

The 
Nation's
Report Card

Mathematics 2003 and 2005

Performance in Puerto Rico

HIGHLIGHTS

National Assessment of Educational Progress



Contents

MARCH 2007

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What is the Nation's Report Card™?

The Nation's Report Card™ informs the public about the academic achievement of elementary and secondary students in the United States and its jurisdictions, including Puerto Rico. Report cards communicate the findings of the National Assessment of Educational Progress (NAEP), a continuing and nationally representative measure of achievement in various subjects over time. The Nation's Report Card™ compares performance among states, urban districts, public and private schools, and student demographic groups.

For over three decades, NAEP assessments have been conducted periodically in reading, mathematics, science, writing, history, geography, and other subjects. By making objective information available on student performance at the national, state, and local levels, NAEP is an integral part of our nation's evaluation of the condition and progress of education. Only information related to academic achievement and relevant variables is collected. The privacy

of individual students is protected, and the identities of participating schools are not released. NAEP is a congressionally mandated project of the National Center for Education Statistics (NCES) within the Institute of Education Sciences of the U.S. Department of Education. The Commissioner of Education Statistics is responsible for carrying out the NAEP project. The National Assessment Governing Board oversees and sets policy for NAEP.

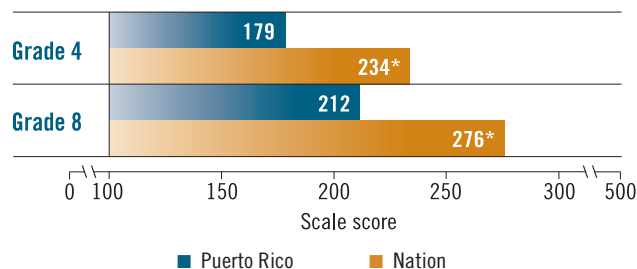
Executive Summary

The NAEP mathematics assessment was administered to public school students in Puerto Rico for the first time in 2003. Although NAEP had previously administered some of the assessment in Spanish to students who required accommodations, this was the first time an entire NAEP administration was in a language other than English. The NAEP mathematics assessment was administered again to public school students in both fourth- and eighth-grades in Puerto Rico in 2005. This report presents the results of the NAEP mathematics assessment for Puerto Rico for 2003 and 2005. Because of modifications to the 2005 Puerto Rico administration, results from 2003 should not be compared to results from 2005. Although parallel changes were not made in the nation in 2005, within year comparisons between Puerto Rico and the nation are valid.

2003 Findings

- On average, fourth- and eighth-grade students in Puerto Rico scored lower than public school students in the nation.

Figure A.
Average NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003



* Significantly different ($p < .05$) from students in Puerto Rico.

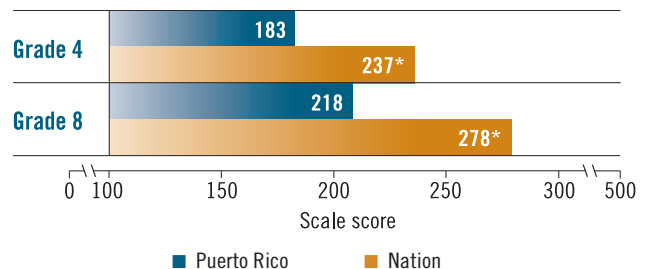
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

- At fourth-grade, 9 percent of students in Puerto Rico and 76 percent of students in the nation scored at or above *Basic*. At eighth-grade, 4 percent of students in Puerto Rico and 67 percent of students in the nation scored at or above *Basic*.
- Fourth-grade female students in Puerto Rico scored significantly higher than male students in the geometry and spatial sense content area.

2005 Findings

- Overall, fourth- and eighth-grade students in Puerto Rico scored lower, on average, than public school students in the nation.

Figure B.
Average NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

- Twelve percent of students in Puerto Rico and 79 percent of students in the nation scored at or above *Basic* in grade 4. Six percent of students in Puerto Rico and 68 percent of students in the nation scored at or above *Basic* in grade 8.
- Eighth-grade female students in Puerto Rico scored significantly higher than male students in the data analysis and probability content area.

About this report

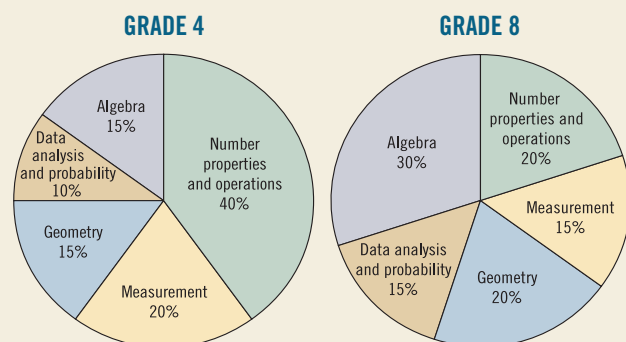
Throughout this report, results for Puerto Rico are compared to results for public school students in the nation because in Puerto Rico only public school students participated in the 2003 and 2005 NAEP mathematics assessments. The national sample does not include Puerto Rico at this time, although the intent is to include Puerto Rico as part of the national sample in future NAEP administrations.

Understanding the Results

The Mathematics Framework

The content of the mathematics assessment is based on a framework which describes in detail how mathematics should be assessed by NAEP. The framework was developed by the National Assessment Governing Board in a comprehensive process involving a broad spectrum of interested parties, including teachers, curriculum specialists, subject-matter specialists, school administrators, parents, and members of the general public. The NAEP mathematics framework specifies the content to be assessed at each grade level and the percentage of questions to be assessed in each of five content areas (exhibit 1). The frameworks are available at <http://www.nagb.org/pubs/pubs.html>.

Exhibit 1.
Distribution of NAEP mathematics items, by grade and content area in 2005



Revisions are periodically made to the framework to reflect changing curricular emphases and objectives. Whenever possible, NAEP maintains a connection to previous frameworks when revisions are made. In 2005, names of some of the content areas changed but the percentage of questions to be assessed in each of five content areas remained the same for grade 4. At grade 8, there was a 5 percent decreased emphasis on number properties and operations and a corresponding 5 percent increased emphasis on algebra compared to 2003.

In addition to specifying content, the 2005 framework called for an assessment that measures different levels

of mathematical complexity to assure that NAEP assesses a variety of ways of knowing and doing mathematics. The level of complexity of a question is determined by the cognitive demands that it places on students. For example, a question with a high level of complexity at grade 4 might ask students to explain and justify their solutions to a problem.

Administering the NAEP Mathematics Assessment in Puerto Rico

Title I of the Elementary and Secondary Education Act of 1965, as amended, requires all jurisdictions receiving Title I funds to participate in the National Assessment of Educational Progress in fourth- and eighth-grade reading and mathematics every other year beginning in 2003. The U.S. Department of Education decided that Puerto Rico should not participate in the NAEP reading assessment, because that assessment measures a student's ability to read in English, and Spanish is the language of instruction in Puerto Rico.

The NAEP mathematics assessment was translated into Spanish to allow Puerto Rico to participate on a trial basis. First in 2003 and then again in 2005, the NAEP mathematics assessment was administered to fourth- and eighth-grade public school students in Puerto Rico. The content of both the 2003 and 2005 NAEP assessments was the same as the content administered to all other jurisdictions for those years.

In future NAEP administrations, the intent is to include Puerto Rico as part of the national sample. The Puerto Rico results for 2003 and 2005 were not combined with those of other states or jurisdictions because of concerns that translated items used in Puerto Rico were not functioning like the English-only items used in the nation. Further analysis of the 2003 and 2005 assessments concluded that the Puerto Rico results were accurate in terms of the NAEP scale, and comparisons between Puerto Rico and the nation could be made. However, the Puerto Rico 2003 results cannot be compared to those for 2005 because changes were made to the 2005 assessment to improve the translation. Details are provided in the forthcoming *Technical Report of the NAEP Mathematics Assessment in Puerto Rico: Focus on Statistical Issues*. This report will be available at http://nationsreportcard.gov/puertorico_2005/.

Reporting the Results

This report is one of a series of three on the administration and results of the 2003 and 2005 NAEP mathematics assessments in Puerto Rico. The forthcoming *Technical Report of the NAEP Mathematics Assessment in Puerto Rico: Focus on Statistical Issues* provides details on the technical quality of the NAEP assessments administered in Puerto Rico. A second report, *Mathematics 2005 Performance in Puerto Rico: Focus on the Content Areas*, provides results by content area and includes a discussion of student performance on a sample of items. This, the third report, presents results for Puerto Rico and the nation in two ways: as average scores on the NAEP mathematics scale and as percentages of students attaining different NAEP mathematics achievement levels. Published reports are available at http://nationsreportcard.gov/puertorico_2005/.

Scale Scores. NAEP mathematics results are reported for both grades on the same 0–500 scale. The NAEP mathematics assessment is a composite combining separate scales for each of the five mathematics content areas. Results for each content area are also reported on a 0–500 scale. Average scale scores are computed for groups, not for individual students. The average scores are based on analyses of the percentages of students who answered each item successfully; NAEP does not produce individual student scores. While the score ranges at each grade in mathematics are identical, the scales were derived independently at each grade. Therefore, average scale scores across grades cannot be compared. For example, equal scale scores on the grade 4 and grade 8 scales do not imply equal levels of mathematics achievement. In this report, average scores are presented for public school students in Puerto Rico and the nation. Scale scores of students at selected percentiles are used to illustrate the relative performance of students in both Puerto Rico and the nation.

Achievement Levels. In addition to scale scores, results are presented in terms of mathematics achievement levels as adopted by the Governing Board. Achievement levels are intended to measure how well students' actual achievement matches the achievement expected of them. At each grade level, the achievement-level cut scores are placed on the mathematics scales and percentages of students performing at or above three achievement levels are reported (exhibit 2). The three achievement levels are: *Basic*, *Proficient*, and *Advanced*. Percentages below *Basic* are also reported.

Exhibit 2.

NAEP achievement levels

The three NAEP achievement levels from lowest to highest are *Basic*, *Proficient*, and *Advanced*.

Basic: This level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.

Proficient: This level represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter.

Advanced: This level signifies superior performance.

Cut scores

Cut scores represent the minimum score required for performance at each NAEP achievement level. The mathematics cut scores on the 0–500 NAEP scale that define the lower boundaries of each of the achievement levels are:

	Grade 4	Grade 8
<i>Basic</i>	214	262
<i>Proficient</i>	249	299
<i>Advanced</i>	282	333

The Governing Board established its achievement levels in 1990 based upon the NAEP mathematics content framework and a standard-setting process. A cross section of educators and interested citizens from across the nation were asked to judge what students should know and be able to do relative to the content set out in the NAEP mathematics framework. As provided by law, NCES, upon review of congressionally mandated evaluations of NAEP, has determined that achievement levels are to be used on a trial basis and should be interpreted with caution. NAEP achievement levels have been widely used by national and state officials.

Interpreting Results

NAEP uses widely accepted statistical standards in analyzing sample data. In the tables and charts of this report, the symbol (*) is used to indicate scores or percentages that have been determined to be statistically significant from one another at the .05 level, with appropriate adjustments for multiple comparisons. Differences between scale scores or percentages are calculated using unrounded numbers. In some instances, the result of the subtraction differs from what would be obtained by subtracting the rounded values shown in the accompanying figure or table.

2003 Results

4th
Grade

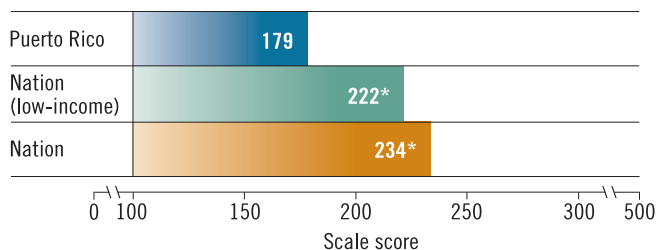


Overall performance differences between Puerto Rico and the nation

Overall performance on the NAEP mathematics assessment is summarized on a 0–500 scale. Figure 1 presents the average scale scores of students from Puerto Rico, students from low-income families in the nation, and all students from the nation.

On average, in 2003, students at grade 4 in Puerto Rico scored lower on the mathematics assessment than students in the nation. The average scale score for students in Puerto Rico was 179, compared with 234 for the nation. Puerto Rican students' scores were 42 points lower than those of students from low-income families and 55 points lower than students in the nation.

Figure 1.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003



* Significantly different ($p < .05$) from students in Puerto Rico.

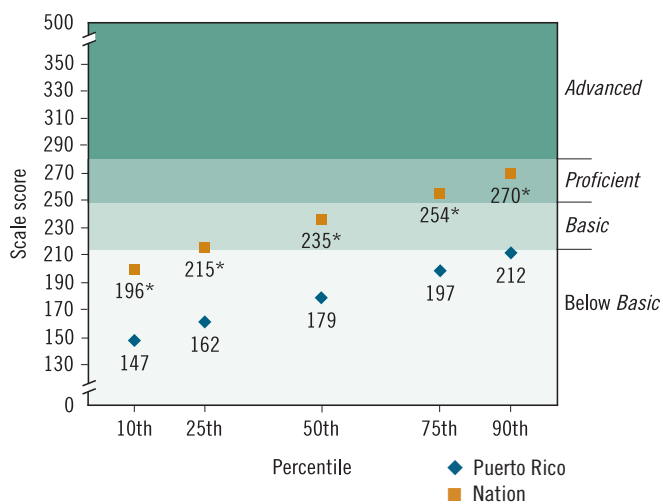
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

A note on family income

NAEP collects data on students' eligibility for free or reduced-priced school lunch as an indicator of family economic status. Eligibility for free or reduced-price lunch is determined by a student's family income in relation to the federally established poverty level. See <http://www.fns.usda.gov/cnd/lunch/> for more information. For reporting purposes, the term low-income is used when referring to students who are eligible for free or reduced-price lunch under the National School Lunch Program. One-hundred percent of the students at grades 4 and 8 in Puerto Rico were eligible for free or reduced-price lunch in 2003. This percentage differed significantly from the nation, where 44 percent of fourth-graders and 36 percent of eighth-graders were from low-income families, as determined by their eligibility for free or reduced-price lunch.

To get a better picture of the Puerto Rico NAEP results, scores on the mathematics assessment for students scoring at selected percentiles are presented in figure 2. A percentile indicates the percentage of students whose scores fall at or below a particular score. Examining the performance of students at selected percentiles can indicate whether lower-, middle-, or higher-scoring students diverge from the picture for students overall. The 10th and 25th percentiles represent lower-scoring students, the 50th percentile represents middle-scoring students, and the 75th and 90th percentiles represent higher-scoring students.

Figure 2.
Fourth-grade NAEP mathematics scores at selected percentiles for public school students in Puerto Rico and the nation in 2003



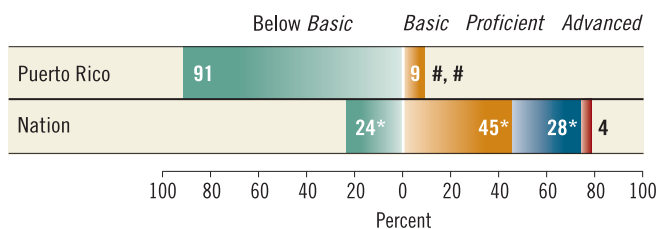
* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

In 2003, similar differences between fourth-graders in Puerto Rico and the nation were found at various percentiles spanning the entire distribution (figure 2). Scale scores were consistently higher for fourth-graders in the nation than for those in Puerto Rico. For example, fourth-graders at the 90th percentile in Puerto Rico had a score of 212 compared to a score of 270 in the nation. In the nation, 75 percent of students had scores above 215 (i.e., the score for the nation at the 25th percentile).

For the 2003 NAEP mathematics assessment, 9 percent of fourth-graders in Puerto Rico performed at or above *Basic* (figure 3). In the nation, 76 percent of fourth-graders performed at or above *Basic*.

Figure 3.
Percentage of fourth-grade public school students in Puerto Rico and the nation, by NAEP mathematics achievement level in 2003



Rounds to zero for proficient and advanced levels.

* Significantly different ($p < .05$) from students in Puerto Rico.

NOTE: Detail may not sum to totals because of rounding.

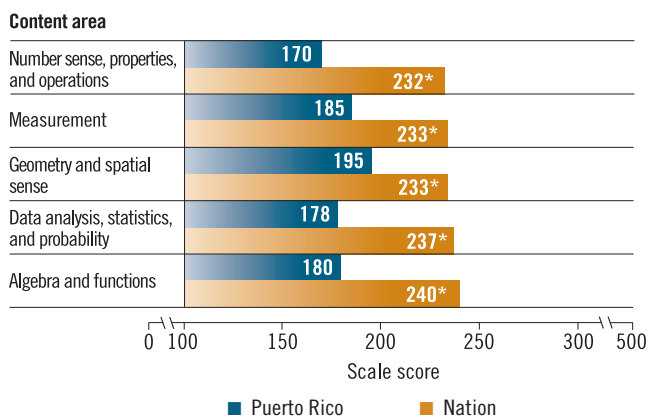
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.



Content area differences between Puerto Rico and the nation

On average, fourth-grade students in Puerto Rico scored lower than national public school students in each mathematics content area. At grade 4, differences between the performance of Puerto Rico and the nation were between 58 and 61 points for three of the five mathematics content areas. For the content areas of geometry and spatial sense, and measurement, the differences were 38 and 48 points, respectively (figure 4).

Figure 4.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003, by content area



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

Gender differences in Puerto Rico in geometry and spatial sense

Puerto Rican male and female students' scores on the mathematics assessment overall were not significantly different (table 1). However, there was a significant difference between male and female students' scores in the geometry and spatial sense content area. Female students scored 5 points higher than male students. In the nation, male students scored higher than female students in mathematics overall and in each content area except geometry and spatial sense, where there was no significant difference.

Table 1.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003, by gender

Content area	Puerto Rico		Nation	
	Male	Female	Male	Female
Overall	179	179	235*	233
Number sense, properties, and operations	171	170	233*	230
Measurement	186	184	236*	231
Geometry and spatial sense	192*	198	233	233
Data analysis, statistics, and probability	176	180	237*	236
Algebra and functions	181	179	241*	238

* Significantly different ($p < .05$) from female students.

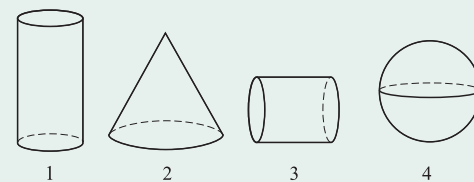
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

Geometry and spatial sense

The geometry and spatial sense content area focuses on the calculation of lengths, areas, and volumes of common shapes, as well as the concepts of symmetry and transformation.

Students in grade 4 are expected to be familiar with simple plane figures such as lines, circles, triangles, and rectangles, as well as solid figures such as cubes, spheres, and cylinders. They are also expected to be able to recognize examples of parallel and perpendicular lines.

Grade 4 sample question



Which of these shapes are cylinders?

- Ⓐ 1 and 2
 Ⓑ 1 and 3
 Ⓒ 2 and 4
 Ⓓ 3 and 4

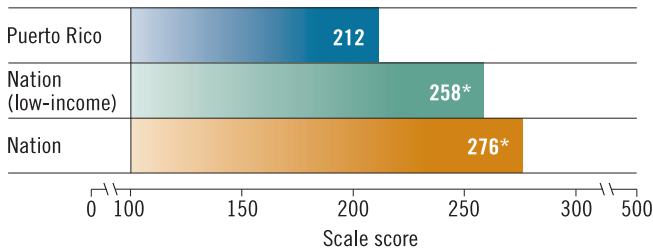
2003 Results

8th Grade

Overall performance differences between Puerto Rico and the nation

The average scale score for eighth-grade students in Puerto Rico was 212, compared with 276 for the nation. As shown in figure 5, eighth-graders in Puerto Rico scored 46 points lower than students from low-income families in the nation and 64 points lower than students in the nation.

Figure 5. Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003



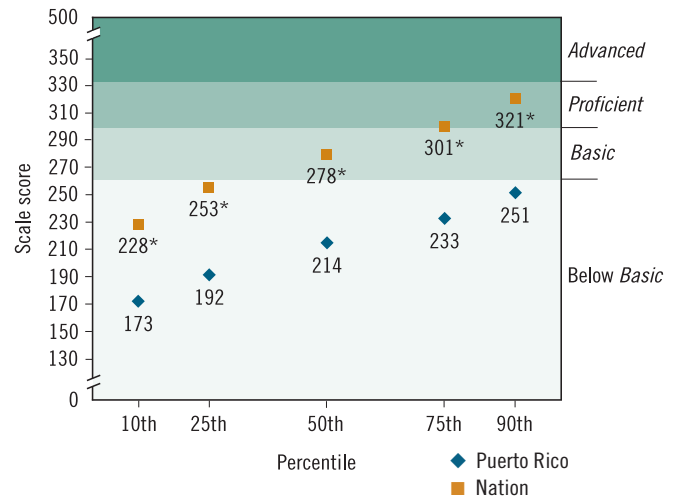
* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.



Eighth-graders at the 90th percentile in Puerto Rico had a score of 251 (below *Basic*) compared to a score of 321 (*Proficient*) for their peers in the nation (figure 6).

Figure 6. Eighth-grade NAEP mathematics scores at selected percentiles for public school students in Puerto Rico and the nation in 2003

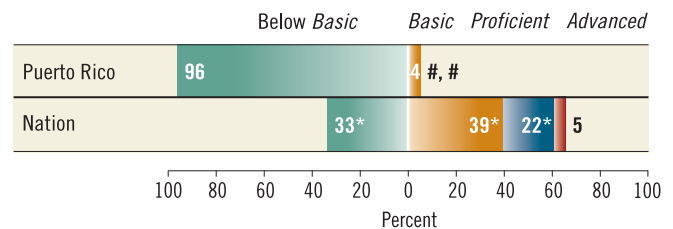


* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

The results from the 2003 NAEP Puerto Rico assessment show that 4 percent of eighth-graders performed at or above *Basic* in 2003 (figure 7). The percentage of eighth-graders in the nation who performed at or above *Basic* was substantially higher (67 percent).

Figure 7. Percentage of eighth-grade public school students in Puerto Rico and the nation, by NAEP mathematics achievement level in 2003



Rounds to zero for proficient and advanced levels.

* Significantly different ($p < .05$) from students in Puerto Rico.

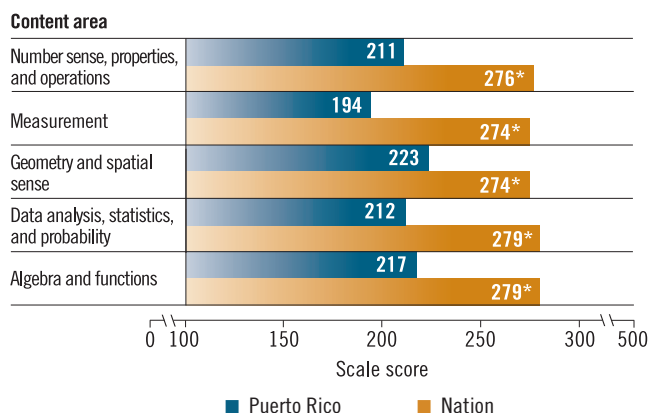
NOTE: Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

Average scores in Puerto Rico below *Basic* in all content areas

Students from Puerto Rico scored lower than students from the nation in all five NAEP mathematics content areas. The difference between students in Puerto Rico and the nation was between 51 and 67 points for all content areas except measurement, where the difference was 80 points (figure 8).

Figure 8.
Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003, by content area



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

No gender differences in grade 8 in Puerto Rico

Average scores for male and female students in grade 8 in Puerto Rico and the nation are shown in table 2. There were no significant differences between Puerto Rican male and female students' scores overall or in any of the five mathematics content areas. In the nation, male students scored higher than female students in mathematics overall and in each content area except geometry and spatial sense, and algebra and functions, where there were no significant differences.

Table 2.
Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2003, by gender

Content area	Puerto Rico		Nation	
	Male	Female	Male	Female
Overall	212	213	277*	275
Number sense, properties, and operations	209	214	277*	274
Measurement	197	191	276*	271
Geometry and spatial sense	222	224	274	273
Data analysis, statistics, and probability	210	213	280*	278
Algebra and functions	216	217	279	278

* Significantly different ($p < .05$) from female students.

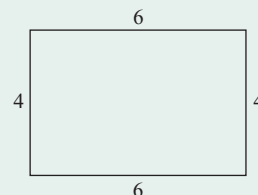
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 Mathematics Assessment.

Measurement

The measurement content area focuses on the use of numbers and measures to describe and compare mathematical and real-world objects.

At grade 8, the emphasis is on the use of square units for measuring areas and surface area, cubic units for measuring volume, degrees for measuring angles, and constructed units such as miles per hour.

Grade 8 sample question

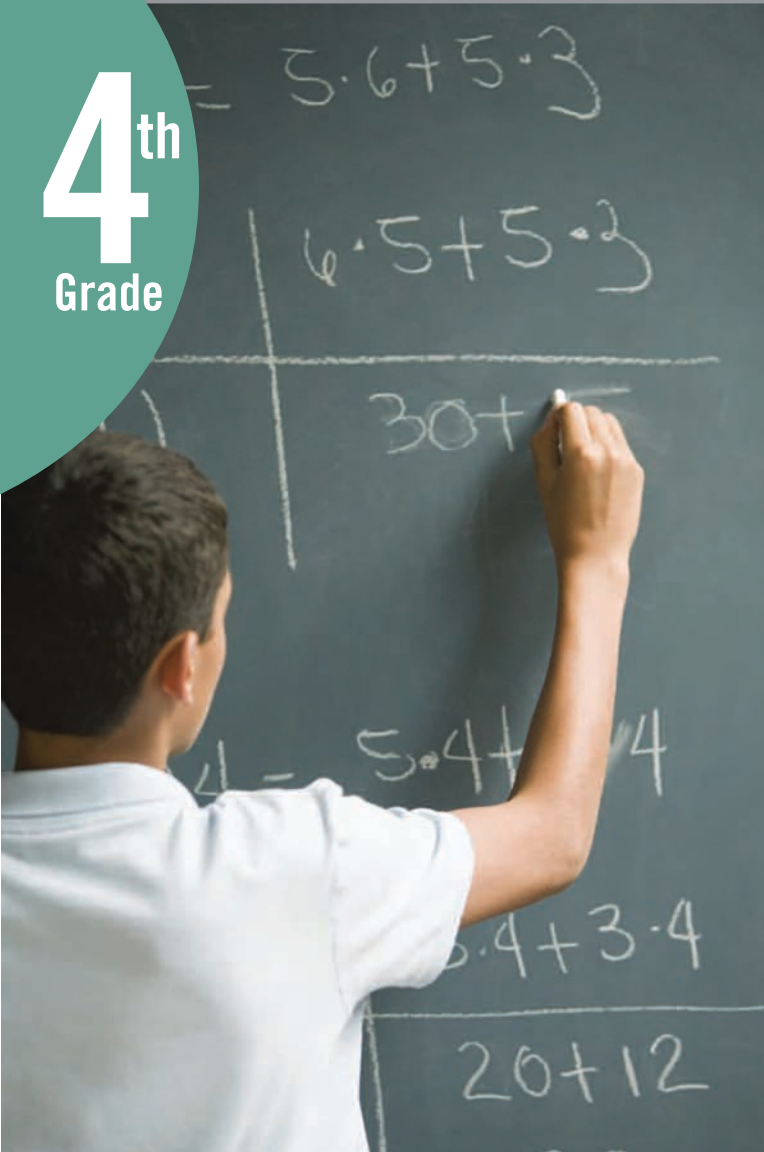


Which of the following numerical expressions gives the area of the rectangle above?

- A 4×6
- B $4 + 6$
- C $2(4 \times 6)$
- D $2(4 + 6)$
- E $4 + 6 + 4 + 6$

2005 Results

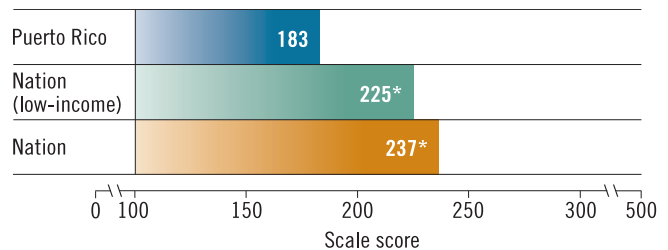
4th
Grade



Overall performance differences between Puerto Rico and the nation

On average, fourth-graders in Puerto Rico scored lower than students in the nation on the NAEP mathematics assessment. The average scale score for fourth-grade students in Puerto Rico was 183 compared to 237 in the nation. On average, Puerto Rican students scored 42 points lower than students from low-income families in the nation and 54 points lower than students in the nation.

Figure 9.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

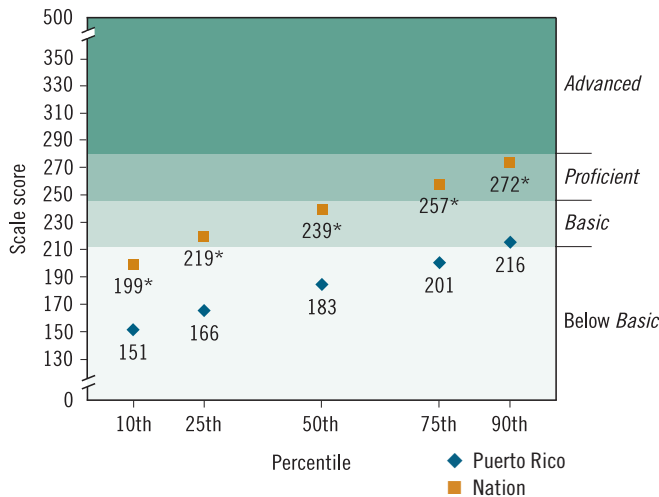
A note on students with disabilities

In 2003, the percentage of fourth-graders identified as students with disabilities in Puerto Rico did not differ from the nation. At eighth-grade, 8 percent of students in Puerto Rico were identified as students with disabilities. This percentage differed from the nation, where 11 percent of students were identified as students with disabilities.

In 2005, the percentage of fourth-graders identified as students with disabilities in Puerto Rico differed from the nation. In Puerto Rico, 15 percent were identified as students with disabilities, compared to 12 percent in the nation. The percentage of eighth-graders identified as students with disabilities in Puerto Rico did not differ from the nation.

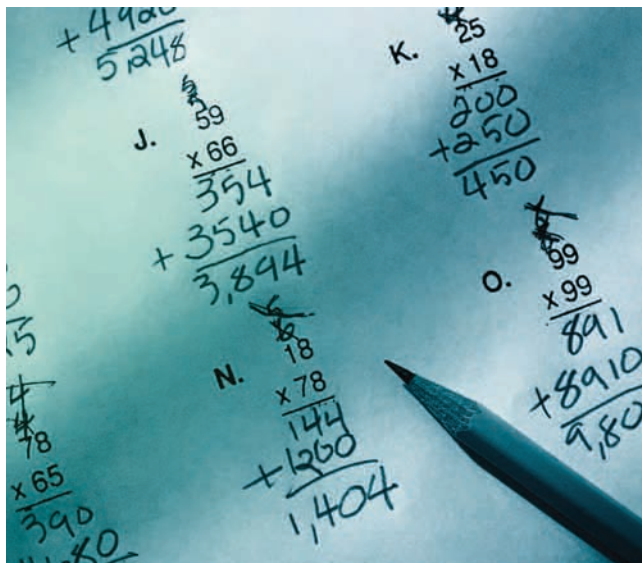
Lower-, middle-, and higher-performing students in Puerto Rico scored lower than students in the nation at corresponding percentiles (figure 10). Fourth-graders at the 90th percentile in Puerto Rico had a score of 216 compared to a score of 272 for students at the 90th percentile in the nation. Lower performing students (those at the 25th percentile) had scores of 166 and 219 in Puerto Rico and the nation, respectively.

Figure 10. Fourth-grade NAEP mathematics scores at selected percentiles for public school students in Puerto Rico and the nation in 2005



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.



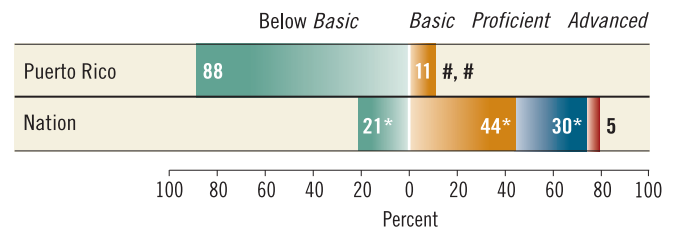
More information on the 2003 and 2005 NAEP mathematics assessments in Puerto Rico

Details on the technical quality of the NAEP assessments are presented in the forthcoming *Technical Report of the NAEP Mathematics Assessment in Puerto Rico: Focus on Statistical Issues*.

Details of student performance by content area can be found in *Mathematics 2005 Performance in Puerto Rico: Focus on the Content Areas* available at http://nationsreportcard.gov/puertorico_2005/.

As shown in figure 11, the results from the 2005 NAEP Puerto Rico assessment indicate that 12 percent of fourth-graders performed at or above *Basic* in mathematics. The percentage of fourth-graders in the nation who performed at or above *Basic* was significantly higher (79 percent).

Figure 11. Percentage of fourth-grade public school students in Puerto Rico and the nation, by NAEP mathematics achievement level in 2005



Rounds to zero for proficient and advanced levels.

* Significantly different ($p < .05$) from students in Puerto Rico.

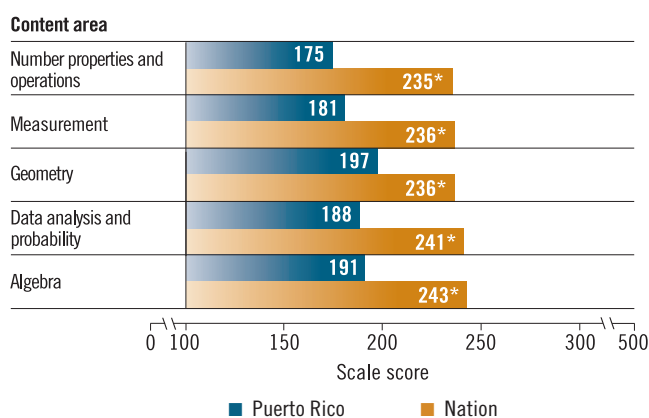
NOTE: Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Score differences between students in Puerto Rico and the nation in all content areas

On average, fourth-grade students in Puerto Rico scored lower than students in the nation overall and in each mathematics content area (figure 12). Differences between the performance of students in Puerto Rico and the nation were between 52 and 60 points for all content areas except geometry, where the difference was 39 points.

Figure 12.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005, by content area



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Number properties and operations

The number properties and operations content area focuses on ways to represent, calculate, and estimate numbers.

At grade 4, students are expected to have an understanding of numbers, operations, estimation, and applications to real-world situations.

Gender differences in grade 4 in Puerto Rico in geometry

On average, Puerto Rican male and female students' scores were not significantly different on the overall mathematics assessment (table 3). However, there was a significant difference in geometry scores, where female students scored 4 points higher than male students. In the nation, male students scored higher than female students overall and in each content area except geometry, where there was no significant difference.

Table 3.
Average fourth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005, by gender

Content area	Puerto Rico		Nation	
	Male	Female	Male	Female
Overall	184	183	238*	236
Number properties and operations	178	173	237*	234
Measurement	181	182	238*	234
Geometry	195*	199	235	236
Data analysis and probability	188	188	241*	240
Algebra	190	192	244*	242

* Significantly different ($p < .05$) from female students

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Grade 4 sample question

There are 30 people in the music room. There are 74 people in the cafeteria. How many more people are in the cafeteria than the music room?

- (A) 40
- (B) 44
- (C) 54
- (D) 104

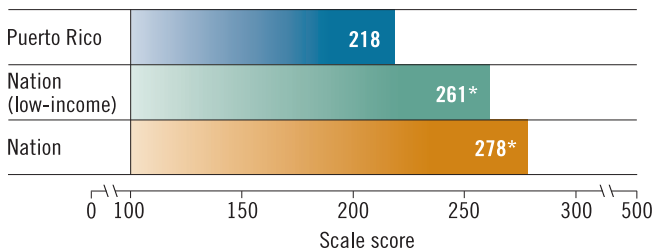
2005 Results

8th Grade

Average scores below *Basic* in grade 8 in Puerto Rico

On average, eighth-grade students in Puerto Rico scored lower on the NAEP mathematics assessment than eighth-grade students in the nation. The average scale score was 218 and 278 for students in Puerto Rico and the nation, respectively. As shown in figure 13, students in Puerto Rico scored 43 points lower than students from low-income families in the nation and 59 points lower than students in the nation.

Figure 13. Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005



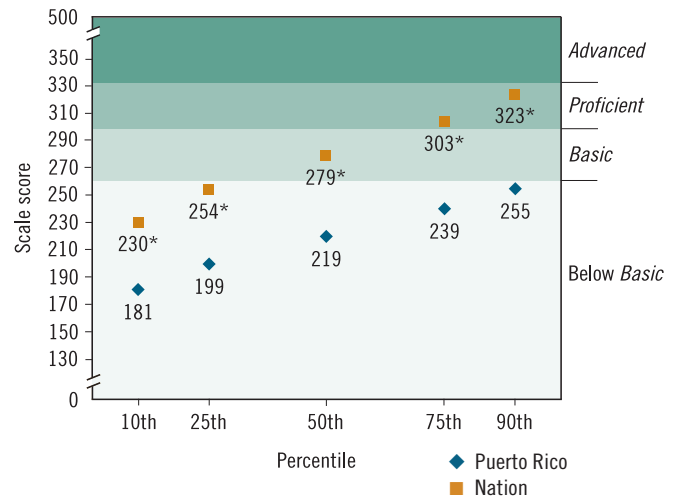
* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.



Eighth-graders at the 90th percentile in Puerto Rico had a score of 255 (below *Basic*) compared to a score of 323 (*Proficient*) for their peers in the nation (figure 14).

Figure 14. Eighth-grade NAEP mathematics scores at selected percentiles for public school students in Puerto Rico and the nation in 2005

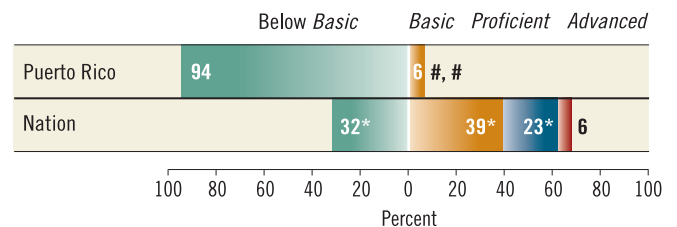


* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

As shown in figure 15, the results from the 2005 NAEP Puerto Rico assessment indicate that 6 percent of eighth-graders performed at or above *Basic*. The majority of students in Puerto Rico scored below *Basic* (94 percent). In comparison, 32 percent of students in the nation scored below *Basic*.

Figure 15. Percentage of eighth-grade public school students in Puerto Rico and the nation, by NAEP mathematics achievement level in 2005



Rounds to zero for proficient and advanced levels.

* Significantly different ($p < .05$) from students in Puerto Rico.

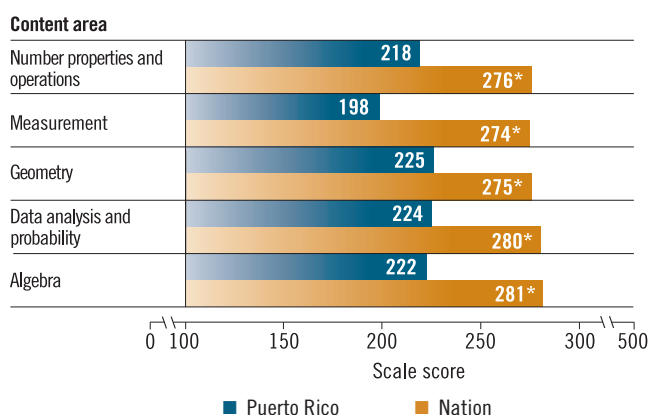
NOTE: Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Content area differences in grade 8 between Puerto Rico and the nation

On average, eighth-grade students in Puerto Rico scored lower than students in the nation in each of the five mathematics content areas. Differences between the performance of Puerto Rico and the nation were between 49 and 59 points for each content area except measurement, where the difference was 76 points (figure 16).

Figure 16.
Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005, by content area



* Significantly different ($p < .05$) from students in Puerto Rico.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Gender differences in Puerto Rico in data analysis and probability area

Average scores for male and female eighth-graders in Puerto Rico and the nation are shown in table 4. In the nation, male students scored higher than female students in mathematics overall and in the number properties and operations, and measurement content areas. On average, Puerto Rican male and female students' scores were not significantly different on the assessment overall and for four of the five content areas. However, female students scored 8 points higher than male students in the content area of data analysis and probability.

Table 4.
Average eighth-grade NAEP mathematics scores for public school students in Puerto Rico and the nation in 2005, by gender

Content area	Puerto Rico		Nation	
	Male	Female	Male	Female
Overall	217	220	278*	277
Number properties and operations	217	218	278*	274
Measurement	200	196	277*	272
Geometry	224	227	275	275
Data analysis and probability	220*	228	280	280
Algebra	220	224	280	281

* Significantly different ($p < .05$) from female students.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Data analysis and probability

The data analysis and probability content area focuses on students' skills in four areas: data representation, characteristics of data sets, experiments and samples, and probability.

At grade 8, students are expected to have knowledge of experiments and samples, recognize possible sources of bias in sampling, and identify random versus nonrandom sampling.

Grade 8 sample question

A package of candies contained only 10 red candies, 10 blue candies, and 10 green candies. Bill shook up the package, opened it, and started taking out one candy at a time and eating it. The first 2 candies he took out and ate were blue. Bill thinks the probability of getting a blue candy on his third try is $\frac{10}{30}$ or $\frac{1}{3}$.

Is Bill correct or incorrect? Explain your answer.

Technical Notes

NAEP sampling procedures in Puerto Rico

The schools and students participating in the NAEP assessment are chosen to be nationally representative. Sampling was conducted in two stages. In the first stage, schools were selected from stratified frames within each jurisdiction. In the second stage, students were selected from within schools. Sampling procedures in Puerto Rico did not differ from the procedures in other jurisdictions because the intent is to include Puerto Rico as part of the national sample in future NAEP administrations.

For the trial NAEP administrations in 2003 and 2005, approximately 100 schools and 3,000 students per grade were sampled in public schools in Puerto Rico. Private schools did not participate in the trial NAEP administrations in Puerto Rico. Table 5 presents the sample sizes and target populations for the 2003 and 2005 fourth- and eighth-grade mathematics assessment for public school students in Puerto Rico and the nation. Information is only presented for public school students in the nation, although private school students did participate.

Table 5.
Student sample size and target populations for NAEP mathematics assessment for public school students in Puerto Rico and the nation, by grade and year

Grade and year	Puerto Rico		Nation	
	Student sample size	Target population	Student sample size	Target population
Grade 4: 2003	3,000	48,000	191,400	3,603,000
Grade 8: 2003	2,800	45,000	153,500	3,575,000
Grade 4: 2005	2,800	42,000	168,900	3,745,000
Grade 8: 2005	2,800	40,000	159,200	3,662,000

NOTE: Student sample sizes are rounded to the nearest hundred, and target populations are rounded to the nearest thousand.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 and 2005 Mathematics Assessments.

School and student participation rates

To reduce the possibility of biased estimates, NCES and the Governing Board established participation rate standards that all jurisdictions, including Puerto Rico, are required to meet. Results are reported for jurisdictions that have weighted participation rates of at least 85 percent. In the 2003 and 2005 Puerto Rico assessments, this participation rate standard was met at both grades 4 and 8. Table 6 provides school participation rates and Table 7 provides student participation rates.

Table 6.
Number and percentage of public schools participating in NAEP mathematics assessment in Puerto Rico and the nation, by grade and year

Grade and year	Puerto Rico		Nation	
	Number of schools	Weighted percent	Number of schools	Weighted percent
Grade 4: 2003	110	100	6,910	99.8
Grade 8: 2003	100	100	5,530	99.6
Grade 4: 2005	110	100	8,700	99.6
Grade 8: 2005	110	100	6,460	99.5

NOTE: The numbers of schools are rounded to the nearest tenth.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 and 2005 Mathematics Assessments.

Table 7.
Number and percentage of public school students participating in NAEP mathematics assessment in Puerto Rico and the nation, by grade and year

Grade and year	Puerto Rico		Nation	
	Number of students	Weighted percent	Number of students	Weighted percent
Grade 4: 2003	3,000	94	184,300	94
Grade 8: 2003	2,800	92	147,600	91
Grade 4: 2005	2,800	95	163,000	94
Grade 8: 2005	2,800	93	152,800	91

NOTE: The numbers of students are rounded to the nearest hundred.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 and 2005 Mathematics Assessments.

Accommodations

In 2003, the NAEP mathematics assessment began permitting the use of accommodations, such as extra testing time or individual rather than group administration, for students who required them. In the nation, accommodations were provided to students with disabilities and to English language learners. However, in Puerto Rico, the NAEP mathematics assessment was translated into Spanish because Spanish is the language of instruction in Puerto Rico. Therefore, accommodations were only provided to students with disabilities. Table 8 presents the number and percentage of students with disabilities who received accommodations at grades 4 and 8 in Puerto Rico and the nation in 2003 and 2005.

Table 8.
Number and percentage of participating public school students with disabilities who received accommodations for NAEP mathematics assessment in Puerto Rico and the nation, by grade and year

Grade and year	Puerto Rico		Nation	
	Number of students accommodated (unweighted)	Percent of students accommodated (weighted)	Number of students accommodated (unweighted)	Percent of students accommodated (weighted)
Grade 4: 2003	100	4	13,800	7
Grade 8: 2003	<50	2	9,800	6
Grade 4: 2005	400	14	13,300	8
Grade 8: 2005	200	8	10,900	7

NOTE: The numbers of students are rounded to the nearest hundred.

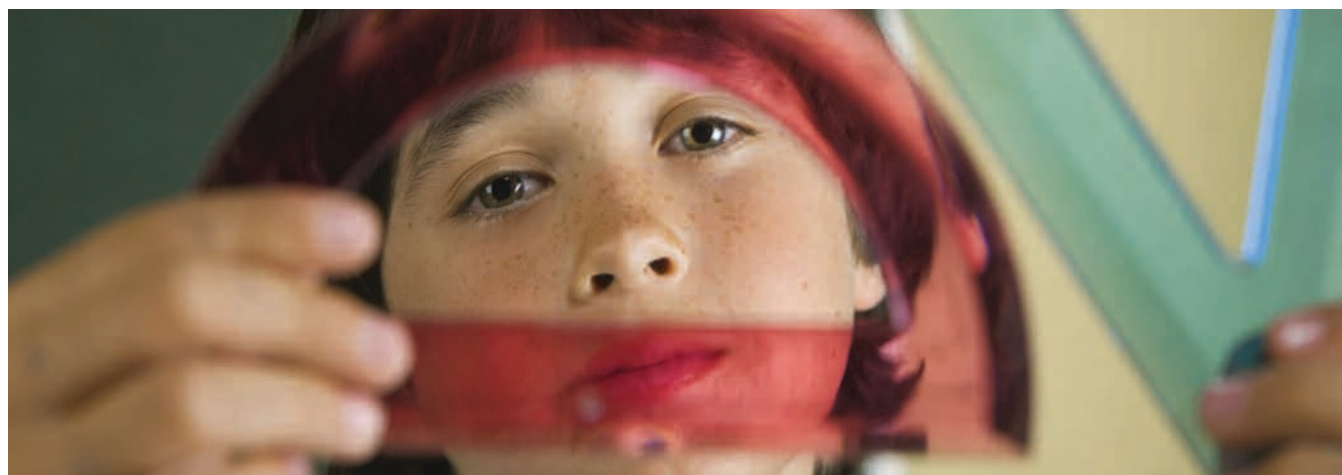
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003 and 2005 Mathematics Assessments.

Interpreting statistical significance

Comparisons between groups are based on statistical tests that consider both the size of the differences and the standard errors of the two statistics being compared. Standard errors are margins of error, and estimates based on smaller samples are likely to have larger margins of error than estimates based on larger samples. The size of the standard errors may also be influenced by other factors, such as how representative the students are of the population as a whole.

When an estimate, such as an average score, has a large standard error, a difference between that score and another that seems large may not be statistically significant. Differences of the same magnitude may or may not be statistically significant, depending on the size of the standard error of the statistics. For example, a 1-point difference between male and female students may be statistically significant in the nation, while a 3-point difference between these same groups may not be significant in Puerto Rico because of the smaller sample size on which the estimate is based. Standard errors for the NAEP scores and percentages presented in this report are available at <http://nces.ed.gov/nationsreportcard/nde>.

Any difference between scores or percentages that is identified as higher, lower, larger, or smaller in this report has been determined to be statistically significant at the .05 level with appropriate adjustments for multiple comparisons.



Quality of the Puerto Rico 2003 assessment results

This was the first attempt to conduct an entire NAEP administration in a language other than English. Preliminary analysis of data for the 2003 mathematics assessment showed three important differences between Puerto Rico and other jurisdictions:

High Percentage of Missing Data. Of those who participated, there were more missing responses in Puerto Rico than in the nation overall. Preliminary analyses of the Puerto Rico 2003 data identified two types of missing data: omitted items and not reached items. An item was considered omitted if a student skipped that question but answered one or more questions following it. An item was considered as not reached when neither that question nor any question following it in the section was answered. The percentage of omitted and not reached items in Puerto Rico was not only substantially higher than the national rate, but also higher than any other jurisdiction's rate. Note that the calculation of an average score takes into account omitted and incorrect responses, but not reached items are not included in the calculation.

Low Percentage of Correct Items. In addition to the high percentage of missing responses, there was also a high percentage of incorrect responses in Puerto Rico. The average percentage of correct items was significantly lower for students in Puerto Rico than for students in the nation. This could indicate either a problem with how items functioned in Puerto Rico or reflect knowledge and skills of students in the nation.

High Levels of Item Misfit. The most problematic result to emerge from the 2003 Puerto Rican mathematics assessment was item misfit. Item misfit is defined as a mismatch between expected and actual student performance on a test item. Although items

functioned as expected in the nation, the translated items did not function as expected in Puerto Rico.

Changes made to the 2005 Puerto Rico administration

In light of initial concerns about the quality of the Puerto Rico data, important enhancements were made to the translation procedures for the 2005 assessment. Key among these changes were: (1) the addition of two Puerto Rican mathematics teachers to the expert review panel and, (2) adaptation of topics and language usage to incorporate the unique linguistic and cultural characteristics of Puerto Rico.

In addition, a number of changes were implemented to improve various components of the assessment process. First, the administration script in Puerto Rico was revised to give students explicit directions to move on to the next question when they did not know the answer. The revised script also included extensive explanations of the different item types in the assessment. These changes were made because students in Puerto Rico may not have been familiar with the NAEP assessment format.

Second, in an attempt to reduce the number of items with missing responses, students were provided with an additional 10 minutes to complete each of the two timed mathematics sections. Thus, students in Puerto Rico were given a total of 70 minutes to complete the two mathematics sections in 2005, compared to 50 minutes in 2003. Fifty minutes is the standard time given to students in other jurisdictions.

Additional analysis of the 2003 and 2005 data indicated that the Puerto Rico results were accurate in terms of the NAEP scale and thus comparisons could be made between Puerto Rico and the nation. Because of translation changes made to the 2005 assessment, Puerto Rico results from 2003 cannot be compared with those of 2005.

About the NAEP administration in Puerto Rico

A full discussion of the content, administration, and data quality can be found in the forthcoming *Technical Report of the NAEP Mathematics Assessment in Puerto Rico: Focus on Statistical Issues*. Published reports are available at http://nationsreportcard.gov/puertorico_2005/.



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