

Chapter 2

Performance at the TIMSS 2011 International Benchmarks

The five East Asian countries had the largest percentages of fourth grade students (30–43%) reach the TIMSS 2011 Advanced International Benchmark. Building on this head start, these five countries pulled away from the rest of the world by a considerable margin at the eighth grade, with by far the largest percentages of students reaching this benchmark—nearly half (47–49%) in Chinese Taipei, Singapore, and Korea.

Remarkably, nine countries raised achievement across their entire fourth grade student distribution, from low to high performers, improving across all four international benchmarks over the past decade; only one declined across all four benchmarks. At the eighth grade, only three countries showed improvement across all benchmarks, and three had declines.

TIMSS Mathematics Benchmarks:

Advanced International Benchmark 625

High International Benchmark 550

Intermediate International Benchmark 475

Low International Benchmark 400

The TIMSS achievement scale summarizes student performance on test items designed to measure breadth of content in number, algebra, geometry, and data as well as a range of cognitive processes within the knowing, applying, and reasoning domains. TIMSS reports achievement at four points along the scale as international benchmarks: Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475), and Low International Benchmark (400).

This chapter presents the mathematics results at the TIMSS 2011 International Benchmarks. To interpret achievement at the benchmarks, the TIMSS & PIRLS International Study Center worked with the TIMSS 2011 Science and Mathematics Item Review Committee (SMIRC) to conduct a detailed scale anchoring analysis to describe mathematics achievement at the benchmarks. The chapter contains those descriptions along with a number of example items together with results, to illustrate performance at the benchmarks.

TIMSS 2011 Mathematics Framework

The items used in TIMSS 2011 were selected and developed based on the TIMSS 2011 Mathematics Framework contained in the *TIMSS 2011 Assessment Frameworks*. The mathematics assessments at the fourth and eighth grade each were organized around two dimensions: a content dimension specifying the subject matter or content domains to be assessed, and a cognitive dimension specifying the thinking processes that students are likely to use as they engage with the content. As illustrated below, the fourth grade has three content domains: number, geometric shapes and measures, and data display. Number received 50 percent of the assessment emphasis, geometric shapes and measures 35 percent, and data display 15 percent. At the eighth grade, there are four content domains: number, algebra, geometry, and data and chance. Number and algebra each received 30 percent of the assessment emphasis,

while geometry and data and chance each received 20 percent. The same three cognitive domains—knowing, applying, and reasoning—were used at both fourth and eighth grades, although there was somewhat less emphasis on knowing at the eighth grade and slightly more emphasis on reasoning.

Fourth Grade Content Domains	Eighth Grade Content Domains
50% Number	30% Number
35% Geometric Shapes and Measures	30% Algebra
15% Data Display	20% Geometry
	20% Data and Chance

Fourth Grade Cognitive Domains	Eighth Grade Cognitive Domains
40% Knowing	35% Knowing
40% Applying	40% Applying
20% Reasoning	25% Reasoning

● **Advanced International Benchmark**

625 *Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning.* They can solve a variety of multi-step word problems involving whole numbers, including proportions. Students at this level show an increasing understanding of fractions and decimals. Students can apply geometric knowledge of a range of two- and three-dimensional shapes in a variety of situations. They can draw a conclusion from data in a table and justify their conclusion.

○ **High International Benchmark**

550 *Students can apply their knowledge and understanding to solve problems.* Students can solve word problems involving operations with whole numbers. They can use division in a variety of problem situations. They can use their understanding of place value to solve problems. Students can extend patterns to find a later specified term. Students demonstrate understanding of line symmetry and geometric properties. Students can interpret and use data in tables and graphs to solve problems. They can use information in pictographs and tally charts to complete bar graphs.

● **Intermediate International Benchmark**

475 *Students can apply basic mathematical knowledge in straightforward situations.* Students at this level demonstrate an understanding of whole numbers and some understanding of fractions. Students can visualize three-dimensional shapes from two-dimensional representations. They can interpret bar graphs, pictographs, and tables to solve simple problems.

○ **Low International Benchmark**

400 *Students have some basic mathematical knowledge.* Students can add and subtract whole numbers. They have some recognition of parallel and perpendicular lines, familiar geometric shapes, and coordinate maps. They can read and complete simple bar graphs and tables.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Fourth Grade Results for the TIMSS 2011 International Benchmarks in Mathematics

Fourth Grade TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.1 summarizes what fourth grade students scoring at the TIMSS International Benchmarks typically know and can do in mathematics. Detailed descriptions of each benchmark level are presented together with example items in subsequent sections of the chapter.

There was substantial variation in performance between students achieving at the high end of the scale and the low end of the scale. At the fourth grade, students at the Advanced International Benchmark applied their understanding and knowledge in a variety of relatively complex situations and were able to explain their reasoning. They could solve a variety of multi-step word problems, and showed an increasing understanding of fractions and decimals. Also, they applied geometric knowledge in a range of situations and could draw a conclusion from a table. Students at the High International Benchmark could solve word problems involving operations with whole numbers, and were able to interpret and use data in tables and graphs to solve problems. At the Intermediate International Benchmark students demonstrated an understanding of whole numbers, they could visualize three-dimensional shapes from two-dimensional representations, and they could interpret a variety of graphs. Students at the Low International Benchmark were able to add and subtract whole numbers, recognize some geometric shapes, and read simple graphs and tables.

Fourth Grade Achievement at the TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.2 presents the percentage of students reaching each TIMSS 2011 International Benchmark. The results are presented in descending order according to the percentage of students reaching the Advanced International Benchmark, first for countries that tested fourth grade students, followed by those who tested sixth grade students and benchmarking participants on the second page. The percentage of students reaching the Advanced Benchmark is indicated in the bar graph with a black dot. Because students who reached the Advanced Benchmark also reached the other benchmarks, the percentages illustrated in the graphic and shown in the columns to the right are cumulative.

The five East Asian countries had the largest percentages of students reaching the Advanced International Benchmark. Singapore had 43 percent of their students reach the Advanced International Benchmark, followed by

Korea (39%), Hong Kong SAR (37%), Chinese Taipei (34%), and Japan (30%). Northern Ireland was next with 24 percent, then England, 18 percent, followed by a group of eight countries with 10 to 13 percent.

Exhibit 2.2 also provides useful information about the distribution of achievement in each country. For example, even though the Netherlands had fewer students (5%) reaching the advanced level than did the top-performing Asian countries, it had just as many fourth grade students reaching the low level (99%).

As a point of reference, Exhibit 2.2 provides the median at the fourth grade for each of the benchmarks at the bottom of each of the four right hand columns. By definition, half of the countries will have a percentage in the column above the median and half will be below the median. The median percentages of students reaching the International Benchmarks were as follows: Advanced—4 percent, High—28 percent, and Intermediate—69 percent. Many countries are able to educate almost all of their fourth grade students to a basic level of mathematics achievement, as evidenced by a median percentage for the Low International Benchmark of 90 percent.

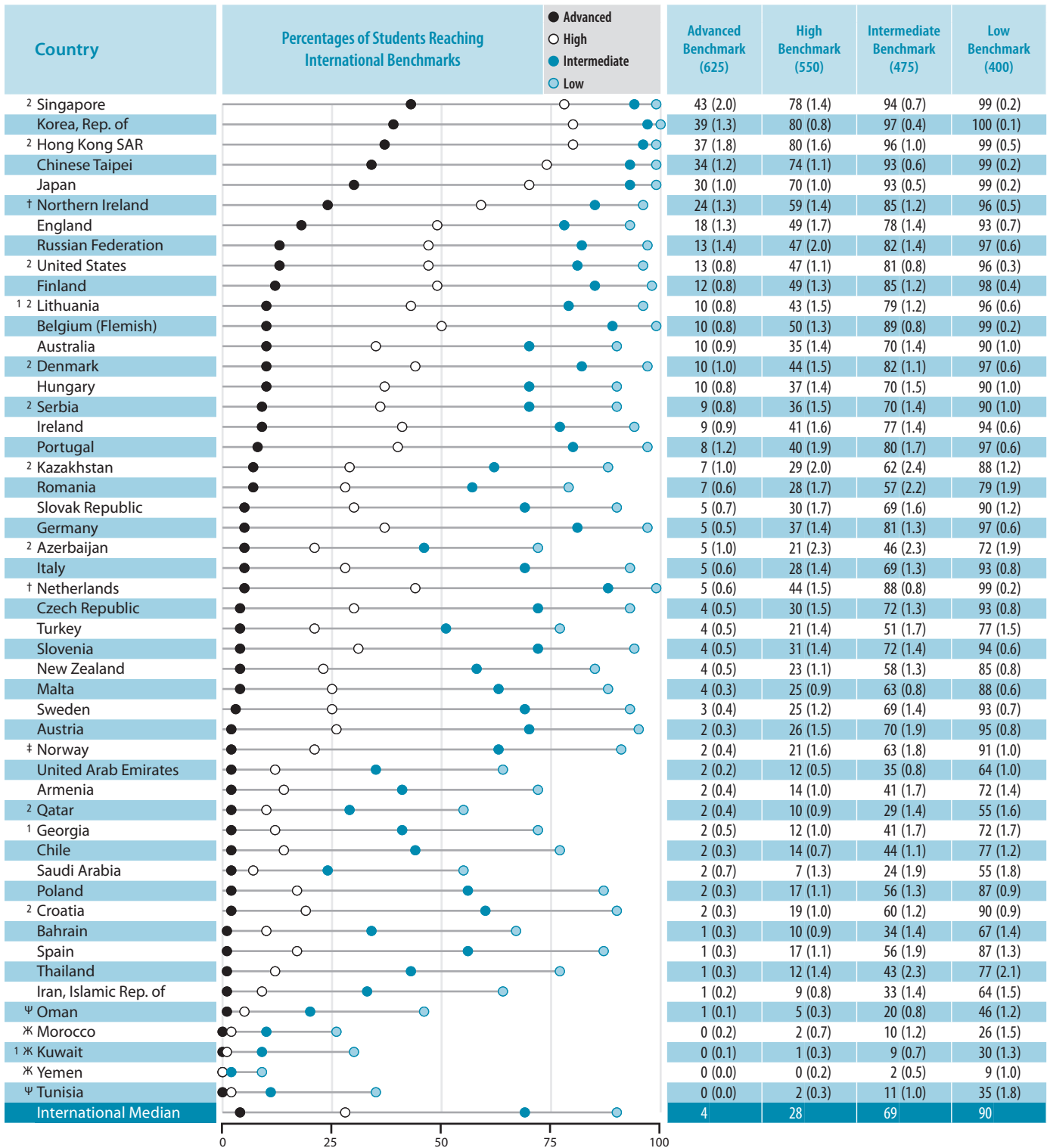
Fourth Grade Trends in Performance at the TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.3 shows the changes in percentages of fourth grade students reaching the benchmarks for countries and benchmarking participants that also participated in TIMSS 1995, 2003, and/or 2007. An up arrow indicates that the percentage of students reaching a benchmark is higher in 2011 than the past cycle, and a down arrow indicates that the percentage is lower in 2011. The patterns in this exhibit generally mirror the trends in average achievement discussed in Chapter 1, and can provide further information about countries' improvement or decline over time.

In general, there were more improvements across the International Benchmarks in 2011 than there were declines. Remarkably, a number of countries have improved since 1995 at all four benchmarks, including Korea (with a ceiling effect at the Low Benchmark), Hong Kong SAR, Japan, England, the United States, Australia, Portugal, Slovenia, and Iran. Singapore and Norway had gains at all except the Advanced Benchmark, and New Zealand improved at the two lower levels.

The Czech Republic was the only country to show declines at all four levels since 1995, although it showed signs of recovery with improvement at all four levels since 2007. Austria declined at all except the low level, and the Netherlands declined at the two top levels.

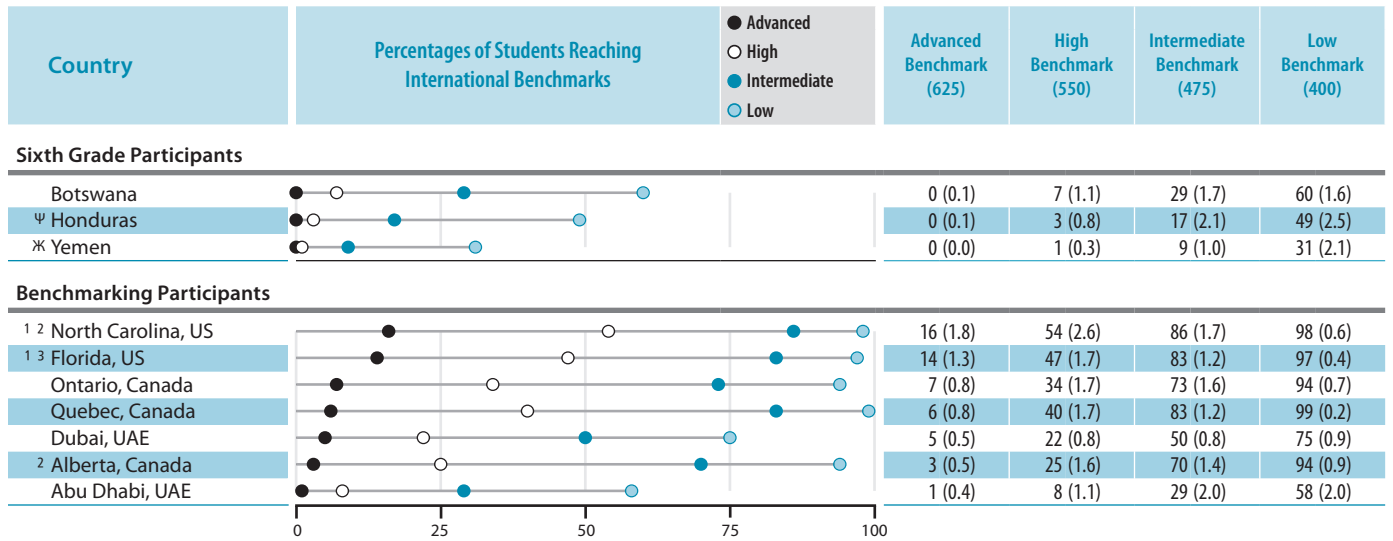
Exhibit 2.2: Performance at the International Benchmarks of Mathematics Achievement



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

⌘ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
^ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation is less than 25% but exceeds 15%.
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and ⌘.
 (.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.2: Performance at the International Benchmarks of Mathematics Achievement (Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.3: Trends in Percentages of Students Reaching the International Benchmarks of Mathematics Achievement

Country	Advanced International Benchmark (625)				High International Benchmark (550)			
	Percent of Students				Percent of Students			
	2011	2007	2003	1995	2011	2007	2003	1995
Singapore	43	41	38	38	78	74	73	70 ▲
Korea, Rep. of	39			25 ▲	80			70 ▲
Hong Kong SAR	37	40	22 ▲	17 ▲	80	81	67 ▲	56 ▲
Chinese Taipei	34	24 ▲	16 ▲		74	66 ▲	61 ▲	
Japan	30	23 ▲	21 ▲	22 ▲	70	61 ▲	60 ▲	61 ▲
England	18	16	14 ▲	7 ▲	49	48	43 ▲	24 ▲
Russian Federation	13	16	11		47	48	41	
United States	13	10 ▲	7 ▲	9 ▲	47	40 ▲	35 ▲	37 ▲
Lithuania	10	10	10		43	42	44	
Belgium (Flemish)	10		10		50		51	
Australia	10	9	5 ▲	6 ▲	35	35	26 ▲	27 ▲
Denmark	10	7 ▲			44	36 ▲		
Hungary	10	9	10	11	37	35	41 ▼	38
Ireland	9			10	41			40
Portugal	8			1 ▲	40			11 ▲
Slovak Republic	5	5			30	26		
Germany	5	6			37	37		
Italy	5	6	6		28	29	29	
Netherlands	5	7	5	12 ▼	44	42	44	50 ▼
Czech Republic	4	2 ▲		16 ▼	30	19 ▲		46 ▼
Slovenia	4	3	2 ▲	2 ▲	31	25 ▲	18 ▲	14 ▲
New Zealand	4	5	5	4	23	26 ▼	26 ▼	19
Sweden	3	3			25	24		
Austria	2	3		10 ▼	26	26		42 ▼
Norway	2	2	1 ▲	2	21	15 ▲	10 ▲	16 ▲
Armenia	2		2		14		13	
Georgia	2	1			12	10		
Iran, Islamic Rep. of	1	0 ▲	0 ▲	0 ▲	9	3 ▲	2 ▲	3 ▲
Ψ Tunisia	0	0	0		2	1	1	

Benchmarking Participants

Ontario, Canada	7	4 ▲	5	4 ▲	34	29 ▲	29	22 ▲
Quebec, Canada	6	5	3 ▲	13 ▼	40	34 ▲	25 ▲	50 ▼
Dubai, UAE	5	2 ▲			22	12 ▲		
Alberta, Canada	3	3		9 ▼	25	25		39 ▼

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations. An empty cell indicates a country did not participate in that year's assessment.

Exhibit 2.3: Trends in Percentages of Students Reaching the International Benchmarks of Mathematics Achievement (Continued)

Country	Intermediate International Benchmark (475)				Low International Benchmark (400)			
	Percent of Students				Percent of Students			
	2011	2007	2003	1995	2011	2007	2003	1995
Singapore	94	92	91	89 ▲	99	98	97 ▲	96 ▲
Korea, Rep. of	97			94 ▲	100			99
Hong Kong SAR	96	97	94 ▲	87 ▲	99	100	99	97 ▲
Chinese Taipei	93	92	92		99	99	99	
Japan	93	89 ▲	89 ▲	89 ▲	99	98 ▲	98 ▲	98 ▲
England	78	79	75	54 ▲	93	94	93	82 ▲
Russian Federation	82	81	76 ▲		97	95 ▲	95	
United States	81	77 ▲	72 ▲	71 ▲	96	95	93 ▲	92 ▲
Lithuania	79	77	79		96	94	96	
Belgium (Flemish)	89		90		99		99	
Australia	70	71	64 ▲	61 ▲	90	91	88	86 ▲
Denmark	82	76 ▲			97	95		
Hungary	70	67	76 ▼	72	90	88	94 ▼	91
Ireland	77			73	94			91 ▲
Portugal	80			37 ▲	97			70 ▲
Slovak Republic	69	63 ▲			90	88		
Germany	81	78			97	96		
Italy	69	67	65		93	91	89 ▲	
Netherlands	88	84 ▲	89	87	99	98 ▲	99	99
Czech Republic	72	59 ▲		79 ▼	93	88 ▲		95 ▼
Slovenia	72	67 ▲	55 ▲	45 ▲	94	92 ▲	84 ▲	77 ▲
New Zealand	58	61	61	51 ▲	85	85	86	78 ▲
Sweden	69	68			93	93		
Austria	70	69		77 ▼	95	93 ▲		94
Norway	63	52 ▲	41 ▲	53 ▲	91	83 ▲	75 ▲	84 ▲
Armenia	41		43		72		75	
Georgia	41	35 ▲			72	67 ▲		
Iran, Islamic Rep. of	33	20 ▲	17 ▲	15 ▲	64	53 ▲	45 ▲	44 ▲
ψ Tunisia	11	9 ▲	9		35	28 ▲	28 ▲	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Benchmarking Participants

Ontario, Canada	73	71	70	59 ▲	94	94	94	86 ▲
Quebec, Canada	83	74 ▲	69 ▲	87 ▼	99	96 ▲	94 ▲	98
Dubai, UAE	50	37 ▲			75	69 ▲		
Alberta, Canada	70	69		74	94	94		93

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

Fourth Grade TIMSS 2011 Low International Benchmark

Exhibit 2.4 presents the description of student achievement at the Low International Benchmark. Students demonstrated some basic mathematical knowledge, including adding and subtracting with whole numbers. They recognized familiar geometric shapes, and could read and complete simple bar graphs and tables.

As specified in the TIMSS 2011 Mathematics Framework, half of the fourth grade assessment was devoted to items in the number domain. More specifically, the framework covered whole numbers, fractions and decimals, number sentences, and patterns. Working with whole numbers is the foundation of mathematics in the primary school; and often, items answered correctly by students achieving at the lower scale levels involved operations with whole numbers and decimals.

Exhibit 2.5 presents Example Item 1, an addition word problem exemplifying student achievement at the Low International Benchmark. In TIMSS 2011, some of the constructed response items were worth 1 point and some 2 points, and the illustrative answers provided with the example items always show an answer that received full credit. The number of possible points for each constructed-response item is indicated across the bottom of the exhibit. With an international average of 73 percent correct across the fourth grade countries, this whole number addition item was relatively easy for students in many countries.

Exhibit 2.6 contains Example Item 2 from the data display domain. By the fourth grade, students should be developing skills in representing data, and this item is an example of the types of problems successfully solved by students reaching the Low Benchmark. The item asked students to complete a bar graph based on given information. Again, the international average was 73 percent, and this task was relatively easy for students in a number of countries

● **Low International Benchmark**

400

Summary

Students have some basic mathematical knowledge. Students can add and subtract whole numbers. They have some recognition of parallel and perpendicular lines, familiar geometric shapes, and coordinate maps. They can read and complete simple bar graphs and tables.

Students at this level can add and subtract whole numbers. For example, they can add a four-digit and a three-digit whole number. They are familiar with numbers into the thousands.

Students have some recognition of parallel and perpendicular lines and familiar geometric shapes. They can locate positions on a map (e.g., A3). Students can read and complete simple bar graphs and tables.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.5: Low International Benchmark – Example Item 1

Country	Percent Full Credit
² Singapore	93 (0.8) ▲
Korea, Rep. of	93 (1.2) ▲
Japan	91 (1.1) ▲
Chinese Taipei	89 (1.6) ▲
Portugal	89 (1.6) ▲
² Croatia	89 (1.2) ▲
² Serbia	87 (1.7) ▲
² Hong Kong SAR	86 (1.8) ▲
Russian Federation	86 (1.3) ▲
² United States	84 (0.9) ▲
Hungary	84 (1.6) ▲
Slovak Republic	83 (1.7) ▲
Italy	83 (1.7) ▲
Spain	83 (1.7) ▲
^{1 2} Lithuania	82 (1.9) ▲
Ireland	82 (1.8) ▲
Slovenia	81 (2.2) ▲
Belgium (Flemish)	81 (1.8) ▲
Turkey	81 (2.0) ▲
† Netherlands	81 (1.9) ▲
Malta	81 (1.7) ▲
² Kazakhstan	80 (2.3) ▲
† Northern Ireland	80 (2.3) ▲
Czech Republic	79 (2.4) ▲
Austria	79 (1.8) ▲
Germany	79 (1.5) ▲
England	78 (2.3) ▲
Romania	77 (2.2) ▲
Chile	77 (1.8) ▲
² Denmark	77 (1.7) ▲
Thailand	76 (2.5)
Sweden	75 (2.2)
¹ Georgia	75 (2.3)
Poland	75 (2.1)
International Avg.	73 (0.3)
Iran, Islamic Rep. of	70 (2.1)
Armenia	70 (1.8)
Australia	69 (2.2)
² Azerbaijan	68 (2.6)
Finland	68 (2.6) ▼
‡ Norway	67 (2.7) ▼
Bahrain	64 (2.4) ▼
United Arab Emirates	54 (1.3) ▼
New Zealand	52 (1.7) ▼
Tunisia	48 (2.4) ▼
² Qatar	48 (1.9) ▼
Oman	41 (1.6) ▼
Saudi Arabia	39 (2.4) ▼
Morocco	35 (2.1) ▼
¹ Kuwait	24 (1.9) ▼
Yemen	15 (1.9) ▼

Content Domain: Number

Cognitive Domain: Applying

Description: Solves a word problem involving addition of three-digit whole numbers

There are 218 passengers and 191 crew members on a ship.
How many people are on the ship altogether?

Answer: 409

Copyright protected by IEA. This item may not be used for commercial purposes without express permission from IEA.

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Sixth Grade Participants	
Botswana	74 (1.9)
Honduras	67 (2.7) ▼
Yemen	34 (2.7) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} North Carolina, US	88 (2.0) ▲
Quebec, Canada	88 (1.5) ▲
^{1 3} Florida, US	87 (2.0) ▲
² Alberta, Canada	76 (2.2)
Ontario, Canada	74 (2.3)
Dubai, UAE	70 (1.7)
Abu Dhabi, UAE	47 (2.5) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

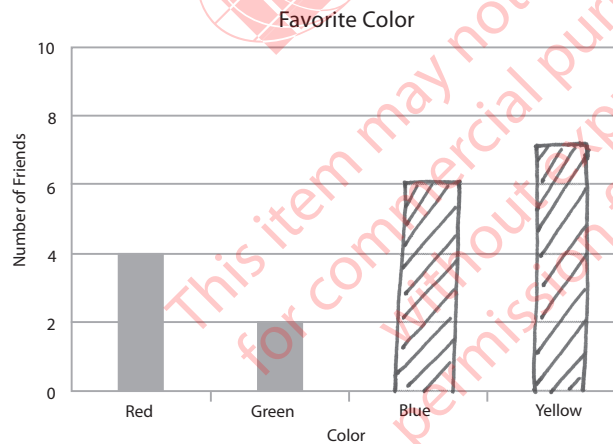
Country	Percent Full Credit
Korea, Rep. of	97 (0.7) ▲
² Singapore	95 (0.8) ▲
² Hong Kong SAR	95 (1.1) ▲
Japan	93 (1.1) ▲
† Northern Ireland	92 (1.6) ▲
† Netherlands	91 (1.5) ▲
England	89 (1.3) ▲
Finland	88 (1.7) ▲
Germany	88 (1.2) ▲
^{1 2} Lithuania	87 (1.9) ▲
Ireland	87 (1.5) ▲
Chinese Taipei	87 (1.8) ▲
Belgium (Flemish)	86 (1.3) ▲
Australia	84 (1.6) ▲
Portugal	84 (2.0) ▲
² Denmark	84 (1.7) ▲
Sweden	83 (2.0) ▲
Malta	83 (1.8) ▲
Hungary	83 (1.5) ▲
Russian Federation	81 (1.6) ▲
New Zealand	81 (2.2) ▲
Austria	80 (1.9) ▲
Slovenia	80 (1.9) ▲
Thailand	78 (2.5) ▲
² United States	78 (1.2) ▲
Spain	78 (1.9) ▲
Slovak Republic	77 (1.7) ▲
Czech Republic	77 (2.4) ▲
Italy	77 (2.1) ▲
Bahrain	75 (2.1) ▲
² Croatia	74 (2.3) ▲
‡ Norway	74 (2.5) ▲
International Avg.	73 (0.3)
Turkey	73 (2.1) ▲
² Kazakhstan	73 (2.7) ▲
Poland	73 (2.0) ▲
² Qatar	70 (2.0) ▲
Chile	69 (2.1) ▼
United Arab Emirates	68 (1.3) ▼
² Serbia	67 (2.3) ▼
Romania	62 (2.7) ▼
Saudi Arabia	60 (2.4) ▼
Oman	57 (1.6) ▼
¹ Georgia	56 (2.7) ▼
¹ Kuwait	55 (1.8) ▼
Iran, Islamic Rep. of	54 (2.0) ▼
² Azerbaijan	47 (2.7) ▼
Armenia	41 (2.4) ▼
Tunisia	24 (2.0) ▼
Morocco	23 (1.8) ▼
Yemen	13 (1.6) ▼

Content Domain: Data Display
Cognitive Domain: Applying
Description: Completes a bar graph from data in a table

Darin asked his friends to name their favorite color. He collected the information in the table shown below.

Favorite Color	Number of Friends
Red	4
Green	2
Blue	6
Yellow	7

Then Darin started to draw a graph to show the information. Complete Darin's graph.



The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Sixth Grade Participants	
Botswana	62 (2.0) ▼
Honduras	40 (3.3) ▼
Yemen	31 (2.9) ▼

Country	Percent Full Credit
Benchmarking Participants	
Quebec, Canada	89 (1.6) ▲
Ontario, Canada	87 (1.5) ▲
^{1 2} North Carolina, US	82 (2.2) ▲
² Alberta, Canada	81 (2.0) ▲
^{1 3} Florida, US	80 (2.3) ▲
Dubai, UAE	75 (1.7) ▲
Abu Dhabi, UAE	62 (2.5) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Fourth Grade TIMSS 2011 Intermediate International Benchmark

Exhibit 2.7 provides the description of student achievement at the Intermediate International Benchmark. Most countries had the majority of their students reaching this benchmark. Students at this level demonstrated an understanding of whole numbers, as well as some understanding of one-place decimals, proportion, geometric patterns, symmetry, and movement on a grid. They can match data in pie charts and tables to bar graphs.

Example Item 3 in Exhibit 2.8 is a word problem involving addition of one-place decimals. The average percent correct was 60 percent, with a considerable range in performance. In Korea and Japan, 95–97 percent of students answered correctly, compared to 19 percent in Yemen and Kuwait.

Exhibit 2.9 presents Example Item 4 from the domain of geometric figures. It asks students to visualize a three-dimensional shape made of cubes. On average, internationally, 63 percent of the fourth grade students answered correctly. Across the fourth grade, sixth grade, and benchmarking participants, in most cases the majority of students could do this task.

Exhibit 2.10 presents Example 5 from the data display domain, asking students to choose which graph presents the same information as shown in the pie chart. The international average was 71 percent correct, and it is clear from the country-by-country results that this material is covered in most but not all countries. In general, most students did relatively well across the fourth grade, sixth grade, and benchmarking participants.

● Intermediate International Benchmark

475 Summary

Students can apply basic mathematical knowledge in straightforward situations. Students at this level demonstrate an understanding of whole numbers and some understanding of fractions. Students can visualize three-dimensional shapes from two-dimensional representations. They can interpret bar graphs, pictographs, and tables to solve simple problems.

Students at this level demonstrate an understanding of whole numbers. For example, they can identify the value of a digit in a four-digit number and solve problems involving multiplication of one-digit numbers. Students can add one-place decimals and can identify an expression that represents a situation involving addition or subtraction. They can identify representations of unit and non-unit fractions and solve simple proportional problems involving halving. They can extend simple geometric patterns to determine the next terms.

Students can visualize three-dimensional shapes from two-dimensional representations including recognizing some properties of familiar solids. They can order a set of angles by size. They can recognize a line of symmetry and draw the reflection of a simple shape. They can identify the movement on a grid necessary to get from one position to another.

Students can interpret information in bar graphs, pictographs, and tables to solve simple problems. They can read and interpret different representations of the same data. For example, they can match data in pie charts and tables to bar graphs.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Korea, Rep. of	97 (0.7) ▲
Japan	95 (0.9) ▲
² Singapore	92 (1.1) ▲
Chinese Taipei	92 (1.1) ▲
Finland	86 (1.7) ▲
Belgium (Flemish)	86 (1.4) ▲
Portugal	84 (2.2) ▲
Germany	76 (1.7) ▲
Ireland	75 (2.0) ▲
† Northern Ireland	74 (2.6) ▲
^{1 2} Lithuania	74 (2.2) ▲
England	74 (2.4) ▲
² United States	74 (1.8) ▲
² Hong Kong SAR	74 (1.9) ▲
† Netherlands	73 (1.9) ▲
² Denmark	73 (2.0) ▲
Austria	72 (2.2) ▲
Italy	69 (2.1) ▲
Malta	67 (1.9) ▲
Russian Federation	67 (1.9) ▲
Sweden	65 (2.3) ▲
Chile	64 (1.7) ▲
² Kazakhstan	63 (2.7)
² Azerbaijan	62 (2.7)
Australia	62 (2.2)
Hungary	61 (2.4)
International Avg.	60 (0.3)
Slovak Republic	60 (2.5)
Poland	59 (2.3)
Czech Republic	59 (2.6)
‡ Norway	59 (3.2)
Spain	58 (2.6)
Romania	57 (2.7)
Turkey	56 (1.9) ▼
Slovenia	54 (2.3) ▼
² Serbia	54 (2.0) ▼
² Croatia	54 (2.2) ▼
New Zealand	48 (2.3) ▼
¹ Georgia	48 (2.4) ▼
Bahrain	44 (2.4) ▼
Thailand	44 (1.8) ▼
² Qatar	42 (2.6) ▼
Armenia	41 (2.2) ▼
United Arab Emirates	41 (1.2) ▼
Saudi Arabia	30 (2.5) ▼
Morocco	30 (2.2) ▼
Oman	29 (2.1) ▼
Iran, Islamic Rep. of	29 (1.9) ▼
Tunisia	28 (2.2) ▼
Yemen	19 (1.8) ▼
¹ Kuwait	19 (1.8) ▼

Content Domain: Number
Cognitive Domain: Applying
Description: Solves a word problem involving addition of decimals (one place)

Duncan first traveled 4.8 km in a car and then he traveled 1.5 km in a bus.
 How far did Duncan travel?

A 6.3 km
 B 5.8 km
 C 5.13 km
 D 4.95 km

Copyright protected by IEA. This item may not be used for commercial purposes without express permission from IEA.

Country	Percent Correct
Sixth Grade Participants	
Botswana	62 (2.3)
Honduras	46 (3.1) ▼
Yemen	27 (2.1) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} North Carolina, US	80 (2.8) ▲
^{1 3} Florida, US	72 (2.5) ▲
Quebec, Canada	69 (2.6) ▲
² Alberta, Canada	61 (2.1)
Ontario, Canada	57 (2.2)
Dubai, UAE	55 (1.5) ▼
Abu Dhabi, UAE	34 (2.1) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Chinese Taipei	95 (0.8) ▲
Belgium (Flemish)	90 (1.2) ▲
† Netherlands	90 (1.5) ▲
Korea, Rep. of	85 (1.3) ▲
Germany	85 (1.6) ▲
Japan	84 (1.5) ▲
Portugal	84 (1.8) ▲
Finland	81 (2.0) ▲
² Hong Kong SAR	80 (1.7) ▲
^{1 2} Lithuania	78 (1.9) ▲
² Singapore	78 (1.4) ▲
² Denmark	77 (1.9) ▲
Czech Republic	74 (2.2) ▲
Sweden	74 (1.9) ▲
‡ Norway	74 (2.5) ▲
Australia	74 (2.2) ▲
Austria	74 (2.5) ▲
† Northern Ireland	72 (2.1) ▲
Slovenia	70 (1.9) ▲
Hungary	70 (1.9) ▲
² Serbia	70 (2.5) ▲
² United States	69 (1.3) ▲
Russian Federation	68 (2.1) ▲
England	67 (2.5)
Ireland	66 (2.3)
Slovak Republic	66 (2.2)
New Zealand	63 (2.0)
Poland	63 (2.4)
International Avg.	63 (0.3)
² Croatia	62 (2.3)
Chile	59 (1.9)
Romania	57 (2.6) ▼
² Kazakhstan	57 (2.4) ▼
Malta	57 (2.4) ▼
Spain	55 (2.5) ▼
Thailand	53 (2.5) ▼
Italy	52 (2.3) ▼
¹ Georgia	51 (2.2) ▼
Bahrain	50 (2.3) ▼
Armenia	47 (2.4) ▼
² Azerbaijan	46 (2.8) ▼
Turkey	45 (1.8) ▼
Iran, Islamic Rep. of	44 (2.0) ▼
Saudi Arabia	43 (2.9) ▼
United Arab Emirates	41 (1.3) ▼
² Qatar	38 (2.4) ▼
Oman	33 (1.7) ▼
Tunisia	32 (2.2) ▼
Morocco	31 (2.2) ▼
¹ Kuwait	31 (2.0) ▼
Yemen	31 (2.2) ▼

Content Domain: Geometric Shapes and Measures
Cognitive Domain: Applying
Description: Determines the number of cubes in a stack with some hidden

Ann stacks these boxes in the corner of the room. All the boxes are the same size.
 How many boxes does she use?

(A) 25
 (B) 19
 18
 (D) 13

Country	Percent Correct
Sixth Grade Participants	
Botswana	43 (1.9) ▼
Yemen	39 (1.8) ▼
Honduras	38 (3.2) ▼

Country	Percent Correct
Benchmarking Participants	
Quebec, Canada	77 (1.9) ▲
² Alberta, Canada	72 (2.3) ▲
Ontario, Canada	70 (2.3) ▲
^{1 3} Florida, US	68 (2.9)
^{1 2} North Carolina, US	68 (3.0)
Abu Dhabi, UAE	45 (2.6) ▼
Dubai, UAE	43 (1.4) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Korea, Rep. of	95 (0.9) ▲
Japan	92 (1.1) ▲
² Singapore	89 (1.0) ▲
² Hong Kong SAR	88 (1.5) ▲
Chinese Taipei	87 (1.4) ▲
Russian Federation	86 (1.7) ▲
Finland	84 (2.1) ▲
² United States	83 (1.1) ▲
Germany	83 (1.8) ▲
Portugal	82 (1.9) ▲
Slovenia	82 (2.0) ▲
² Denmark	81 (1.6) ▲
Australia	81 (1.9) ▲
Italy	81 (1.9) ▲
† Netherlands	80 (2.0) ▲
Austria	79 (1.9) ▲
† Northern Ireland	78 (2.2) ▲
Slovak Republic	78 (1.9) ▲
^{1 2} Lithuania	77 (2.4) ▲
Belgium (Flemish)	76 (2.4) ▲
England	76 (2.0) ▲
Hungary	76 (2.1) ▲
² Kazakhstan	76 (2.3) ▲
Chile	75 (1.8) ▲
Turkey	75 (1.4) ▲
Spain	75 (2.0) ▲
Ireland	75 (2.1)
New Zealand	73 (1.9)
Poland	72 (2.1)
Czech Republic	72 (2.1)
‡ Norway	72 (2.8)
Sweden	71 (2.2)
International Avg.	71 (0.3)
Romania	71 (2.6)
Bahrain	69 (2.1)
Malta	69 (2.0)
² Serbia	69 (2.7)
² Croatia	66 (2.5)
Thailand	65 (2.6) ▼
United Arab Emirates	63 (1.3) ▼
² Qatar	61 (2.7) ▼
Saudi Arabia	61 (2.7) ▼
¹ Georgia	61 (2.5) ▼
Iran, Islamic Rep. of	55 (2.6) ▼
Oman	52 (1.7) ▼
² Azerbaijan	52 (2.8) ▼
¹ Kuwait	46 (2.2) ▼
Armenia	39 (2.4) ▼
Morocco	33 (1.9) ▼
Tunisia	32 (2.2) ▼
Yemen	22 (1.8) ▼

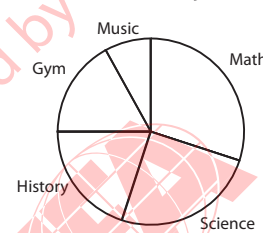
Content Domain: Data Display

Cognitive Domain: Reasoning

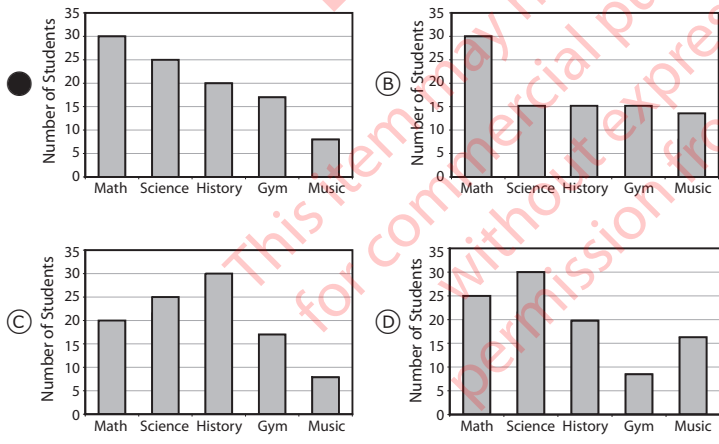
Description: Identifies the bar graph that matches the information shown in a pie chart

Mr. Johnson asked the students in his school about their favorite subject.

This pie chart shows how many students liked each of 5 subjects.



Which graph shows the same information as the pie chart?



Country	Percent Correct
Sixth Grade Participants	
Botswana	65 (2.2) ▼
Honduras	49 (3.4) ▼
Yemen	46 (2.8) ▼

Country	Percent Correct
Benchmarking Participants	
² Alberta, Canada	83 (1.9) ▲
^{1 2} North Carolina, US	82 (2.7) ▲
^{1 3} Florida, US	81 (2.1) ▲
Ontario, Canada	80 (1.6) ▲
Quebec, Canada	77 (1.5) ▲
Dubai, UAE	70 (1.7)
Abu Dhabi, UAE	59 (2.4) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and †. (.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Fourth Grade TIMSS 2011 High International Benchmark

Exhibit 2.11 presents the description of achievement at the High International Benchmark. The length of the description signals that students reaching this level demonstrated some competency with many of the topics in the framework. For example, their skills in number included solving problems involving two-digit numbers, division, and proportional reasoning. They could solve a variety of problems involving symmetry. In addition, they could interpret and use data in tables and graphs to solve problems.

Example Item 6 shown in Exhibit 2.12 illustrates the growing facility in the number domain demonstrated by students at the High Benchmark. This is a word problem set in a real life context and involving measurements—specifically, the addition of time. This word problem was solved correctly by 52 percent of the students internationally, on average.

Exhibit 2.13 presents Example Item 7, a constructed response item from the geometric shapes domain assessing understanding of symmetry. Students were given three sides of the shape on the grid and asked to finish drawing the shape according to the specifications. Internationally, on average, 42 percent of the students successfully completed a five-sided symmetrical shape. The top performance was in Hong Kong SAR, where 84 percent of the students could do this problem; but the next highest achievement was in Korea with two-thirds answering successfully.

Example Item 8 shown in Exhibit 2.14 is an example of a data display problem likely to be answered correctly by students reaching the High Benchmark. Because students needed to read the problem and the graph, and devise a strategy for using the information in the graph to answer the question, this item was classified as multi-step reasoning problem. Internationally, on average, 54 percent of the students answered correctly.

○ High International Benchmark

550

Summary

Students can apply their knowledge and understanding to solve problems. Students can solve word problems involving operations with whole numbers. They can use division in a variety of problem situations. They can use their understanding of place value to solve problems. Students can extend patterns to find a later specified term. Students demonstrate understanding of line symmetry and geometric properties. Students can interpret and use data in tables and graphs to solve problems. They can use information in pictographs and tally charts to complete bar graphs.

Students at this level can solve word problems involving operations with whole numbers. They can multiply two-digit numbers and use division in a variety of problem situations. They can use their understanding of place value to solve problems. For example, they can identify the missing digit in a number given its place value, the sum closest to a given value, and appropriately rounded numbers. They show some understanding of multiples and factors.

Students can read unlabelled gradations on a scale and solve a word problem involving measures and proportional reasoning. They can solve word problems involving addition of time. They can add two-place decimals and order unit fractions. They can write a number between two consecutive whole numbers. Students can extend patterns to find a later specified term and use two-step rules to continue a pattern.

Students demonstrate understanding of line symmetry. For example, they can draw lines of symmetry, reflect shapes across a line of symmetry and identify symmetrical shapes. They can classify shapes according to given properties. They can recognize right angles, parallel, and perpendicular lines in different orientations. They can find perimeters of simple figures. They can recognize a net of a cube and the stack of cubes with largest volume.

Students can interpret and use data in tables and graphs to solve problems. For example, they can compare data from two sources to draw conclusions. They can use information in pictographs and tally charts to complete bar graphs.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Chinese Taipei	85 (1.5) ▲
Korea, Rep. of	82 (1.8) ▲
² Singapore	82 (1.4) ▲
² Hong Kong SAR	76 (2.0) ▲
† Netherlands	73 (2.2) ▲
† Northern Ireland	73 (2.3) ▲
Japan	69 (1.8) ▲
Czech Republic	69 (2.5) ▲
^{1 2} Lithuania	67 (2.0) ▲
Poland	67 (2.0) ▲
Germany	65 (2.1) ▲
Russian Federation	65 (1.8) ▲
Finland	65 (2.4) ▲
Belgium (Flemish)	63 (2.3) ▲
England	63 (2.6) ▲
Sweden	62 (2.2) ▲
² Serbia	60 (2.8) ▲
² Denmark	60 (2.7) ▲
Slovak Republic	58 (3.0) ▲
Hungary	57 (2.3) ▲
² United States	57 (1.5) ▲
‡ Norway	55 (3.2)
Ireland	54 (3.2)
Slovenia	54 (2.1)
² Azerbaijan	52 (3.2)
Austria	52 (2.4)
International Avg.	52 (0.3)
Australia	51 (2.4)
² Croatia	49 (2.1)
New Zealand	49 (2.1)
Romania	48 (2.3)
Portugal	47 (2.9)
² Kazakhstan	47 (2.9)
Turkey	46 (2.0) ▼
Italy	45 (2.3) ▼
Armenia	43 (2.3) ▼
Malta	41 (2.2) ▼
Thailand	41 (2.7) ▼
Chile	40 (1.9) ▼
¹ Georgia	37 (2.3) ▼
Spain	34 (2.1) ▼
Tunisia	33 (1.9) ▼
Iran, Islamic Rep. of	33 (2.3) ▼
United Arab Emirates	32 (1.2) ▼
² Qatar	30 (1.8) ▼
Yemen	29 (1.9) ▼
Saudi Arabia	26 (2.1) ▼
Bahrain	25 (2.0) ▼
Morocco	24 (2.4) ▼
¹ Kuwait	23 (1.7) ▼
Oman	21 (1.3) ▼

Content Domain: Number
Cognitive Domain: Applying
Description: Solves a word problem involving addition of time and conversion between hours and minutes

A train left Redville at 8:45 a.m. It arrived in Bedford 2 hours and 18 minutes later. What time did it arrive in Bedford?

(A) 11:15 a.m.
 (B) 11:13 a.m.
 (C) 11:03 a.m.
 (D) 10:53 a.m.

Copyright protected by IEA. This item may not be used for commercial purposes without express permission from IEA.

Country	Percent Correct
Sixth Grade Participants	
Honduras	25 (2.7) ▼
Yemen	25 (2.0) ▼
Botswana	23 (2.0) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} North Carolina, US	66 (2.8) ▲
^{1 3} Florida, US	54 (2.9)
Quebec, Canada	54 (2.4)
Ontario, Canada	53 (2.6)
² Alberta, Canada	51 (2.5)
Dubai, UAE	42 (1.9) ▼
Abu Dhabi, UAE	30 (2.0) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

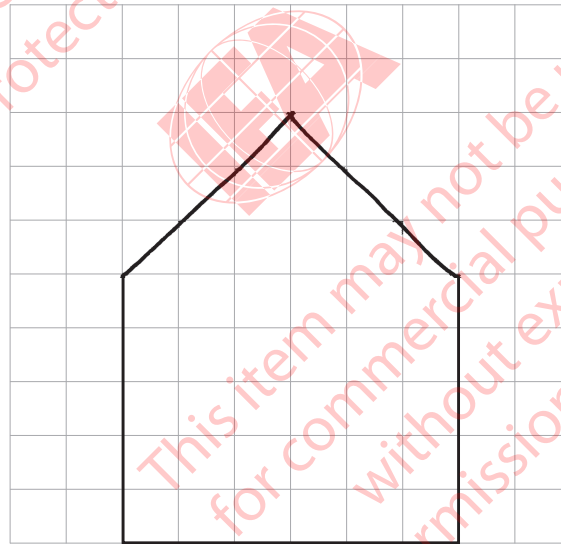
Country	Percent Full Credit
² Hong Kong SAR	84 (2.0) ▲
Korea, Rep. of	67 (1.8) ▲
England	61 (2.6) ▲
² Singapore	61 (2.0) ▲
Russian Federation	61 (2.7) ▲
² Denmark	57 (2.2) ▲
² Kazakhstan	55 (2.6) ▲
Slovenia	55 (2.3) ▲
† Northern Ireland	53 (2.3) ▲
Portugal	53 (3.4) ▲
Belgium (Flemish)	52 (2.5) ▲
^{1 2} Lithuania	52 (2.4) ▲
² United States	51 (1.6) ▲
Italy	50 (2.5) ▲
Australia	50 (2.0) ▲
Slovak Republic	47 (2.1) ▲
Ireland	47 (2.6)
¹ Georgia	46 (2.7)
Sweden	45 (2.8)
Finland	45 (2.5)
² Azerbaijan	45 (3.2)
Chinese Taipei	44 (2.0)
Germany	44 (2.2)
Malta	44 (2.2)
Czech Republic	43 (2.6)
Romania	42 (2.6)
Hungary	42 (2.5)
International Avg.	42 (0.3)
New Zealand	42 (2.1)
Armenia	41 (2.8)
Spain	41 (2.7)
Iran, Islamic Rep. of	40 (2.3)
Japan	39 (1.9)
Poland	39 (1.9)
‡ Norway	38 (2.6)
Chile	38 (2.0) ▼
Thailand	37 (2.6) ▼
Bahrain	31 (3.3) ▼
² Serbia	31 (2.5) ▼
Oman	31 (1.7) ▼
² Croatia	29 (1.9) ▼
United Arab Emirates	29 (1.2) ▼
† Netherlands	29 (2.3) ▼
Saudi Arabia	29 (2.7) ▼
Austria	26 (2.1) ▼
² Qatar	26 (2.3) ▼
Turkey	26 (1.7) ▼
Morocco	23 (2.0) ▼
Tunisia	19 (1.8) ▼
¹ Kuwait	17 (1.7) ▼
Yemen	5 (1.1) ▼

Content Domain: Geometric Shapes and Measures

Cognitive Domain: Applying

Description: Completes a shape so that it has line symmetry and a given number of sides

Jay has to draw a shape.
It must have 5 sides.
It must have one line of symmetry.
Jay has started to draw the shape.
Complete Jay's shape.



The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Sixth Grade Participants	
Honduras	35 (2.7) ▼
Botswana	28 (2.2) ▼
Yemen	16 (1.8) ▼

Country	Percent Full Credit
Benchmarking Participants	
Quebec, Canada	59 (2.5) ▲
Ontario, Canada	52 (2.5) ▲
^{1 3} Florida, US	50 (3.4) ▲
^{1 2} North Carolina, US	50 (3.0) ▲
² Alberta, Canada	37 (2.5)
Dubai, UAE	36 (1.8) ▼
Abu Dhabi, UAE	26 (2.1) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Correct
Chinese Taipei	79 (1.9) ▲
² Hong Kong SAR	78 (2.0) ▲
Korea, Rep. of	75 (1.3) ▲
[†] Netherlands	74 (2.1) ▲
² Singapore	73 (1.8) ▲
Japan	71 (2.0) ▲
Portugal	70 (2.8) ▲
[‡] Norway	67 (2.3) ▲
Germany	67 (2.0) ▲
² Denmark	66 (2.0) ▲
England	65 (2.5) ▲
Sweden	64 (2.4) ▲
^{1 2} Lithuania	64 (2.1) ▲
Ireland	64 (2.5) ▲
Slovenia	64 (1.9) ▲
Finland	63 (2.1) ▲
² United States	63 (1.5) ▲
Belgium (Flemish)	62 (2.2) ▲
New Zealand	60 (2.1) ▲
[†] Northern Ireland	59 (2.9) ▲
² Serbia	59 (2.4) ▲
Australia	58 (2.1) ▲
Austria	57 (2.5) ▲
¹ Georgia	55 (2.3) ▲
International Avg.	54 (0.3)
Russian Federation	53 (2.4) ▲
Malta	52 (2.4) ▲
² Croatia	51 (2.1) ▲
Poland	51 (2.5) ▲
Slovak Republic	50 (2.1) ▲
Spain	50 (2.5) ▲
Turkey	50 (2.0) ▼
Chile	50 (2.0) ▼
Italy	49 (2.4) ▼
Romania	48 (2.7) ▼
² Kazakhstan	47 (2.1) ▼
Hungary	47 (2.1) ▼
Thailand	46 (2.6) ▼
Czech Republic	45 (2.7) ▼
Iran, Islamic Rep. of	44 (1.8) ▼
United Arab Emirates	41 (1.3) ▼
² Qatar	41 (2.5) ▼
Bahrain	39 (2.4) ▼
Saudi Arabia	38 (2.3) ▼
Oman	33 (1.7) ▼
Armenia	29 (2.2) ▼
Morocco	29 (1.8) ▼
Yemen	29 (2.2) ▼
¹ Kuwait	26 (2.0) ▼
Tunisia	26 (1.9) ▼
² Azerbaijan	--

Content Domain: Data Display
Cognitive Domain: Reasoning
Description: Solves a multi-step reasoning problem using data from a bar graph

The graph shows the number of students at each grade in the Pine School.

Pine School

In the Pine School there is room in each grade for 30 students. How many more students could be in the school?

(A) 20
 (B) 25
 (C) 30
 35

Country	Percent Correct
Sixth Grade Participants	
Honduras	47 (2.7) ▼
Yemen	45 (2.4) ▼
Botswana	41 (2.2) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} North Carolina, US	61 (2.9) ▲
² Alberta, Canada	60 (2.3) ▲
Ontario, Canada	58 (2.3)
^{1 3} Florida, US	56 (2.4)
Dubai, UAE	48 (2.2) ▼
Quebec, Canada	46 (2.7) ▼
Abu Dhabi, UAE	37 (2.6) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
 A dash (-) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Fourth Grade TIMSS 2011 Advanced International Benchmark

Exhibit 2.15 describes fourth grade performance at the Advanced International Benchmark. Students reaching this level demonstrated facility with many of the topics in the TIMSS 2011 Mathematics Framework. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the High, Intermediate, and Low Benchmarks. They could solve a variety of multi-step word problems involving whole numbers and demonstrated an increasing understanding of fractions and decimals. Students could apply geometric knowledge about a range of shapes and solve problems involving area and perimeter. Finally, they could explain their reasoning, and organize, interpret, and represent data to solve two-step problems.

Example Item 9 in Exhibit 2.16 shows an example of the types of items students at the Advanced International Benchmark could answer correctly. This constructed-response multi-step numerical reasoning problem was answered successfully by 27 percent of the students internationally, on average. It is interesting to note that the five top-performing East Asian countries had the highest achievement on this reasoning item, with approximately half of their students able to provide the correct answer.

Example Item 10 in Exhibit 2.17 shows a constructed-response item in a somewhat different format. To demonstrate their understanding of various geometric properties, students needed to answer the series of questions correctly. They needed to be able to visualize the two solids and apply their understanding of geometric terms such as square, face, and right angle. Internationally, on average, only one-third of the fourth grade students were able to do so.

● Advanced International Benchmark

625

Summary

Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning. They can solve a variety of multi-step word problems involving whole numbers, including proportions. Students at this level show an increasing understanding of fractions and decimals. Students can apply geometric knowledge of a range of two- and three-dimensional shapes in a variety of situations. They can draw a conclusion from data in a table and justify their conclusion.

Students can solve a variety of multi-step word problems involving whole numbers. They can solve proportion problems and number sentences involving whole numbers. Students at this level show an increasing understanding of fractions and decimals. They can determine equivalent fractions represented in a variety of ways. Given a fraction, they can identify a larger fraction with a different denominator. They can identify the smallest among a set of one- and two-place decimals and use their knowledge of decimals to solve two-step problems. They can identify a two-step rule for a linear relationship between the first and second numbers in a set of ordered pairs.

Students can apply geometric knowledge of a range of two- and three-dimensional shapes in a variety of situations. They can estimate the length of a curved line. Students can use their knowledge of perimeter to solve a multi-step problem. Students can determine the areas of simple figures. For example, they can find the area of a figure composed of squares and half squares, determine the area of an isosceles triangle on a grid, and calculate the area of a rectangle. Students can determine the number of cubes that fill a given rectangular box.

Students can organize, interpret, and represent data to solve two-step problems. They can draw a conclusion from data in a table and justify their conclusion.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
² Hong Kong SAR	59 (2.2) ▲
Japan	56 (2.2) ▲
Korea, Rep. of	52 (2.0) ▲
² Singapore	52 (1.9) ▲
Chinese Taipei	48 (2.1) ▲
England	47 (2.3) ▲
† Northern Ireland	45 (2.7) ▲
² Serbia	45 (2.4) ▲
Czech Republic	41 (2.7) ▲
² Denmark	40 (2.1) ▲
Portugal	40 (2.4) ▲
Ireland	39 (2.3) ▲
^{1 2} Lithuania	37 (2.6) ▲
Sweden	36 (2.6) ▲
† Netherlands	36 (2.3) ▲
Finland	35 (2.2) ▲
² United States	34 (1.5) ▲
Slovak Republic	34 (2.2) ▲
Australia	31 (1.9) ▲
Germany	29 (1.9)
Russian Federation	28 (2.0)
International Avg.	27 (0.3)
² Azerbaijan	26 (2.7)
New Zealand	26 (1.8)
Romania	26 (2.5)
Turkey	26 (1.6)
Hungary	26 (1.7)
Belgium (Flemish)	25 (1.8)
² Kazakhstan	25 (2.3)
² Croatia	25 (2.1)
Armenia	25 (2.5)
Italy	23 (2.2)
Poland	22 (1.7) ▼
Spain	21 (1.8) ▼
Malta	21 (1.6) ▼
Slovenia	21 (1.9) ▼
Thailand	20 (2.1) ▼
‡ Norway	19 (2.0) ▼
Austria	17 (1.6) ▼
Chile	16 (1.5) ▼
¹ Georgia	14 (2.2) ▼
Saudi Arabia	13 (2.1) ▼
Morocco	13 (1.5) ▼
United Arab Emirates	12 (0.8) ▼
Bahrain	11 (1.6) ▼
Iran, Islamic Rep. of	9 (1.0) ▼
² Qatar	8 (1.7) ▼
Oman	5 (0.8) ▼
Tunisia	4 (0.7) ▼
Yemen	3 (0.7) ▼
¹ Kuwait	2 (0.6) ▼

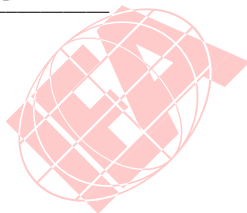
Content Domain: Number
Cognitive Domain: Reasoning
Description: Solves a multi-step numerical reasoning problem

In a soccer tournament, teams get:
 3 points for a win
 1 point for a tie
 0 points for a loss

Zedland has 11 points.

What is the **smallest** number of games Zedland could have played?

Answer: 5



The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Sixth Grade Participants	
Honduras	10 (1.9) ▼
Yemen	9 (1.6) ▼
Botswana	7 (1.4) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} North Carolina, US	39 (3.2) ▲
Ontario, Canada	36 (2.5) ▲
^{1 3} Florida, US	35 (3.1) ▲
² Alberta, Canada	35 (2.3) ▲
Quebec, Canada	26 (2.7)
Dubai, UAE	14 (1.1) ▼
Abu Dhabi, UAE	11 (1.7) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and ‡. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Portugal	70 (2.1) ▲
Austria	67 (2.4) ▲
† Northern Ireland	58 (2.6) ▲
England	58 (2.4) ▲
² Hong Kong SAR	57 (2.3) ▲
Chinese Taipei	53 (2.4) ▲
Japan	53 (2.0) ▲
² United States	50 (1.4) ▲
² Denmark	47 (2.0) ▲
Australia	45 (2.2) ▲
Ireland	45 (2.6) ▲
Germany	44 (2.5) ▲
Korea, Rep. of	44 (2.1) ▲
Italy	44 (2.1) ▲
Hungary	42 (2.0) ▲
Belgium (Flemish)	42 (2.3) ▲
Poland	42 (2.1) ▲
Chile	41 (2.1) ▲
² Singapore	41 (2.2) ▲
Malta	40 (2.2) ▲
Slovenia	39 (2.3) ▲
² Croatia	35 (1.9)
^{1 2} Lithuania	34 (2.5)
Finland	33 (2.7)
International Avg.	32 (0.3)
New Zealand	32 (1.9)
Romania	32 (2.8)
² Serbia	28 (2.1) ▼
² Qatar	27 (2.0) ▼
² Kazakhstan	27 (2.6) ▼
Spain	26 (2.4) ▼
United Arab Emirates	26 (1.2) ▼
‡ Norway	26 (2.7) ▼
Oman	26 (1.5) ▼
Russian Federation	22 (1.8) ▼
Sweden	20 (1.9) ▼
† Netherlands	20 (2.0) ▼
¹ Kuwait	20 (1.9) ▼
Slovak Republic	19 (1.7) ▼
Czech Republic	18 (1.9) ▼
Armenia	16 (1.9) ▼
Iran, Islamic Rep. of	15 (1.2) ▼
¹ Georgia	15 (1.7) ▼
Bahrain	13 (1.8) ▼
Tunisia	11 (1.5) ▼
Saudi Arabia	11 (1.5) ▼
² Azerbaijan	6 (1.2) ▼
Thailand	6 (1.3) ▼
Turkey	4 (1.1) ▼
Yemen	1 (0.5) ▼
Morocco	--

Content Domain: Geometric Shapes and Measures
Cognitive Domain: Knowing
Description: Given the pictures of two common solids, classifies four statements as true or false

Figure A

Figure B

Here are some statements about Figure A and Figure B. Put an X to show whether each statement is true or false.

Statement	True	False
A and B both have a square face.	X	
A and B both have the same number of faces.		X
All the angles in A are right angles.	X	
B has more edges than A.		X
Some of the edges in B are curved.		X

The answer shown illustrates the type of student response that was given 2 of 2 points.

Country	Percent Full Credit
Sixth Grade Participants	
Botswana	19 (1.7) ▼
Honduras	12 (1.6) ▼
Yemen	5 (1.0) ▼

Country	Percent Full Credit
Benchmarking Participants	
Quebec, Canada	57 (2.5) ▲
Ontario, Canada	46 (2.1) ▲
^{1 2} North Carolina, US	46 (3.2) ▲
^{1 3} Florida, US	44 (2.7) ▲
Dubai, UAE	29 (1.7)
² Alberta, Canada	29 (2.1)
Abu Dhabi, UAE	22 (2.0) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
 A dash (–) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Eighth Grade Results for the TIMSS International Benchmarks in Mathematics

Eighth Grade Achievement at the TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.18 provides an overview of eighth grade achievement at the TIMSS 2011 International Benchmarks. The next sections of the chapter contain detailed descriptions of each level accompanied with example items. The top and bottom of the scale differentiates between those advanced eighth grade students who have a solid foundation across the TIMSS mathematics topics including algebra, compared to those at the low end with mathematics understanding in closer alignment to the TIMSS fourth grade topics.

Students at the Advanced International Benchmark can reason with information and make generalizations. In number, they can solve a variety of fraction, percent, and proportion problems, and in algebra they can solve problems involving equations, formulas, and functions. They also can reason with geometric figures and data from several sources to solve multi-step problems. In contrast, students at the Low International Benchmark have some knowledge of whole number and decimals, operations, and basic graphs.

Eighth Grade Achievement at the TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.19 presents the percentage of students reaching each TIMSS 2011 International Benchmark. The results are presented in descending order according to the percentage of students reaching the Advanced International Benchmark, first for countries that tested eighth-grade students, and then for ninth-grade students and benchmarking participants on the following page. The percentage of students reaching the Advanced Benchmark is indicated in the bar graph with a black dot. Because students who reached the Advanced Benchmark also reached the other benchmarks, the percentages shown in the graphic and in the data columns to the right are cumulative.

At the eighth grade, clearly the East Asian countries, particularly, Chinese Taipei, Singapore, and Korea, are pulling away from the rest of the world in mathematics achievement by a considerable margin.

Capitalizing on the head start demonstrated by their fourth grade students, the five East Asian countries had the largest percentages of eighth grade students reaching the Advanced International Benchmark. Very impressively, Chinese Taipei, Singapore, and Korea had nearly half their students (47–49%) reach

● **Advanced International Benchmark**

625 *Students can reason with information, draw conclusions, make generalizations, and solve linear equations.* Students can solve a variety of fraction, proportion, and percent problems and justify their conclusions. Students can express generalizations algebraically and model situations. They can solve a variety of problems involving equations, formulas, and functions. Students can reason with geometric figures to solve problems. Students can reason with data from several sources or unfamiliar representations to solve multi-step problems.

○ **High International Benchmark**

550 *Students can apply their understanding and knowledge in a variety of relatively complex situations.* Students can use information from several sources to solve problems involving different types of numbers and operations. Students can relate fractions, decimals, and percents to each other. Students at this level show basic procedural knowledge related to algebraic expressions. They can use properties of lines, angles, triangles, rectangles, and rectangular prisms to solve problems. They can analyze data in a variety of graphs.

● **Intermediate International Benchmark**

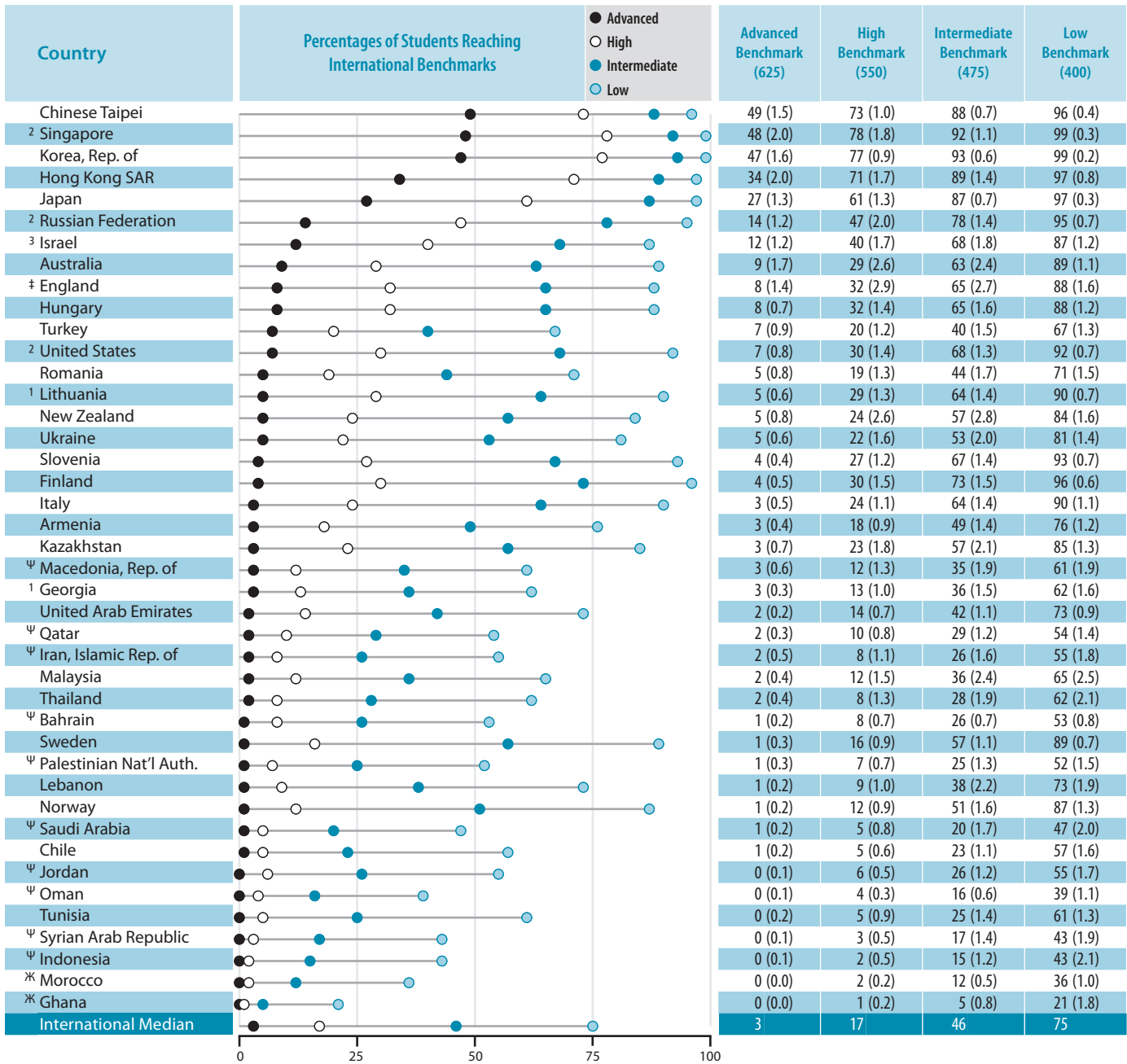
475 *Students can apply basic mathematical knowledge in a variety of situations.* Students can solve problems involving decimals, fractions, proportions, and percentages. They understand simple algebraic relationships. Students can relate a two-dimensional drawing to a three-dimensional object. They can read, interpret, and construct graphs and tables. They recognize basic notions of likelihood.

○ **Low International Benchmark**

400 *Students have some knowledge of whole numbers and decimals, operations, and basic graphs.*

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

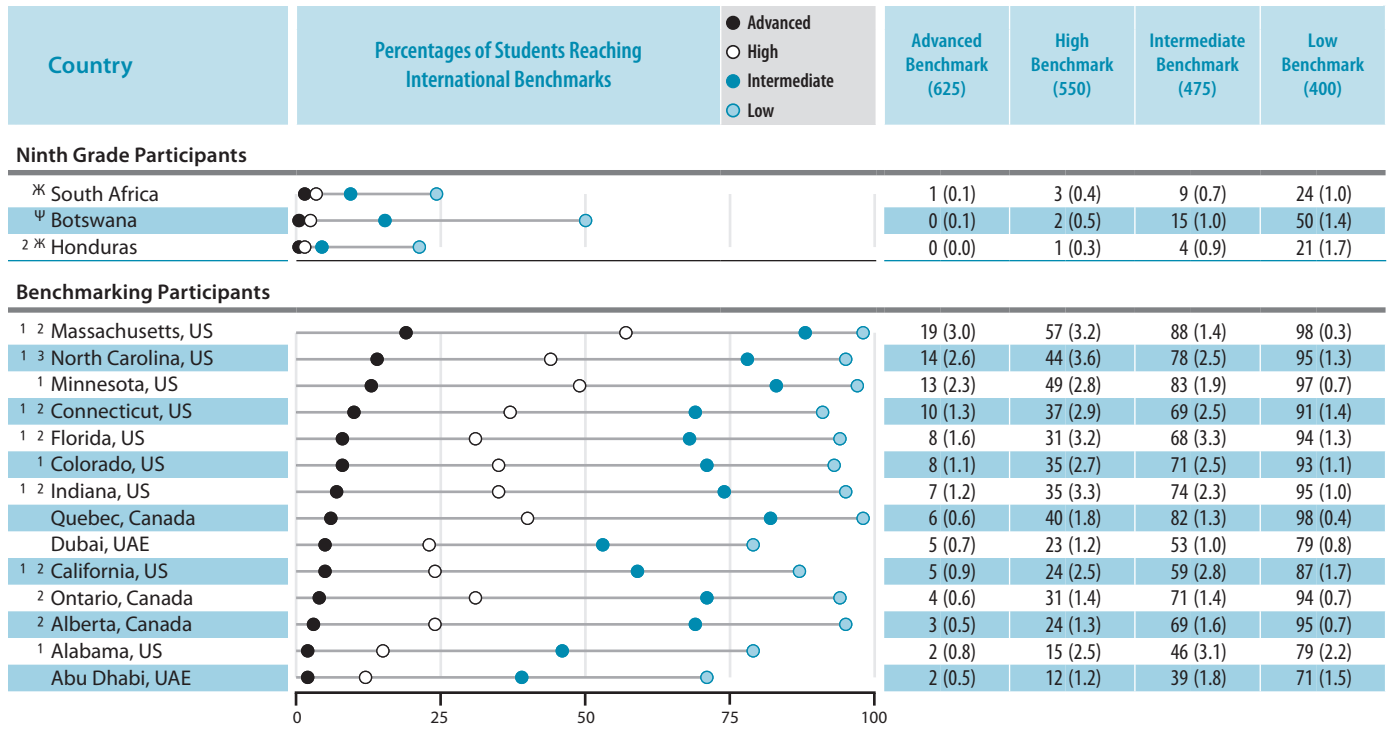
Exhibit 2.19: Performance at the International Benchmarks of Mathematics Achievement



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
 ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation is less than 25% but exceeds 15%.
 See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.19: Performance at the International Benchmarks of Mathematics Achievement (Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

the Advanced International Benchmark. Hong Kong SAR had about one-third of students (34%) reach the Advanced Benchmark and Japan had about one-fourth (27%). Next, the Russian Federation and Israel had 12 to 14 percent, and the remaining countries all had less than 10 percent of their students reaching the Advanced Benchmark. Several of the US benchmarking states did have from 10–19 percent of students reaching the Advanced Benchmark, including Massachusetts, North Carolina, Minnesota, and Connecticut.

Exhibit 2.19 also provides useful information about the distribution of achievement in each country. For example, some countries such as Turkey are doing relatively better at the top end of the distribution, with 7 percent reaching the Advanced Benchmark, although only 67 percent reached the Low Benchmark. In comparison, Slovenia, Finland, and Italy had only 3 to 4 percent reaching the Advanced Benchmark but nearly all students (at least 90%) reaching the low level.

As a point of reference, Exhibit 2.19 provides the median at the eighth grade for each of the benchmarks at the bottom of each of the four right hand columns. By definition, half of the countries will have a percentage in the column above the median and half will be below the median. The median percentages of students reaching the International Benchmarks were as follows: Advanced–3 percent, High–17 percent, Intermediate–46 percent, and Low–75 percent. In comparison, at the fourth grade, the median percentage for the Low International Benchmark was 90 percent. Compared to fourth grade, more eighth grade students were being “left behind” their classmates. That is, except in the top-five countries and several other countries (the Russian Federation, the United States, Slovenia, Lithuania, Finland, and Italy), more than 10 percent of the students did not reach the Low Benchmark, which is characterized as similar to the TIMSS fourth grade topics.

Eighth Grade Trends in Performance at the TIMSS 2011 International Benchmarks of Mathematics Achievement

Exhibit 2.20 shows the changes in percentages of eighth grade students reaching the benchmarks for countries and benchmarking participants that also participated in TIMSS 1995, 1999, 2003, and/or 2007. An up arrow indicates that the percentage of students reaching a benchmark is higher in 2011 than the past cycle, and a down arrow indicates that the percentage is lower in 2011. The patterns in this exhibit generally mirror the trends in average achievement discussed in Chapter 1, and can provide further information about countries' improvement or decline over time.

Three countries improved since 1995 at all four benchmarks, including Korea, the United States, and Lithuania. The Russian Federation and Iran had gains at the two highest levels and Slovenia improved at the two lower levels. A number of other countries have shown improvements since 2007 at all four levels, including Singapore, the Russian Federation, Ukraine, Georgia, Bahrain, and the Palestinian National Authority. Tunisia improved at the three top levels between 2007 and 2011, and also Italy improved at three levels (all except advanced). There were also three countries that declined since 1995 at all four benchmarks: Hungary, Sweden, and Norway. Singapore and Japan declined at all except the Advanced Benchmark and Romania and New Zealand at the two lower benchmarks. Some countries had recent declines since 2007, including Jordan at all four levels, Sweden at all except the low level, Malaysia at all except the advanced level, and Thailand and Indonesia at the two middle levels.

Exhibit 2.20: Trends in Percentages of Students Reaching the International Benchmarks of Mathematics Achievement

Country	Advanced International Benchmark (625)					High International Benchmark (550)				
	Percent of Students					Percent of Students				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
Chinese Taipei	49	45	38 ▲	37 ▲		73	71	66 ▲	67 ▲	
Singapore	48	40 ▲	44	42	40 ▲	78	70 ▲	77	77	84 ▼
Korea, Rep. of	47	40 ▲	35 ▲	32 ▲	31 ▲	77	71 ▲	70 ▲	70 ▲	67 ▲
Hong Kong SAR	34	31	31	28 ▲	23 ▲	71	64 ▲	73	70	65
Japan	27	26	24	29	29	61	61	62	66 ▼	67 ▼
Russian Federation	14	8 ▲	6 ▲	12	9 ▲	47	33 ▲	30 ▲	39 ▲	38 ▲
Australia	9	6	7		7	29	24	29		33
England	8	8	5	6	6	32	35	26	25	27
Hungary	8	10	11 ▼	13 ▼	10 ▼	32	36	41 ▼	43 ▼	40 ▼
United States	7	6	7	7	4 ▲	30	31	29	30	26 ▲
Romania	5	4	4	4	4	19	20	21	20	21
Lithuania	5	6	5	3 ▲	2 ▲	29	30	28	18 ▲	17 ▲
New Zealand	5		5	6	6	24		24	26	28
Ukraine	5	3 ▲				22	15 ▲			
Slovenia	4	4	3		4	27	25	21 ▲		22 ▲
Italy	3	3	3	4		24	17 ▲	19 ▲	21	
Armenia	3		2			18		21 ▼		
Ψ Macedonia, Rep. of	3		1 ▲	2		12		9	13	
Georgia	3	1 ▲				13	7 ▲			
Ψ Iran, Islamic Rep. of	2	1 ▲	0 ▲	1 ▲	0 ▲	8	5 ▲	3 ▲	6	4 ▲
Malaysia	2	2	6 ▼	10 ▼		12	18 ▼	30 ▼	36 ▼	
Thailand	2	3		3 ▼		8	12 ▼		17 ▼	
Ψ Bahrain	1	0 ▲	0 ▲			8	3 ▲	2 ▲		
Sweden	1	2 ▼	3 ▼		12 ▼	16	20 ▼	24 ▼		46 ▼
Ψ Palestinian Nat'l Auth.	1	0 ▲	0 ▲			7	3 ▲	4 ▲		
Lebanon	1	1	0 ▲			9	10	4 ▲		
Norway	1	0	0		4 ▼	12	11	10		26 ▼
Chile	1		0	1		5		3 ▲	4	
Ψ Jordan	0	1 ▼	1	3 ▼		6	11 ▼	8	12 ▼	
Ψ Oman	0	0 ▲				4	2 ▲			
Tunisia	0	0 ▲	0 ▲	0		5	3 ▲	1 ▲	5	
Finland (7)	0			5 ▼		14			33 ▼	
Ψ Syrian Arab Republic	0	0				3	3			
Ψ Indonesia	0	0				2	4 ▼			

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Benchmarking Participants

Massachusetts, US	19	16		8 ▲		57	52		33 ▲	
North Carolina, US	14			6 ▲		44			27 ▲	
Minnesota, US	13	8			7	49	41			36 ▲
Connecticut, US	10			9		37			33	
Indiana, US	7		5	7		35		27	32	
Quebec, Canada	6	8	8	18 ▼	14 ▼	40	37	45	60 ▼	54 ▼
Dubai, UAE	5	3				23	17 ▲			
Ontario, Canada	4	6	6	6	3	31	33	34	32	26 ▲
Alberta, Canada	3			7 ▼	6 ▼	24			40 ▼	39 ▼

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations.

An empty cell indicates a country did not participate in that year's assessment.

Trend Notes: Trend results for Finland are based on 7th grade data from 1999 and 2011, and so Finland's 2011 results differ from Exhibit 2.19.

Exhibit 2.20: Trends in Percentages of Students Reaching the International Benchmarks of Mathematics Achievement (Continued)

Country	Intermediate International Benchmark (475)					Low International Benchmark (400)				
	Percent of Students					Percent of Students				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
Chinese Taipei	88	86	85 ▲	85 ▲		96	95	96	95 ▲	
Singapore	92	88 ▼	93	94	98 ▼	99	97 ▲	99	99	100 ▼
Korea, Rep. of	93	90 ▲	90 ▲	91	89 ▲	99	98 ▲	98 ▲	99	97 ▲
Hong Kong SAR	89	85	93	92	88	97	94	98	98	96
Japan	87	87	88	90 ▼	91 ▼	97	97	98 ▼	98 ▼	98 ▼
Russian Federation	78	68 ▲	66 ▲	73	73	95	91 ▲	92 ▲	93	93
Australia	63	61	65		68	89	89	90		90
England	65	69	61	60	61	88	90	90	88	87
Hungary	65	69	75 ▼	75 ▼	74 ▼	88	91 ▼	95 ▼	93 ▼	94 ▼
United States	68	67	64	62 ▲	61 ▲	92	92	90	87 ▲	86 ▲
Romania	44	46	52 ▼	51 ▼	52 ▼	71	73	79 ▼	79 ▼	79 ▼
Lithuania	64	65	63	53 ▲	50 ▲	90	90	90	85 ▲	81 ▲
New Zealand	57		59	57	64 ▼	84		88	84	89 ▼
Ukraine	53	46 ▲				81	76 ▲			
Slovenia	67	65	60 ▲		60 ▲	93	92	90		90 ▲
Italy	64	54 ▲	56 ▲	53 ▲		90	85 ▲	86 ▲	82 ▲	
Armenia	49		54 ▼			76		82 ▼		
Ψ Macedonia, Rep. of	35		34	40		61		66 ▼	70 ▼	
Georgia	36	26 ▲				62	56 ▲			
Ψ Iran, Islamic Rep. of	26	20 ▲	20 ▲	26	24	55	51	55	61 ▼	59
Malaysia	36	50 ▼	66 ▼	70 ▼		65	82 ▼	93 ▼	93 ▼	
Thailand	28	34 ▼		45 ▼		62	66		79 ▼	
Ψ Bahrain	26	19 ▲	17 ▲			53	49 ▲	51 ▲		
Sweden	57	60 ▼	64 ▼		81 ▼	89	90	91 ▼		96 ▼
Ψ Palestinian Nat'l Auth.	25	15 ▲	19 ▲			52	39 ▲	46 ▲		
Lebanon	38	36	27 ▲			73	74	68 ▲		
Norway	51	48	44 ▲		64 ▼	87	85	81 ▲		90 ▼
Chile	23		15 ▲	16 ▲		57		41 ▲	46 ▲	
Ψ Jordan	26	35 ▼	30	33 ▼		55	61 ▼	60 ▼	61 ▼	
Ψ Oman	16	14				39	41			
Tunisia	25	21 ▲	15 ▲	34 ▼		61	61	55 ▲	78 ▼	
Finland (7)	57			77 ▼		90			96 ▼	
Ψ Syrian Arab Republic	17	17				43	47			
Ψ Indonesia	15	19 ▼				43	48			
Benchmarking Participants										
Massachusetts, US	88	82 ▲		69 ▲		98	95 ▲		92 ▲	
North Carolina, US	78			59 ▲		95			87 ▲	
Minnesota, US	83	81			73 ▲	97	97			94 ▲
Connecticut, US	69			68		91			90	
Indiana, US	74		68	71		95		94	93	
Quebec, Canada	82	78	88 ▼	93 ▼	90 ▼	98	97	99 ▼	99 ▼	99 ▼
Dubai, UAE	53	47 ▲				79	74 ▲			
Ontario, Canada	71	74	75 ▼	72	65 ▲	94	95	97 ▼	96 ▼	91 ▲
Alberta, Canada	69			81 ▼	79 ▼	95			97	97

▲ Percent significantly higher than 2011
▼ Percent significantly lower than 2011

Eighth Grade TIMSS 2011 Low International Benchmark

Exhibit 2.21 presents the description of student achievement at the Low International Benchmark. Students have an elementary understanding of whole numbers and decimals and can do basic computations. They can match tables to bar graphs and pictographs and read a simple line graph.

Exhibit 2.22 presents Example Item 1, which involved adding a two-place and three-place decimal. This item, exemplifying performance at the low level, was answered correctly by 72 percent of the eighth grade students, internationally, on average. More than 80 percent of the students answered correctly in many countries.

Example Item 2, shown in Exhibit 2.23, illustrates another type of item students at the low level could answer correctly. One of the algebra topics in the TIMSS 2011 Mathematics Framework at the eighth grade is algebraic expressions, and this item asks students to evaluate a simple algebraic expression. Similar to the results for Example Item 1, internationally, on average, 71 percent of the eighth grade students answered correctly. Also, more than 80 percent of the students answered this substitution item correctly in almost one-third of the countries.

● **Low International Benchmark**

400

Summary

Students have some knowledge of whole numbers and decimals, operations, and basic graphs.

The few items at this level provide some evidence that students have an elementary understanding of whole numbers and decimals and can do basic computations. They can match tables to bar graphs and pictographs and read a simple line graph.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.22: Low International Benchmark – Example Item 1

Country	Percent Full Credit
² Singapore	94 (0.8) ▲
Malaysia	91 (1.2) ▲
Hong Kong SAR	91 (1.5) ▲
Kazakhstan	90 (1.8) ▲
¹ Lithuania	90 (1.5) ▲
² Russian Federation	90 (1.2) ▲
Chinese Taipei	89 (1.1) ▲
² United States	89 (1.0) ▲
Hungary	88 (1.3) ▲
Italy	88 (1.6) ▲
Korea, Rep. of	87 (1.5) ▲
Slovenia	85 (1.7) ▲
Armenia	84 (1.9) ▲
Tunisia	82 (1.8) ▲
³ Israel	82 (1.4) ▲
Australia	82 (2.0) ▲
Norway	81 (1.9) ▲
Lebanon	81 (1.7) ▲
Japan	81 (1.6) ▲
Ukraine	80 (2.4) ▲
United Arab Emirates	79 (1.2) ▲
Sweden	79 (1.7) ▲
‡ England	79 (2.4) ▲
Finland	79 (1.8) ▲
International Avg.	72 (0.3)
Morocco	72 (1.7)
Qatar	72 (1.5)
New Zealand	70 (2.9)
Romania	69 (2.5)
Saudi Arabia	65 (2.5) ▼
Macedonia, Rep. of	65 (2.6) ▼
¹ Georgia	64 (2.9) ▼
Thailand	64 (2.4) ▼
Chile	58 (2.2) ▼
Indonesia	57 (2.2) ▼
Palestinian Nat'l Auth.	56 (1.9) ▼
Oman	49 (1.6) ▼
Turkey	48 (1.8) ▼
Bahrain	43 (2.3) ▼
Iran, Islamic Rep. of	42 (2.2) ▼
Jordan	36 (1.7) ▼
Ghana	36 (2.1) ▼
Syrian Arab Republic	31 (2.4) ▼

Content Domain: Number
 Cognitive Domain: Knowing
 Description: Adds a two-place and a three-place decimal

$42.65 + 5.748 =$

Answer: 48.398

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Ninth Grade Participants	
Botswana	74 (1.4)
² Honduras	66 (2.3) ▼
South Africa	63 (2.0) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} Massachusetts, US	95 (1.3) ▲
¹ Minnesota, US	93 (1.6) ▲
^{1 2} Florida, US	93 (1.8) ▲
¹ Alabama, US	92 (2.5) ▲
^{1 2} Connecticut, US	91 (1.7) ▲
^{1 2} Indiana, US	90 (1.8) ▲
^{1 3} North Carolina, US	90 (2.5) ▲
Quebec, Canada	90 (1.4) ▲
^{1 2} California, US	89 (1.4) ▲
² Alberta, Canada	86 (1.3) ▲
² Ontario, Canada	85 (1.7) ▲
¹ Colorado, US	82 (2.2) ▲
Abu Dhabi, UAE	81 (2.1) ▲
Dubai, UAE	80 (2.1) ▲

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Correct
Korea, Rep. of	92 (1.0) ▲
Chinese Taipei	91 (1.0) ▲
² Singapore	91 (1.1) ▲
² Russian Federation	91 (1.6) ▲
² United States	89 (1.0) ▲
Japan	86 (1.5) ▲
Kazakhstan	86 (1.9) ▲
Hong Kong SAR	83 (1.8) ▲
¹ Lithuania	83 (1.8) ▲
Ukraine	81 (2.5) ▲
Hungary	81 (1.7) ▲
Armenia	81 (1.8) ▲
Italy	80 (2.1) ▲
Slovenia	78 (2.1) ▲
Finland	78 (1.8) ▲
Romania	75 (1.9) ▲
Sweden	75 (1.7) ▲
‡ England	73 (2.9)
³ Israel	72 (2.2)
Macedonia, Rep. of	71 (2.3)
Australia	71 (2.6)
International Avg.	71 (0.3)
Norway	70 (2.5)
¹ Georgia	68 (2.2)
Qatar	66 (1.6) ▼
Turkey	66 (1.8) ▼
Jordan	65 (2.2) ▼
Indonesia	65 (2.4) ▼
Chile	65 (2.1) ▼
Syrian Arab Republic	65 (2.3) ▼
United Arab Emirates	64 (1.4) ▼
Bahrain	64 (2.1) ▼
Tunisia	62 (2.0) ▼
New Zealand	61 (2.6) ▼
Lebanon	60 (2.6) ▼
Palestinian Nat'l Auth.	59 (1.8) ▼
Saudi Arabia	57 (2.4) ▼
Thailand	56 (2.2) ▼
Iran, Islamic Rep. of	51 (2.5) ▼
Ghana	49 (2.1) ▼
Oman	48 (1.5) ▼
Malaysia	47 (2.1) ▼
Morocco	45 (1.8) ▼

Content Domain: Algebra
 Cognitive Domain: Knowing
 Description: Evaluates a simple algebraic expression

$$y = \frac{a+b}{c}$$

$$a = 8, b = 6, \text{ and } c = 2$$
 What is the value of y ?

A 7
 B 10
 C 11
 D 14

Country	Percent Correct
Ninth Grade Participants	
Botswana	62 (2.0) ▼
² Honduras	50 (2.1) ▼
South Africa	43 (1.4) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} Massachusetts, US	94 (1.3) ▲
^{1 2} Indiana, US	93 (1.3) ▲
¹ Minnesota, US	92 (1.5) ▲
^{1 2} Florida, US	90 (2.2) ▲
^{1 2} California, US	89 (2.1) ▲
^{1 3} North Carolina, US	89 (2.5) ▲
^{1 2} Connecticut, US	88 (2.0) ▲
¹ Alabama, US	84 (3.1) ▲
¹ Colorado, US	84 (2.2) ▲
² Ontario, Canada	78 (2.0) ▲
Quebec, Canada	75 (1.8) ▲
Dubai, UAE	73 (1.9)
² Alberta, Canada	71 (2.2)
Abu Dhabi, UAE	64 (2.3) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Eighth Grade TIMSS 2011 Intermediate International Benchmark

Exhibit 2.24 provides the description of student achievement at the Intermediate International Benchmark. Students at this level can solve problems involving decimals, fractions, proportions, and percentages. They know the meaning of simple algebraic expressions and can relate a two-dimensional drawing to a three-dimensional object. They can locate and interpret data presented in various tabular and graphic formats, and have some understanding of the likelihood of an event.

As mentioned in discussing performance at the low level (Example Item 2), algebraic expressions was a topic in the TIMSS Framework. Example Item 3 shown in Exhibit 2.25 is a slightly more difficult item assessing this topic. This item asks students to identify the meaning of a simple algebraic expression, therefore they need to understand the symbolic representation.

Exhibit 2.26 presents Example Item 4 from the domain of geometric figures. One geometry topic is recognizing relationships between three-dimensional and two-dimensional shapes, and this item asked students to recognize a pyramid from its net and then draw it directly from above. On average, internationally, 58 percent of the eighth grade students answered correctly. Clearly, such visualization tasks are more widely taught in some countries than others.

● Intermediate International Benchmark

475

Summary

Students can apply basic mathematical knowledge in a variety of situations. Students can solve problems involving decimals, fractions, proportions, and percentages. They understand simple algebraic relationships. Students can relate a two-dimensional drawing to a three-dimensional object. They can read, interpret, and construct graphs and tables. They recognize basic notions of likelihood.

Students can solve problems involving decimals, fractions, proportions, and percentages in a variety of settings. For example, they can determine proportions of a whole in order to construct pie charts and calculate unit prices to solve a problem.

Students at this level know the meaning of simple algebraic expressions. For example, they can identify an algebraic expression that represents a situation. They can extend number patterns to the next few terms.

Students can relate a two-dimensional drawing to a three-dimensional object and solve a simple problem involving angles.

Students can locate and interpret data presented in tables, bar graphs, pie charts, and line graphs. For example, they can use information in a table to complete a bar graph. They can compare data from two line graphs to solve a problem. They have some understanding of the likelihood of an event and can determine the chances of outcomes of simple events.

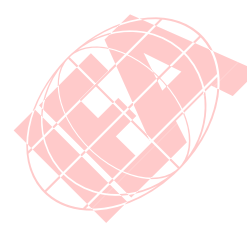
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Hong Kong SAR	94 (1.3) ▲
Korea, Rep. of	91 (1.3) ▲
² Singapore	91 (1.1) ▲
Chinese Taipei	90 (1.3) ▲
² Russian Federation	89 (1.2) ▲
Japan	87 (1.5) ▲
Ukraine	81 (2.1) ▲
² United States	80 (1.2) ▲
Armenia	79 (1.9) ▲
Slovenia	76 (2.0) ▲
¹ Lithuania	75 (2.3) ▲
³ Israel	74 (2.0) ▲
Kazakhstan	73 (1.9) ▲
Hungary	73 (1.9) ▲
Finland	72 (2.2) ▲
‡ England	72 (2.8) ▲
¹ Georgia	71 (1.8) ▲
Australia	71 (2.3) ▲
Jordan	69 (2.0)
United Arab Emirates	66 (1.4)
International Avg.	65 (0.3)
Italy	65 (2.0)
Romania	65 (2.3)
Macedonia, Rep. of	63 (2.5)
Bahrain	62 (1.7)
New Zealand	60 (2.3) ▼
Thailand	60 (2.5) ▼
Lebanon	59 (2.6) ▼
Turkey	58 (1.9) ▼
Chile	58 (2.4) ▼
Saudi Arabia	57 (2.2) ▼
Palestinian Nat'l Auth.	56 (2.0) ▼
Qatar	55 (2.3) ▼
Iran, Islamic Rep. of	55 (2.0) ▼
Sweden	53 (2.0) ▼
Tunisia	49 (1.8) ▼
Indonesia	48 (2.3) ▼
Syrian Arab Republic	48 (2.2) ▼
Oman	47 (1.7) ▼
Malaysia	43 (2.0) ▼
Morocco	41 (1.6) ▼
Ghana	36 (1.8) ▼
Norway	36 (2.6) ▼

Content Domain: Algebra
Cognitive Domain: Knowing
Description: Knows the meaning of a simple algebraic expression involving multiplication and addition

What does $xy + 1$ mean?

(A) Add 1 to y , then multiply by x .
 (B) Multiply x and y by 1.
 (C) Add x to y , then add 1.
 Multiply x by y , then add 1.



Copyright protected by IEA. This item may not be used for commercial purposes without express permission from IEA.

Country	Percent Correct
Ninth Grade Participants	
Botswana	52 (1.7) ▼
South Africa	30 (1.5) ▼
² Honduras	26 (2.0) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} Massachusetts, US	91 (1.9) ▲
¹ Minnesota, US	88 (2.1) ▲
^{1 2} Florida, US	88 (2.6) ▲
^{1 2} Indiana, US	86 (1.6) ▲
^{1 3} North Carolina, US	84 (2.1) ▲
^{1 2} Connecticut, US	83 (2.3) ▲
² Ontario, Canada	81 (2.0) ▲
^{1 2} California, US	79 (2.8) ▲
² Alberta, Canada	78 (2.1) ▲
¹ Alabama, US	77 (2.9) ▲
¹ Colorado, US	76 (3.3) ▲
Dubai, UAE	72 (1.6) ▲
Quebec, Canada	68 (2.0)
Abu Dhabi, UAE	63 (2.5)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Japan	89 (1.2) ▲
Finland	89 (1.1) ▲
Australia	87 (1.2) ▲
Korea, Rep. of	85 (1.3) ▲
New Zealand	84 (1.7) ▲
² Singapore	83 (1.4) ▲
[‡] England	82 (2.1) ▲
² United States	81 (1.0) ▲
Slovenia	81 (1.7) ▲
¹ Lithuania	78 (1.7) ▲
Hungary	77 (1.9) ▲
Hong Kong SAR	77 (2.0) ▲
² Russian Federation	75 (1.7) ▲
Norway	74 (2.4) ▲
Chinese Taipei	74 (1.7) ▲
Chile	70 (1.8) ▲
Italy	70 (2.3) ▲
³ Israel	66 (1.9) ▲
Sweden	65 (1.9) ▲
Kazakhstan	60 (2.4) ▼
Ukraine	59 (3.1) ▼
International Avg.	58 (0.3)
Turkey	57 (1.8) ▼
Malaysia	53 (1.8) ▼
Thailand	51 (2.4) ▼
United Arab Emirates	50 (1.4) ▼
Bahrain	49 (2.5) ▼
Romania	47 (2.2) ▼
Macedonia, Rep. of	47 (2.5) ▼
Iran, Islamic Rep. of	45 (2.2) ▼
Tunisia	44 (1.9) ▼
Jordan	42 (1.8) ▼
Armenia	41 (1.9) ▼
Qatar	40 (2.7) ▼
Palestinian Nat'l Auth.	37 (2.1) ▼
Saudi Arabia	37 (2.2) ▼
¹ Georgia	37 (2.5) ▼
Oman	36 (1.5) ▼
Morocco	35 (1.4) ▼
Indonesia	27 (2.2) ▼
Syrian Arab Republic	26 (2.4) ▼
Lebanon	22 (2.2) ▼
Ghana	10 (1.3) ▼

Content Domain: Geometry
Cognitive Domain: Knowing
Description: Given a net of a three-dimensional object, completes a two-dimensional drawing of it from a specific viewpoint

The shape shown above is cut out of cardboard. The triangle flaps are then folded up along the dotted lines until they touch the edges of the flaps next to them.

Complete the diagram below to show what the shape would look like when viewed from directly above.

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Ninth Grade Participants	
² Honduras	33 (2.5) ▼
Botswana	32 (1.8) ▼
South Africa	26 (1.3) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} Massachusetts, US	90 (1.7) ▲
¹ Minnesota, US	89 (1.7) ▲
² Alberta, Canada	86 (1.6) ▲
² Ontario, Canada	86 (1.4) ▲
¹ Colorado, US	85 (2.1) ▲
^{1 3} North Carolina, US	82 (2.6) ▲
Quebec, Canada	80 (1.9) ▲
^{1 2} Indiana, US	79 (2.8) ▲
^{1 2} Florida, US	79 (2.6) ▲
^{1 2} Connecticut, US	79 (2.8) ▲
^{1 2} California, US	76 (2.8) ▲
¹ Alabama, US	69 (2.6) ▲
Dubai, UAE	57 (1.9) ▼
Abu Dhabi, UAE	50 (2.5) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Eighth Grade TIMSS 2011 High International Benchmark

Exhibit 2.27 presents the description of achievement at the High International Benchmark. Eighth grade students at this level could apply their mathematical knowledge and understanding in a variety of relatively complex situations. For example, they could relate fractions, decimals, and percents to each other. They showed procedural knowledge related to algebraic expressions and could identify the quantity that satisfies two inequalities. They could use properties of lines, angles, and triangles to solve problems. Students also could analyze data from pie charts, line graphs, and bar graphs to solve problems and provide explanations, as well as solve simple problems involving outcomes and probabilities.

Example Item 5, shown in Exhibit 2.28, illustrates the growing facility demonstrated by students at the High Benchmark in converting between percents and fractions. This constructed response item was successfully completed by 37 percent of students, internationally, on average. Singapore was by far the top-performer, with 89 percent correct.

Exhibit 2.29 presents Example Item 6, showing a problem situation involving inequalities represented by balances that can readily be solved using algebra. Nearly four-fifths of the Korean students answered this item correctly. The country-by-country results indicate that students in the East Asian countries are familiar with algebra by the eighth grade, as are students in Finland and the Russian Federation. However, in about a dozen countries, only about one-third or fewer of the students answered this problem correctly. Internationally, on average, 47 percent of the eighth grade students answered correctly.

Example Item 7, shown in Exhibit 2.30, is an example of a data display problem likely to be answered correctly by students reaching the High Benchmark. Students needed to compute the correct proportions from the data in the table, and then construct and label their own pie chart. Internationally, on average, 47 percent of the students answered correctly.

○ High International Benchmark

550 **Summary**

Students can apply their understanding and knowledge in a variety of relatively complex situations. Students can use information from several sources to solve problems involving different types of numbers and operations. Students can relate fractions, decimals, and percents to each other. Students at this level show basic procedural knowledge related to algebraic expressions. They can use properties of lines, angles, triangles, rectangles, and rectangular prisms to solve problems. They can analyze data in a variety of graphs.

Students can use information from several sources to solve problems involving different types of numbers and operations. Students can relate fractions, decimals, and percents to each other. They can solve problems with fractions, proportions, and percentages. Students show understanding of whole number exponents. They can identify the prime factorization of a given number.

Students at this level show basic procedural knowledge related to algebraic expressions. They can evaluate a variety of expressions and formulas. They can simplify an algebraic expression by combining like terms and identify equivalent expressions. They can identify algebraic expressions that correspond to simple situations and add algebraic expressions. Students can identify the solutions of linear equations and a pair of simultaneous linear equations, and identify the quantity that satisfies two inequalities.

Students can use properties of lines, angles, and triangles to solve problems. They can find the perimeter of a square given its area or vice-versa. They can solve problems involving rectangular prisms. Students can produce a drawing that meets given angle specifications. They can recognize rotations and reflections, visualize a figure cut from a folded piece of paper, and draw the missing half of a symmetrical figure.

Students can solve simple problems involving outcomes and probabilities. They can calculate means and determine medians. They can analyze data from pie charts, line graphs, and bar graphs to solve problems and provide explanations.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
² Singapore	89 (1.2) ▲
Korea, Rep. of	76 (1.9) ▲
Hong Kong SAR	76 (2.4) ▲
Chinese Taipei	69 (1.7) ▲
Japan	57 (2.2) ▲
³ Israel	57 (2.1) ▲
² Russian Federation	55 (2.1) ▲
² United States	54 (1.5) ▲
Australia	53 (2.6) ▲
¹ Lithuania	53 (1.9) ▲
Sweden	51 (1.8) ▲
Finland	50 (2.4) ▲
Slovenia	49 (2.2) ▲
† England	48 (3.0) ▲
New Zealand	46 (2.8) ▲
Hungary	46 (2.5) ▲
Italy	46 (2.3) ▲
Norway	42 (2.4) ▲
Malaysia	42 (2.3) ▲
International Avg.	37 (0.3)
United Arab Emirates	37 (1.4)
Kazakhstan	36 (2.5)
Lebanon	35 (2.5)
Armenia	34 (2.2)
Turkey	33 (1.6) ▼
Ukraine	33 (2.7)
Romania	26 (1.8) ▼
Chile	26 (1.5) ▼
Qatar	24 (1.4) ▼
Macedonia, Rep. of	22 (2.0) ▼
Bahrain	22 (1.7) ▼
Iran, Islamic Rep. of	22 (2.0) ▼
Indonesia	20 (1.9) ▼
¹ Georgia	20 (2.0) ▼
Tunisia	19 (1.7) ▼
Thailand	18 (2.1) ▼
Palestinian Nat'l Auth.	18 (1.8) ▼
Syrian Arab Republic	17 (1.9) ▼
Saudi Arabia	12 (1.6) ▼
Morocco	11 (0.8) ▼
Jordan	11 (1.2) ▼
Oman	10 (1.0) ▼
Ghana	8 (1.2) ▼

Content Domain: Number
Cognitive Domain: Knowing
Description: Given the part and the whole, can express the part as a percentage, and given the whole and the percentage, can find the part

Peter, James, and Andrew each had 20 tries at throwing balls into a basket. Complete the missing boxes below.

Name	Number of Successful Shots	Percentage of Successful Shots
Peter	10 out of 20	50 %
James	15 out of 20	75 %
Andrew	16 out of 20	80 %

The answer shown illustrates the type of student response that was given 2 of 2 points.

Country	Percent Full Credit
Ninth Grade Participants	
Botswana	47 (2.0) ▲
South Africa	18 (1.0) ▼
² Honduras	11 (1.3) ▼

Country	Percent Full Credit
Benchmarking Participants	
Quebec, Canada	81 (1.8) ▲
^{1 2} Massachusetts, US	79 (2.5) ▲
¹ Minnesota, US	77 (2.7) ▲
² Alberta, Canada	75 (2.3) ▲
² Ontario, Canada	68 (2.1) ▲
^{1 3} North Carolina, US	62 (3.2) ▲
^{1 2} Connecticut, US	59 (2.8) ▲
^{1 2} Indiana, US	59 (3.6) ▲
^{1 2} Florida, US	58 (4.0) ▲
¹ Colorado, US	51 (3.5) ▲
Dubai, UAE	46 (1.8) ▲
^{1 2} California, US	41 (3.1)
Abu Dhabi, UAE	34 (2.6)
¹ Alabama, US	31 (4.4)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Korea, Rep. of	79 (1.6) ▲
Japan	76 (2.0) ▲
² Singapore	75 (1.7) ▲
Finland	74 (1.9) ▲
Chinese Taipei	74 (1.6) ▲
Hong Kong SAR	68 (2.1) ▲
² Russian Federation	67 (2.2) ▲
† England	62 (2.8) ▲
Australia	62 (2.4) ▲
Sweden	62 (2.1) ▲
¹ Lithuania	61 (2.4) ▲
Hungary	58 (2.3) ▲
Slovenia	58 (2.3) ▲
³ Israel	58 (2.4) ▲
² United States	57 (1.5) ▲
New Zealand	57 (2.4) ▲
Norway	55 (2.5) ▲
Ukraine	54 (2.7) ▲
Italy	51 (2.2) ▲
¹ Georgia	50 (2.6) ▲
Turkey	47 (1.7) ▲
International Avg.	47 (0.3)
Thailand	46 (2.0)
Chile	45 (1.7)
Kazakhstan	43 (2.7)
Romania	40 (2.3) ▼
Armenia	38 (2.4) ▼
United Arab Emirates	37 (1.4) ▼
Iran, Islamic Rep. of	37 (2.1) ▼
Malaysia	36 (2.4) ▼
Macedonia, Rep. of	35 (2.4) ▼
Lebanon	34 (2.4) ▼
Jordan	33 (1.9) ▼
Tunisia	32 (1.8) ▼
Qatar	32 (2.0) ▼
Bahrain	30 (2.1) ▼
Palestinian Nat'l Auth.	26 (2.0) ▼
Saudi Arabia	24 (2.1) ▼
Syrian Arab Republic	22 (2.1) ▼
Oman	22 (1.3) ▼
Morocco	18 (1.2) ▼
Indonesia	18 (1.6) ▼
Ghana	9 (0.9) ▼

Content Domain: Algebra
Cognitive Domain: Reasoning
Description: Identifies the quantity that satisfies two inequalities represented by balances in a problem situation

Jo has three metal blocks. The weight of each block is the same.
 When she weighed one block against 8 grams, this is what happened.

When she weighed all three metal blocks against 20 grams, this is what happened.

Which of the following could be the weight of one metal block?

(A) 5 g
 (B) 6 g
 (C) 7 g
 (D) 8 g

Country	Percent Correct
Ninth Grade Participants	
Botswana	19 (1.6) ▼
South Africa	16 (1.1) ▼
² Honduras	16 (1.7) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} Massachusetts, US	69 (2.6) ▲
Quebec, Canada	67 (2.1) ▲
¹ Minnesota, US	66 (3.2) ▲
^{1 2} Connecticut, US	61 (2.7) ▲
^{1 2} Indiana, US	61 (3.7) ▲
^{1 3} North Carolina, US	60 (3.8) ▲
^{1 2} Florida, US	60 (3.9) ▲
² Alberta, Canada	59 (2.4) ▲
¹ Colorado, US	59 (2.9) ▲
² Ontario, Canada	59 (2.2) ▲
^{1 2} California, US	49 (3.2)
Dubai, UAE	48 (2.7)
¹ Alabama, US	42 (2.9)
Abu Dhabi, UAE	35 (2.3) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

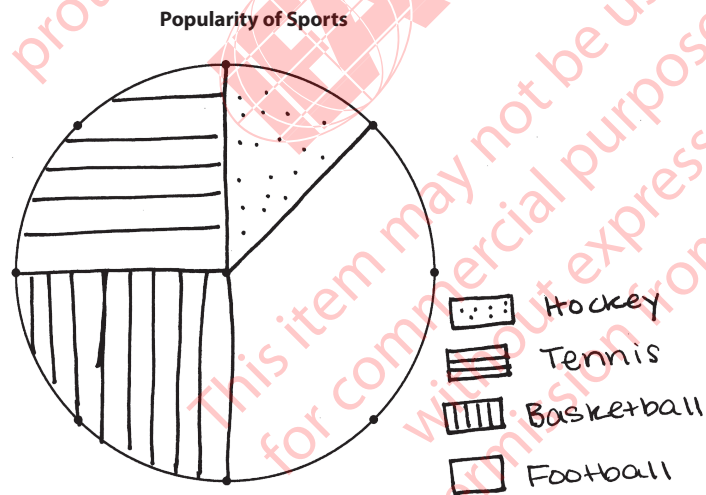
Country	Percent Full Credit
² Singapore	85 (1.5) ▲
Korea, Rep. of	85 (1.4) ▲
Chinese Taipei	80 (1.7) ▲
Hong Kong SAR	76 (1.8) ▲
Japan	75 (1.7) ▲
Finland	70 (2.3) ▲
Slovenia	67 (2.5) ▲
Australia	67 (2.3) ▲
‡ England	65 (3.0) ▲
³ Israel	63 (1.9) ▲
² Russian Federation	63 (2.6) ▲
² United States	62 (1.7) ▲
¹ Lithuania	62 (2.5) ▲
Hungary	62 (2.1) ▲
Norway	61 (2.7) ▲
New Zealand	59 (2.5) ▲
Sweden	58 (1.9) ▲
Italy	54 (2.5) ▲
Malaysia	50 (2.2)
Ukraine	48 (3.0)
Turkey	48 (2.0)
International Avg.	47 (0.3)
Thailand	45 (2.3)
Chile	44 (1.7)
United Arab Emirates	41 (1.4) ▼
Kazakhstan	40 (2.8) ▼
Jordan	34 (2.1) ▼
¹ Qatar	33 (2.2) ▼
Bahrain	33 (1.8) ▼
Oman	30 (1.5) ▼
Palestinian Nat'l Auth.	30 (1.8) ▼
¹ Georgia	30 (2.1) ▼
Romania	29 (2.2) ▼
Indonesia	28 (2.2) ▼
Tunisia	27 (1.9) ▼
Armenia	25 (2.2) ▼
Macedonia, Rep. of	24 (2.1) ▼
Iran, Islamic Rep. of	23 (1.8) ▼
Syrian Arab Republic	23 (2.4) ▼
Saudi Arabia	19 (1.9) ▼
Morocco	18 (1.1) ▼
Lebanon	17 (1.7) ▼
Ghana	11 (1.3) ▼

Content Domain: Data and Chance
Cognitive Domain: Applying
Description: Constructs and labels a pie chart representing a given situation

480 students were asked to name their favorite sport. The results are shown in this table.

Sport	Number of Students
Hockey	60
Football	180
Tennis	120
Basketball	120

Use the information in the table to complete and label this pie chart.



The answer shown illustrates the type of student response that was given 2 of 2 points.

Country	Percent Full Credit
Ninth Grade Participants	
Botswana	40 (1.8) ▼
South Africa	28 (1.5) ▼
² Honduras	23 (2.1) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} Massachusetts, US	74 (2.7) ▲
Quebec, Canada	72 (1.8) ▲
¹ Minnesota, US	71 (2.6) ▲
^{1 2} Connecticut, US	70 (3.6) ▲
^{1 2} Indiana, US	69 (2.7) ▲
¹ Colorado, US	69 (3.6) ▲
^{1 3} North Carolina, US	67 (2.9) ▲
² Ontario, Canada	67 (2.0) ▲
² Alberta, Canada	66 (2.2) ▲
^{1 2} Florida, US	65 (3.8) ▲
^{1 2} California, US	58 (2.8) ▲
¹ Alabama, US	55 (3.8) ▲
Dubai, UAE	48 (1.7)
Abu Dhabi, UAE	40 (2.5) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

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

Eighth Grade TIMSS 2011 Advanced International Benchmark

Exhibit 2.31 describes eighth grade performance at the Advanced International Benchmark. Students reaching this level were adept at many of the topics in the TIMSS 2011 Mathematics Framework. They could reason with a variety of different types of numbers (whole numbers, negative numbers, fractions, and percentages) in routine and non-routine situations and justify their conclusions. They could express generalization algebraically and solve a variety of problems involving equations, formulas, and functions. They could reason with geometric figures to solve problems and reason with data from several sources to solve multi-step problems.

Example Item 8 in Exhibit 2.32 shows an example of the types of items students at the Advanced International Benchmark could answer correctly. It illustrates how students could reason with fractions in an abstract, non-routine situation. They were given two points on a number line representing unspecified fractions, and asked to identify the point that represented their product. Even in the multiple-choice format, only 23 percent of the eighth grade students internationally answered correctly, on average.

Exhibit 2.33 contains Example Item 9, which involves geometric measurement. Specifically, this is a constructed-response item asking students how many books of a given size will fit in a box of a given size. Once again, approximately 60 percent of students or more in the five top-performing East Asian countries could solve this problem. The next highest achievement, however, was 36 percent in the Russian Federation; and in many countries, very few students could solve this problem.

Example Item 10 in Exhibit 2.34 asks students to solve a linear inequality. This was beyond many students in most countries, except in Korea and Chinese Taipei, where 60 and 52 percent, respectively, successfully solved the problem. Forty to 47 percent of students in Armenia, the Russian Federation, Singapore, Israel, and Lebanon also solved this item correctly, though internationally, on average, only 17 percent of the eighth grade students were able to do so.

● Advanced International Benchmark

625

Summary

Students can reason with information, draw conclusions, make generalizations, and solve linear equations. Students can solve a variety of fraction, proportion, and percent problems and justify their conclusions. Students can express generalizations algebraically and model situations. They can solve a variety of problems involving equations, formulas, and functions. Students can reason with geometric figures to solve problems. Students can reason with data from several sources or unfamiliar representations to solve multi-step problems.

Students can solve a variety of fraction, proportion, and percent problems and justify their conclusions. They can reason with different types of numbers, including whole numbers, negative numbers, fractions, and percentages in abstract and non-routine situations. For example, given two points on a number line representing unspecified fractions, students can identify the point that represents their product.

Students can express generalizations either algebraically or in words. For example, they can express the n th term in number patterns. They can write algebraic expressions that model situations in word problems and geometric figures. They can add three simple algebraic expressions with different numerical denominators, subtract expressions, and identify the sum of three consecutive whole numbers given the middle number represented algebraically.

They can solve a variety of problems involving equations, formulas, and functions. For example, they can solve a linear inequality involving fractions, solve linear equations with negative terms, and solve a pair of simultaneous linear equations. They can write an equation to model a situation and solve it. They can identify the linear equation that is satisfied by two ordered pairs or shown graphically. They demonstrate an understanding of slope.

Students can reason with geometric figures to solve problems involving parallel lines, similar triangles, the sum of angles in a triangle, and interior and exterior angles. They also can use their knowledge of geometric figures to solve a wide range of problems about area and volume. For example, they can find the area of a trapezoid inscribed in a rectangle and solve a multi-step word problem involving ratios between volumes. They can use the Pythagorean theorem to find the area of a triangle and the perimeter of a trapezoid. Students can solve distance problems about points on a line or on a coordinate grid.

Students can reason with data from several sources or unfamiliar representations to solve multi-step problems. They demonstrate understanding of the meaning of averages. Students can extrapolate data from a graph and explain why a data representation can be misleading.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Chinese Taipei	53 (2.0) ▲
Hong Kong SAR	47 (2.5) ▲
² Singapore	45 (2.0) ▲
Korea, Rep. of	44 (2.0) ▲
Japan	43 (2.1) ▲
² Russian Federation	31 (2.1) ▲
Sweden	30 (1.8) ▲
‡ England	29 (3.0) ▲
Finland	29 (2.0) ▲
Palestinian Nat'l Auth.	28 (1.8) ▲
³ Israel	27 (2.0) ▲
Oman	26 (1.5) ▲
Syrian Arab Republic	25 (2.2)
Saudi Arabia	25 (1.9)
Jordan	24 (1.6)
Australia	23 (2.1)
Hungary	23 (1.6)
International Avg.	23 (0.3)
² United States	22 (1.5)
Qatar	22 (2.2)
Slovenia	21 (1.9)
Bahrain	21 (1.9)
New Zealand	19 (2.3)
Ukraine	19 (2.0) ▼
Lebanon	18 (2.0) ▼
Malaysia	18 (1.4) ▼
¹ Lithuania	18 (1.8) ▼
Macedonia, Rep. of	17 (2.4) ▼
Iran, Islamic Rep. of	16 (1.2) ▼
Morocco	16 (1.2) ▼
Italy	16 (1.6) ▼
Norway	15 (1.8) ▼
Armenia	15 (1.7) ▼
United Arab Emirates	15 (0.9) ▼
Turkey	15 (1.4) ▼
Tunisia	14 (1.4) ▼
Kazakhstan	14 (1.8) ▼
Chile	14 (1.3) ▼
¹ Georgia	13 (1.7) ▼
Ghana	13 (1.1) ▼
Romania	12 (1.6) ▼
Thailand	12 (1.5) ▼
Indonesia	10 (1.7) ▼

Content Domain: Number
Cognitive Domain: Reasoning
Description: Given two points on a number line representing unspecified fractions, identifies the point that represents their product

Copyright protected by IEA. This item may not be used for commercial purposes without express permission from IEA.

P and Q represent two fractions on the number line above.
 $P \times Q = N$.
 Which of these shows the location of N on the number line?

(A)

(B)

(C)

(D)

Country	Percent Correct
Ninth Grade Participants	
Botswana	13 (1.2) ▼
South Africa	10 (0.9) ▼
² Honduras	8 (1.2) ▼

Country	Percent Correct
Benchmarking Participants	
^{1 2} Massachusetts, US	44 (4.0) ▲
¹ Minnesota, US	38 (3.1) ▲
^{1 3} North Carolina, US	36 (4.1) ▲
^{1 2} Connecticut, US	30 (3.1) ▲
Quebec, Canada	29 (1.8) ▲
² Ontario, Canada	27 (2.0) ▲
² Alberta, Canada	24 (1.9)
¹ Colorado, US	21 (2.4)
^{1 2} Florida, US	20 (2.5)
^{1 2} California, US	19 (2.0)
^{1 2} Indiana, US	19 (2.7)
Abu Dhabi, UAE	16 (1.9) ▼
Dubai, UAE	14 (1.4) ▼
¹ Alabama, US	13 (2.1) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Chinese Taipei	66 (1.8) ▲
Hong Kong SAR	65 (2.1) ▲
Korea, Rep. of	62 (2.0) ▲
² Singapore	60 (1.9) ▲
Japan	58 (1.8) ▲
² Russian Federation	36 (2.6) ▲
³ Israel	34 (2.4) ▲
Kazakhstan	33 (2.5) ▲
¹ Lithuania	30 (2.0) ▲
Australia	29 (2.3) ▲
Finland	29 (2.3)
Malaysia	28 (2.1)
Slovenia	28 (2.6)
New Zealand	27 (2.3)
‡ England	26 (2.3)
² United States	26 (1.5)
Armenia	25 (2.1)
International Avg.	25 (0.3)
Ukraine	23 (2.7)
Norway	22 (2.0)
Italy	22 (2.1)
Romania	22 (2.1)
Hungary	21 (1.7) ▼
Sweden	20 (1.6) ▼
United Arab Emirates	20 (1.3) ▼
Turkey	20 (1.5) ▼
Thailand	16 (1.5) ▼
Chile	16 (1.5) ▼
Macedonia, Rep. of	16 (2.0) ▼
¹ Georgia	15 (1.7) ▼
Palestinian Nat'l Auth.	14 (1.7) ▼
Bahrain	14 (1.5) ▼
Iran, Islamic Rep. of	14 (1.6) ▼
Qatar	13 (1.5) ▼
Tunisia	12 (1.5) ▼
Saudi Arabia	12 (1.7) ▼
Indonesia	11 (1.5) ▼
Oman	11 (0.9) ▼
Lebanon	11 (1.8) ▼
Jordan	9 (0.9) ▼
Syrian Arab Republic	9 (1.5) ▼
Morocco	8 (1.0) ▼
Ghana	4 (1.0) ▼

Content Domain: Geometry
Cognitive Domain: Reasoning
Description: Solves a word problem involving filling a three-dimensional shape with rectangular solids

Ryan is packing books into a rectangular box.
 All the books are the same size.

What is the largest number of books that will fit inside the box?

Answer: 12

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Ninth Grade Participants	
Botswana	7 (1.1) ▼
² Honduras	7 (1.2) ▼
South Africa	4 (0.5) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 2} Massachusetts, US	49 (3.2) ▲
^{1 3} North Carolina, US	46 (3.6) ▲
^{1 2} Indiana, US	45 (3.6) ▲
² Ontario, Canada	39 (2.4) ▲
² Alberta, Canada	39 (2.4) ▲
¹ Minnesota, US	36 (3.2) ▲
Quebec, Canada	34 (2.1) ▲
^{1 2} Connecticut, US	33 (3.3) ▲
¹ Colorado, US	32 (3.9)
^{1 2} Florida, US	32 (3.6) ▲
Dubai, UAE	26 (2.0)
^{1 2} California, US	22 (2.7)
Abu Dhabi, UAE	19 (1.9) ▼
¹ Alabama, US	18 (2.2) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Full Credit
Korea, Rep. of	60 (2.3) ▲
Chinese Taipei	52 (2.0) ▲
Armenia	47 (2.5) ▲
² Russian Federation	46 (3.0) ▲
² Singapore	44 (1.9) ▲
³ Israel	41 (2.5) ▲
Lebanon	40 (3.0) ▲
Hungary	38 (2.3) ▲
Kazakhstan	38 (2.6) ▲
Romania	34 (2.4) ▲
Macedonia, Rep. of	26 (2.9) ▲
¹ Georgia	23 (2.1) ▲
¹ Lithuania	23 (1.9) ▲
² United States	21 (1.6) ▲
International Avg.	17 (0.3)
Hong Kong SAR	16 (2.0)
Oman	15 (1.4)
Bahrain	13 (1.1) ▼
Ghana	13 (1.6) ▼
Morocco	13 (1.2) ▼
Turkey	10 (1.3) ▼
Japan	9 (1.2) ▼
Jordan	9 (1.0) ▼
Finland	8 (1.4) ▼
Australia	8 (1.7) ▼
United Arab Emirates	7 (0.8) ▼
Syrian Arab Republic	7 (1.2) ▼
Qatar	6 (1.3) ▼
Ukraine	6 (1.7) ▼
‡ England	5 (1.3) ▼
Italy	5 (0.9) ▼
Palestinian Nat'l Auth.	4 (0.9) ▼
Saudi Arabia	4 (1.0) ▼
Indonesia	3 (1.1) ▼
Malaysia	3 (0.8) ▼
New Zealand	2 (0.9) ▼
Thailand	2 (0.5) ▼
Slovenia	2 (0.8) ▼
Norway	1 (0.5) ▼
Tunisia	1 (0.6) ▼
Chile	1 (0.2) ▼
Iran, Islamic Rep. of	0 (0.2) ▼
Sweden	--

Content Domain: Algebra
 Cognitive Domain: Knowing
 Description: Solves a linear inequality

Solve this inequality.
 $9x - 6 < 4x + 4$
 Answer: $x < 2$

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
Ninth Grade Participants	
² Honduras	3 (1.4) ▼
Botswana	1 (0.4) ▼
South Africa	1 (0.2) ▼

Country	Percent Full Credit
Benchmarking Participants	
^{1 3} North Carolina, US	38 (4.4) ▲
^{1 2} California, US	35 (3.8) ▲
¹ Minnesota, US	33 (3.2) ▲
^{1 2} Massachusetts, US	33 (4.8) ▲
^{1 2} Indiana, US	33 (3.4) ▲
^{1 2} Connecticut, US	22 (2.4) ▲
^{1 2} Florida, US	19 (3.2)
¹ Colorado, US	13 (2.3)
Dubai, UAE	10 (1.1) ▼
¹ Alabama, US	9 (2.0) ▼
Abu Dhabi, UAE	8 (1.5) ▼
Quebec, Canada	1 (0.4) ▼
² Ontario, Canada	1 (0.3) ▼
² Alberta, Canada	0 (0.2) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and †. Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. A dash (–) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

