

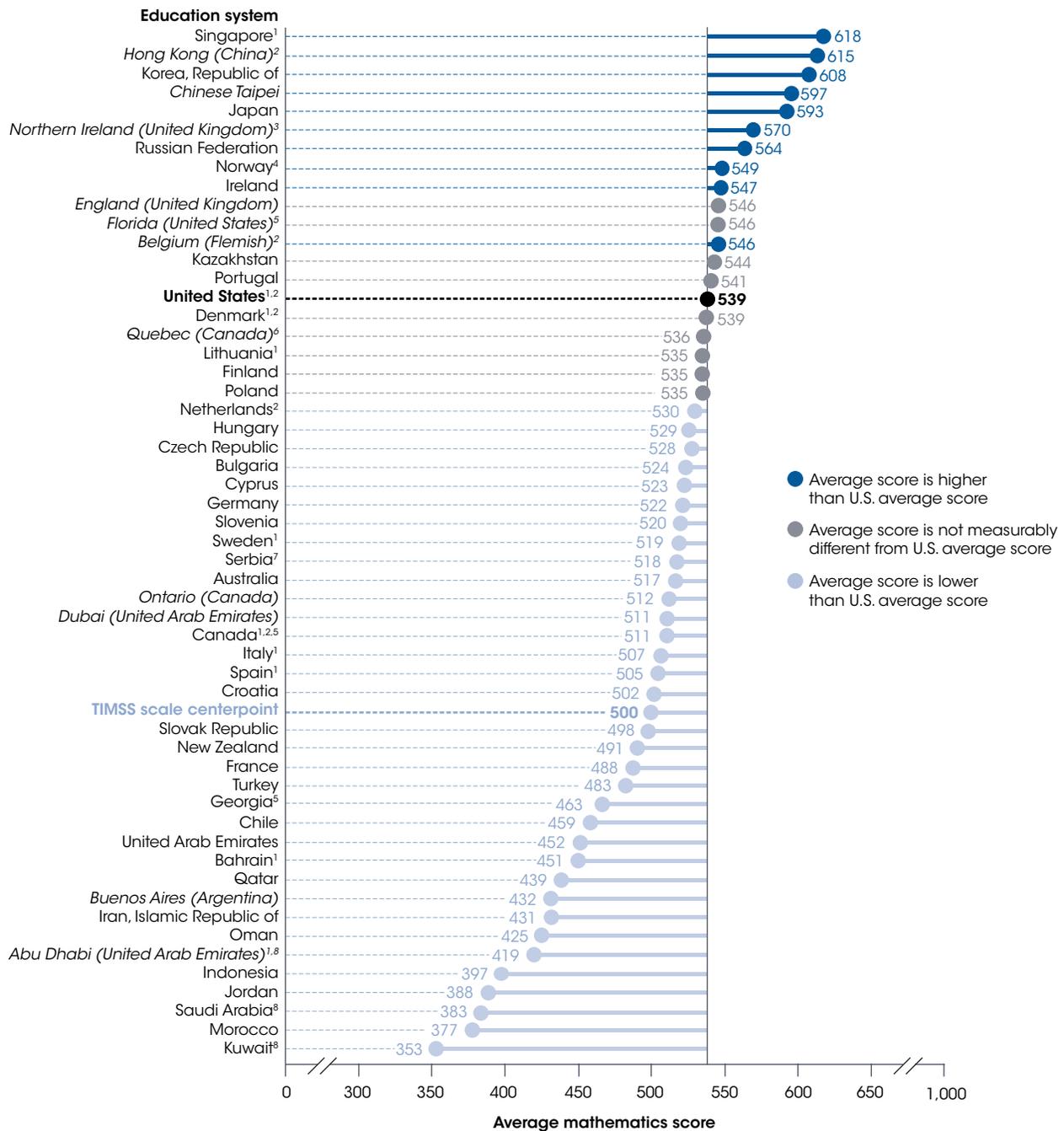
## International Comparisons: U.S. 4th-, 8th-, and 12th-Graders' Mathematics and Science Achievement

*According to the 2015 Trends in International Mathematics and Science Study (TIMSS), the United States was among the top 15 education systems in science (out of 54) at grade 4 and among the top 17 education systems in science (out of 43) at grade 8. In mathematics, the United States was among the top 20 education systems at grade 4 and top 19 education systems at grade 8.*

The Trends in International Mathematics and Science Study (TIMSS) is an international comparative assessment that evaluates mathematics and science knowledge and skills at grades 4 and 8. The TIMSS program also includes TIMSS Advanced, an international comparative study that measures the advanced mathematics and physics achievement of students in their final year of secondary school who are taking or have taken advanced courses. These assessments are coordinated by the TIMSS & PIRLS<sup>1</sup> International Study Center at Boston College, under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), an international organization of national research institutions and government agencies.

In 2015, TIMSS mathematics and science data were collected by 54 education systems at 4th grade and 43 education systems at 8th grade.<sup>2</sup> TIMSS Advanced data were also collected by nine education systems from students in the final year of their secondary schools (in the United States, 12th-graders). Education systems include countries (complete, independent, and political entities) and other benchmarking education systems (portions of a country, nation, kingdom, or emirate, and other non-national entities).<sup>3</sup> In addition to participating in the U.S. national sample, Florida participated individually as a state at the 4th and 8th grades.

Figure 1. Average TIMSS mathematics assessment scale scores of 4th-grade students, by education system: 2015



<sup>1</sup> National Defined Population covers 90 to 95 percent of the National Target Population, as defined by TIMSS.

<sup>2</sup> Met guidelines for sample participation rates only after replacement schools were included.

<sup>3</sup> Nearly satisfied guidelines for sample participation rates after replacement schools were included.

<sup>4</sup> Norway collected data from students in their fifth year of schooling rather than in grade 4 because year 1 in Norway is considered the equivalent of kindergarten rather than the first year of primary school.

<sup>5</sup> National Target Population does not include all of the International Target Population, as defined by TIMSS.

<sup>6</sup> Did not satisfy guidelines for sample participation rates.

<sup>7</sup> National Defined Population covers less than 90 percent of the National Target Population (but at least 77 percent), as defined by TIMSS.

<sup>8</sup> Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15 percent but does not exceed 25 percent.

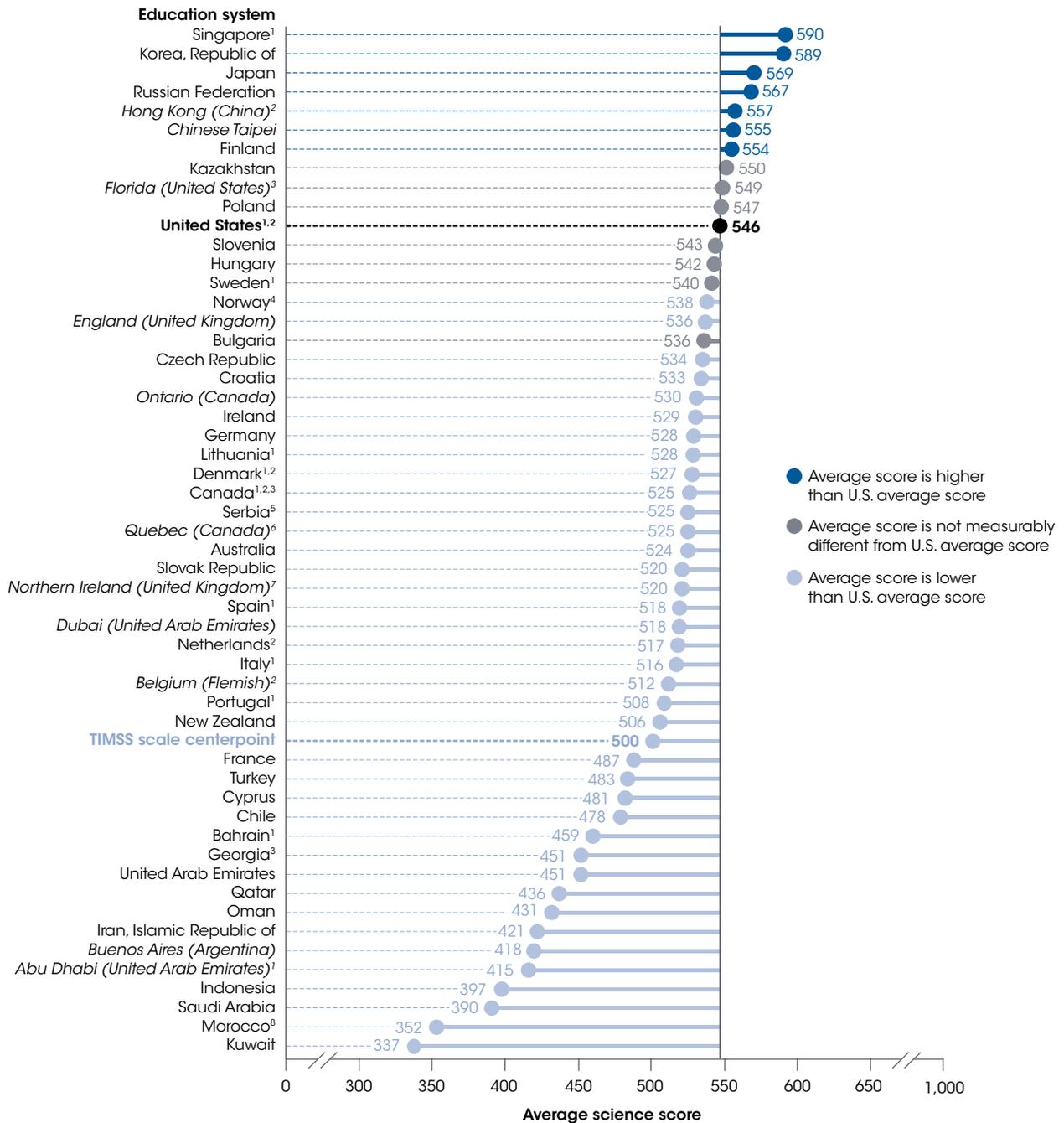
NOTE: Education systems are ordered by average score. Education systems that are not countries are shown in italics. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results (<http://timssandpirls.bc.edu/timss2015/international-results/>). U.S. state data are based on public school students only. The TIMSS scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995. For more information on the International and National Target Populations, see [https://nces.ed.gov/timss/timss15technotes\\_intlreqs.asp](https://nces.ed.gov/timss/timss15technotes_intlreqs.asp).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2015. See *Digest of Education Statistics 2016*, table 602.20.

At grade 4, the U.S. average mathematics score (539) in 2015 was higher than the TIMSS scale centerpoint (500).<sup>4</sup> Ten education systems<sup>5</sup> had higher average mathematics scores than the United States, 9 had scores that were not measurably different, and 34 education systems had lower average scores. The 10 education systems with average mathematics scores above the U.S. score were Belgium (Flemish), Chinese Taipei, Hong Kong (China), Ireland, Japan, Northern Ireland (Great Britain), Norway, the Republic of Korea, the Russian Federation, and Singapore. Florida's average mathematics score was not measurably different from the U.S. national average.

At grade 4, the U.S. average science score (546) in 2015 was also higher than the TIMSS scale centerpoint of 500. Seven education systems had higher average science scores than the United States, 7 had scores that were not measurably different, and 38 education systems had lower average scores. The 7 education systems with average science scores above the U.S. score were Chinese Taipei, Finland, Japan, Hong Kong (China), the Republic of Korea, the Russian Federation, and Singapore. Florida's average science score was not measurably different from the U.S. national average.

Figure 2. Average TIMSS science assessment scale scores of 4th-grade students, by education system: 2015



<sup>1</sup> National Defined Population covers 90 to 95 percent of the National Target Population, as defined by TIMSS.

<sup>2</sup> Met guidelines for sample participation rates only after replacement schools were included.

<sup>3</sup> National Target Population does not include all of the International Target Population, as defined by TIMSS.

<sup>4</sup> Norway collected data from students in their fifth year of schooling rather than in grade 4 because year 1 in Norway is considered the equivalent of kindergarten rather than the first year of primary school.

<sup>5</sup> National Defined Population covers less than 90 percent of the National Target Population (but at least 77 percent), as defined by TIMSS.

<sup>6</sup> Did not satisfy guidelines for sample participation rates.

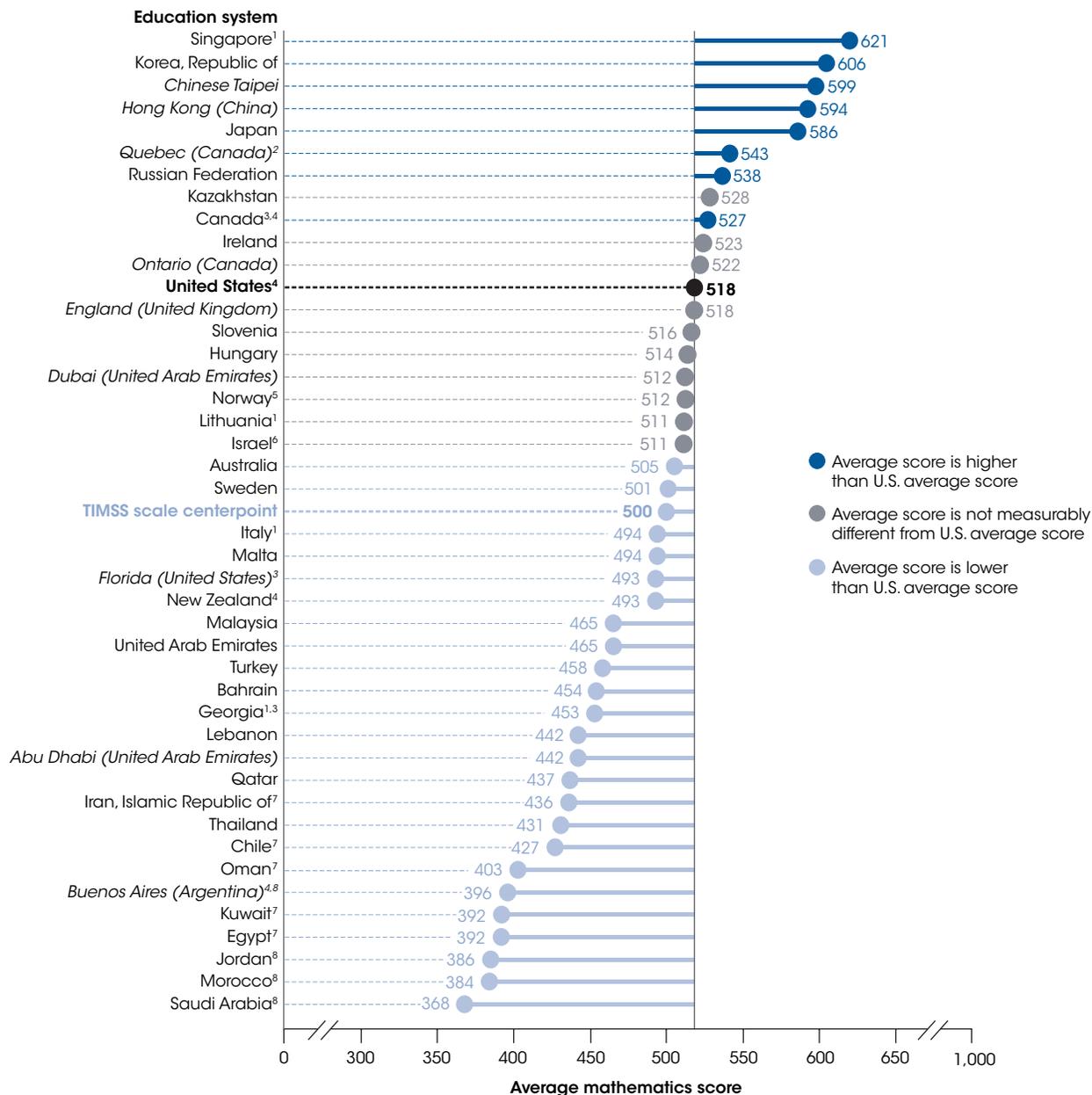
<sup>7</sup> Nearly satisfied guidelines for sample participation rates after replacement schools were included.

<sup>8</sup> Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15 percent but does not exceed 25 percent.

NOTE: Education systems are ordered by average score. Education systems that are not countries are shown in italics. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results (<http://timssandpirls.bc.edu/timss2015/international-results/>). U.S. state data are based on public school students only. The TIMSS scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995. For more information on the International and National Target Populations, see [https://nces.ed.gov/timss/timss15technotes\\_intlreqs.asp](https://nces.ed.gov/timss/timss15technotes_intlreqs.asp).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2015. See *Digest of Education Statistics 2016*, table 602.20.

Figure 3. Average TIMSS mathematics assessment scale scores of 8th-grade students, by education system: 2015

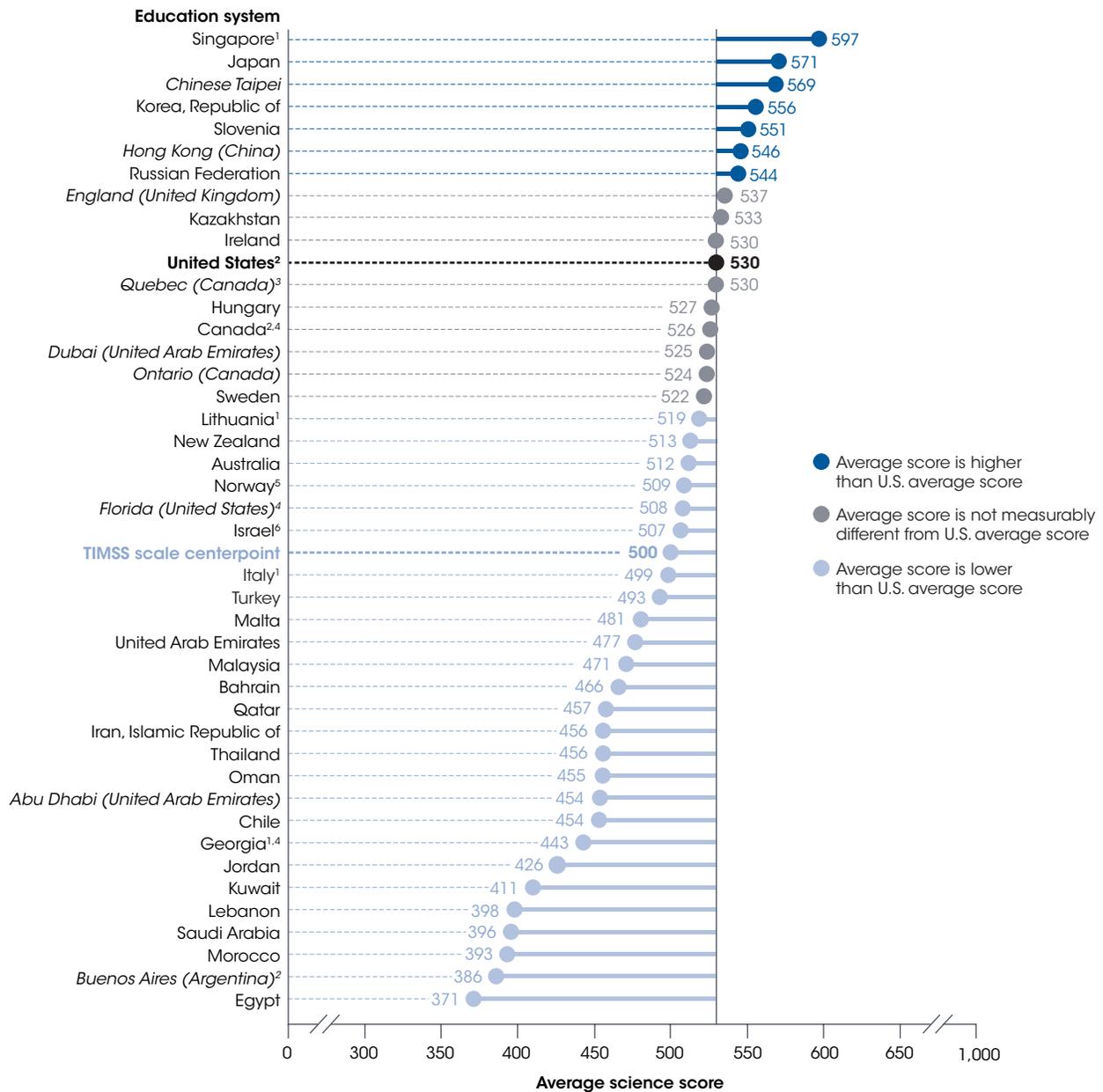


<sup>1</sup> National Defined Population covers 90 to 95 percent of the National Target Population, as defined by TIMSS.  
<sup>2</sup> Did not satisfy guidelines for sample participation rates.  
<sup>3</sup> National Target Population does not include all of the International Target Population, as defined by TIMSS.  
<sup>4</sup> Met guidelines for sample participation rates only after replacement schools were included.  
<sup>5</sup> Norway collected data from students in their fifth year of schooling rather than in grade 4 because year 1 in Norway is considered the equivalent of kindergarten rather than the first year of primary school.  
<sup>6</sup> National Defined Population covers less than 90 percent of the National Target Population (but at least 77 percent), as defined by TIMSS.  
<sup>7</sup> Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15 percent but does not exceed 25 percent.  
<sup>8</sup> Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25 percent.  
 NOTE: Education systems are ordered by average score. Education systems that are not countries are shown in italics. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results (<http://timssandpirls.bc.edu/timss2015/international-results/>). U.S. state data are based on public school students only. The TIMSS scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995. For more information on the International and National Target Populations, see [https://nces.ed.gov/timss/timss15technotes\\_intlreqs.asp](https://nces.ed.gov/timss/timss15technotes_intlreqs.asp).  
 SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2015. See *Digest of Education Statistics 2016*, table 602.30.

At grade 8, the U.S. average mathematics score (518) in 2015 was higher than the TIMSS scale centerpoint of 500. Eight education systems had higher average mathematics scores than the United States, 10 had scores that were not measurably different, and 24 education systems had lower average scores. The 8 education systems with average

mathematics scores above the U.S. score were Canada, Chinese Taipei, Hong Kong (China), Japan, Quebec (Canada), the Republic of Korea, the Russian Federation, and Singapore. Florida's average mathematics score was below the U.S. national average.

Figure 4. Average TIMSS science assessment scale scores of 8th-grade students, by education system: 2015



<sup>1</sup> National Defined Population covers 90 to 95 percent of the National Target Population, as defined by TIMSS.

<sup>2</sup> Met guidelines for sample participation rates only after replacement schools were included.

<sup>3</sup> Did not satisfy guidelines for sample participation rates.

<sup>4</sup> National Target Population does not include all of the International Target Population, as defined by TIMSS.

<sup>5</sup> Norway collected data from students in their fifth year of schooling rather than in grade 4 because year 1 in Norway is considered the equivalent of kindergarten rather than the first year of primary school.

<sup>6</sup> National Defined Population covers less than 90 percent of the National Target Population (but at least 77 percent), as defined by TIMSS.

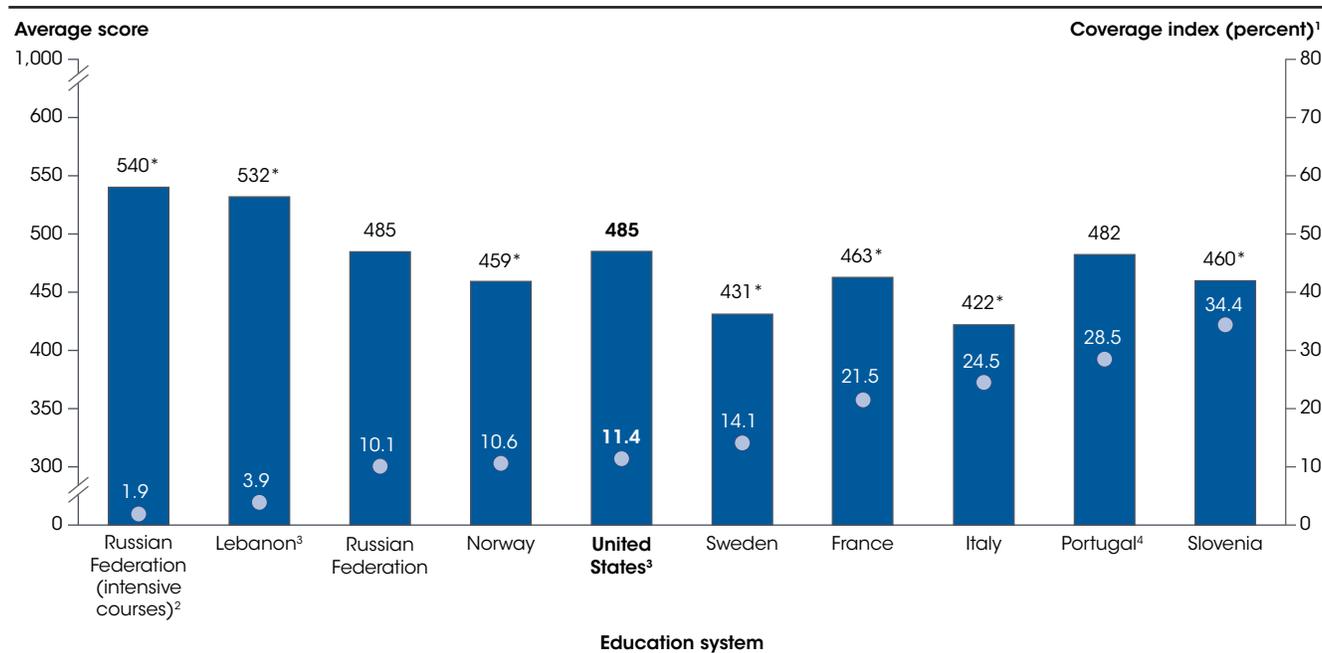
NOTE: Education systems are ordered by average score. Education systems that are not countries are shown in italics. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results (<http://timssandpirls.bc.edu/timss2015/international-results/>). U.S. state data are based on public school students only. The TIMSS scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995. For more information on the International and National Target Populations, see [https://nces.ed.gov/timss/timss15technotes\\_intlreqs.asp](https://nces.ed.gov/timss/timss15technotes_intlreqs.asp).

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2015. See *Digest of Education Statistics 2016*, table 602.30.

At grade 8, the U.S. average science score (530) in 2015 was higher than the TIMSS scale centerpoint of 500. Seven education systems had higher average science scores than the United States, 9 had scores that were not measurably different, and 26 education systems had lower

average scores. The seven education systems with average science scores above the U.S. score were Chinese Taipei, Hong Kong (China), Japan, the Republic of Korea, the Russian Federation, Singapore, and Slovenia. Florida's average science score was below the U.S. national average.

**Figure 5. Average advanced mathematics scores and coverage index of TIMSS Advanced students, by education system: 2015**



\*  $p < .05$ . Significantly different from the U.S. percentage.

<sup>1</sup> The advanced mathematics coverage index is the percentage of the corresponding age cohort covered by students in their final year of secondary school who have taken or are taking advanced mathematics courses. The corresponding age cohort is determined for education systems individually. In the United States, the corresponding age cohort is considered 18-year-olds. For additional details, see the Technical Notes available at <http://nces.ed.gov/timss/timss15technotes.asp>.

<sup>2</sup> Intensive courses are advanced mathematics courses that involve 6 or more hours per week. Results for students in these courses are reported separately from the results for other students from the Russian Federation taking courses that involve 4.5 hours per week.

<sup>3</sup> Did not satisfy guidelines for sample participation rates.

<sup>4</sup> Met guidelines for sample participation rates only after replacement schools were included.

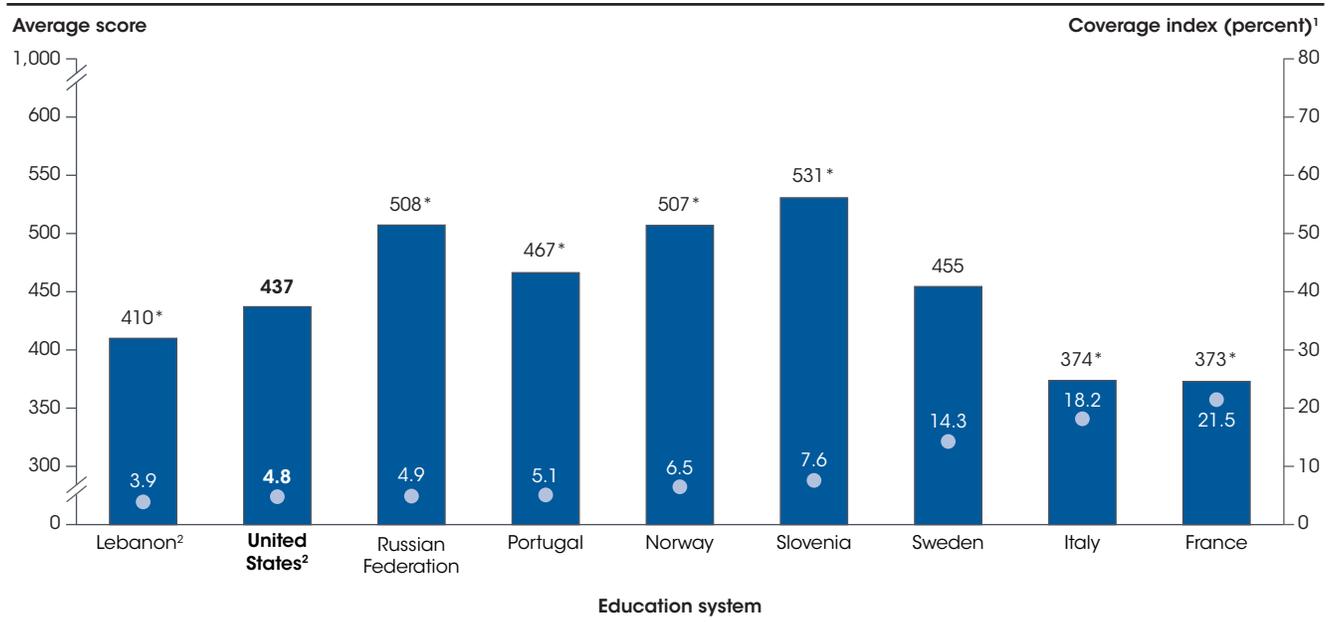
NOTE: Education systems are ordered by the advanced mathematics coverage index. The TIMSS Advanced scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS Advanced scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS) Advanced, 2015. See *Digest of Education Statistics 2016*, table 602.35.

The TIMSS Advanced assessment measures the advanced mathematics and physics achievement of students in their final year of secondary school who are taking or have taken advanced courses. In TIMSS Advanced, the U.S. average advanced mathematics score (485) in 2015 was lower than the TIMSS Advanced scale centerpoint (500). Two education systems had higher average advanced mathematics scores than the United States, two (Portugal and the Russian Federation) had scores that were not measurably different, and five education systems had lower average scores. The education systems with higher average

advanced mathematics scores than the United States were Lebanon and the Russian Federation's intensive track (i.e., advanced students taking 6 or more hours of advanced mathematics per week).<sup>6</sup> Such comparisons, however, should take into account the "coverage index," which represents the percentage of students eligible to take the advanced mathematics assessment. The advanced mathematics coverage index ranged from 1.9 percent for the Russian Federation's intensive track to 34.4 percent in Slovenia.

**Figure 6. Average physics scores and coverage index of TIMSS Advanced students, by education system: 2015**



\*  $p < .05$ . Significantly different from the U.S. percentage.

<sup>1</sup> The physics coverage index is the percentage of the corresponding age cohort covered by students in their final year of secondary school who have taken or are taking physics courses. The corresponding age cohort is determined for education systems individually. In the United States, the corresponding age cohort is considered 18-year-olds. For additional details, see the Technical Notes available at <http://nces.ed.gov/timss/timss15technotes.asp>.

<sup>2</sup> Did not satisfy guidelines for sample participation rates.

NOTE: Education systems are ordered by the advanced physics coverage index. The TIMSS Advanced scale centerpoint is set at 500 points and represents the mean of the overall achievement distribution in 1995. The TIMSS Advanced scale is the same in each administration; thus, a value of 500 in 2015 equals 500 in 1995. SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS) Advanced, 2015. See *Digest of Education Statistics 2016*, table 602.35.

In TIMSS Advanced, the U.S. average physics score (437) in 2015 was lower than the TIMSS Advanced scale centerpoint (500). Four education systems had higher average physics scores than the United States, one (Sweden) had a score that was not measurably different, and three education systems had lower average scores. The education

systems with higher average advanced science scores than the United States were Norway, Portugal, the Russian Federation, and Slovenia. The physics coverage index ranged from 3.9 percent in Lebanon to 21.5 percent in France.

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**Endnotes:**

<sup>1</sup> The Progress in International Reading Literacy Study (PIRLS) evaluates reading literacy at grade 4. For more information on PIRLS, see indicator [International Comparisons: Reading Literacy at Grade 4](#).

<sup>2</sup> Armenia, which participated at both grades, is not included in these counts or the results reported in this indicator because their data are not comparable for trend analyses.

<sup>3</sup> Benchmarking systems are able to participate in TIMSS even though they may not be members of the IEA. Participating allows them the opportunity to assess their students' achievement and to evaluate their curricula in an international context.

<sup>4</sup> TIMSS and TIMSS Advanced scores are reported on a scale from 0 to 1,000, with a scale centerpoint set at 500 and the standard deviation set at 100. The TIMSS scale centerpoint represents the mean of the overall achievement distribution in 1995. The TIMSS scale is the same in each administration; thus,

a value of 500 in 2015 equals 500 in 1995 when that was the international average.

<sup>5</sup> The IEA differentiates between IEA members, referred to always as "countries" and "benchmarking participants." IEA member countries include both "countries," which are complete, independent political entities and "other education systems," or non-national entities (e.g., England, the Flemish community of Belgium). Non-national entities that are not IEA member countries (i.e., Florida, Abu Dhabi) are designated as "benchmarking participants." For convenience, the generic term "education systems" is used when summarizing across results.

<sup>6</sup> The Russian Federation tested two samples in advanced mathematics in 2015. Results for students in the intensive mathematics courses of 6 or more hours per week are reported separately from the results for the Russian Federation's advanced students taking courses of only 4.5 hours per week.

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**Reference tables:** *Digest of Education Statistics 2016*, tables 602.20, 602.30, and 602.35

**Glossary:** N/A

**Related indicators and resources:** [International Comparisons: Reading Literacy at Grade 4](#); [International Comparisons: Science, Reading, and Mathematics Literacy of 15-Year-Old Students](#); [Mathematics Performance](#); [Science Performance](#)