chapter

The timss 1999 international benchmarks delineate performance of the top 10 percent, top quarter, top half, and lower quarter of students in the entities

to identify the sets of items that students reaching each international benchmark were likely to answer correctly and those at the next lower benchmark were unlikely to answer correctly.[2] The sets of items thus produced represented the accomplishments of students reaching each benchmark and were used by a panel of subject-matter experts from the timss countries to develop the benchmark descriptions.[3] The work of the panel involved developing a short description for each item of the mathematical understandings demonstrated by students answering it correctly, summarizing students' knowledge and understandings across the set of items for each benchmark to provide more general statements of achievement, and selecting example items illustrating the descriptions.

How Should the Descriptions Be Interpreted?

In general, the parts of the descriptions that relate to the understanding of mathematical concepts or familiarity with procedures are relatively straightforward. It needs to be acknowledged, however, that the cognitive behavior necessary to answer some items correctly may vary according to students' experience. An item may require only simple recall for a student familiar with the item's content and context, but necessitate problem-solving strategies from one unfamiliar with the material. Nevertheless, the descriptions are based on what the panel believed to be the way the great majority of eighth-grade students could be expected to perform.

It also needs to be emphasized that the descriptions of achievement characteristic of students at the international benchmarks are based solely on student performance on the timss 1999 items. Since those items were developed in particular to sample the mathematics domains prescribed for this study, neither the set of items nor the descriptions based on them purport to be comprehensive. There are undoubtedly other mathematics curriculum elements on which students at the various benchmarks would have been successful if they had been included in the assessment.

Please note that students reaching a particular benchmark demonstrated the knowledge and understandings characterizing that benchmark as well as those characterizing the lower benchmarks. The description of achievement at each benchmark is cumulative, building on the description of achievement demonstrated by students at the lower benchmarks.

2 For example, for the Top 10% Benchmark, an item was included if at least 65 percent of students scoring at the scale point corresponding to this benchmark answered the item correctly and less than 50 percent of students scoring at the Upper Quarter Benchmark answered it correctly. Similarly, for the Upper Quarter Benchmark, an item was included if at least 65 percent of students scoring at that point answered the item correctly and less than 50 percent of students at the Median Benchmark answered it correctly.

3 The participants in the scale anchoring process are listed in Appendix E.

Achievement at the Top 10% Benchmark

Exhibit 2.1 describes performance at the Top 10% Benchmark. Students reaching this benchmark demonstrated the ability to organize information in problem-solving situations and to apply their understanding of mathematical relationships. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the three lower benchmarks.

Example Item 1 in Exhibit 2.2 illustrates the type of measurement item a student performing at the Top 10% Benchmark generally answered correctly. As can be seen, students had to apply their knowledge of the area of rectangles and inscribed shapes to solve a two-step problem about the area of a garden path. The international average for this item was 42 percent correct, indicating that this was a relatively difficult item for eighth graders around the world. Nevertheless, more than two-thirds of the students answered the item correctly in Hong Kong, Singapore, Japan, Chinese Taipei, and Korea. Among the Benchmarking participants, eighth graders in the Naperville School District did as well as their counterparts in the high-performing Asian countries, with 69 percent answering correctly. Generally, however, students in the United States – in the country as a whole and in the Benchmarking entities – performed relatively less well than students internationally on measurement questions involving relationships between shapes. No other Benchmarking entity performed significantly above the international average on this test question, and students in six Benchmarking entities and in the United States overall performed significantly below the international average. On average internationally, more than 20 percent of students chose Option A, solving for the area of the larger rectangle rather than that of the path. Option C was an equally popular distracter, selected by more than 20 percent of students internationally.

Unlike students performing at lower benchmarks, students reaching the Top 10% Benchmark typically could correctly answer multistep word problems. Example Item 2 in Exhibit 2.3 requires students to select relevant information from two advertisements to solve a complex multistep word problem involving decimals. Given the price for each issue of a magazine and a certain number of free issues, students were asked to calculate which of the two magazine subscriptions was the less expensive for 24 issues. Students received full credit if they showed correct calculations for at least one of the subscriptions, identified the less expensive magazine, and calculated the difference between the two

Students can organize information, make generalizations, and explain solution strategies in non-routine problem solving situations. They can organize information and make generalizations to solve problems; apply knowledge of numeric, geometric, and algebraic relationships to solve problems (e.g., among fractions, decimals, and percents; geometric properties; and algebraic rules); and find the equivalent forms of algebraic expressions.

Students can organize information in problem-solving situations. They can select and organize information from two sources to solve a complex word problem involving decimals and organize information to solve a multi-step word problem involving whole numbers.

Students can correctly order the four basic operations in computing with decimals and fractions. Students use their understanding of fractions and decimals in multi-step problem situations. They can solve a problem involving both addition and subtraction of simple common fractions and a problem involving multiplication and subtraction of decimals. They can solve word problems involving fractions and decimals which require analysis of the verbal relations described. They can order a set of decimal fractions of up to three decimal places and can identify the pair of numbers satisfying given conditions involving ordering integers, decimals, and fractions. They can solve a time-distance-rate problem involving decimals and the conversion of minutes to seconds. They can work with part-whole ratios and can solve word problems to find the percent change.

Students can apply their knowledge of measurement in more complex problem situations. They can solve problems involving area and perimeter of rectangles and area of inscribed triangles. They apply knowledge of properties of squares to solve multi-step word

the World, Naperville, the Michigan Invitational Group, Montgomery County, the Academy School District, and Oregon – performed significantly above the international average, their performance was below that of the top performers, ranging from 54 to 39 percent correct. Most students added the sequence number to the number of circles in the preceding figure: 1275 + 51 = 1326. Very few calculated the answer by a general expression: n(n+1)/2 or 51(52)/2 (although 13 percent of the Dutch students did so).

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Data Representation, Analysis and Probability

Description: Selects relevant information from two advertisements to solve a complex word problem involving decimals.

Chris pl

The answer shown illustrates the type of student response that was given full credit.

	Overall Percent Correct
Singapore	57 (2.1) ▲
Korea, Rep. of	52 (1.5) ▲
Chinese Taipei	50 (1.8) ▲
Belgium (Flemish) †	42 (1.7) ▲
Naperville Sch. Dist. #203, IL	41 (2.6) ▲
Japan	39 (1.5) ▲
First in the World Consort., IL	36 (2.9) ▲
Montgomery County, MD [2]	35 (2.8) ▲
Hong Kong, SAR †	34 (1.8) ▲
Czech Republic	34 (2.5) ▲
Canada	32 (1.8) ▲
Connecticut	32 (2.7) ●
Texas	31 (4.0) ●
Russian Federation	30 (2.4) ●
Project SMART Consortium, OH	30 (3.5) ●
Indiana †	29 (3.5) ●
Massachusetts	29 (2.7) ●
Michigan Invitational Group, MI	29 (2.2) ●
Academy School Dist. #20, CO	27 (2.5) ●
Italy	27 (1.7) ●
Jersey City Public Schools, NJ	27 (4.4) ●
SW Math/Sci. Collaborative, PA	27 (3.2) ●
Guilford County, NC [2]	26 (2.4) ●
Pennsylvania	26 (2.9) ●
United States	26 (1.4) ●
Michigan	26 (2.2) ●
Illinois	25 (3.1) ●
Netherlands †	25 (2.7) ●
South Carolina	25 (2.2) ●
Idaho	25 (2.8) ●
North Carolina	23 (2.2) ●
Maryland	23 (2.1) ●
Oregon	22 (2.5) ●
Delaware Science Coalition, DE	22 (3.8) ●
Missouri	21 (1.6) ●
Fremont/Lincoln/WestSide PS, NE	20 (3.7) ●
Chicago Public Schools, IL	19 (3.4) ●
England †	17 (1.9) ▼
Rochester City Sch. Dist., NY	15 (2.3) ▼
Miami-Dade County PS, FL	11 (2.3) ▼
International Avg. (All Countries)	24 (0.3)

▲ Participant average significantly higher than international average

● No statistically significant difference between participant average and international average

▼ Participant average significantly lower than international average

Significance tests adjusted for multiple comparisons

* The item was answered fully correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Geometry

Description: Uses properties of similar triangles to find the length of a corresponding side.

Korea, Rep. of	70 (1.9)	▲
Japan	68 (1.9)	▲
Singapore	64 (2.7)	▲
Hong Kong, SAR	56 (2.2)	▲
Naperville Sch. Dist. #203, IL	56 (3.6)	▲
First in the World Consort., IL	52 (4.7)	▲
Chinese Taipei	52 (2.3)	▲
Belgium (Flemish)	50 (3.2)	▲
Academy School Dist. #20, CO	46 (4.2)	●
Guilford County, NC	45 (5.4)	●
Netherlands	44 (3.1)	●

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

* The item was answered fully correctly by a majority of students reaching this benchmark.

States in

Achievement at the Upper Quarter Benchmark

Exhibit 2.6 describes performance at the Upper Quarter Benchmark. Eighth-grade students performing at this level applied their mathematical knowledge and understandings in a wide variety of relatively complex problem situations. For example, they demonstrated facility with fractions in various formats, as illustrated by Example Item 5 shown in Exhibit 2.7. This item required students to shade squares in a rectangular grid to represent a given fraction. Since the grid is divided into squares that are a multiple of the fraction's denominator, more than one step is required to solve the problem. Internationally, about half the students (49 percent on average) were able to shade in nine of the 24 squares to represent 3/8 of the region. Eighty percent or more of the students in Singapore, Hong Kong, Belgium (Flemish), Korea, and Chinese Taipei answered the question correctly. No Benchmarking entities performed that well, but students in the First in World Consortium, Naperville, the Michigan Invitational Group, and Massachusetts performed significantly above the international average.

Example Item 6 is a proportional reasoning word problem that students at the Upper Quarter Benchmark typically answered correctly (see Exhibit 2.8). Given the number of magazines sold by each of two boys and the total amount of money made from the sales, students were to calculate how much money one of the boys made by selling his 80 magazines. On average, 44 percent of students internationally answered this question correctly. In Singapore and Chinese Taipei at least three-quarters of the students answered correctly. No Benchmarking participant performed significantly above the international average, and students in Maryland, the Michigan Invitational Group, the Chicago Public Schools, the Rochester City School District, and the Miami-Dade County Public Schools performed significantly below the international average.

Students reaching the Upper Quarter Benchmark generally were able to apply knowledge of geometric properties. In Example Item 7 in Exhibit 2.9, students needed to use their knowledge of the properties of parallelograms and rectangles to solve for the area of the rectangle (dimensions not labeled) that was part of a different figure with given dimensions. Three-quarters or more of the students in Singapore, Japan, Hong Kong, Korea, and Chinese Taipei answered the item correctly. Internationally, however, less than half the eighth-grade students (43 percent on average) did so. The United States performed

significantly below the international average, as did eight of the Benchmarking entities: North Carolina, South Carolina, Missouri, the Delaware Science Coalition, and the public school systems in Jersey City, Chicago, Miami-Dade, and Rochester.

Example Item 8 shown in Exhibit 2.10 asks students for the number of triangles of a given dimension needed to cover a rectangle of given dimensions. The international average on this item was 46 percent correct. Many students (approximately 29 percent internationally) incorrectly chose Option A, which is half the number of required triangles needed to fill the rectangle but just enough to cover the perimeter. Japanese students had the highest performance on this item, with 80 percent answering correctly. About two-thirds or more of the students in Korea, Hong Kong, Singapore, Belgium (Flemish), and the Netherlands answered the item correctly. Performance among the Benchmarking participants ranged from 62 percent correct responses in Naperville to 30 percent in Miami-Dade. The United States as a whole performed at about the international average, and most of the Benchmarking jurisdictions performed similarly.

Unlike students at lower benchmarks, those reaching the Upper Quarter Benchmark typically could solve simple linear equations. As illustrated by Example Item 9 in Exhibit 2.11, for example, students successfully solved for the value of x in a linear equation involving the variable on both sides of the equation. Eighty percent or more of the students in Japan, Hong Kong, and Korea answered this item correctly. Even though the United States did relatively well in algebra (see Chapter 3), this problem posed difficulties for students in the Benchmarking entities. Naperville (72 percent) and First in the World (61 percent) were the only Benchmarking participants that performed significantly above the international average of 44 percent correct responses. The United States performed below average (34 percent) on this question, as did students in 11 of the Benchmarking entities.

Students can apply their understanding and knowledge in a wide variety of relatively complex

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

Content Area: Measurement

Description: Finds the area of a rectangle contained in a parallelogram of given dimensions.

The fig

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

	Overall Percent Correct
Singapore	83 (1.5) ▲
Japan	80 (1.2) ▲
Hong Kong, SAR †	78 (1.6) ▲
Korea, Rep. of	78 (1.3) ▲
Chinese Taipei	75 (1.4) ▲
Naperville Sch. Dist. #203, IL	65 (2.8) ▲
Belgium (Flemish) †	65 (2.0) ▲
First in the World Consort., IL	62 (4.3) ▲
Canada	58 (1.6) ▲
Netherlands †	55 (4.7) ●
Academy School Dist. #20, CO	49 (3.4) ●
Russian Federation	49 (2.8) ●
Italy	48 (2.1) ●
England †	48 (2.3) ●
Czech Republic	46 (2.9) ●
Oregon	46 (4.0) ●
Michigan Invitational Group, MI	46 (3.9) ●
Montgomery County, MD [2]	45 (3.9) ●
Project SMART Consortium, OH	44 (4.5) ●
Massachusetts	44 (2.8) ●
Illinois	41 (2.9) ●
Idaho	41 (3.8) ●
Connecticut	40 (4.2) ●
SW Math/Sci. Collaborative, PA	40 (3.6) ●
Texas	40 (4.1) ●
Michigan	39 (2.9) ●
Fremont/Lincoln/WestSide PS, NE	38 (3.5) ●
Indiana †	38 (3.9) ●
Pennsylvania	34 (2.9) ▼
Maryland	34 (2.5) ▼
Guilford County, NC [2]	34 (4.6) ●
United States	34 (1.4) ▼
North Carolina	33 (2.9) ▼
South Carolina	32 (3.2) ▼
Missouri	30 (2.5) ▼
Delaware Science Coalition, DE	24 (3.6) ▼
Jersey City Public Schools, NJ	22 (4.1) ▼
Chicago Public Schools, IL	18 (4.4) ▼
Miami-Dade County PS, FL	14 (2.4) ▼
Rochester City Sch. Dist., NY	12 (1.9) ▼
International Avg. (All Countries)	43 (0.3)

▲ Participant average significantly higher than international average

● No statistically significant difference between participant average and international average

▼ Participant average significantly lower than international average

Significance tests adjusted for multiple comparisons

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

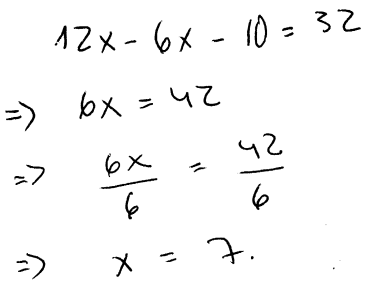
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Algebra

Description: Solves a linear equation involving transposing.

Find

7



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

	Overall Percent Correct
Japan	85 (1.4) ▲
Hong Kong, SAR †	80 (1.9) ▲
Korea, Rep. of	80 (1.5) ▲
Russian Federation	77 (3.1) ▲
Singapore	75 (2.8) ▲
Chinese Taipei	73 (2.0) ▲
Naperville Sch. Dist. #203, IL	72 (3.6) ▲
Czech Republic	66 (2.8) ▲
First in the World Consort., IL	61 (5.0) ▲
Belgium (Flemish) †	58 (1.9) ▲
Academy School Dist. #20, CO	57 (5.1) ●
Montgomery County, MD [2]	55 (4.1) ●
Italy	46 (2.8) ●
Indiana †	44 (5.7) ●
Michigan	40 (3.7) ●
Guilford County, NC [2]	40 (6.1) ●
Massachusetts	39 (3.7) ●
South Carolina	39 (3.9) ●
Texas	38 (5.3) ●
SW Math/Sci. Collaborative, PA	38 (3.8) ●
Oregon	37 (3.9) ●
Maryland	35 (3.7) ●
Idaho	34 (5.2) ●
United States	34 (1.8) ▼
Michigan Invitational Group, MI	33 (6.5) ●
Canada	33 (3.1) ▼
Project SMART Consortium, OH	32 (5.3) ●
Connecticut	32 (3.7) ▼
Illinois	32 (4.1) ▼
Pennsylvania	31 (2.6) ▼
North Carolina	27 (3.9) ▼
Rochester City Sch. Dist., NY	27 (5.2) ▼
Jersey City Public Schools, NJ	26 (5.0) ▼
England †	26 (2.7) ▼
Delaware Science Coalition, DE	25 (5.2) ▼
Missouri	24 (3.1) ▼
Fremont/Lincoln/WestSide PS, NE	22 (4.1) ▼
Netherlands †	19 (2.9) ▼
Miami-Dade County PS, FL	17 (4.8) ▼
Chicago Public Schools, IL	10 (2.3) ▼
International Avg. (All Countries)	44 (0.4)

▲ Participant average significantly higher than international average

● No statistically significant difference between participant average and international average

▼ Participant average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Achievement at the Median Benchmark

Students at the Median Benchmark demonstrated the ability to apply basic mathematical knowledge in straightforward situations (see Exhibit 2.12). For example, as shown by Example Item 10 in Exhibit 2.13, students showed that they understand rounding and can use it to estimate the results of computations. Given the number of rows of cars in a parking lot and the number of cars in each row, students chose the number sentence that would give the best estimate of the total number of cars. While students at the Lower Quarter Benchmark rounded to the nearest hundred, students at the Median Benchmark successfully rounded numbers to get the best estimate for a product. Moreover, middle-performing students demonstrated greater competence with word problems than did those at the Lower Quarter Benchmark. The Benchmarking participants performed particularly well on this test question involving rounding. The international average percent correct for this item was 65 percent, and all except five Benchmarking entities performed significantly above the international average. Among the high-achieving countries, Singapore outperformed other countries with 94 percent correct, followed by 85 percent in Hong Kong. More than 85 percent of students answered correctly in Naperville, the First in the World Consortium, Guilford County, the Academy School District, the Southwest Pennsylvania Math and Science Collaborative, Indiana, North Carolina, and Connecticut.

In geometry, students at the Median Benchmark were able to locate a point on a grid with five-unit divisions that lies between the grid lines (see Example Item 11 in Exhibit 2.14). Fifty-eight percent of students on average internationally correctly chose Point S as the point on the grid that could have the coordinates (7,16). In Japan, Korea, Chinese Taipei, Hong Kong, and Singapore, 80 percent or more of the students answered correctly, as did students in Naperville and First in the World. Generally, the Benchmarking participants performed relatively well on this question, with 13 of them performing significantly above the international average. As might be anticipated, students answering incorrectly most commonly chose Point Q (16,7).

Example Item 12 shown in Exhibit 2.15 illustrates students' emerging familiarity with algebraic representation. Internationally on average, nearly two-thirds of students correctly identified the linear equation corresponding to a given verbal statement involving a variable. In Hong Kong, Singapore, Japan, and Korea, 85 percent or more of the students answered correctly, and eighth graders in several Benchmarking

• Median Benchmark

Summary

Students can apply basic mathematical knowledge in straightforward situations. They can add or subtract to solve one-step word problems involving whole numbers and decimals; identify representations of common fractions and relative sizes of fractions; solve for missing terms in proportions; recognize basic notions of percents and probability; use basic properties of geometric figures; read and interpret graphs, tables, and scales; and understand simple algebraic relationships.

Students can apply basic mathematical knowledge in straightforward situations. They are able to use addition and subtraction to solve one-step word problems involving whole numbers and decimals. They can round whole numbers to the nearest hundred and identify the number sentence that gives the best estimate for the product of two numbers after rounding. Students can arrange four given digits in descending and ascending order to form the largest and smallest possible numbers, and find the difference between those two numbers. Students can approximate the quantity remaining after an amount is reduced by a given percent.

Students demonstrate an understanding of place value in decimal numbers. They can estimate the location of a point representing a decimal number in tenths on a number line marked in whole numbers and identify an unlabeled midway point on a number line marked in tenths. They can set up and solve one-step problems involving addition and subtraction of numbers having up to three decimal places, including situations where the numbers have a different number of decimal places. Given an object of one length, to one decimal place, they can estimate the length of another object.

Students can select the smallest fraction from a list of fractions and can recognize models representing fractions as shaded regions. They can find the missing term in a proportion in word problems and number sentences. Students can solve a simple word problem involving the likelihood of a successful outcome.

Students are able to select the appropriate metric unit to measure the mass of an object. They recognize the inverse relationship between the length of a unit and the number of units required to cover a distance.

Students can locate and interpret data presented in bar graphs, pictographs, pie graphs, and line graphs. Given a table of values for two variables, they can select the graph that represents the given data.

Students can solve problems involving the properties of congruent figures and can select a pair of similar triangles from a set of triangles. They can visualize a rotation of a three-dimensional figure made of cubes. They can locate points in the first quadrant of the Cartesian plane.

Students can select an expression to represent a situation involving multiplication, and identify a linear equation corresponding to a verbal statement. They can find a missing value in a table of values relating x and y values. Using the properties of a balance, they can reason to find an unknown weight. Given diagrams representing the first few terms of a sequence, growing in one dimension, and a partially completed table, they can find the next two terms.

50th Percentile: 479

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Content Area: Fractions and Number Sense

Description: In a word problem, uses rounding to identify the number sentence that gives the best estimate for the product.

	Overall Percent Correct	
Naperville Sch. Dist. #203, IL	95 (2.1)	▲
Singapore	94 (1.0)	▲
First in the World Consort., IL	93 (3.2)	▲
Guilford County, NC [2]	87 (3.4)	▲
Academy School Dist. #20, CO	87 (3.0)	▲
SW Math/Sci. Collaborative, PA	87 (3.1)	▲
Indiana †	86 (2.6)	▲
North Carolina	86 (1.9)	▲
Connecticut	86 (3.6)	▲
Michigan Invitational Group, MI	85 (3.8)	▲
Illinois	85 (2.2)	▲
Hong Kong, SAR †	85 (1.7)	▲
Montgomery County, MD [2]	85 (3.2)	▲
Michigan	85 (2.6)	▲
Chicago Public Schools, IL	84 (2.1)	▲
Oregon	84 (2.1)	▲
Belgium (Flemish) †	83 (3.0)	▲
Japan	82 (1.4)	▲
Korea, Rep. of	82 (1.2)	▲
Chinese Taipei	81 (1.5)	▲
South Carolina	81 (2.9)	▲
Texas	81 (3.5)	▲
Netherlands †	81 (3.1)	▲
Idaho	81 (3.6)	▲
Pennsylvania	80 (3.9)	▲
Project SMART Consortium, OH	80 (4.7)	▲
United States	79 (1.8)	▲
Canada	78 (2.1)	▲
Czech Republic	78 (2.3)	▲
Massachusetts	76 (2.8)	▲
Missouri	75 (2.6)	▲
Fremont/Lincoln/WestSide PS, NE	75 (4.0)	●
Delaware Science Coalition, DE	74 (3.2)	●
England †	74 (2.8)	▲
Maryland	74 (1.9)	▲
Jersey City Public Schools, NJ	71 (3.2)	●
Rochester City Sch. Dist., NY	67 (3.8)	●
Russian Federation	65 (2.7)	●
Miami-Dade County PS, FL	60 (3.5)	●
Italy	52 (2.5)	▼
International Avg. (All Countries)	65 (0.4)	52(2.7)01_36711.7)01_367119.756(7

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

[2] National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Geometry

Description: Locates the point on a grid with 5-unit divisions when the point lies between the grid lines.

Which point on t

	Overall Percent Correct	
Naperville Sch. Dist. #203, IL	88 (2.9)	▲
Japan	84 (1.7)	▲
Korea, Rep. of	84 (1.4)	▲
Chinese Taipei	83 (1.5)	▲
First in the World Consort., IL	82 (3.2)	▲
Hong Kong, SAR †	81 (1.7)	▲
Singapore	80 (2.3)	▲
Netherlands †	78 (2.5)	▲
North Carolina	78 (3.2)	▲
Jersey City Public Schools, NJ	76 (4.4)	▲
Guilford County, NC [2]	75 (4.2)	▲
England †	75 (3.2)	▲
SW Math/Sci. Collaborative, PA	74 (3.3)	▲
Texas	74 (3.4)	▲
South Carolina	73 (3.5)	▲
Academy School Dist. #20, CO	73 (3.3)	▲
Montgomery County, MD [2]	73 (3.0)	▲
Michigan	72 (2.9)	▲
Pennsylvania	71 (2.0)	▲
Russian Federation	71 (2.2)	▲
Belgium (Flemish) †	71 (2.5)	▲
Oregon	70 (5.3)	●
Michigan Invitational Group, MI	69 (3.8)	●
Illinois	69 (3.3)	▲
Project SMART Consortium, OH	68 (4.8)	●
Canada	67 (2.6)	▲
Indiana †	67 (3.2)	●
United States	67 (1.6)	▲
Maryland	67 (3.7)	●
Massachusetts	64 (3.0)	●
Italy	62 (2.2)	●
Connecticut	61 (4.5)	●
Delaware Science Coalition, DE	60 (4.6)	●
Missouri	60 (3.0)	●
Czech Republic	58 (3.2)	●
Chicago Public Schools, IL	57 (5.3)	●
Miami-Dade County PS, FL	56 (4.2)	●
Idaho	56 (5.8)	●
Rochester City Sch. Dist., NY	55 (4.7)	●
Fremont/Lincoln/WestSide PS, NE	54 (6.1)	●
International Avg. (All Countries)	58 (0.4)	

▲ Participant average significantly higher than international average

● No statistically significant difference between participant average and international average

▼ Participant average significantly lower than international average

Significance tests adjusted for multiple comparisons

Achievement at the Lower Quarter Benchmark

As shown in Exhibit 2.16, the few items anchoring at the Lower Quarter Benchmark provided evidence that students performing at this level can add, subtract, and round with whole numbers. For example, students answering Example Item 13 correctly rounded 691 and 208 to estimate their sum as close to the sum of 700 and 200 (see Exhibit 2.17). The international average was 80 percent correct, and 27 countries had three-quarters or more of their students choosing the correct answer. In four countries – Singapore, Belgium (Flemish), Japan, and the Netherlands – 95 percent or more of the students gave the correct response. That level of performance was attained by students in twelve Benchmarking entities: Naperville, Indiana, the Michigan Invitational Group, the Southwest Pennsylvania Math and Science Collaborative, Montgomery County, the Project smart Consortium, Connecticut, Pennsylvania, Illinois, Missouri, Texas, and the First in the World Consortium. Again, the Benchmarking participants did comparatively well on this rounding item. In all, students in every Benchmarking entity except the Miami-Dade County Public Schools achieved significantly above the international average.

As illustrated by Example Item 14 in Exhibit 2.18, students at the Lower Quarter Benchmark generally could subtract one three-decimal-place number from another with multiple regrouping. Internationally on average, 77 percent of the eighth-grade students selected the correct response to this item. Students in Texas (89 percent) performed significantly above the international average and similarly to students in Singapore, Korea, and the Russian Federation (88 to 90 percent). All of the other Benchmarking participants performed near the international average except the Michigan Invitational Group (60 percent), whose students performed below it.

Students at this level could subtract one four-digit integer from another involving multiple regrouping with zeroes (see Example Item 15 in Exhibit 2.19). On this subtraction item also, students in Texas (90 percent) performed similarly to those in Singapore, Chinese Taipei, and Hong Kong (90 to 92 percent). Students in the Naperville School District (88 percent), the Academy School District (84 percent), and Massachusetts (82 percent) also performed significantly above the international average of 74 percent.

Students can do basic computations with whole numbers.

The few items at this level provide some evidence that students can add, subtract, and round

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Fractions and Number Sense

Description: Subtracts a three-decimal-place number from another with multiple regrouping.

Singapore	90 (1.4)	▲
Texas	89 (2.1)	▲
Korea, Rep. of	88 (1.2)	▲
Russian Federation	88 (1.9)	▲
Japan	86 (1.3)	▲
Czech Republic	85 (2.8)	●
Chinese Taipei	84 (1.5)	▲
Naperville Sch. Dist. #203, IL	84 (2.9)	●
Chicago Public Schools, IL	83 (2.8)	●
Hong Kong, SAR †	83 (1.8)	▲
Indiana †	82 (2.7)	●
Montgomery County, MD 2	82 (3.4)	●
South Carolina	81 (2.6)	●
Academy School Dist. #20, CO	81 (3.3)	●
Canada	80 (1.8)	●
Illinois	78 (2.2)	●
Guilford County, NC 2	78 (4.0)	●
Pennsylvania	78 (2.8)	●
Project SMART Consortium, OH	78 (3.3)	●
Rochester City Sch. Dist., NY	77 (3.9)	●
Massachusetts	77 (2.6)	●
Maryland	77 (2.2)	●
United States	77 (1.7)	●
Italy	77 (2.3)	●
Connecticut	77 (4.0)	●
SW Math/Sci. Collaborative, PA	76 (3.4)	●
Jersey City Public Schools, NJ	76 (5.2)	●
North Carolina	76 (2.6)	●
Idaho	75 (3.9)	●
Michigan	74 (3.1)	●
Oregon	73 (3.6)	●
Belgium (Flemish) †	73 (2.0)	●
First in the World Consort., IL	73 (3.5)	●
Miami-Dade County PS, FL	71 (4.0)	●
Netherlands †	69 (4.3)	●
Missouri	68 (4.2)	●
Delaware Science Coalition, DE	68 (3.5)	●
Fremont/Lincoln/WestSide PS, NE	61 (5.6)	●
Michigan Invitational Group, MI	60 (4.4)	▼
England †	59 (2.7)	▼

Naperville Sch. Dist. #203, IL	99 (1.0)	▲
Japan	96 (0.8)	▲
Singapore	95 (0.9)	▲
Belgium (Flemish) †	95 (1.5)	▲
First in the World Consort., IL	95 (2.7)	▲
Academy School Dist. #20, CO	92 (2.1)	▲
Korea, Rep. of	92 (0.9)	▲
England †	92 (2.2)	▲
Chinese Taipei	91 (1.2)	▲
Czech Republic	91 (1.9)	▲
Illinois	91 (1.8)	▲
Project SMART Consortium, OH	91 (3.7)	●
Indiana †	91 (1.9)	▲
SW Math/S Tf1943.7dath/S TfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTfTf		