapore	11 ▲	25 ▲	-2	-27
Armenia	50 ▲	64 ▲	35 ▲	-30
Malta	50 ▲	68 ▲	32 ▲	-35
Bahrain	43 ▲	63 ▲	28 ▲	-35
Kazakhstan	#	22 ▲	-15	-37
Qatar	55 ▲	85 ▲	28 ▲	-58
Dubai-UAE	83 ▲	124 ▲	46 ▲	-77

GRADE 8 MATHEMATICS				
	2011–2019 change in:			
Education system	Average score	Scores of low-performing students	Scores of high-performing students	Score gap
Widening in score gap				
United States	**6**	**-24 ▼**	**35 ▲**	**59**
Abu Dhabi-UAE	-13 ▼	-36 ▼	13 ▲	48
United Arab Emirates	18 ▲	-4	38 ▲	43
Sweden	18 ▲	7	33 ▲	26
Finland	-5	-17 ▼	6	23
Ontario-CAN	18 ▲	8	29 ▲	21
Korea, Republic of	-6	-17 ▼	3	20
Narrowing score gap				
South Africa (9)	38 ▲	45 ▲	27 ▲	-18
Chinese Taipei	3	16 ▲	-4	-19
Oman	45 ▲	57 ▲	32 ▲	-26
Jordan	14 ▲	35 ▲	3	-32
Morocco	17 ▲	36 ▲	-2	-38
Qatar	34 ▲	57 ▲	19	-38
Saudi Arabia	#	20 ▲	-21 ▼	-41
Georgia	30 ▲	59 ▲	13	-46

GRADE 8 SCIENCE				
	2011–2019 change in:			
Education system	Average score	Scores of low-performing students	Scores of high-performing students	Score gap
Widening in score gap				
Abu Dhabi-UAE	-41 ▼	-103 ▼	14 ▲	117
United Arab Emirates	8 ▲	-39 ▼	40 ▲	80
Hong Kong-CHN	-32 ▼	-61 ▼	#	61
Finland	-10 ▼	-42 ▼	13 ▲	55
United States	**-2**	**-27 ▼**	**17 ▲**	**45**
Sweden	12 ▲	-12	30 ▲	42
Ontario-CAN	#	-13 ▼	15 ▲	28
Saudi Arabia	-5	-13	3	16
Korea, Republic of	1	-6	10 ▲	16
Narrowing score gap				
Oman	37 ▲	46 ▲	29 ▲	-17
Georgia	27 ▲	42 ▲	23 ▲	-19
South Africa (9)	38 ▲	50 ▲	23 ▲	-26
Singapore	18 ▲	31 ▲	4	-28
Qatar	56 ▲	82 ▲	35 ▲	-47

▲ 2019 score significantly higher than 2011 score

▼ 2019 score significantly hower than 2011 score

Rounds to zero.

NOTE: This table includes education systems that participated in TIMSS in both 2011 and 2019 at either grade and had a significant change ($p < .05$) in the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) over that time period. Education systems are grouped by whether the score gap widened or narrowed. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. Italics indicate the education systems that participated in TIMSS 2011 and 2019 at both grades. For "South Africa (9)," the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

TABLE A2. Participation in TIMSS 2011 and 2019, by grade

Education system	Grade 4	Grade 8	Education system	Grade 4	Grade 8
Abu Dhabi-UAE	•	•	Kuwait	•	
Armenia	•		Lebanon		•
Australia	•	•	*Lithuania*	•	•
Austria	•		Malaysia		•
Azerbaijan	•		Malta	•	
Bahrain	•	•	*Morocco*	•	•
Belgium (Flemish)-BEL	•		Netherlands	•	
Chile	•	•	*New Zealand*	•	•
Chinese Taipei	•	•	Northern Ireland-GBR	•	
Croatia	•		*Oman*	•	•
Czech Republic	•		*Ontario-CAN*	•	•
Denmark	•		Poland	•	
Dubai-UAE	•	•	Portugal	•	
England-GBR	•	•	*Qatar*	•	•
Finland	•	•	*Quebec-CAN*	•	•
Georgia	•	•	Romania		•
Germany	•		*Russian Federation*	•	•
Hong Kong-CHN	•	•	*Saudi Arabia*	•	•
Hungary	•	•	Serbia	•	
Iran, Islamic Republic of	•	•	*Singapore*	•	•
Ireland	•		Slovak Republic	•	
Israel		•	South Africa (9)		•
Italy	•	•	Spain	•	
Japan	•	•	*Sweden*	•	•
Jordan		•	Turkey		•
Kazakhstan	•	•	*United Arab Emirates*	•	•
Korea, Republic of	•	•	***United States***	•	•

• Indicates participation in particular assessment
NOTE: Education systems are ordered alphabetically. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. Italics indicate the education systems that participated in TIMSS 2011 and 2019 at both grades. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A1. Changes in score gaps between high- and low-performing students on the TIMSS 4th-grade mathematics scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap	2019 Average score	Education system	2011–2019 Change in score gap	2019 Average score
Singapore	1	625 ▲	Australia	2	516 ▲
Hong Kong-CHN	17 *	602 ▲	Azerbaijan	-62 *	515 ▲
Korea, Republic of	4	600 ▲	Italy	-14 *	515 ▲
Chinese Taipei	-19 *	599 ▲	Kazakhstan	-44 *	512 ▲
Japan	-5	593 ▲	Ontario-CAN	14	512 ▲
Russian Federation	-15 *	567 ▲	Slovak Republic	-4	510 ▲
Northern Ireland-GBR	6	566 ▲	Croatia	#	509 ▲
England-GBR	-9	556 ▲	Malta	-2	509 ▲
Ireland	#	548 ▲	Serbia	-4	508 ▲
Dubai-UAE	-52 *	544 ▲	Spain	6	502
Lithuania	3	542 ▲	Armenia	-54 *	498
Austria	7	539 ▲	New Zealand	19 *	487 ▼
Netherlands	23 *	538 ▲	Georgia	-17	482 ▼
United States	**24 ***	**535 ▲**	United Arab Emirates	1	481 ▼
Czech Republic	12	533 ▲	Bahrain	-4	480 ▼
Belgium (Flemish)-BEL	22 *	532 ▲	Qatar	-34 *	449 ▼
Quebec-CAN	16 *	532 ▲	Iran, Islamic Rep. of	6	443 ▼
Finland	21 *	532 ▲	Chile	-16 *	441 ▼
Portugal	22 *	525 ▲	Abu Dhabi-UAE	5	441 ▼
Denmark	11	525 ▲	Oman	-5	431 ▼
Hungary	-22 *	523 ▲	Saudi Arabia	14	398 ▼
Sweden	18 *	521 ▲	Morocco	-4	383 ▼
Germany	18 *	521 ▲	Kuwait	29 *	383 ▼
Poland	13	520 ▲			

■ 2019 score gap significantly wider than 2011 score gap
□ 2019 score gap not significantly different from 2011 score gap
■ 2019 score gap significantly narrower than 2011 score gap

▲ 2019 average score significantly higher than the TIMSS centerpoint
▼ 2019 average score significantly lower than the TIMSS centerpoint

Rounds to zero.
* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are ordered by 2019 average score. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 1 for standard errors (**https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041**).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A2. Changes in score gaps between high- and low-performing students on the TIMSS 4th-grade science scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap	2019 Average score	Education system	2011–2019 Change in score gap	2019 Average score
Singapore	-27 *	595 ▲	Netherlands	30 *	518 ▲
Korea, Republic of	#	588 ▲	Germany	18 *	518 ▲
Russian Federation	-23 *	567 ▲	Serbia	-7	517 ▲
Japan	11	562 ▲	Spain	-15	511 ▲
Chinese Taipei	-18 *	558 ▲	Italy	-18 *	510 ▲
Finland	10	555 ▲	Portugal	-13	504
Dubai-UAE	-77 *	545 ▲	New Zealand	-7	503
United States	**14 ***	**539 ▲**	Belgium (Flemish)-BEL	24 *	501
Lithuania	12	538 ▲	Malta	-35 *	496 ▼
Sweden	-1	537 ▲	Kazakhstan	-37 *	494
England-GBR	-26 *	537 ▲	Bahrain	-35 *	493 ▼
Czech Republic	-7	534 ▲	United Arab Emirates	6	473 ▼
Australia	-5	533 ▲	Chile	-10	469 ▼
Hong Kong-CHN	3	531 ▲	Armenia	-30 *	466 ▼
Poland	-14 *	531 ▲	Georgia	-13	454 ▼
Hungary	-17 *	529 ▲	Qatar	-58 *	449 ▼
Ireland	-9	528 ▲	Iran, Islamic Rep. of	-3	441 ▼
Ontario-CAN	-4	524 ▲	Oman	-21 *	435 ▼
Croatia	-7	524 ▲	Azerbaijan	-24 *	427 ▼
Denmark	-9	522 ▲	Abu Dhabi-UAE	19 *	418 ▼
Austria	9	522 ▲	Saudi Arabia	19	402 ▼
Quebec-CAN	17 *	522 ▲	Kuwait	-6	392 ▼
Slovak Republic	3	521 ▲	Morocco	-25	374 ▼
Northern Ireland-GBR	4	518 ▲			

- 2019 score gap significantly wider than 2011 score gap
- 2019 score gap not significantly different from 2011 score gap
- 2019 score gap significantly narrower than 2011 score gap

▲ 2019 average score significantly higher than the TIMSS centerpoint

▼ 2019 average score significantly lower than the TIMSS centerpoint

Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are ordered by 2019 average score. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 2 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A3. Changes in score gaps between high- and low-performing students on the TIMSS 8th-grade mathematics scale, by education system: 2011 and 2019

Education system	2011–2019 Change in score gap	2019 Average score	Education system	2011–2019 Change in score gap	2019 Average score
Singapore	12	616 ▲	Turkey	-10	496
Chinese Taipei	-19 *	612 ▲	Kazakhstan	10	488 ▼
Korea, Republic of	20 *	607 ▲	New Zealand	9	482 ▼
Japan	-1	594 ▲	Bahrain	-12	481 ▼
Hong Kong-CHN	16	578 ▲	Romania	-11	479 ▼
Russian Federation	#	543 ▲	United Arab Emirates	43 *	473 ▼
Quebec-CAN	11	543 ▲	Georgia	-46 *	461 ▼
Dubai-UAE	-5	537 ▲	Malaysia	-7	461 ▼
Ontario-CAN	21 *	530 ▲	Iran, Islamic Rep. of	-2	446 ▼
Lithuania	7	520 ▲	Qatar	-38 *	443 ▼
Israel	4	519 ▲	Chile	-13	441 ▼
Australia	11	517 ▲	Abu Dhabi-UAE	48 *	436 ▼
Hungary	4	517 ▲	Lebanon	-6	429 ▼
United States	**59 ***	**515 ▲**	Jordan	-32 *	420 ▼
England-GBR	7	515 ▲	Oman	-26 *	411 ▼
Finland	23 *	509 ▲	Saudi Arabia	-41 *	394 ▼
Sweden	26 *	503	South Africa (9)	-18 *	389 ▼
Italy	-5	497	Morocco	-38 *	388 ▼

- 2019 score gap significantly wider than 2011 score gap
- 2019 score gap not significantly different from 2011 score gap
- 2019 score gap significantly narrower than 2011 score gap

▲ 2019 average score significantly higher than the TIMSS centerpoint

▼ 2019 average score significantly lower than the TIMSS centerpoint

Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are ordered by 2019 average score. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 3 for standard errors (**https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041**).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019

FIGURE A4. Changes in score gaps between high- and low-performing students on the TIMSS 8th-grade science scale, by education system: 2011 and 2019

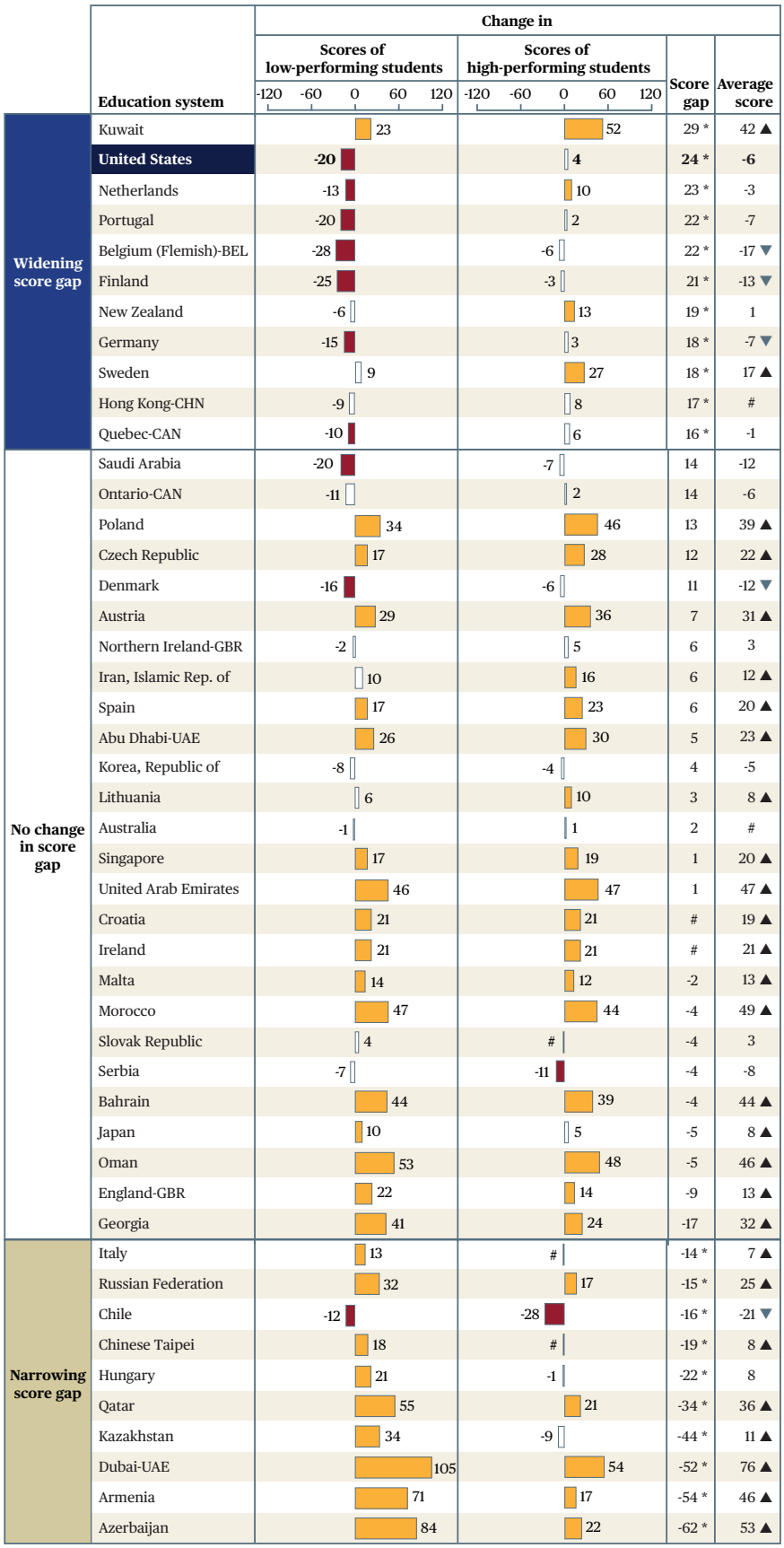
Education system	2011–2019 Change in score gap	2019 Average score	Education system	2011–2019 Change in score gap	2019 Average score
Singapore	-28 *	608 ▲	Italy	-5	500
Chinese Taipei	-4	574 ▲	New Zealand	16	499
Japan	-7	570 ▲	Bahrain	3	486 ▼
Korea, Republic of	16 *	561 ▲	Kazakhstan	17	478 ▼
Dubai-UAE	-7	548 ▲	Qatar	-47 *	475 ▼
Russian Federation	-2	543 ▲	United Arab Emirates	80 *	473 ▼
Finland	55 *	543 ▲	Romania	14	470 ▼
Quebec-CAN	5	537 ▲	Chile	11	462 ▼
Lithuania	3	534 ▲	Malaysia	-15	460 ▼
Hungary	2	530 ▲	Oman	-17 *	457 ▼
Australia	9	528 ▲	Jordan	-10	452 ▼
United States	**45 ***	**522 ▲**	Iran, Islamic Rep. of	-5	449 ▼
Ontario-CAN	28 *	522 ▲	Georgia	-19 *	447 ▼
Sweden	42 *	521 ▲	Saudia Arabia	16 *	431 ▼
England-GBR	16	517 ▲	Abu Dhabi-UAE	117 *	420 ▼
Turkey	-14	515 ▲	Morocco	-3	394 ▼
Israel	5	513 ▲	Lebanon	17	377 ▼
Hong Kong-CHN	61 *	504	South Africa (9)	-26 *	370 ▼

■ 2019 score gap significantly wider than 2011 score gap
□ 2019 score gap not significantly different from 2011 score gap
■ 2019 score gap significantly narrower than 2011 score gap

▲ 2019 average score significantly higher than the TIMSS centerpoint
▼ 2019 average score significantly lower than the TIMSS centerpoint

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Score gap refers to the gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile). Education systems are ordered by 2019 average score. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 4 for standard errors (**https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041**).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A5. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 4th-grade mathematics scale, by education system: 2011 and 2019



2019 score significantly higher than 2011 score
2019 score not significantly different from 2011 score
2019 score significantly lower than 2011 score
▲ 2019 average score significantly higher than 2011 average score
▼ 2019 average score significantly lower than 2011 average score

Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 1 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A6. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 4th-grade science scale, by education system: 2011 and 2019

	Education system	Change in: Scores of low-performing students (-120 -60 0 60 120)	Change in: Scores of high-performing students (-120 -60 0 60 120)	Score gap	Average score
Widening score gap	Netherlands	-27	3	30 *	-13 ▼
	Belgium (Flemish)-BEL	-21	3	24 *	-8 ▼
	Abu Dhabi-UAE	1	20	19 *	6
	Germany	-19	-1	18 *	-9 ▼
	Quebec-CAN	-4	13	17 *	6
	United States	**-14**	**#**	**14 ***	**-5**
No change in score gap	Saudi Arabia	-39	-20	19	-27 ▼
	Lithuania	18	30	12	23 ▲
	Japan	-3	8	11	3
	Finland	-21	-11	10	-16 ▼
	Austria	-14	-5	9	-9 ▼
	United Arab Emirates	35	42	6	45 ▲
	Northern Ireland-GBR	#	3	4	2
	Slovak Republic	-15	-12	3	-11 ▼
	Hong Kong-CHN	-5	-2	3	-4
	Korea, Republic of	1	2	#	1
	Sweden	5	4	-1	4
	Iran, Islamic Rep. of	-11	-14	-3	-12 ▼
	Ontario-CAN	-1	-5	-4	-4
	Australia	19	15	-5	17 ▲
	Kuwait	50	44	-6	45 ▲
	New Zealand	10	3	-7	6
	Serbia	5	-2	-7	1
	Croatia	13	5	-7	8 ▲
	Czech Republic	1	-7	-7	-3
	Denmark	-1	-10	-9	-6
	Ireland	16	7	-9	12 ▲
	Chile	-6	-15	-10	-11 ▼
	Portugal	-13	-26	-13	-18 ▼
	Georgia	9	-5	-13	-1
	Spain	15	-1	-15	6
	Morocco	115	91	-25	110 ▲
Narrowing score gap	Poland	33	19	-14 *	26 ▲
	Hungary	5	-13	-17 *	-5
	Italy	-5	-23	-18 *	-14 ▼
	Chinese Taipei	17	-2	-18 *	6 ▲
	Oman	70	50	-21 *	58 ▲
	Russian Federation	26	3	-23 *	15 ▲
	Azerbaijan	2	-23	-24 *	-11
	England-GBR	23	-3	-26 *	8 ▲
	Singapore	25	-2	-27 *	11 ▲
	Armenia	64	35	-30 *	50 ▲
	Malta	68	32	-35 *	50 ▲
	Bahrain	63	28	-35 *	43 ▲
	Kazakhstan	22	-15	-37 *	#
	Qatar	85	28	-58 *	55 ▲
	Dubai-UAE	124	46	-77 *	83 ▲

2019 score significantly higher than 2011 score
2019 score not significantly different from 2011 score
2019 score significantly lower than 2011 score

▲ 2019 average score significantly higher than 2011 average score
▼ 2019 average score significantly lower than 2011 average score

Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes all education systems that participated in TIMSS at 4th grade in both 2011 and 2019. Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 2 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

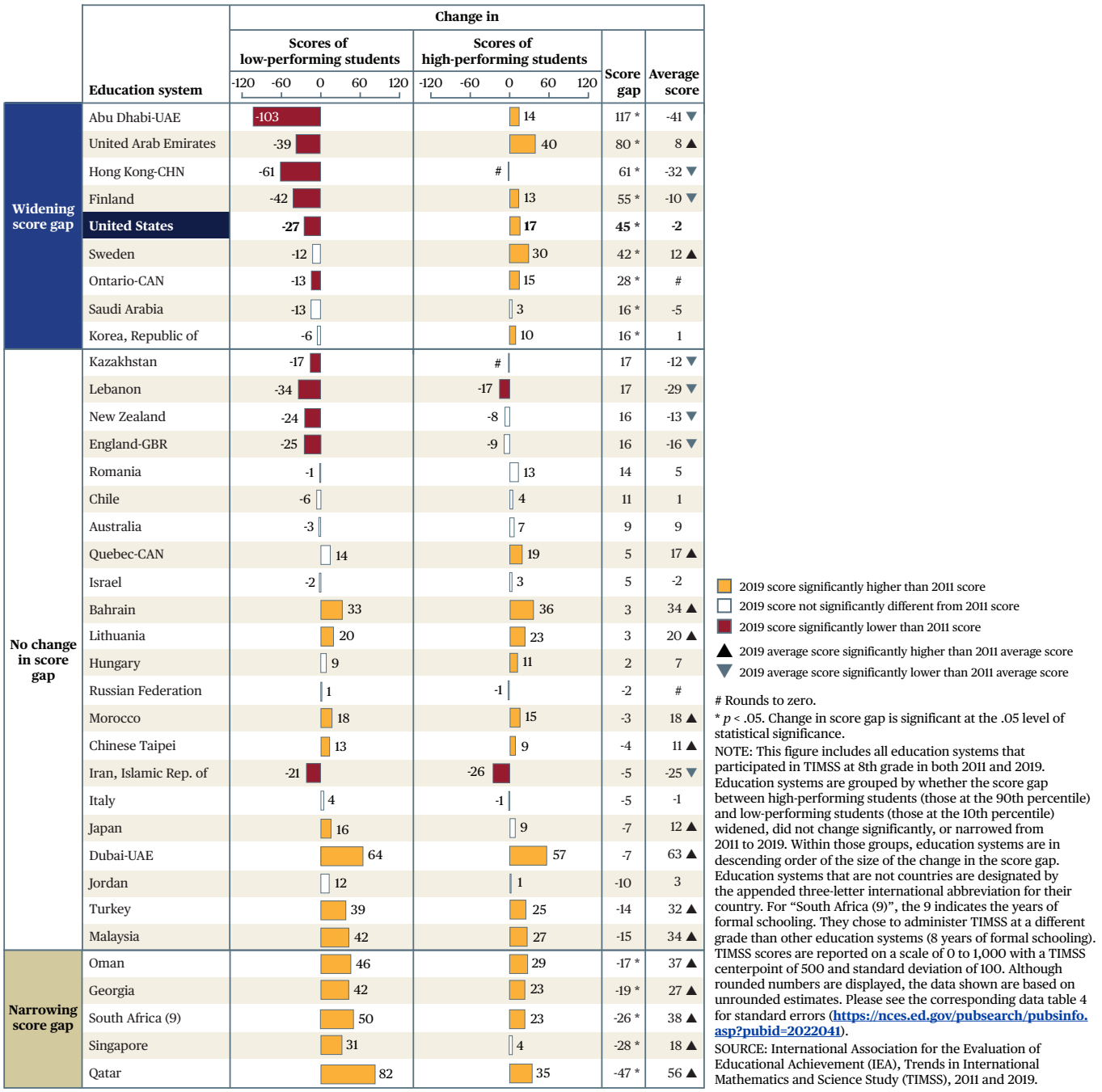
FIGURE A7. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 8th-grade mathematics scale, by education system: 2011 and 2019

	Education system	Change in: Scores of low-performing students	Change in: Scores of high-performing students	Score gap	Average score
		-120 -60 0 60 120	-120 -60 0 60 120		
Widening score gap	**United States**	**-24**	**35**	**59 ***	**6**
	Abu Dhabi-UAE	-36	13	48 *	-13 ▼
	United Arab Emirates	-4	38	43 *	18 ▲
	Sweden	7	33	26 *	18 ▲
	Finland	-17	6	23 *	-5
	Ontario	8	29	21 *	18 ▲
	Korea, Republic of	-17	3	20 *	-6
No change in score gap	Hong Kong-CHN	-15	2	16	-7
	Singapore	-7	6	12	5
	Quebec-CAN	7	18	11	12 ▲
	Australia	4	15	11	12
	Kazakhstan	-1	9	10	1
	New Zealand	-9	#	9	-6
	England-GBR	5	12	7	8
	Lithuania	15	22	7	18 ▲
	Hungary	13	17	4	12 ▲
	Israel	7	11	4	3
	Russian Federation	7	6	#	5
	Japan	27	26	-1	24 ▲
	Iran, Islamic Rep. of	33	31	-2	31 ▲
	Italy	4	-1	-5	-1
	Dubai-UAE	59	54	-5	59 ▲
	Lebanon	-15	-21	-6	-20 ▼
	Malaysia	27	20	-7	21 ▲
	Turkey	44	34	-10	43 ▲
	Romania	24	13	-11	21 ▲
	Bahrain	71	59	-12	72 ▲
	Chile	29	16	-13	24 ▲
Narrowing score gap	South Africa (9)	45	27	-18 *	38 ▲
	Chinese Taipei	16	-4	-19 *	3
	Oman	57	32	-26 *	45 ▲
	Jordan	35	3	-32 *	14 ▲
	Morocco	36	-2	-38 *	17 ▲
	Qatar	57	19	-38 *	34 ▲
	Saudi Arabia	20	-21	-41 *	#
	Georgia	59	13	-46 *	30 ▲

2019 score significantly higher than 2011 score
2019 score not significantly different from 2011 score
2019 score significantly lower than 2011 score
▲ 2019 average score significantly higher than 2011 average score
▼ 2019 average score significantly lower than 2011 average score

Rounds to zero.
* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.
NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 3 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.

FIGURE A8. Changes in scores of low- and high-performing students, score gaps, and average scores on the TIMSS 8th-grade science scale, by education system: 2011 and 2019



Rounds to zero.

* $p < .05$. Change in score gap is significant at the .05 level of statistical significance.

NOTE: This figure includes all education systems that participated in TIMSS at 8th grade in both 2011 and 2019. Education systems are grouped by whether the score gap between high-performing students (those at the 90th percentile) and low-performing students (those at the 10th percentile) widened, did not change significantly, or narrowed from 2011 to 2019. Within those groups, education systems are in descending order of the size of the change in the score gap. Education systems that are not countries are designated by the appended three-letter international abbreviation for their country. For "South Africa (9)", the 9 indicates the years of formal schooling. They chose to administer TIMSS at a different grade than other education systems (8 years of formal schooling). TIMSS scores are reported on a scale of 0 to 1,000 with a TIMSS centerpoint of 500 and standard deviation of 100. Although rounded numbers are displayed, the data shown are based on unrounded estimates. Please see the corresponding data table 4 for standard errors (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022041).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011 and 2019.