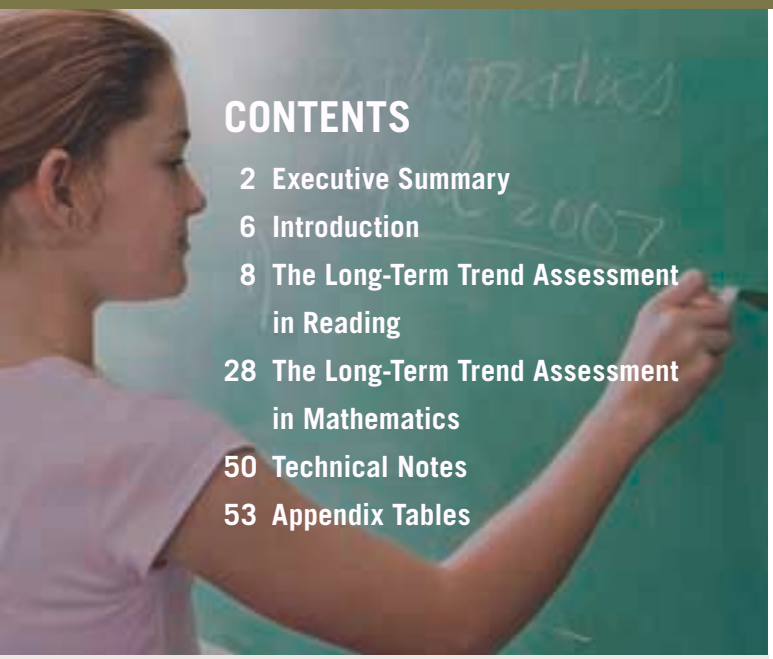
NATIONAL CENTER FOR EDUCATION STATISTICS
Institute of Education Sciences
U.S. Department of Education
NCES 2009–479

# NAEP 2008 Trends in Academic Progress

READING 1971–2008 | MATHEMATICS 1973–2008

The Nation's Report Card



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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. 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.

Since 1969, NAEP assessments have been conducted periodically in reading, mathematics, science, writing, U.S. history, civics, geography, and other subjects. NAEP collects and reports information on student performance at the national, state, and local levels, making the assessment an integral part of our nation's evaluation of the condition and progress of education. Only academic achievement data and related background information are collected. The privacy of individual students and their families is protected.

NAEP is a congressionally authorized 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

This report presents the results of the NAEP long-term trend assessments in reading and mathematics, which were most recently given in the 2007–08 school year to students at ages 9, 13, and 17. Nationally representative samples of over 26,000 public and private school students were assessed in each subject area.

The long-term trend assessments make it possible to chart educational progress since the early 1970s. Results in reading are available for 12 assessments going back to the first in 1971. The first of 11 assessments in mathematics was administered in 1973. Throughout this report, the most recent results are compared to those from 2004 and from the first year the assessment was conducted.

The original assessment format, content, and procedures were revised somewhat in 2004 to update content and provide accommodations to students with disabilities and English language learners. The knowledge and skills assessed, however, remain essentially the same since the first assessment year.

## Improvements seen in reading and mathematics

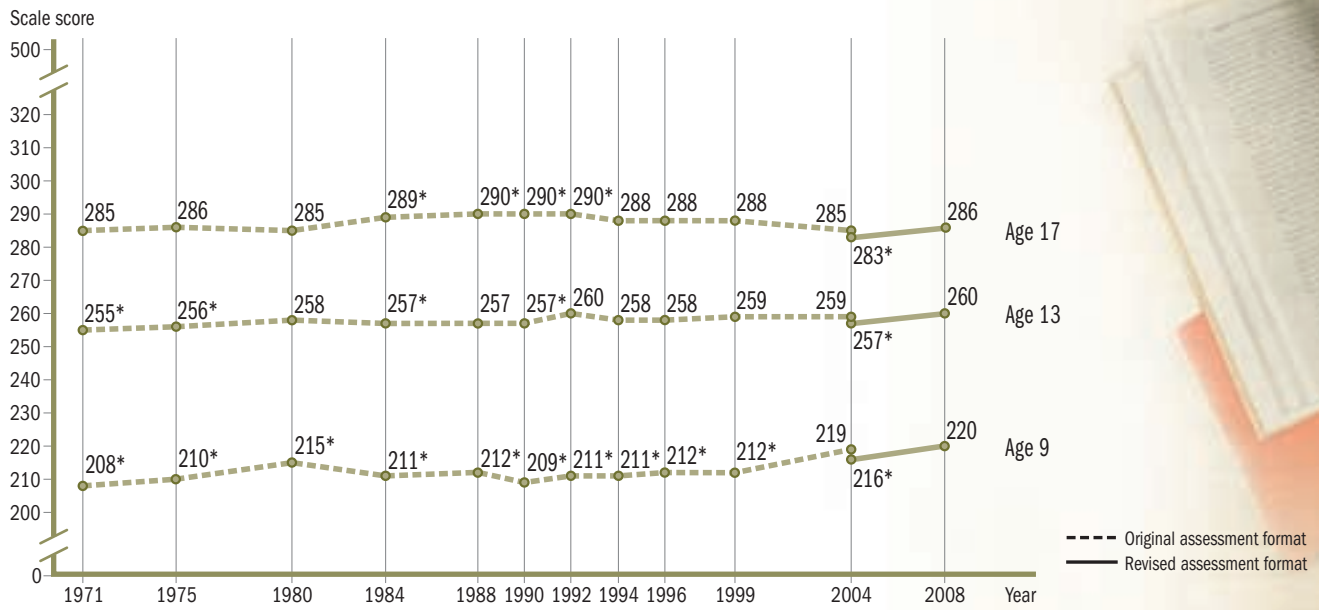
**In reading,** average scores increased at all three ages since 2004 (figure A). Average scores were 12 points higher than in 1971 for 9-year-olds and 4 points[1] higher for 13-year-olds. The average reading score for 17-year-olds was not significantly different from that in 1971.

**In mathematics,** average scores for 9- and 13-year-olds increased since 2004, while the average score for 17-year-olds did not change significantly (figure B). Average scores were 24 points higher than in 1973 for 9-year-olds and 15 points higher for 13-year-olds. The average mathematics score for 17-year-olds was not significantly different from that in 1973.

[1] The score-point change is based on the difference between unrounded scores as opposed to the rounded scores shown in the figure.

# Reading

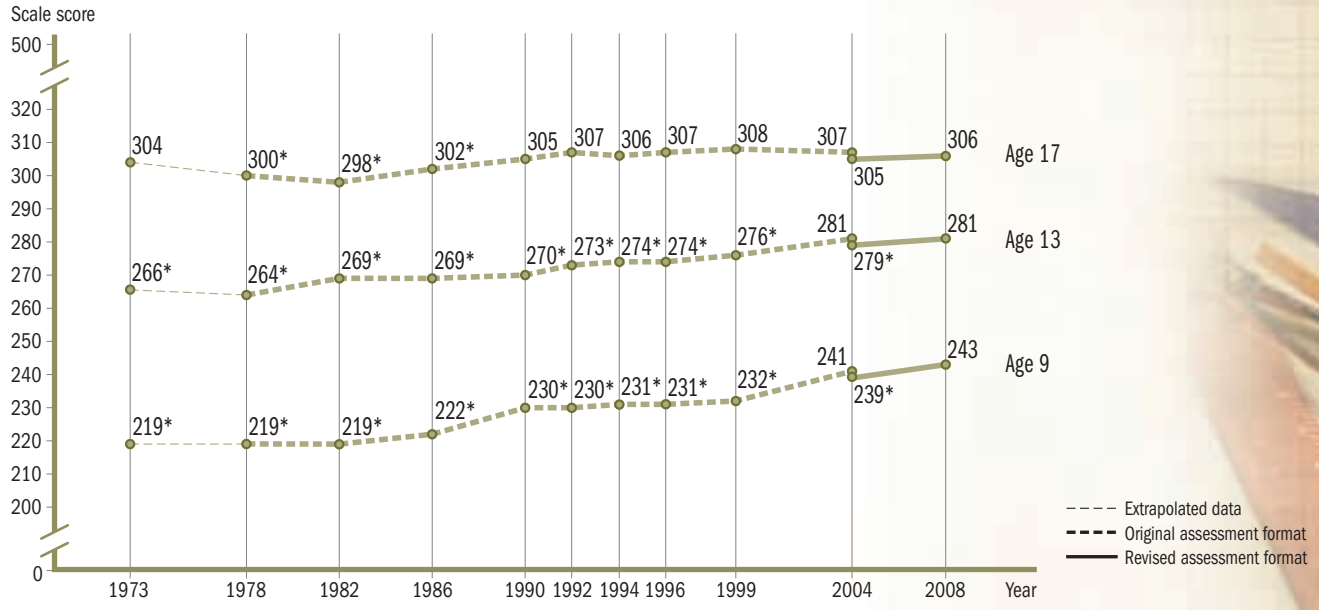
**FIGURE A.** Trend in NAEP reading average scores for 9-, 13-, and 17-year-old students




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

# Mathematics

**FIGURE B.** Trend in NAEP mathematics average scores for 9-, 13-, and 17-year-old students




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1973–2008 Long-Term Trend Mathematics Assessments.

## Black students make greater gains from early 1970s than White students

Average reading scores were higher in 2008 than in the first assessment year for White, Black, and Hispanic students. Across the three age groups, increases from 1971 to 2008 were larger for Black students than for White students. Increases from 1975 to 2008 were greater for Hispanic than for White students at ages 9 and 17, but were not significantly different at age 13.

In comparison to 2004, average reading scores were higher in 2008 for White students at all three ages, for Black students at ages 9 and 13, and for Hispanic students at age 9.

Across all three age groups, increases in average mathematics scores from 1973 to 2008 were greater for both Black and Hispanic students than for White students.

In comparison to 2004, average mathematics scores were higher in 2008 for White students at age 9. There were no significant changes in scores for 9-, 13-, and 17-year-old Black and Hispanic students or for 13- and 17-year-old White students over the same period.

## Most racial/ethnic score gaps narrow compared to first assessment

While the reading score gaps between White and Black students at all three ages showed no significant change from 2004 to 2008, the gaps did narrow in 2008 compared to 1971. White – Hispanic gaps in reading scores also showed no significant change from 2004 to 2008 but were smaller in 2008 than in 1975 at ages 9 and 17.

Across all three age groups, neither the White – Black nor White – Hispanic gaps in mathematics changed significantly from 2004 to 2008, but both were smaller in 2008 than in 1973.

### Reading

| | Changes from 1971 | | |
|---|---|---|---|
| Age group | White | Black | Hispanic[1] |
| Age 9 | ↑ 14 points | ↑ 34 points | ↑ 25 points |
| Age 13 | ↑ 7 points | ↑ 25 points | ↑ 10 points |
| Age 17 | ↑ 4 points | ↑ 28 points | ↑ 17 points |
| | **Changes from 2004** | | |
| Age group | White | Black | Hispanic |
| Age 9 | ↑ 4 points | ↑ 7 points | ↑ 8 points |
| Age 13 | ↑ 4 points | ↑ 8 points | ↔ |
| Age 17 | ↑ 7 points | ↔ | ↔ |

[1] Results for Hispanic students were first available in 1975. Therefore, the results shown in the 1971 section for Hispanic students are from the 1975 assessment.

### Mathematics

| | Changes from 1973 | | |
|---|---|---|---|
| Age group | White | Black | Hispanic |
| Age 9 | ↑ 25 points | ↑ 34 points | ↑ 32 points |
| Age 13 | ↑ 16 points | ↑ 34 points | ↑ 29 points |
| Age 17 | ↑ 4 points | ↑ 17 points | ↑ 16 points |
| | **Changes from 2004** | | |
| Age group | White | Black | Hispanic |
| Age 9 | ↑ 5 points | ↔ | ↔ |
| Age 13 | ↔ | ↔ | ↔ |
| Age 17 | ↔ | ↔ | ↔ |

↑ Indicates the score was higher in 2008.
↔ Indicates that there was no significant change in the score in 2008.

**Changes in the student population** over time show a decrease in the percentages of White students and an increase in the percentages of Hispanic students across all three age groups. For example, the percentage of 9-year-olds assessed in reading who were White decreased from 80 percent in 1975 to 56 percent in 2008, and the percentage of Hispanic students increased from 5 to 20 percent over the same period. The proportion of Black students has remained more stable over time, making up 14 percent of 9-year-olds assessed in reading in 1971 and 16 percent in 2008.

## For students whose parents did not finish high school, mathematics scores increase compared to 1978

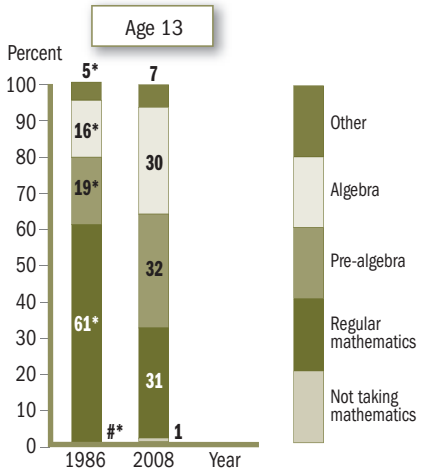
The average mathematics scores for 13- and 17-year-olds whose parents did not finish high school were higher than they were 30 years ago. At age 13, the score in 2008 for students whose parents did not finish high school was not significantly different from the score in 2004 but was 23 points higher than in 1978. At age 17, the average mathematics score for students whose parents did not finish high school was 5 points higher in 2008 than in 2004 and 12 points higher than in 1978.

Scores for 13-year-olds whose parents had higher levels of education were also higher in 2008 than in 1978 but not significantly different compared to 2004. There were no significant changes in the scores for 17-year-olds whose parents had higher levels of education in comparison to 2004 or 1978.

## Percentages of students taking higher-level mathematics increasing

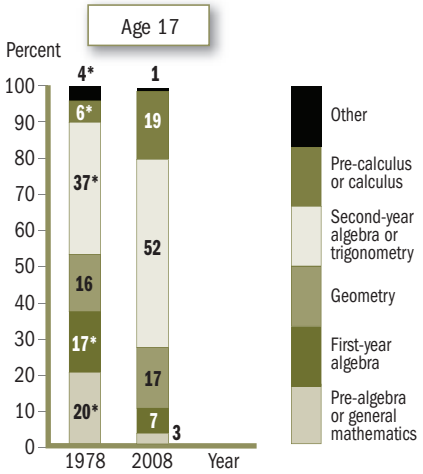
Taking higher-level mathematics courses was generally associated with higher scores on the 2008 mathematics assessment at ages 13 and 17. For example, 13-year-olds who were enrolled in algebra classes scored higher on average than those enrolled in pre-algebra or regular mathematics. The percentages of 13-year-olds who reported taking pre-algebra or algebra in 2008 were higher than the percentages in 1986 (figure C). The percentage of 17-year-olds who reported they had taken pre-calculus or calculus was higher in 2008 than in 1978, as was the percentage who had taken second-year algebra or trigonometry (figure D).

**FIGURE C.** Percentage of 13-year-old students in NAEP mathematics, by type of mathematics course they have taken during the school year: 1986 and 2008




# Rounds to zero.
* Significantly different ($p < .05$) from 2008.
NOTE: Results for 1986 are from the original assessment format, and results for 2008 are from the revised assessment format. 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), 1986 and 2008 Long-Term Trend Mathematics Assessments.

**FIGURE D.** Percentage of 17-year-old students in NAEP mathematics, by highest-level mathematics course they have ever taken: 1978 and 2008




* Significantly different ($p < .05$) from 2008.
NOTE: The "pre-algebra or general mathematics" response category includes "pre-algebra or introduction to algebra" and "general, business, or consumer mathematics" and students who did not take any of the listed courses. The "other" response category includes students for whom the highest-level mathematics course could not be determined due to missing or inconsistent responses. Results for 1978 are from the original assessment format, and results for 2008 are from the revised assessment format. 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), 1978 and 2008 Long-Term Trend Mathematics Assessments.

# Introduction

The reporting of fair and accurate trends in student academic achievement is the primary purpose of NAEP. In this report, results from NAEP's long-term trend assessments provide an examination of student performance in reading and mathematics across four decades.

NAEP includes two components: the main assessments and the long-term trend assessments. Main NAEP assessments are periodically updated or changed to reflect current curricula and standards. The long-term trend assessments have measured essentially the same knowledge and skills since the 1970s. While both provide valuable information, it is not possible to accurately compare results from the two components because of differences in content and procedures.

## Overview of the Long-Term Trend Assessments

This report presents results from the most recent NAEP long-term trend assessments, which were administered during the 2007–08 school year, as well as results from previous administrations of the long-term trend assessments in reading and mathematics. The reading assessment was first administered in 1971, and the mathematics assessment was first administered in 1973. The long-term trend program has used essentially the same assessments in each administration year to provide data that can be used to evaluate changes in student performance over long periods of time. In 2004, a number of changes were made to the long-term trend assessment to update the assessment content and procedures while maintaining the ability to report trends over the long term. Some of the changes included replacing questions that were based on outdated contexts; changing some administration procedures; and, most notably, providing accommodations for students with disabilities and for English language learners. These revisions did not alter the knowledge and skills that are assessed by the long-term trend assessments.

To ensure that results from the revised assessment format could be validly compared to results from earlier assessments, a special bridge study was conducted in 2004. The study involved administering both the original and revised versions to determine how the revisions may have affected the results. Because of the rigorous design of the study, differences in 2004 results from the original and revised versions could be attributed solely to the inclusion of students who would have been excluded if accommodations had not been offered in the revised version. These differences were comparable to those seen when accommodations were first introduced in the main NAEP assessments. Average scores from the 2004 revised format were lower than scores from the original format for 9-year-olds overall in reading and for 9-year-old male students in reading and mathematics. This is consistent with expectations, given the increased inclusion in the revised assessment results of students with disabilities and English language learners who otherwise would have been excluded from the assessment. It was therefore concluded that, bearing in mind the differences in the populations of students assessed (accommodated vs. not accommodated), future assessment results could be compared to those from earlier assessments based on the original version. For a full discussion of the differences between the two assessments and findings, see the Technical Notes of this report and refer to *NAEP 2004 Trends in Academic Progress: Three Decades of Student Performance in Reading and Mathematics*, available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005464.

In the tables and figures of this report, results from 2004 are shown for both the original and revised versions of the assessments. Results from 2004 that are based on the original version are labeled *original assessment format* and are comparable to results from earlier assessment years in which accommodations were not available. The *revised assessment format* instituted in 2004 provides accommodations to students who otherwise would have been excluded from the assessment. In 2008, only the revised assessment format was administered. Therefore, this report compares the 2008 results to the results of the 2004 revised assessment format because both used the same instruments and administration procedures and were administered to a more inclusive population of students.

## Results Provided in This Report

The results presented in this report are based on nationally representative samples of students at ages 9, 13, and 17 (table 1). These samples included both public and private school students.

**TABLE 1.** Number of participating schools and students in NAEP reading and mathematics assessments, by student age group: 2008

| | Reading | | Mathematics | |
|---|---|---|---|---|
| Age group | Schools | Students | Schools | Students |
| Age 9 | 440 | 8,600 | 430 | 8,600 |
| Age 13 | 420 | 8,400 | 420 | 8,500 |
| Age 17 | 440 | 9,600 | 440 | 9,600 |

NOTE: The numbers of schools are rounded to the nearest ten, and 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), 2008 Long-Term Trend Reading and Mathematics Assessments.

### *Scale scores*

The reading and mathematics results are reported as scores on a 0–500 scale. Average scores are reported overall for each age and for selected groups of students. Although the score ranges for both subjects are identical, the reading and mathematics results cannot be compared to each other because they were scaled separately.

### *Percentiles*

To show trends in performance for lower-, middle-, and higher-performing students, scores are also reported at five percentiles (10th, 25th, 50th, 75th, and 90th). Percentiles indicate the percentage of students whose scores fell below a particular point on the scale. For example, 75 percent of students' scores fell below the 75th percentile score.

### *Performance levels*

For each subject area, this report provides descriptions of the knowledge and skills that are likely to be demonstrated by students at five levels on the scale—150, 200, 250, 300, and 350. Although the same five levels are used for each age group, the likelihood of attaining higher performance levels is directly related to a student's age because older students have had more educational experience. Therefore, only those performance levels that are most likely to show significant changes across the assessment years are discussed for each age.

## Interpreting the Results

### *Changes in performance over time*

In discussing performance trends, this report focuses on comparing results from 2008 with those from 2004 and from the first year the assessment was conducted. Comparisons between 2008 and 2004 are discussed based on the results of the revised assessment, although the results for both original and revised assessments for 2004 are shown in the tables and figures.

Consistent with widely accepted statistical standards, only those findings that are statistically significant at the .05 level with appropriate adjustments for multiple comparisons (using the False Discovery Rate procedure) are reported. In the tables and figures of this report, the symbol (*) is used to indicate that an earlier year's score or percentage is significantly different from the 2008 results. Score differences or gaps cited in this report are calculated based on differences between unrounded numbers. Consequently, they may not be identical to differences that would be obtained by subtracting the rounded values in the tables and figures.

Changes in performance results over time may reflect not only changes in students' knowledge and skills but also in other factors, such as changes in student demographics, education programs and policies, and teacher qualifications.

### *Accommodations and exclusions in NAEP*

Beginning in 2004, the long-term trend assessments provided accommodations for students with disabilities and English language learners who could not otherwise be meaningfully assessed. Even with the availability of accommodations, however, some students may still be excluded. Variations in exclusion and accommodation rates that may be due to changes in identification, inclusion, and accommodation policies should be considered when comparing students' performance over time. See the Technical Notes for more information on accommodations and exclusions.

### *Differences between groups*

The reader is cautioned against making simple causal inferences about group differences, as a complex mix of educational and socioeconomic factors may affect student performance. See the Technical Notes for more information.

# The Long-Term Trend Assessment in Reading

The NAEP long-term trend reading assessment required students to answer questions based on a variety of age-appropriate reading materials such as stories, poems, reports, and advertisements. The assessment was designed to measure students' ability to

- locate specific information in the text provided,
- make inferences based on information in two or more parts of the text, and
- identify the main idea in the text.

Students' reading skills were measured using mostly multiple-choice questions and some constructed-response (or open-ended) questions. Each student took only a part of the assessment, consisting of three 15-minute sections. The complete 2008 reading assessment contained between 36 and 40 reading passages at each age (table 2). Students read between 8 and 15 passages and were asked between one and five questions about each passage. Sample questions are presented later in this section.

**TABLE 2.** Number of reading passages and questions in NAEP reading assessment, by student age group: 2008

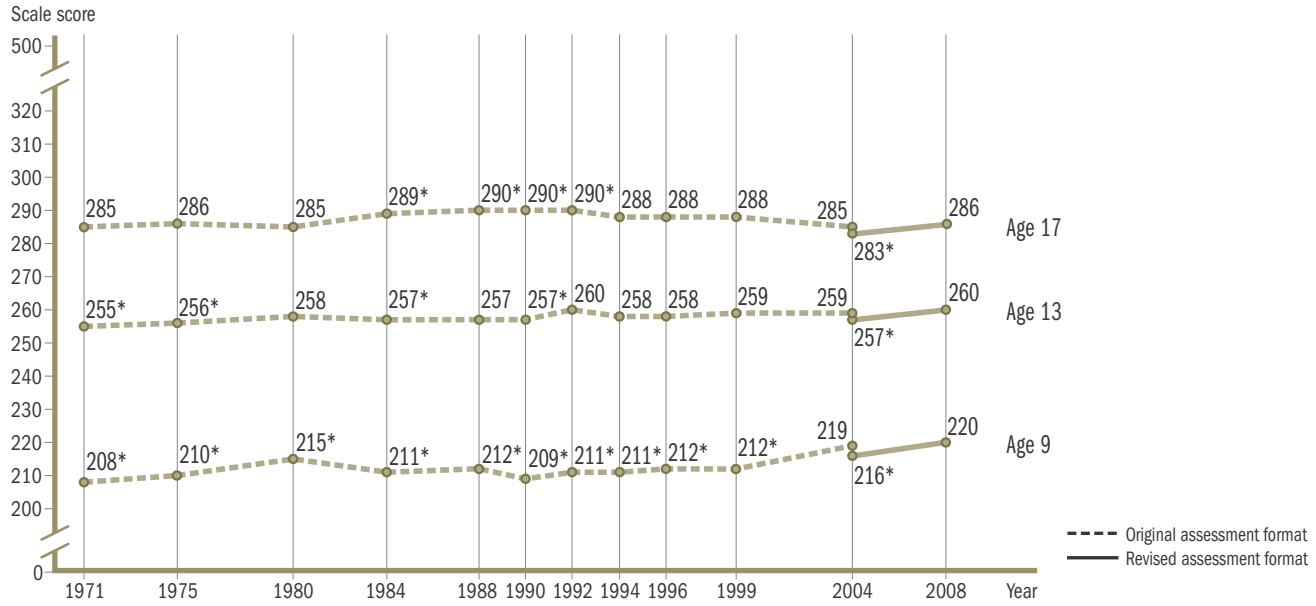
| Age group | Reading passages | Multiple-choice questions | Constructed-response questions |
|---|---|---|---|
| Age 9 | 37 | 84 | 4 |
| Age 13 | 40 | 100 | 7 |
| Age 17 | 36 | 96 | 8 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

## Reading skills improve

Overall, the national trend in reading showed improvement from 2004 to 2008 at all three ages (figure 1). The average reading score for 9-year-olds was higher in 2008 than in all previous assessment years, increasing 4 points since 2004 and 12 points in comparison to 1971. While the average score for 13-year-olds in 2008 was higher than in both 2004 and 1971, it was not always significantly different from the scores in all the assessment years in between. The average reading score for 17-year-olds was higher in 2008 than in 2004 but was not significantly different from the score in 1971.

**FIGURE 1.** Trend in NAEP reading average scores for 9-, 13-, and 17-year-old students




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

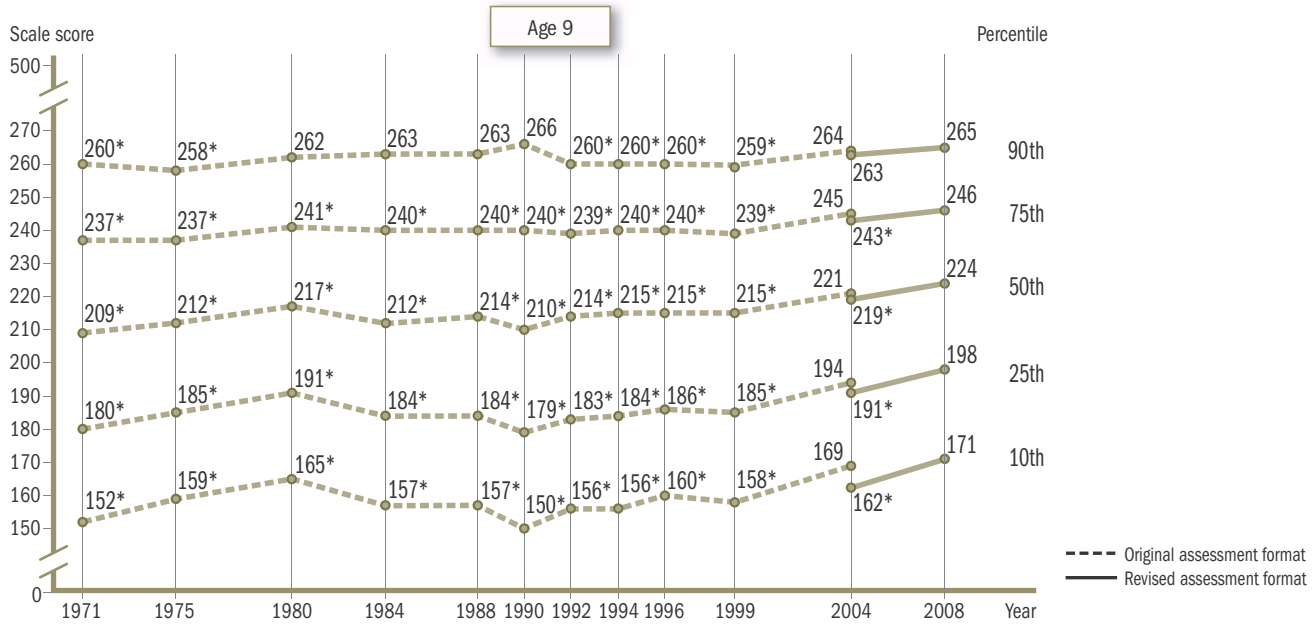
## Lower-performing 9- and 13-year-olds make gains

Like the overall average reading score, the scores for 9-year-olds at the 10th, 25th, 50th, and 75th percentiles were higher in 2008 than in all previous assessment years (figure 2). While there was no significant change in the score for the highest-performing 9-year-olds (those at the 90th percentile) from 2004 to 2008, the score in 2008 was higher than in 1971.

While the overall average score for 13-year-olds was higher in 2008 than in both 2004 and 1971, the results varied for students performing at different percentile levels. Scores increased since 2004 for lower-performing students (those at the 10th and 25th percentiles), but there were no significant changes in the scores over the same period for middle- and higher-performing students (those at the 50th, 75th, and 90th percentiles). Increases were seen for all but the lowest-performing 13-year-olds (those at the 10th percentile) in 2008 compared to 1971.

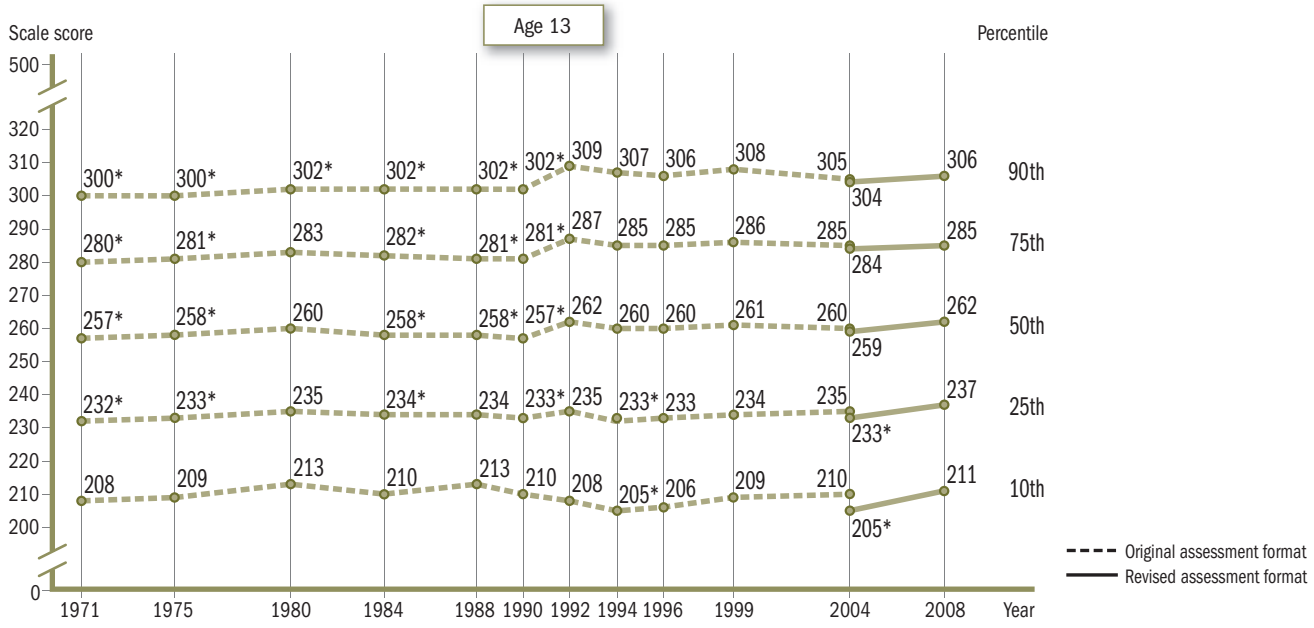
Gains for 17-year-olds at the 25th and 75th percentiles contributed to the overall increase in the average reading score from 2004 to 2008. There were no significant changes in the scores for students at the 10th, 50th, and 90th percentiles over the same period. Scores did not change significantly in 2008 compared to 1971 for 17-year-olds at any of the five percentile levels.

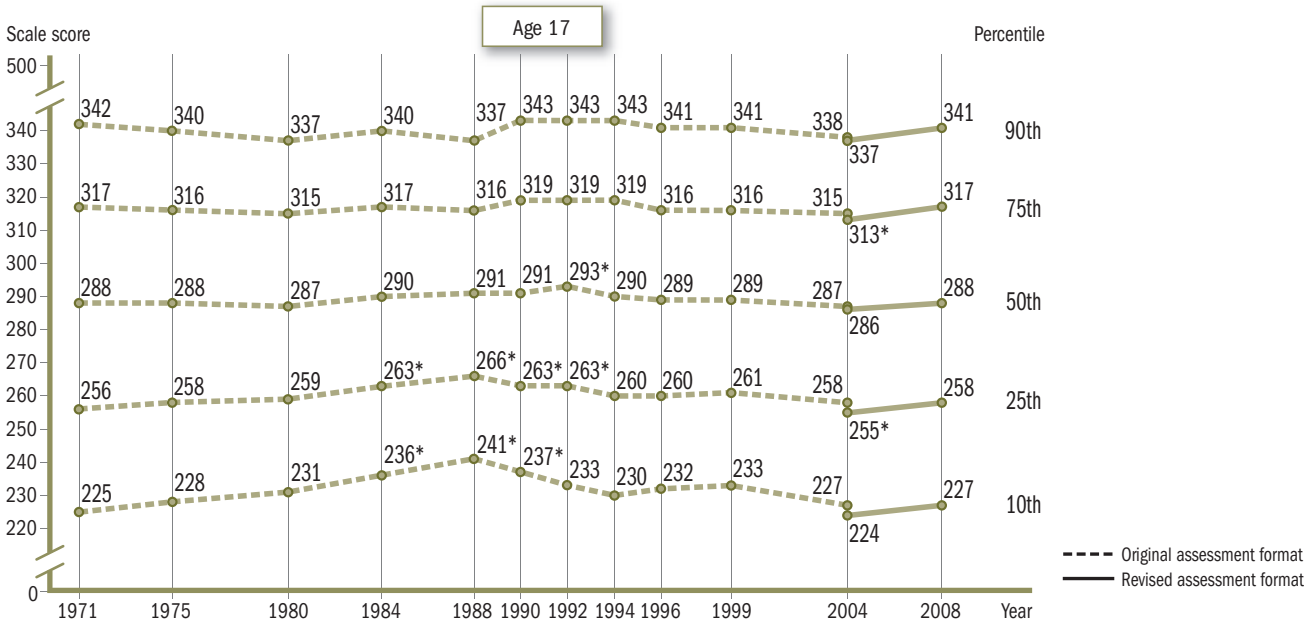
**FIGURE 2.** Trend in NAEP reading percentile scores for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 2.** Trend in NAEP reading percentile scores for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

## No significant change for 17-year-olds at any performance level

The skills and abilities demonstrated by students performing at different points on the reading scale help provide additional context for understanding changes in students' performance over time. While there have been some increases in the percentages of 9- and 13-year-olds at different levels, the percentages of 17-year-olds at different levels have not changed significantly in comparison to 2004 or 1971 (figure 3).

At age 9, at least 90 percent of students in each assessment year since 1971 could perform the simple, discrete reading tasks described for performance level 150. In the 2008 reading assessment, 96 percent performed at this level or above, an increase of 2 percentage points since 2004 and 5 percentage points in comparison to 1971.

Seventy-three percent of 9-year-olds in 2008 showed evidence of the partially developed skills and understanding described for level 200. This percentage was higher than the percentages in either 2004 or 1971.

In addition to demonstrating the abilities described for levels 150 and 200, students performing at or above level 250 demonstrated the ability to interrelate ideas and make generalizations about what they read. Twenty-one percent of 9-year-olds performed at or above level 250 in 2008, which was not significantly different from the percentage in 2004 but was higher than the percentage in 1971.

At age 13, at least 92 percent of students performed at or above level 200 in each assessment year. The percentage of students performing at or above this level in 2008 was 2 percentage points higher than in 2004 but was not significantly different from 1971.

Sixty-three percent of 13-year-olds performed at or above level 250 in 2008. A higher percentage of students reached this level in 2008 than in either 2004 or 1971.

Thirteen percent of students at age 13 were able to understand complicated information as described for level 300. This percentage was not significantly different from the percentage in 2004 but was higher than in 1971.

Among 17-year-olds, 80 percent of students performed at or above level 250 in 2008; 39 percent performed at or above level 300; and 6 percent were able to learn from specialized reading materials as described for level 350. For all three levels, the percentages of students in 2008 did not differ significantly from the percentages in 2004 or 1971.

## Reading Performance-Level Descriptions

**Level 350: Learn from Specialized Reading Materials**
Readers at this level can extend and restructure the ideas presented in specialized and complex texts. Examples include scientific materials, literary essays, and historical documents. Readers are also able to understand the links between ideas, even when those links are not explicitly stated, and to make appropriate generalizations. Performance at this level suggests the ability to synthesize and learn from specialized reading materials.

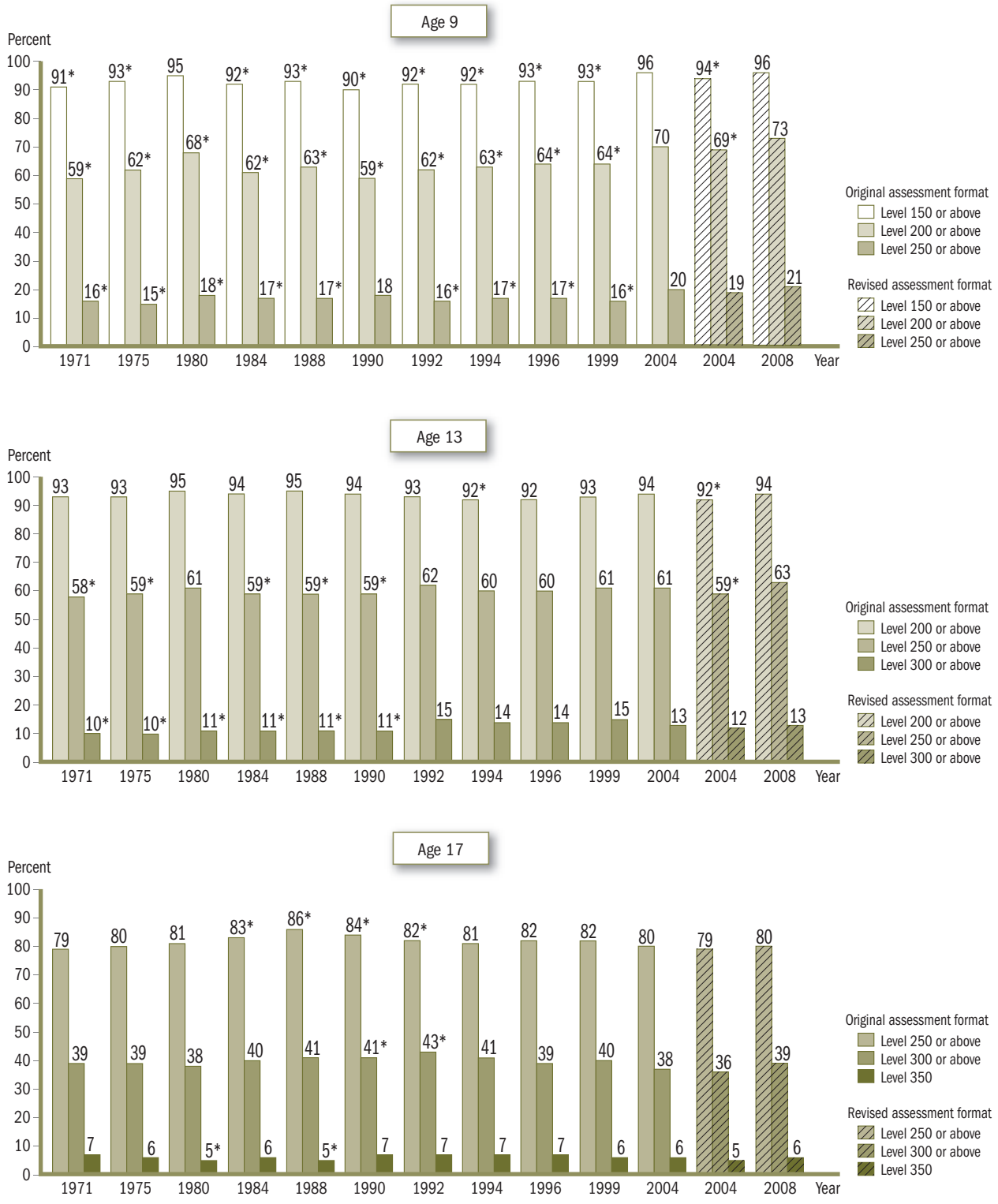
**Level 300: Understand Complicated Information**
Readers at this level can understand complicated literary and informational passages, including material about topics they study at school. They can also analyze and integrate less familiar material about topics they study at school as well as provide reactions to and explanations of the text as a whole. Performance at this level suggests the ability to find, understand, summarize, and explain relatively complicated information.

**Level 250: Interrelate Ideas and Make Generalizations**
Readers at this level use intermediate skills and strategies to search for, locate, and organize the information they find in relatively lengthy passages and can recognize paraphrases of what they have read. They can also make inferences and reach generalizations about main ideas and the author's purpose from passages dealing with literature, science, and social studies. Performance at this level suggests the ability to search for specific information, interrelate ideas, and make generalizations.

**Level 200: Demonstrate Partially Developed Skills and Understanding**
Readers at this level can locate and identify facts from simple informational paragraphs, stories, and news articles. In addition, they can combine ideas and make inferences based on short, uncomplicated passages. Performance at this level suggests the ability to understand specific or sequentially related information.

**Level 150: Carry Out Simple, Discrete Reading Tasks**
Readers at this level can follow brief written directions. They can also select words, phrases, or sentences to describe a simple picture and can interpret simple written clues to identify a common object. Performance at this level suggests the ability to carry out simple, discrete reading tasks.

**FIGURE 3.** Trend in NAEP reading performance-level results for 9-, 13-, and 17-year-old students




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

## Black students make greater gains compared to 1971 than White students

At age 9, White and Black students had higher average reading scores in 2008 than in all previous assessment years (figure 4). The average score for 9-year-old White students was 14 points higher in 2008 than in 1971, while the score for Black students was 34 points higher than in 1971.

At age 13, White and Black students had higher scores in 2008 than in 2004 and 1971. White students showed a 7-point gain, and Black students showed a 25-point gain in 2008 compared to 1971.

At age 17, the average reading score increased for White students from 2004 to 2008 but showed no significant change for Black students. Comparing 1971 to 2008, White students showed a gain of 4 points, while Black students showed a gain of 28 points.[1]

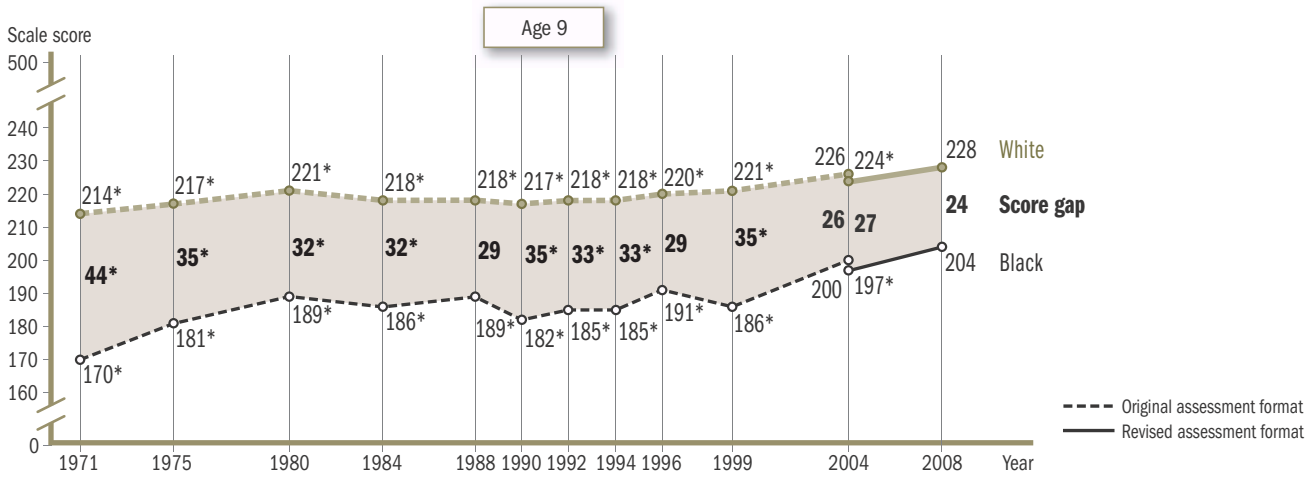
## No significant change in White – Black score gaps since 2004

While there were no significant changes in the gaps in reading scores between White and Black students from 2004 to 2008, the gaps at all three ages were narrower in 2008 than in 1971. The gaps narrowed by 20 points, 17 points,[2] and 24 points at ages 9, 13, and 17, respectively.

[1] The score-point change is based on the difference between unrounded scores as opposed to the rounded scores shown in the figure.

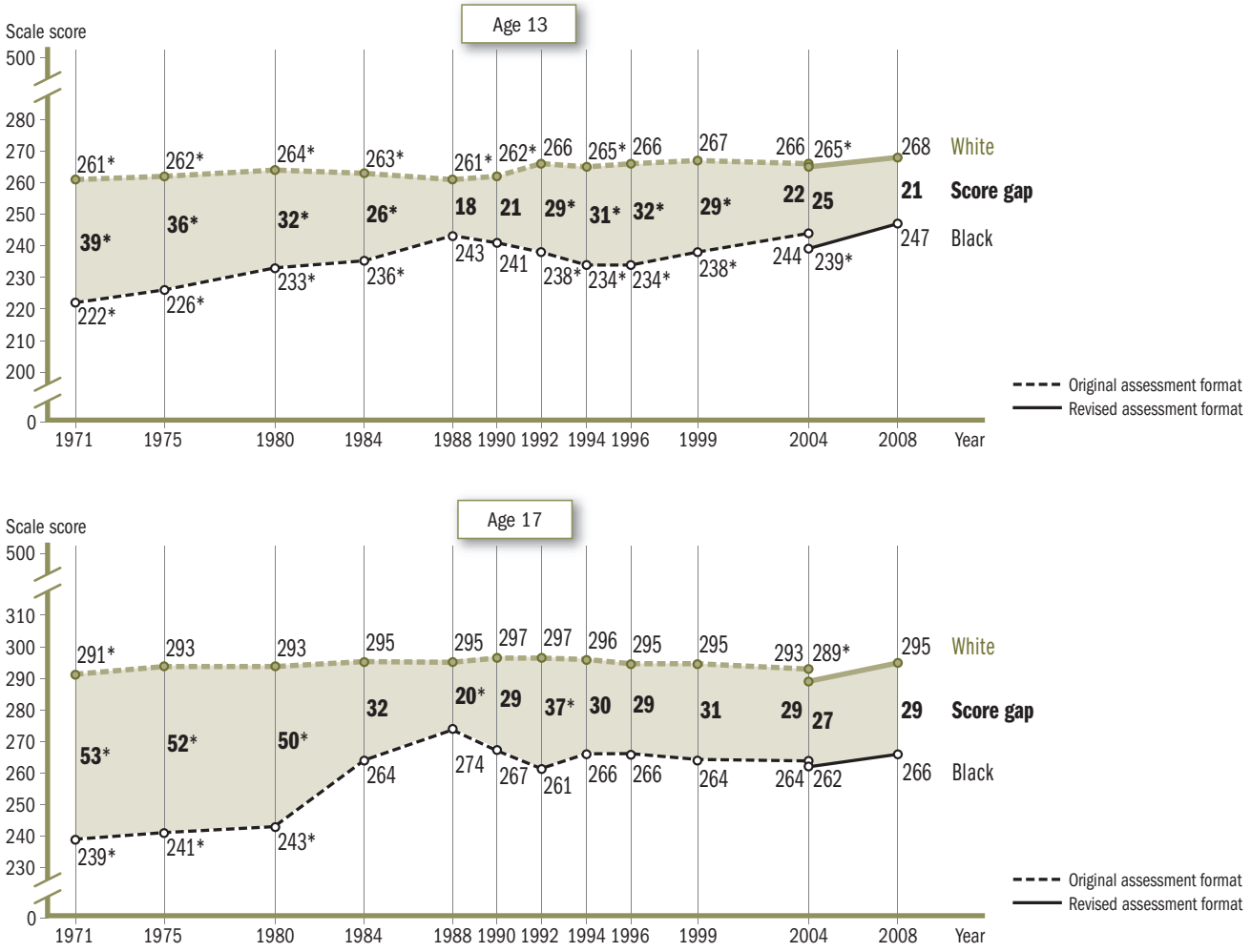
[2] The score-gap change is based on the difference between unrounded score gaps as opposed to the rounded score gaps shown in the figure.

**FIGURE 4.** Trend in White – Black NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 4.** Trend in White – Black NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
NOTE: Score gaps are calculated based on differences between unrounded average scores. Black includes African American. The White and Black race categories exclude Hispanic origin.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

## About Student Demographics

Each assessment year, NAEP gathers information on student demographics. Reading results are available for White and Black students back to the 1971 long-term trend assessment, and for Hispanic students back to 1975. Because results for Asian/Pacific Islander students were not reportable for some of the previous assessment years, they are not included in this report. In the assessments administered between 1971 and 2004, students were assigned to a racial/ethnic category based on the assessment administrator's observation. One of the changes introduced as part of the revised assessment format in 2004 was the reporting of students' race/ethnicity based on information collected from school records (see the Technical Notes for more information).

Changes in the student population over time show a decrease in the percentages of White students in 2008 compared to 1971 at all three ages. In contrast, the percentages of Hispanic students increased in 2008 compared to 1975 at all three ages. For example, the percentage of White 9-year-olds decreased from 80 percent in 1975 to 56 percent in 2008, and the percentage of Hispanic 9-year-olds increased from 5 to 20 percent over the same period (see appendix table A-1). The percentage of Black students did not show a significant change from 14 percent of 9-year-olds in 1971 to 16 percent in 2008.

## Gains for Hispanic students vary by age

At age 9, the average reading score for Hispanic students was higher in 2008 than in all previous assessment years (figure 5). Hispanic students showed an 8-point gain between 2004 and 2008 and a 25-point[3] gain in comparison to 1975.

At ages 13 and 17, there were no significant changes in scores for Hispanic students since 2004, but scores at both ages were higher in 2008 than in 1975. Compared to 1975, scores increased in 2008 by 10 points at age 13 and by 17 points at age 17.

## No significant change in White – Hispanic score gaps since 2004

Across all three age groups, there were no significant changes in the gaps in reading scores between White and Hispanic students from 2004 to 2008. However, when compared to 1975, the gaps in 2008 narrowed by 13 points at age 9 and by 15 points at age 17. The White – Hispanic score gap for 13-year-old students did not change significantly in 2008 compared to 1975.

[3] The score-point change is based on the difference between unrounded scores as opposed to the rounded scores shown in the figure.

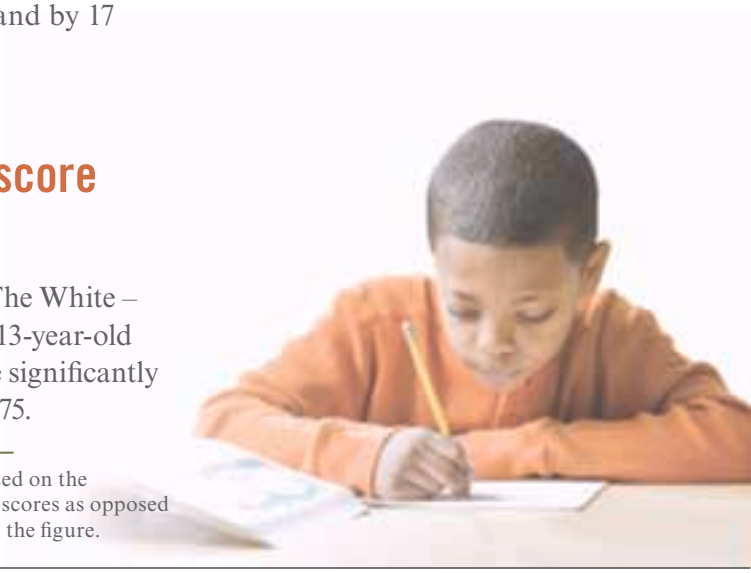
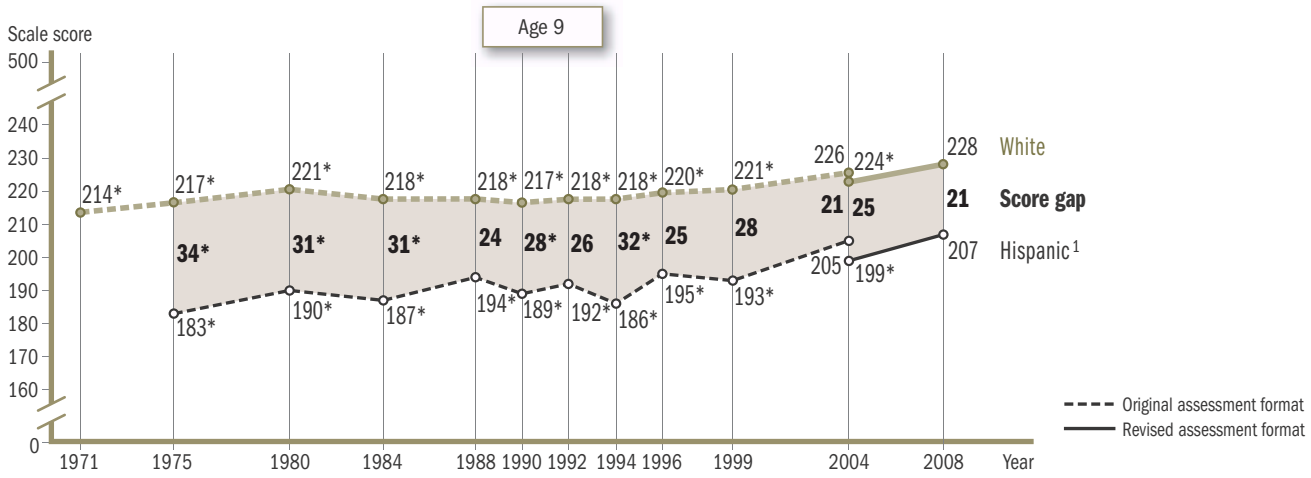
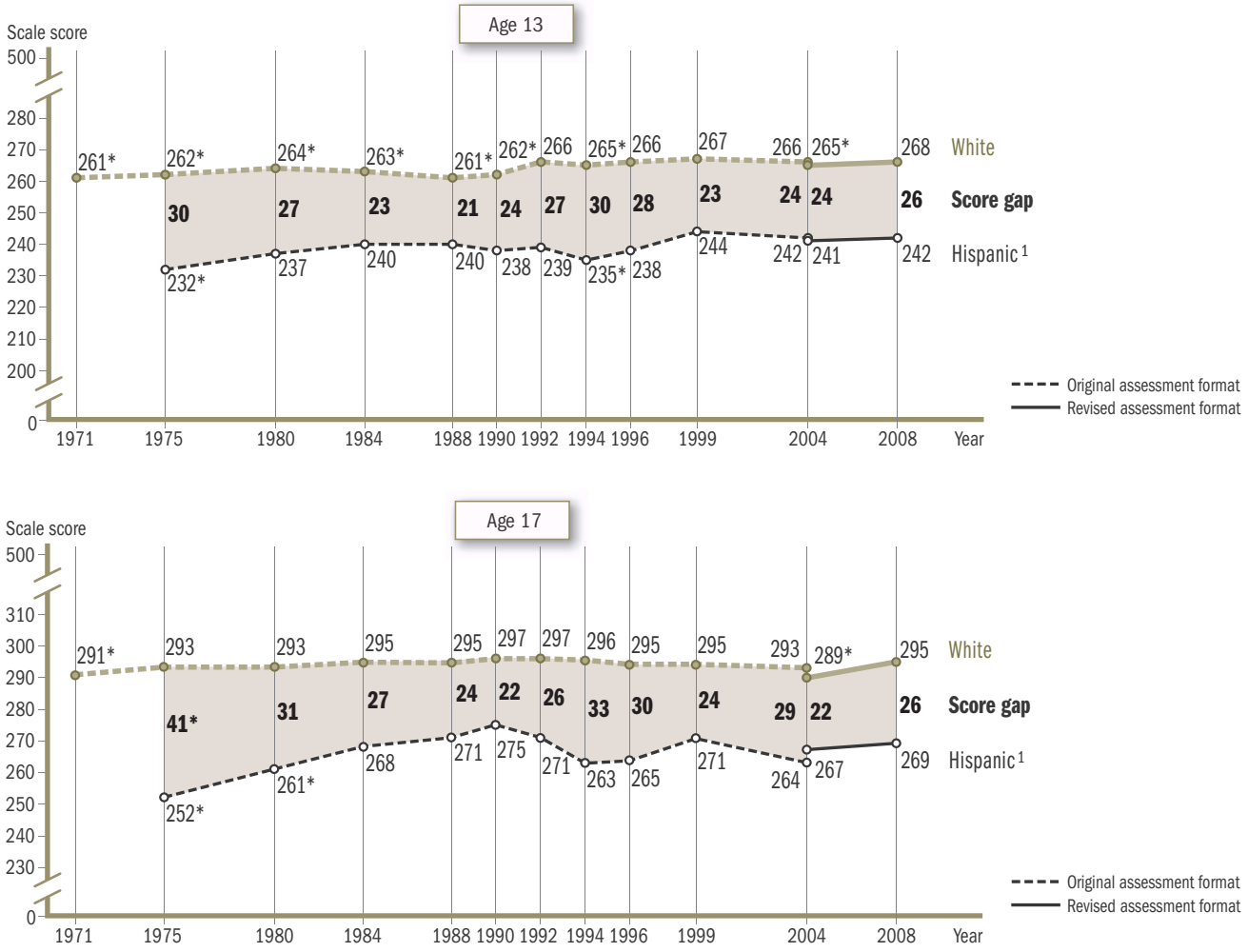


**FIGURE 5.** Trend in White – Hispanic NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 5.** Trend in White – Hispanic NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.

[1] Hispanic was not reported as a separate race/ethnicity category in 1971, but data for Hispanic students were included in the overall national results.

NOTE: Score gaps are calculated based on differences between unrounded average scores. Hispanic includes Latino. The White race category excludes Hispanic origin.

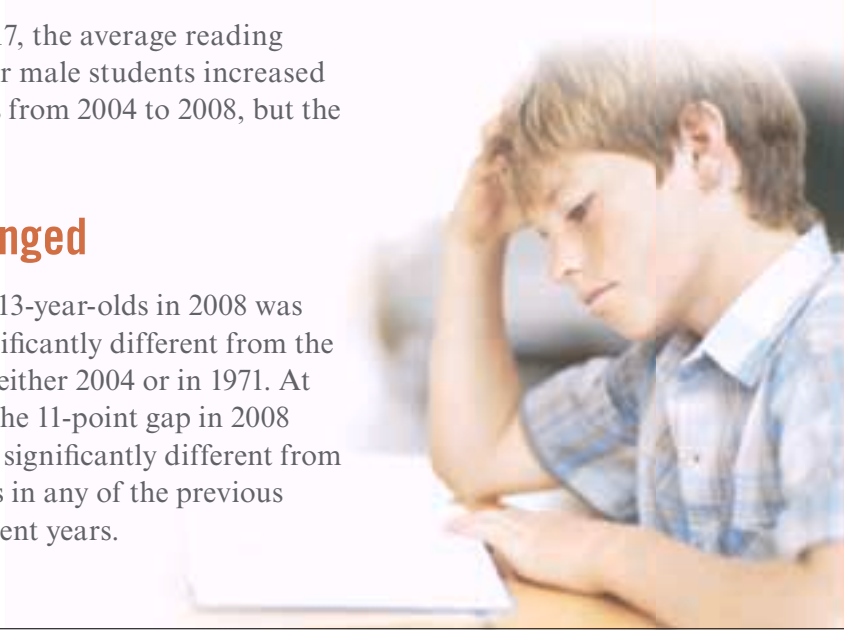
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

## Scores increase since 2004 for males at all three ages

The overall improvement in reading for 9-year-olds was also seen in the results for both male and female students. Average scores for both male and female 9-year-olds were higher in 2008 than in any previous assessment year (figure 6).

Progress since 2004 varied by gender at age 13. The reading score for 13-year-old male students was higher in 2008 than in 2004, while the score for female students showed no significant change. In comparison to 1971, scores were higher in 2008 for both male and female students.

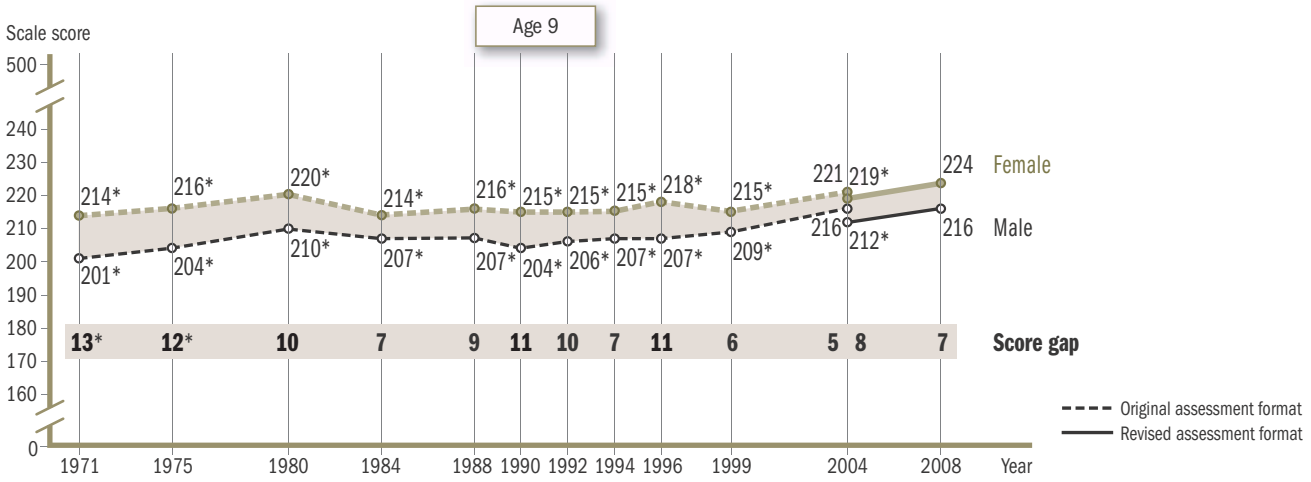
At age 17, the average reading score for male students increased 4 points from 2004 to 2008, but the score for female students did not change significantly over the same period. There was no significant change for either male or female students when the scores in 2008 were compared to those in 1971.



## Most gender gaps remain unchanged

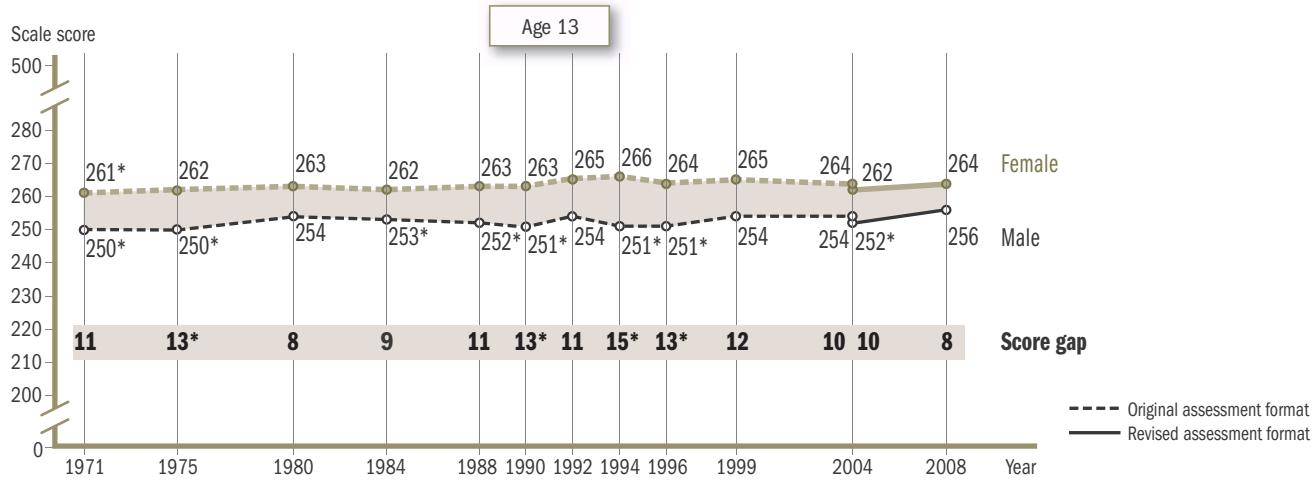
Across all three age groups, female students continued to score higher on average in reading than male students in 2008. At age 9, the 7-point gap in 2008 was not significantly different from the gap in 2004 but was narrower than the gap in 1971. The 8-point gender gap for 13-year-olds in 2008 was not significantly different from the gaps in either 2004 or in 1971. At age 17, the 11-point gap in 2008 was not significantly different from the gaps in any of the previous assessment years.

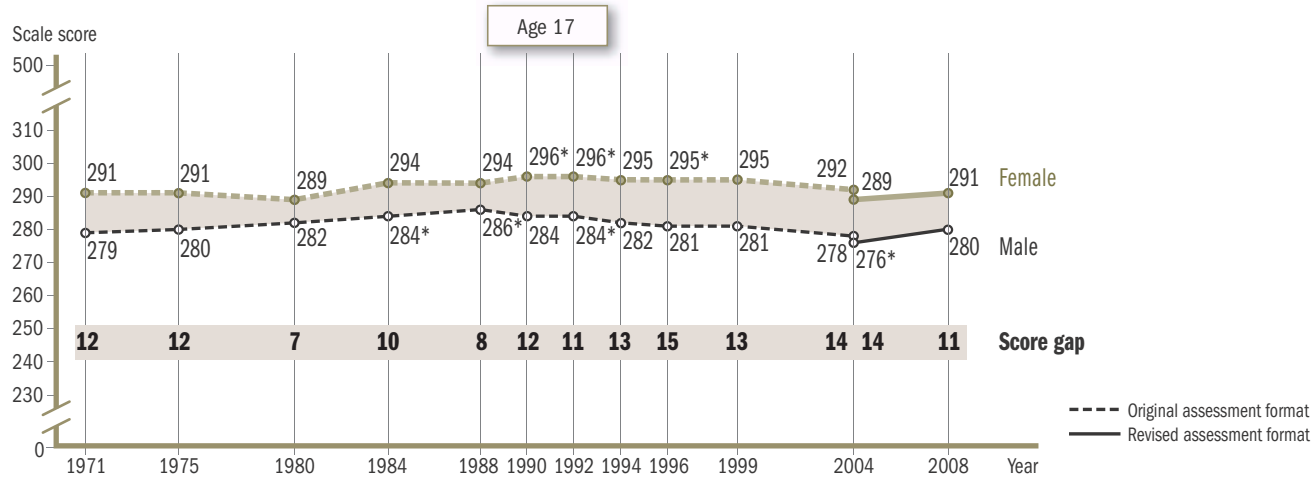
**FIGURE 6.** Trend in Female – Male NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 6.** Trend in Female – Male NAEP reading average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
NOTE: Score gaps are calculated based on differences between unrounded average scores.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1971–2008 Long-Term Trend Reading Assessments.

## Reading scores improve for 9-year-old public and private school students over long term

In 2008, between 90 and 92 percent of 9-, 13-, and 17-year-olds attended public schools, and between 4 and 5 percent attended Catholic schools (see appendix table A-1). While the percentages of students attending public schools have not changed significantly in comparison to 1980 at any of the three ages, the percentages of 9- and 13-year-olds attending Catholic schools were lower in 2008 than in 1980.

Average reading scores for public school students at all three ages increased in 2008 in comparison to 2004 (table 3). When compared to 1980 (the earliest results available), the score for 9-year-old public school students was higher in 2008. However, scores for 13- and 17-year-old public school students in 2008 showed no significant changes compared to their scores in 1980.

Nine-year-olds attending private schools[4] scored higher in 2008 than in 1980, while 13-year-olds showed no significant change in their score when comparing 2008 to 1980. The score for 9-year-old Catholic school students in 2008 was higher than their scores in 1980 and 2004.

In 2008, public school students scored lower than private school students at ages 9 and 13. Scores were lower for public school students than for Catholic school students at all three ages in 2008.

[4] Private schools include Catholic schools.

## School Participation in NAEP

Results by the type of school that students attended are available for the long-term trend reading assessments back to 1980. Assessment participation rates fell below the required standard for reporting results for 9- and 13-year-olds attending private schools in 2004, for 17-year-olds attending private schools in all the assessment years, and for 17-year-olds attending Catholic schools in 2004. In 1996, results for 17-year-old students attending Catholic schools are not reported because the sample size was insufficient to permit a reliable estimate. See the section on School and Student Participation Rates in the Technical Notes for more information.

**TABLE 3.** Average scores in NAEP reading, by student age group and type of school: Various years, 1980–2008

| Age group and type of school | 1980 | 1984 | 1988 | 1990 | 1992 | 1994 | 1996 | 1999 | 2004[1] | 2004[2] | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age 9** | | | | | | | | | | | |
| Public | 214* | 209* | 210* | 208* | 209* | 209* | 210* | 210* | 217 | 214* | 218 |
| Private | 227* | 223* | 223* | 228* | 225* | 225* | 227* | 226* | ‡ | ‡ | 237 |
| Catholic | 226* | 221* | 223* | 225* | 223* | 223* | 227 | 225 | 228 | 230* | 235 |
| **Age 13** | | | | | | | | | | | |
| Public | 257 | 255* | 256 | 255* | 257 | 256 | 256 | 257 | 257 | 255* | 258 |
| Private | 271 | 271 | 268 | 270 | 276 | 276 | 273 | 276 | ‡ | ‡ | 275 |
| Catholic | 270 | 270 | 266* | 273 | 275 | 273 | 275 | 279 | 278 | 276 | 275 |
| **Age 17[3]** | | | | | | | | | | | |
| Public | 284 | 287* | 289* | 289* | 288* | 286 | 287 | 286 | 283 | 281* | 284 |
| Catholic | 300 | 301 | 300 | 307 | 308 | 301 | ‡ | 305 | ‡ | ‡ | 303 |

‡ Reporting standards not met.
* Significantly different ($p < .05$) from 2008.
[1] Original assessment format. Results prior to 2004 are also from the original assessment format.
[2] Revised assessment format. Results after 2004 are also from the revised assessment format.
[3] For students at age 17, results are not shown for private schools because the minimum participation guidelines for reporting were not met.
NOTE: For all age groups, results are not available for 1971 and 1975.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1980–2008 Long-Term Trend Reading Assessments.

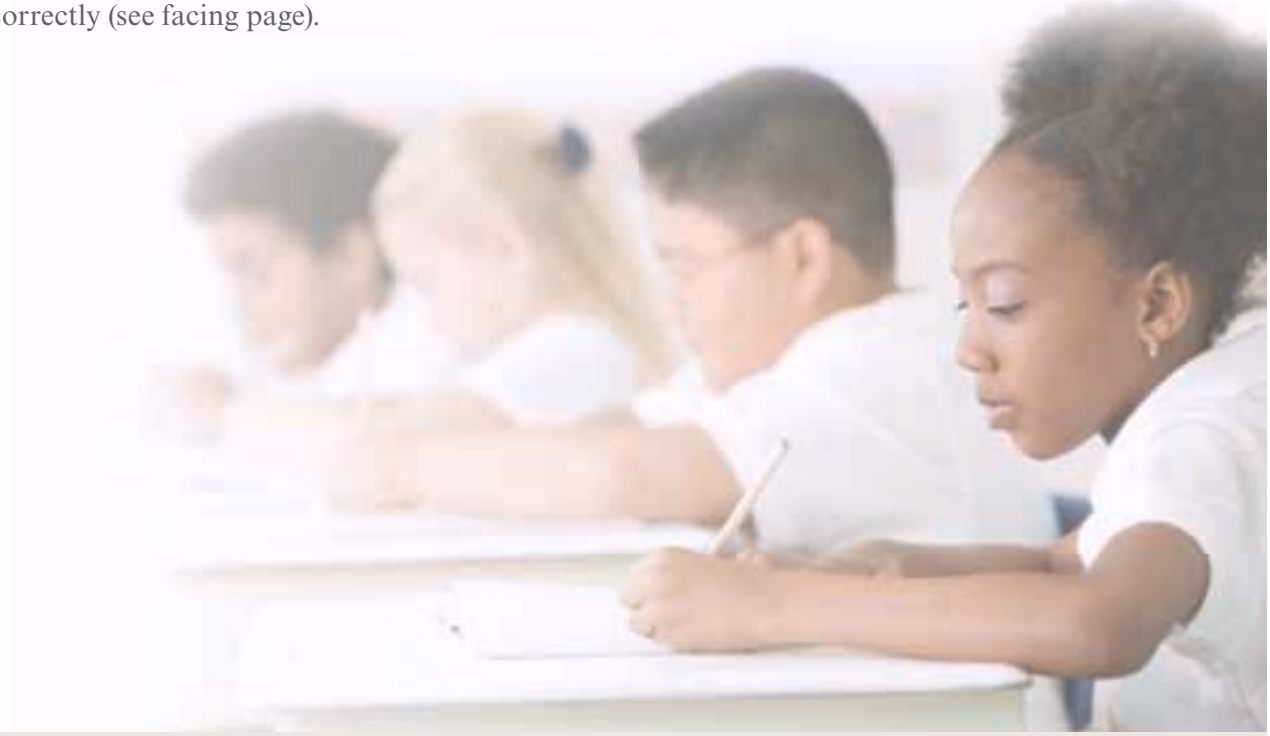
## Sample Questions

Beginning in 2004, as a result of modifications to the long-term trend reading assessment, it became possible to share questions with the public. Again in 2008, some of the questions that have been administered to students since the early 1970s are being released. These released questions will not be administered in future NAEP long-term trend assessments.

The NAEP long-term trend reading assessment contains a range of reading materials, from simple narrative passages to complex articles on specialized topics. The selections include stories, poems, essays, reports, and passages from textbooks, as well as samples of a train schedule, telephone bill, and advertisements. While some passages in the assessment were administered across the age levels, passage length and difficulty generally increased at ages 13 and 17.

Two sample reading questions for each age group are presented in this section. These questions provide some insight into the types of comprehension skills measured by the long-term trend reading assessment. The response options for the multiple-choice sample questions are provided as the students saw them, and the oval for the correct answer is filled in. Constructed-response questions in the long-term trend reading assessment were typically scored using a 5-level scoring guide, which categorized the accuracy and level of detail provided in the student responses.

In the sample questions that follow, the percentages of students who answered correctly overall and within each performance level are shown in the tables below each sample. For example, 67 percent of age 9 students answered the first reading sample question correctly, while 30 percent of age 9 students at performance level 150 answered the question correctly (see facing page).



## For More Information

Additional sample questions from the 2008 long-term trend assessments can be found at http://nces.ed.gov/nationsreportcard/itmrls.

## Sample Reading Passage and Questions

### AGE 9

# Frontier Women

Like the early colonial women settlers of the backwoods, frontier women made everything their families needed. Most began work at daybreak and did not rest until late evening. They cooked, spun cloth, made clothing, raised children, and tried to keep their dirt homes clean. They cleared and plowed fields, tended and harvested crops, milked the cows, raised hogs, rode and trained horses, and did just about every chore on the farm.

The women not only worked, they also made most of their own tools. To make pitchforks, they attached handles to deer antlers. Many of the women learned to use a knife well enough to carve spoons, forks, and bowls out of animal bones. They fashioned cups and containers out of vegetable gourds and animal horns.

**Sample question 1** asked students to make an inference based on the details of the passage to determine the best overall description of early colonial women.

**Which statement best describes the frontier women?**

- (A) They lived dangerous lives and tamed the West.
- (B) They hunted to provide food for their families.
- (C) They frequently worried about the safety of their homes.
- (D) They worked hard and possessed many skills.

Percentage of correct responses for 9-year-old students at each performance level: 2008

| Overall | Below level 150 | Level 150 | Level 200 | Level 250 |
|---|---|---|---|---|
| 67 | 26 | 30 | 75 | 99 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

**Sample question 2** asked students to identify specific information from the passage.

**According to the article, what did frontier women make from animal horns and bones?**

- (A) Jewelry and ornaments
- (B) Tools and eating utensils
- (C) Beds and household furniture
- (D) Toys and horseshoes

Percentage of correct responses for 9-year-old students at each performance level: 2008

| Overall | Below level 150 | Level 150 | Level 200 | Level 250 |
|---|---|---|---|---|
| 83 | 20 | 56 | 94 | 99 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

## Sample Reading Passage and Questions

## AGE 13

# Elephant Seals

Elephant seals cannot always be found together or even on land. In fact, for most of the year they prefer to be alone and at sea. But there are two reasons these seals gather on shore each year.

One is to escape the stinging effect of saltwater when they molt, or shed their old hair for new hair. At this time large patches of skin are also shed with the old hair. That is what makes them so sensitive to salt. The other reason elephant seals come ashore is to give birth to their young and to mate.

During the mating season, the seals are as heavy as they will ever be during the year. Females may weigh as much as 1,700 pounds. Males may weigh close to 6,000 pounds and be 17 feet long.

Much of the weight of these animals is fat, which they gain from their diet of squid and other seafood. This fat insulates them from the cold and provides the energy for the long periods when they eat nothing at all. But unfortunately for the seals, their blubber is also a very rich source of oil. The fat from a large male may yield up to 210 gallons of oil.

Although the animals are huge, they can be approached without fear, for on land they move fairly slowly. Unlike many other types of seals, elephant seals have little fear of people. Thus, when large-scale hunting of seals began around 1850, it didn't take long to kill most of them. By the 1890's scientists supposed that these seals had been hunted off.

In 1911 it was a great surprise when a small herd of about 100 seals was found on a Mexican island near the coast of Baja California. This discovery was reported to the Mexican government, which immediately stationed soldiers on the island with orders to shoot anyone harming the seals. As you can imagine, the seals prospered and within another sixty years the size of the herd had greatly increased.

One feature of elephant seal behavior may have aided this remarkable comeback. The males engage in savage fighting that leaves one bull "King of the Beach." The winner is a champion prizefighter in the elephant seal world and, as a reward, he will have more "wives" on his part of the beach than any other bull. Farther down the beach, however, there are also other champions. This type of grouping helps the seals, for the strength of the most powerful bulls is passed on to the baby elephant seals. And in a vast ocean where these pups have to outswim an occasional white shark or killer whale, speed and strength are important.

Most of the fighting among males takes place in early December. They arrive at the Mexican island and other areas several weeks before the females so their problems will be settled before their wives arrive. From this time until they leave in March, the bulls eat nothing at all. They stay on shore and live only on the food and water contained in their stored fat.

Females arrive on the beaches in late December. Several days later each gives birth to a pup that weighs about 90 pounds. For one month the mother seal also eats nothing at all. In fact, she does very little other than nurse her pup. By the end of this 30-day period the pup may have tripled its weight, now weighing close to 300 pounds. At that time the mother leaves the pup to survive by itself. She then mates. One year later she gives birth to another pup.

And so the story goes, just as it did for thousands of years before the hunters arrived. Now, with the hunters gone and the seals recovered, this story should continue for thousands of years more.

**Sample question 3** asked students to recognize the overall informative purpose of the passage and the emphasis on the seals' appearance and habits.

**What is the main purpose of this article?**

- (A) To explain why elephant seals are important to humans
- (B) To convince the reader that elephant seals are not harmful to humans
- (C) To describe the appearance and habits of elephant seals
- (D) To convince the reader that laws should be made to protect elephant seals

Percentage of correct responses for 13-year-old students at each performance level: 2008

| Overall | Below level 200 | Level 200 | Level 250 | Level 300 |
|---|---|---|---|---|
| 63 | 32 | 55 | 67 | 82 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

**Sample question 4** asked students to identify a specific cause of seal behavior presented in the passage.

**Why do elephant seals come ashore each year?**

- (A) To eat and store up food
- (B) To escape the winter migration of the white sharks and to avoid the cold water
- (C) To rest up from their hard life at sea and hibernate
- (D) To escape the saltwater and to give birth to their young

Percentage of correct responses for 13-year-old students at each performance level: 2008

| Overall | Below level 200 | Level 200 | Level 250 | Level 300 |
|---|---|---|---|---|
| 74 | 26 | 52 | 88 | 99 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

## Sample Reading Passage and Questions

### AGE 17

# Travels with Charley in Search of America

Even the cabin was dismal and damp. I turned the gas mantle high, lit the kerosene lamp, and lighted two burners of my stove to drive the loneliness away. The rain drummed on the metal roof. Nothing in my stock of food looked edible. The darkness fell and the trees moved closer. Over the rain drums I seemed to hear voices, as though a crowd of people muttered and mumbled offstage. Charley was restless. He didn't bark an alarm, but he growled and whined uneasily, which is very unlike him, and he didn't eat his supper and he left his water dish untouched—and that by a dog who drinks his weight in water every day and needs to because of the outgo. I succumbed utterly to my desolation, made two peanut-butter sandwiches, and went to bed and wrote letters home, passing my loneliness around. Then the rain stopped falling and the trees dripped and I helped spawn a school of secret dangers. Oh, we can populate the dark with horrors, even we who think ourselves informed and sure, believing nothing we cannot measure or weigh. I knew beyond all doubt that the dark things crowding in on me either did not exist or were not dangerous to me, and still I was afraid. I thought how terrible the nights must have been in a time when men knew the things were there and were deadly. But no, that's wrong. If I knew they were there, I would have weapons against them, charms, prayers, some kind of alliance with forces equally strong but on my side. Knowing they were not there made me defenseless against them and perhaps more afraid.

**Sample question 5** asked students to use their understanding of the narrator's words in the passage to recognize the nature of his fear.

**Which of the following best describes the man's fear?**

- (A) He was worried that his dog was becoming ill.
- (B) He kept having fearful thoughts even though he knew there was no danger.
- (C) He suspected that there were dangerous animals outside.
- (D) He heard voices of people trying to break into the cabin.

Percentage of correct responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 84 | 58 | 84 | 97 | 99 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

**Sample question 6** is a constructed-response question that asked students to interpret the overall mood or feeling of a short literary passage and then to explain how the writer of the passage created the mood. Responses to this question were rated with a 5-level scoring guide in one of the following categories:

5 – Mood identified and substantiated with multiple pieces of evidence

4 – Mood identified and substantiated

3 – Mood identified and substantiated with minimal evidence

2 – Mood identified without substantiation

1 – Unable to identify mood

The following sample response was rated as level 5 because it correctly identified the mood of the passage and provided multiple pieces of evidence. Overall, 3 percent of 17-year-olds provided responses that were rated as level 5.

**Think about the article again. Write down a few words that describe the mood or feeling of the story.**

dismal, eerie, mysterious, dark,

**Explain how the writer created this mood.**

The writer created this mood through description of the setting. The cabin is described as dismal and lonely, and the rain on the roof along with the unknown creatures outside the cabin give it an eerie mood. Also, the fact that the main character knows he shouldn't be scared yet still is is somewhat mysterious because maybe subconciously he knows that the should be afraid. The strange behavior of the dog supports this arguement as well.

Percentage of level 5 responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 3 | # | # | 5 | 16 |

# Rounds to zero.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

The following sample response was rated as level 3 because it provided minimal evidence of how the author created the mood. Overall, 74 percent of 17-year-olds wrote responses that were rated as level 3 or better.

**Think about the article again. Write down a few words that describe the mood or feeling of the story.**

The mood of the story is creepy

**Explain how the writer created this mood.**

The writers mood was created because of where the story took place. who wouldn't feel scared in the dark woods?

Percentage of level 3 or better responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 74 | 44 | 73 | 89 | 97 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Reading Assessment.

# The Long-Term Trend Assessment in Mathematics

The NAEP long-term trend mathematics assessment required students to respond to a variety of age-appropriate questions. The assessment was designed to measure a student's

- knowledge of basic mathematical facts,
- ability to carry out computations using paper and pencil,
- knowledge of basic formulas such as those applied in geometric settings, and
- ability to apply mathematics to daily-living skills such as those involving time and money.

Students' mathematics skills were measured using mostly multiple-choice questions and some constructed-response questions. Each student took only a part of the assessment, consisting of three 15-minute sections. The complete 2008 mathematics assessment contained between 103 and 126 multiple-choice questions and between 30 and 36 constructed-response questions at each age (table 4). Unlike certain sections in the main NAEP assessment, students were not permitted to use a calculator in the long-term trend mathematics assessment. Sample questions are presented later in this section.

**TABLE 4.** Number of multiple-choice and constructed-response questions in NAEP mathematics assessment, by student age group: 2008

| Age group | Multiple-choice questions | Constructed-response questions |
|---|---|---|
| Age 9 | 103 | 33 |
| Age 13 | 120 | 36 |
| Age 17 | 126 | 30 |

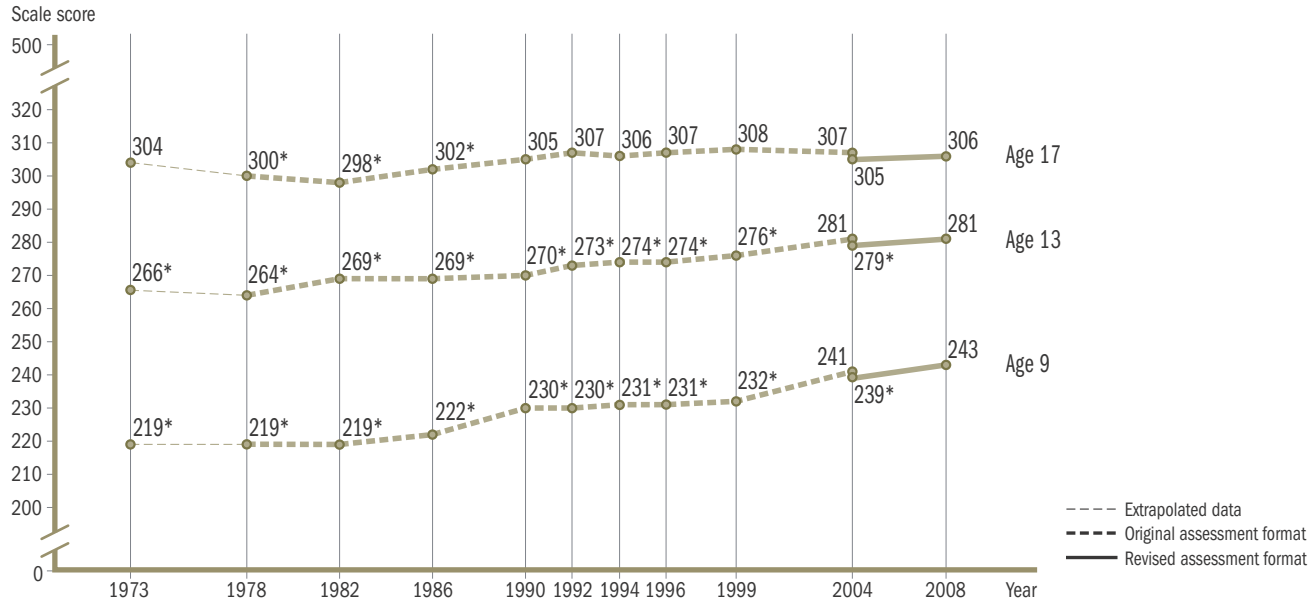
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

## Scores increase for 9- and 13-year-olds

Overall, average scores in mathematics for 9- and 13-year-olds were higher in 2008 than in all previous assessment years (figure 7). The average score for 9-year-olds in 2008 increased 4 points since 2004 and 24 points compared to 1973. Thirteen-year-olds scored 3 points[5] higher than in 2004 and 15 points higher than in 1973. In contrast, the average score for 17-year-olds in 2008 was not significantly different from the scores in 2004 and 1973.

[5] The score-point change is based on the difference between unrounded scores as opposed to the rounded scores shown in the figure.

**FIGURE 7.** Trend in NAEP mathematics average scores for 9-, 13-, and 17-year-old students




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1973–2008 Long-Term Trend Mathematics Assessments.

### Extrapolated Results

The mathematics results from 1973 were extrapolated using a mean proportion correct to calculate average scores for students overall and by race/ethnicity and gender. All other results, including percentile and performance-level data, are shown beginning in 1978. See the Technical Notes for more information.

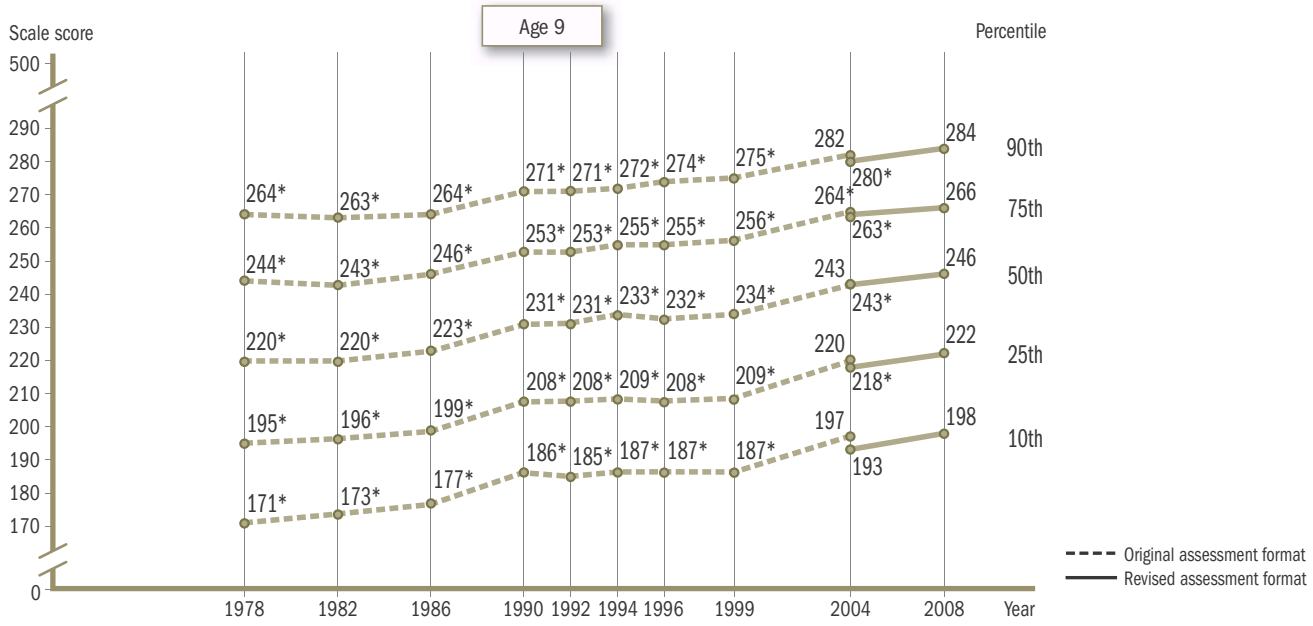
## Improvement for lower-, middle-, and higher-performing students varies by age

The overall gain in mathematics since 2004 for 9-year-olds was also seen in increases for all but the lowest-performing students (figure 8). While there was no significant change in the score for 9-year-olds performing at the 10th percentile from 2004 to 2008, the score in 2008 was 27 points higher than in 1978. Scores were higher in 2008 than in all previous assessment years for students at the 25th, 50th, 75th, and 90th percentiles.

While the overall average score for 13-year-olds was higher in 2008 than in both 2004 and 1978, the results varied for students performing at different percentile levels. Scores increased since 2004 for students at the 10th and 50th percentiles, but there were no significant changes for students who scored at the 25th, 75th, and 90th percentiles over the same period. Students performing at all five percentile levels scored higher in 2008 compared to 1978.

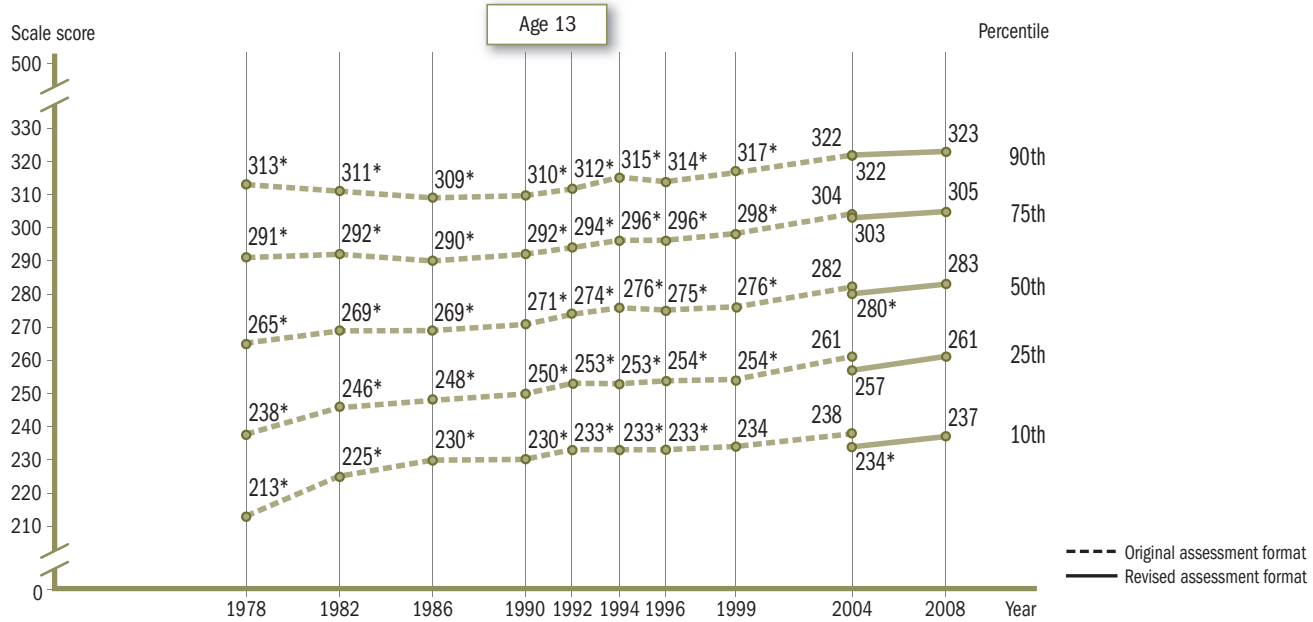
As in the overall scale score results for 17-year-olds, there were no significant changes in scores from 2004 to 2008 for students at any of the five percentile levels. Scores for lower- and middle-performing 17-year-olds (at the 10th, 25th, and 50th percentiles) were higher in 2008 than in 1978.

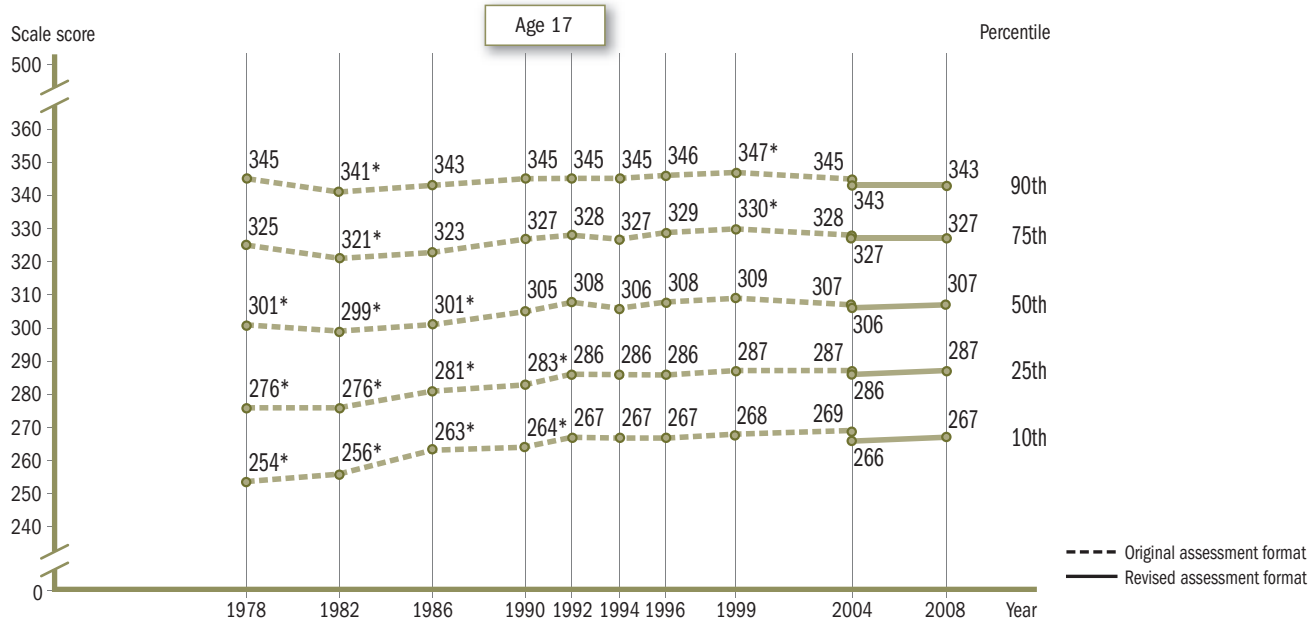
**FIGURE 8.** Trend in NAEP mathematics percentile scores for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 8.** Trend in NAEP mathematics percentile scores for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

## Students' understanding of basic operations improves compared to 1978

The skills and knowledge demonstrated by students performing at different points on the mathematics scale help provide additional context for understanding changes in students' performance over time.

In each assessment year since 1978, at least 97 percent of 9-year-old students demonstrated the knowledge of simple arithmetic facts described for performance level 150 (figure 9). The percentage of students performing at this level or above in 2008 was not significantly different from the percentage in 2004 but was higher than in 1978.

The beginning mathematical skills and understandings described for performance level 200 were demonstrated by 89 percent of 9-year-olds in 2008. This was an increase of 2 percentage points since 2004 and an increase of 19 percentage points in comparison to 1978.

In addition to demonstrating the skills and knowledge described for levels 150 and 200, students performing at or above performance level 250 demonstrated the ability to begin to apply basic mathematical operations. The percentage of 9-year-olds performing at or above this level was higher in 2008 than in both 2004 and 1978.

The percentages of 13-year-olds performing at or above the 200 and 250 levels in 2008 were not significantly different from the percentages in 2004 but were higher than the percentages in 1978. In addition to demonstrating the skills and knowledge described for the 200 and 250 levels, 30 percent of 13-year-olds were able to use the moderately complex procedures and reasoning indicative of performance described for level 300. Although not significantly different from the percentage in 2004, this percentage was higher than in 1978.

Ninety-six percent of 17-year-olds performed at or above level 250 in 2008, and 59 percent performed at or above level 300. These percentages were not significantly different from the percentages in 2004 but were higher than in 1978.

Six percent of 17-year-olds in 2008 demonstrated the skills associated with multistep problem solving and algebra described at level 350. This percentage was not significantly different from the percentages in 2004 or 1978.

## Mathematics Performance-Level Descriptions

**LEVEL 350: Multistep Problem Solving and Algebra**
Students at this level can apply a range of reasoning skills to solve multistep problems. They can solve routine problems involving fractions and percents, recognize properties of basic geometric figures, and work with exponents and square roots. They can solve a variety of two-step problems using variables, identify equivalent algebraic expressions, and solve linear equations and inequalities. They are developing an understanding of functions and coordinate systems.

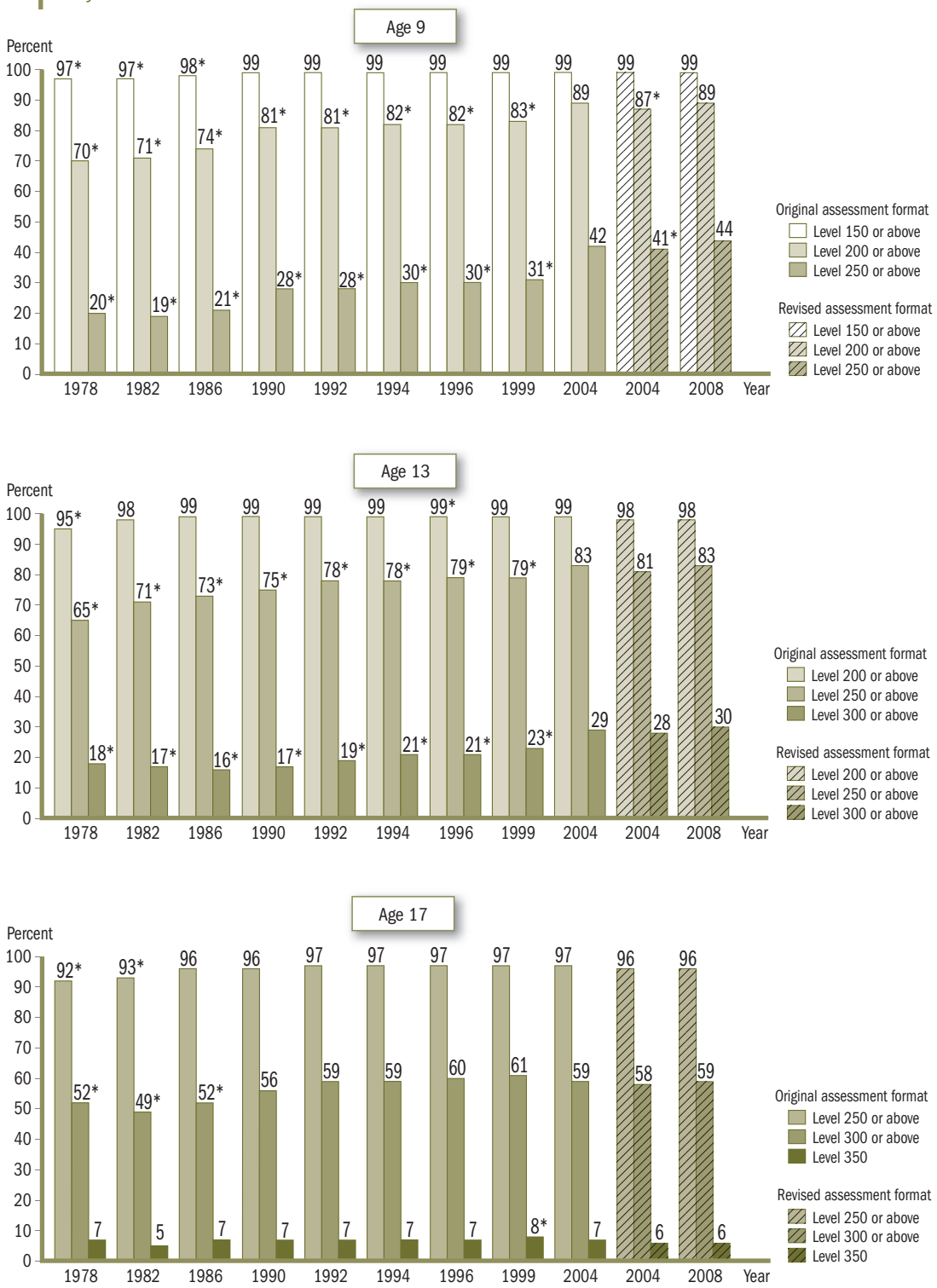
**LEVEL 300: Moderately Complex Procedures and Reasoning**
Students at this level are developing an understanding of number systems. They can compute with decimals, simple fractions, and commonly encountered percents. They can identify geometric figures, measure lengths and angles, and calculate areas of rectangles. These students are also able to interpret simple inequalities, evaluate formulas, and solve simple linear equations. They can find averages, make decisions based on information drawn from graphs, and use logical reasoning to solve problems. They are developing the skills to operate with signed numbers, exponents, and square roots.

**LEVEL 250: Numerical Operations and Beginning Problem Solving**
Students at this level have an initial understanding of the four basic operations. They are able to apply whole number addition and subtraction skills to one-step word problems and money situations. In multiplication, they can find the product of a two-digit and a one-digit number. They can also compare information from graphs and charts and are developing an ability to analyze simple logical relations.

**LEVEL 200: Beginning Skills and Understandings**
Students at this level have considerable understanding of two-digit numbers. They can add two-digit numbers but are still developing an ability to regroup in subtraction. They know some basic multiplication and division facts, recognize relations among coins, can read information from charts and graphs, and use simple measurement instruments. They are developing some reasoning skills.

**LEVEL 150: Simple Arithmetic Facts**
Students at this level know some basic addition and subtraction facts, and most can add two-digit numbers without regrouping. They recognize simple situations in which addition and subtraction apply. They also are developing rudimentary classification skills.

**FIGURE 9.** Trend in NAEP mathematics performance-level results for 9-, 13-, and 17-year-old students



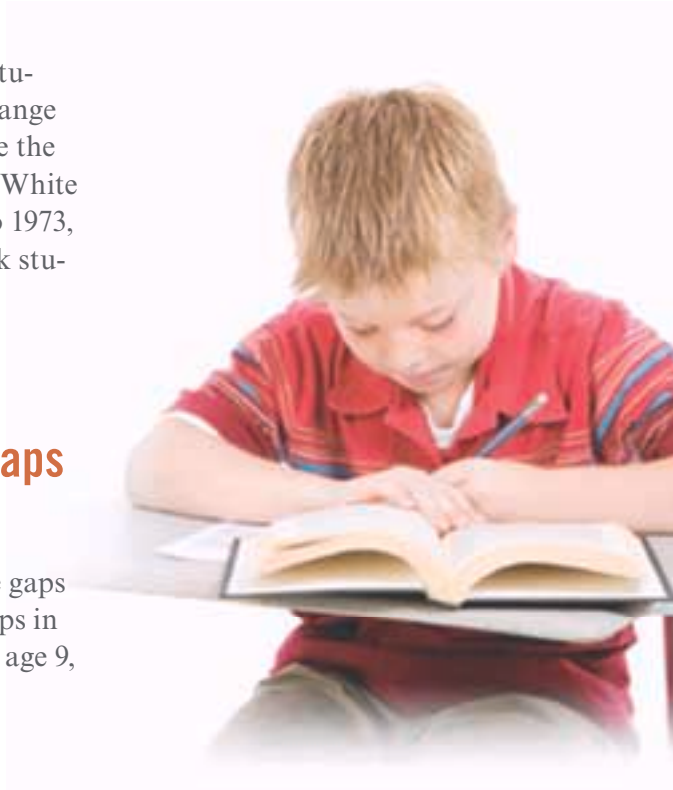

* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

## Black students make greater gains than White students compared to 1973

At age 9, the average mathematics score increased from 2004 to 2008 for White students but showed no significant change for Black students (figure 10). In comparison to 1973, scores in 2008 were 25 points higher for White students and 34 points higher for Black students.

At age 13, neither White nor Black students' scores showed a significant change from 2004 to 2008. However, comparing 1973 to 2008, White students gained 16 points compared to 34 points for Black students.

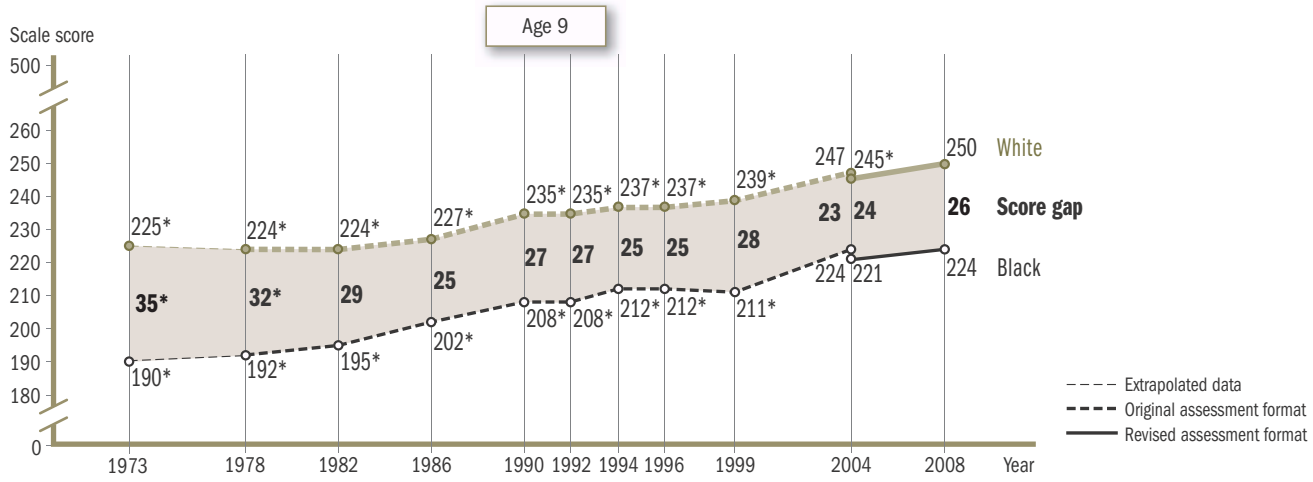
Similarly, at age 17, the score for neither White nor Black students showed a significant change between 2004 and 2008, while the score was 4 points higher for White students in 2008 compared to 1973, and 17 points higher for Black students over the same period.



## No significant change in White – Black score gaps since 2004

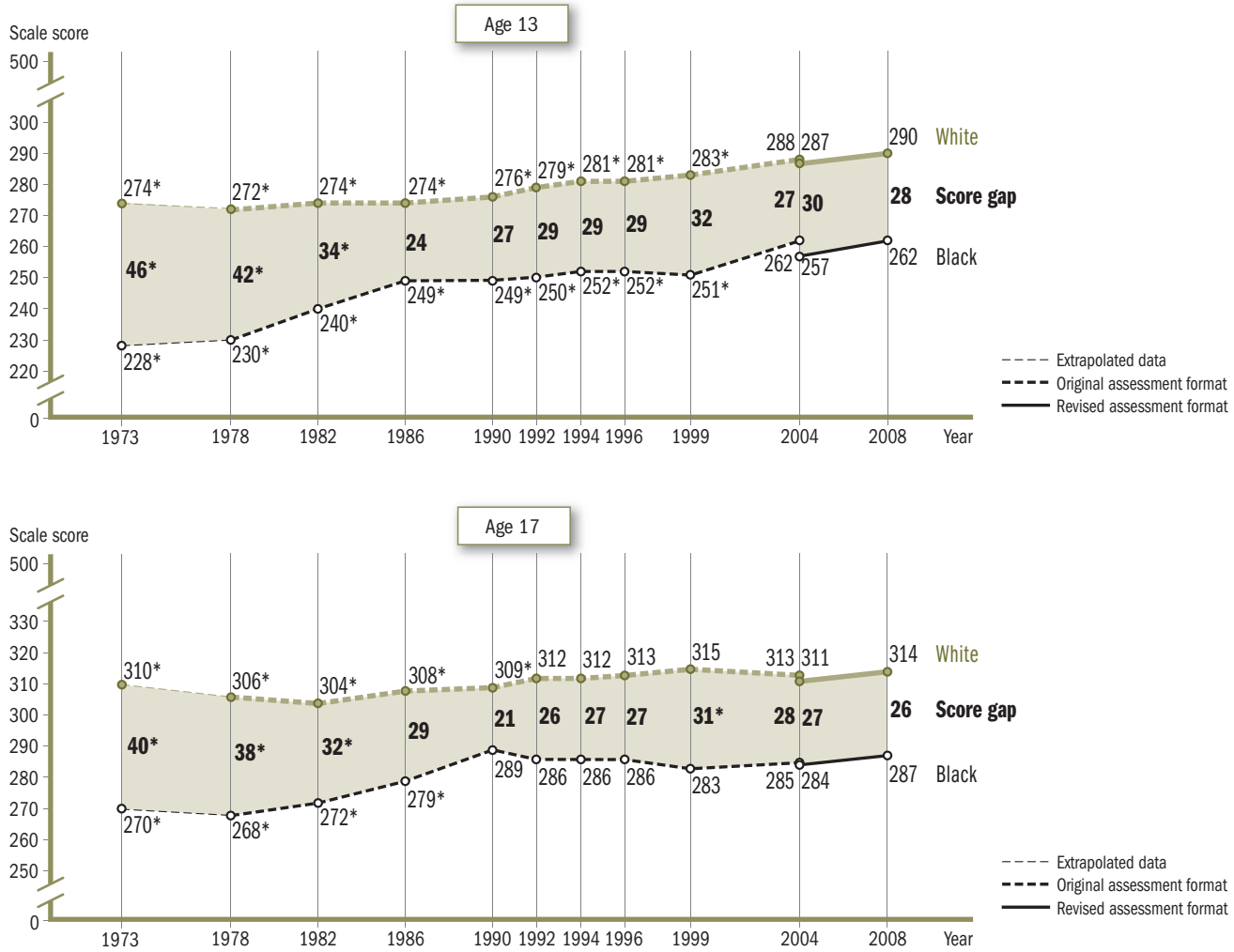
While the score gaps between White and Black students at all three ages showed no significant change between 2004 and 2008, the gaps did narrow in 2008 compared to 1973. In comparison to the gaps in 1973, the White – Black gaps in 2008 narrowed by 9 points at age 9, by 18 points at age 13, and by 14 points at age 17.

**FIGURE 10.** Trend in White – Black NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 10.** Trend in White – Black NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
NOTE: Score gaps are calculated based on differences between unrounded average scores. Black includes African American. The White and Black race categories exclude Hispanic origin.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1973–2008 Long-Term Trend Mathematics Assessments.

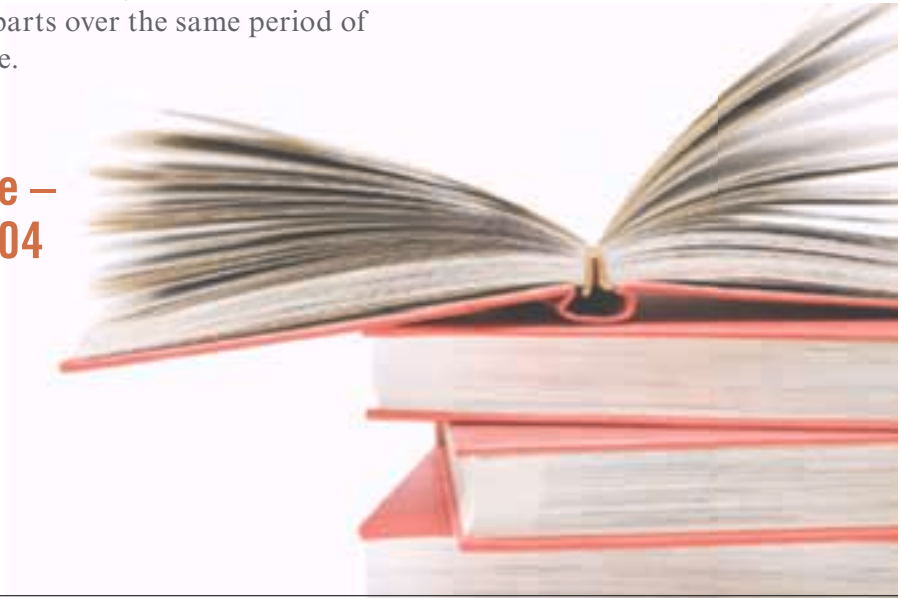
## About Student Demographics

Each assessment year, NAEP gathers information on student demographics. For the mathematics assessment, the percentages of students assessed by race/ethnicity are available going back to 1978. Because results for Asian/Pacific Islander students were not reportable for some of the previous assessment years, they are not included in this report. In the assessments administered between 1978 and 2004, students were assigned to a racial/ethnic category based on the assessment administrator's observation. One of the changes introduced as part of the revised assessment format in 2004 was the reporting of students' race/ethnicity based on information collected from school records (see the Technical Notes for more information).

Changes in student population over time show decreases in the percentages of White students in 2008 compared to 1978 at all three ages. In contrast, the percentages of Hispanic students increased, and the percentages of Black students showed no significant changes over the same period of time. For example, the percentage of White 9-year-olds decreased from 79 percent in 1978 to 54 percent in 2008, and the percentage of Hispanic 9-year-olds increased from 5 to 23 percent over the same period (see appendix table A-2).

## Hispanic students make greater gains than White students compared to 1973

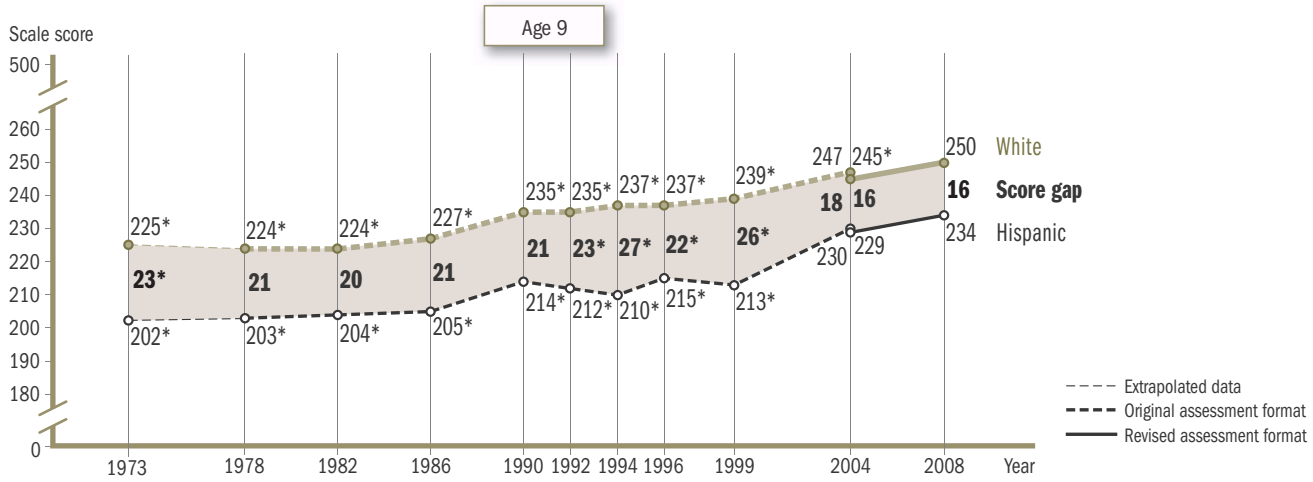
At all three ages, there were no significant changes in scores for Hispanic students since 2004, but scores were higher in 2008 than in 1973 (figure 11). Compared to 1973, gains for Hispanic students of 32 points, 29 points, and 16 points at ages 9, 13, and 17, respectively, were larger than the gains made by their White counterparts over the same period of time.



## No significant change in White – Hispanic score gaps since 2004

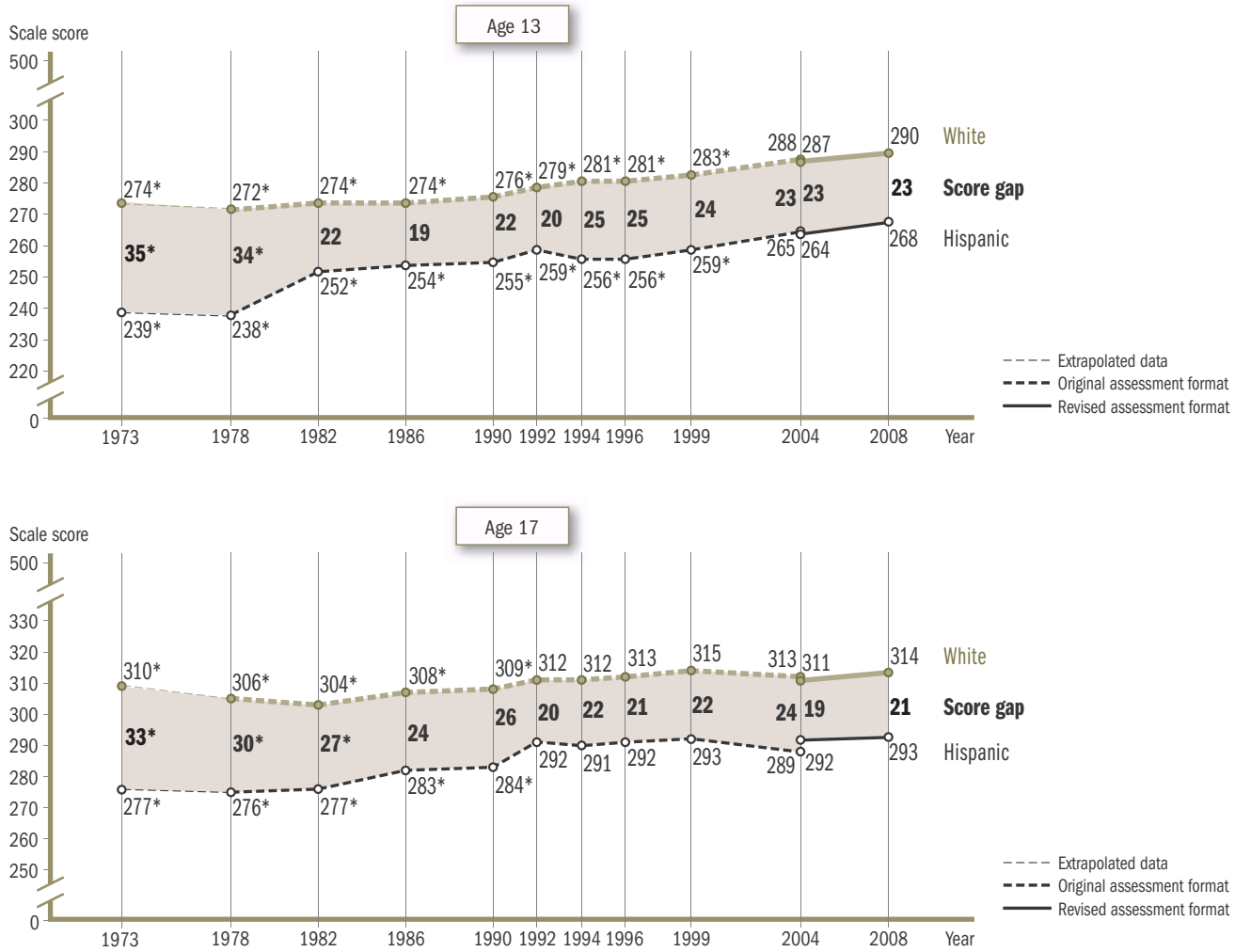
For all three age groups, there were no significant changes in the White – Hispanic score gaps from 2004 to 2008. However, when compared to 1973, the gaps in 2008 narrowed by 7 points at age 9 and by 12 points at ages 13 and 17.

**FIGURE 11.** Trend in White – Hispanic NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students




See notes at end of figure.

**FIGURE 11.** Trend in White – Hispanic NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




* Significantly different ($p < .05$) from 2008.
NOTE: Score gaps are calculated based on differences between unrounded average scores. Hispanic includes Latino. The White race category excludes Hispanic origin.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1973–2008 Long-Term Trend Mathematics Assessments.

## Progress for male and female students varies by age

The overall improvement in mathematics for 9-year-olds was also seen in the results for both male and female students. Both male and female 9-year-olds scored higher in 2008 than in any previous assessment year (figure 12).

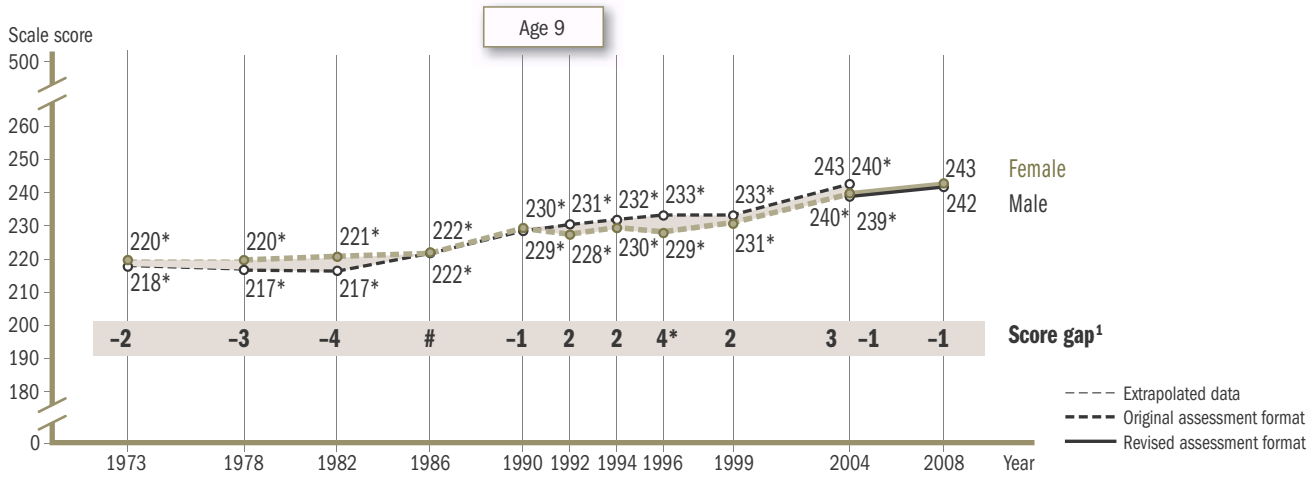
At age 13, the pattern of improvement was mixed. Compared to 2004, the average mathematics score for male students was higher in 2008, but the score for female students did not show a significant change. Average scores for both male and female students were higher in 2008 than in 1973.

At age 17, the average mathematics scores for both male and female students in 2008 were not significantly different from their scores in 2004 or 1973.

## No significant change in most gender gaps

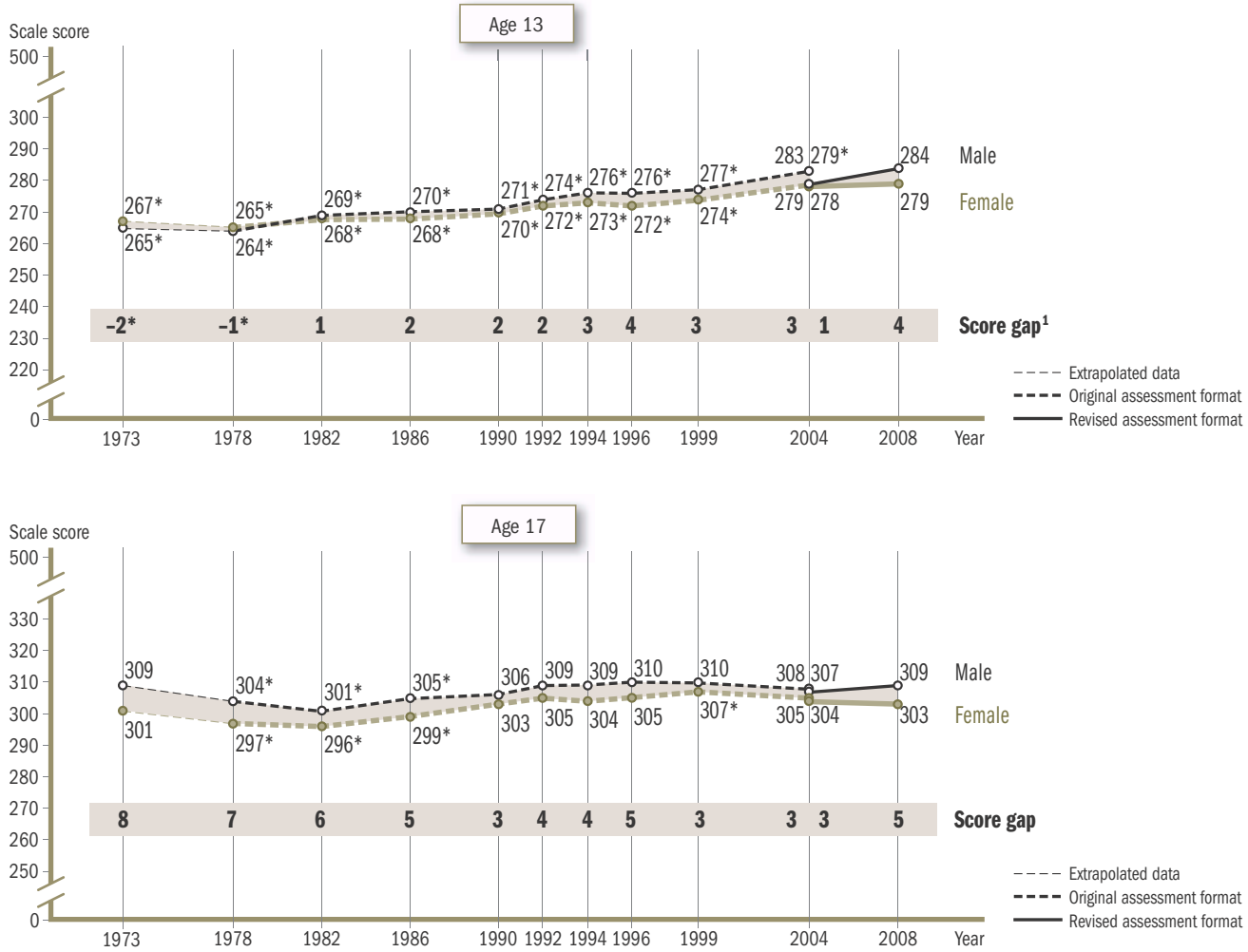
While there was no significant difference in the average mathematics scores for male and female 9-year-olds in 2008, male students did score higher than female students at ages 13 and 17. At age 13, the male – female gap in 2008 was not significantly different when compared to 2004 but was larger than in 1973. At age 17, the gender score gap in 2008 was not significantly different from the gaps in previous assessment years.

**FIGURE 12.** Trend in Male – Female NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students

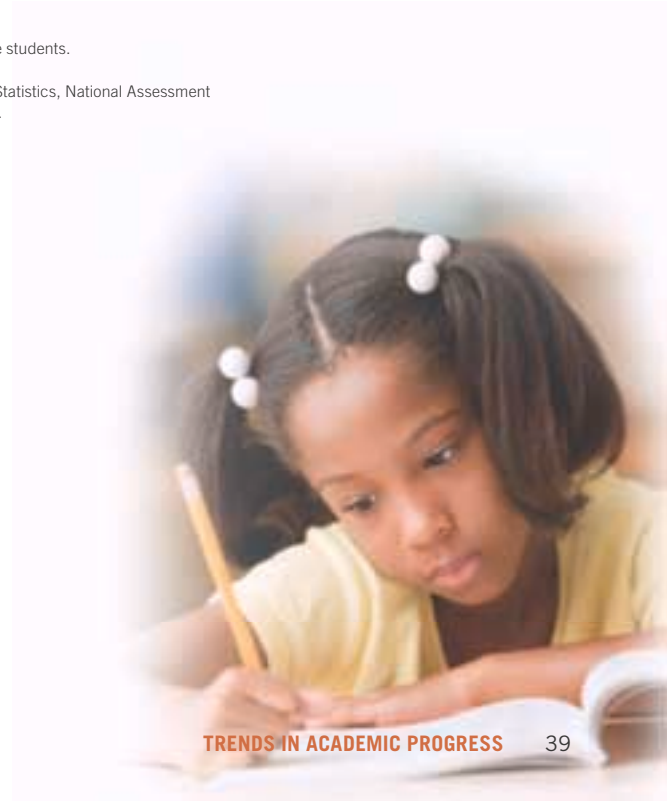



See notes at end of figure.

**FIGURE 12.** Trend in Male – Female NAEP mathematics average scores and score gaps for 9-, 13-, and 17-year-old students—Continued




# Rounds to zero.
* Significantly different ($p < .05$) from 2008.
[1] Negative numbers indicate that the average score for male students was lower than the score for female students.
NOTE: Score gaps are calculated based on differences between unrounded average scores.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1973–2008 Long-Term Trend Mathematics Assessments.



## Score increases for 17-year-olds whose parents did not finish high school

Both 13- and 17-year-old students were asked to indicate the highest level of education of at least one of their parents. See the Technical Notes for more information about the questions that students were asked. Students at age 9 were not asked about their parents' education level because their responses in previous NAEP assessments were not reliable.

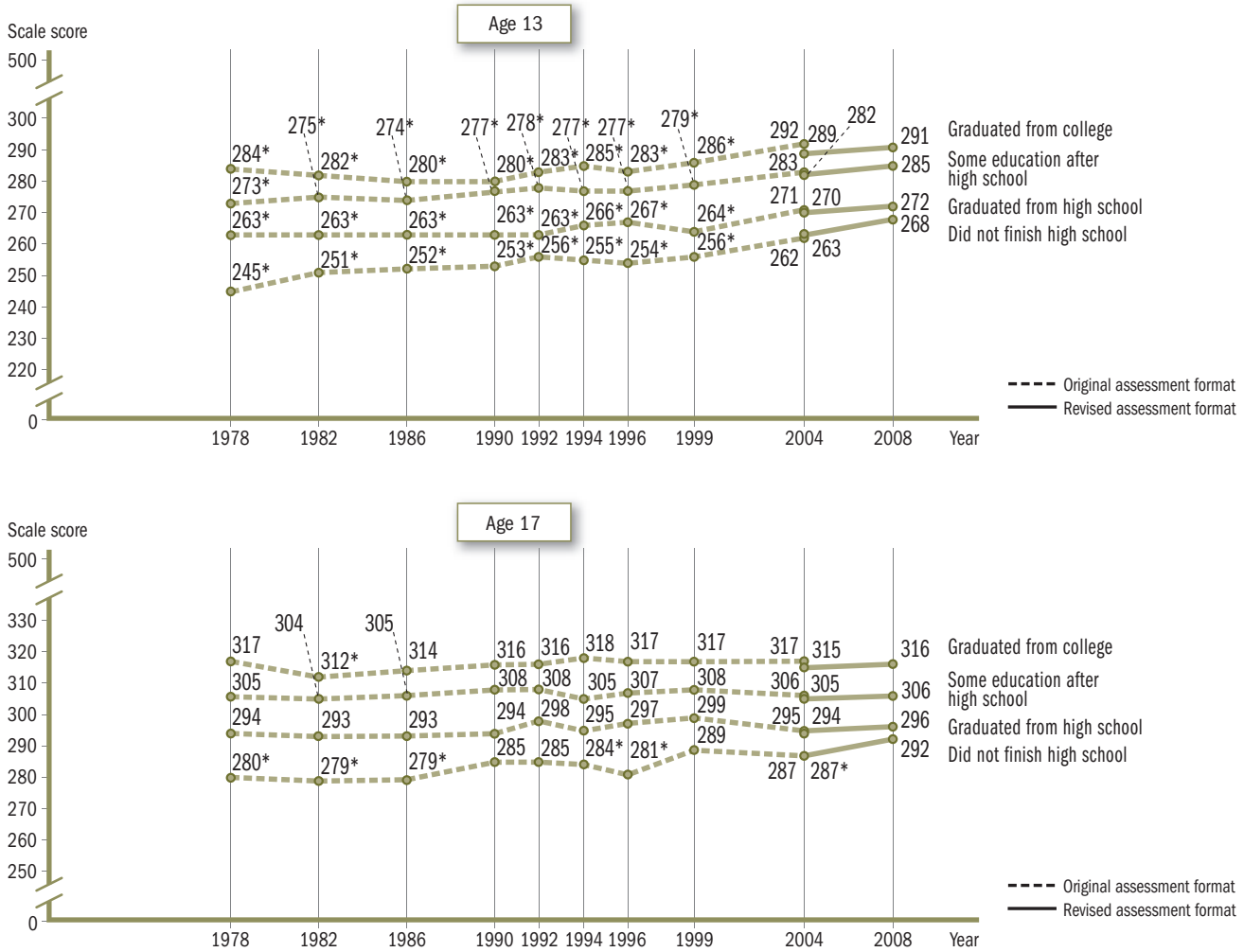
In the 2008 assessment, 48 percent of 13-year-olds and 46 percent of 17-year-olds indicated that at least one parent graduated from college (see appendix table A-2). At both ages, these percentages were higher in 2008 compared to 1978.

While the average mathematics score for 17-year-olds overall did not change significantly since 2004, the score for students who indicated that their parents did not finish high school was higher in 2008 than in 2004 and 1978 (figure 13). There were no significant changes in average scores in 2008 compared to 2004 or 1978 for all the other student-reported levels of parental education.

At age 13, there were no significant changes in average scores since 2004 regardless of the student-reported level of parental education. However, average scores were higher in 2008 than in 1978 across all student-reported levels of parental education.

Overall, higher average mathematics scores were associated with higher levels of parental education in 2008. At both ages, students who reported that at least one parent graduated from college scored higher than students who reported lower levels of parental education.

**FIGURE 13.** Trend in NAEP mathematics average scores for 13- and 17-year-old students, by highest level of parental education




* Significantly different ($p < .05$) from 2008.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

## About Parents' Education Level

Changes in the student population since 1978 show a decrease in the percentages of students who reported that neither parent had finished high school, and a corresponding increase in the percentages of students who reported that at least one parent had graduated from college. For example, the percentage of 17-year-olds who reported that neither parent had finished high school decreased from 13 percent in 1978 to 9 percent in 2008. During the same time period, the percentage of 17-year-olds who reported that at least one parent had graduated from college increased from 32 percent to 46 percent. Similar patterns are evident among 13-year-olds as well (see appendix table A-2).

## Mathematics scores higher than in 1978 for public and Catholic school students at all three ages

In 2008, between 90 and 92 percent of 9-, 13-, and 17-year-olds attended public schools, and between 4 and 5 percent attended Catholic schools (see appendix table A-2). While the percentages of students attending public schools have not changed significantly in comparison to 1978 at any of the three ages, the percentage of 9-year-olds attending Catholic schools was lower in 2008 than in 1978.

The average mathematics score for public school students increased by 3 points at age 9 from 2004 to 2008, with no significant changes in the scores for students at ages 13 and 17 over the same time period (table 5). The scores for public school students at all three ages were higher in 2008 compared to 1978.

Results for students attending private schools[6] showed an increase in the average mathematics scores from 1978 to 2008 for 9- and 13-year-olds. Scores for Catholic school students were higher in 2008 than in 1978 at all three ages.

In 2008, public school students scored lower than their private school counterparts at ages 9 and 13. Public school students scored lower than Catholic school students at all three ages in 2008.

[6] Private schools include Catholic schools.

### School Participation in NAEP

Results by the type of school that students attended are available for the long-term trend mathematics assessments back to 1978. Participation rates fell below the required standard for reporting results for 9- and 13-year-olds attending private schools in 2004, for 17-year-olds attending private schools in all the assessment years, and for 17-year-olds attending Catholic schools in 2004. In 1996, results for 17-year-old students attending Catholic schools are not reported because the sample size was insufficient to permit a reliable estimate. See the section on School and Student Participation Rates in the Technical Notes for more information.

**TABLE 5.** Average scores in NAEP mathematics, by student age group and type of school: Various years, 1978–2008

| Age group and type of school | 1978 | 1982 | 1986 | 1990 | 1992 | 1994 | 1996 | 1999 | 2004[1] | 2004[2] | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age 9** | | | | | | | | | | | |
| Public | 217* | 217* | 220* | 229* | 228* | 229* | 230* | 231* | 241 | 239* | 242 |
| Private | 230* | 232* | 232* | 238* | 242* | 245* | 239* | 242* | ‡ | ‡ | 252 |
| Catholic | 230* | 232* | 233* | 235* | 241* | 243* | 239* | 241* | 242* | 247 | 251 |
| **Age 13** | | | | | | | | | | | |
| Public | 263* | 267* | 269* | 269* | 272* | 273* | 273* | 274* | 280 | 278 | 280 |
| Private | 279* | 281* | 276* | 280* | 283* | 285* | 286* | 288* | ‡ | ‡ | 295 |
| Catholic | 279* | 280* | 273* | 279* | 280* | 283* | 285 | 288 | 289 | 289 | 293 |
| **Age 17[3]** | | | | | | | | | | | |
| Public | 300* | 297* | 301* | 304 | 305 | 304 | 306 | 307 | 306 | 304 | 305 |
| Catholic | 309* | 309* | 314 | 311 | 320 | 317 | ‡ | 320 | ‡ | ‡ | 317 |

‡ Reporting standards not met.
* Significantly different ($p < .05$) from 2008.
[1] Original assessment format. Results prior to 2004 are also from the original assessment format.
[2] Revised assessment format. Results after 2004 are also from the revised assessment format.
[3] For students at age 17, results are not shown for private schools because the minimum participation guidelines for reporting were not met.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

# Higher-level courses associated with higher scores

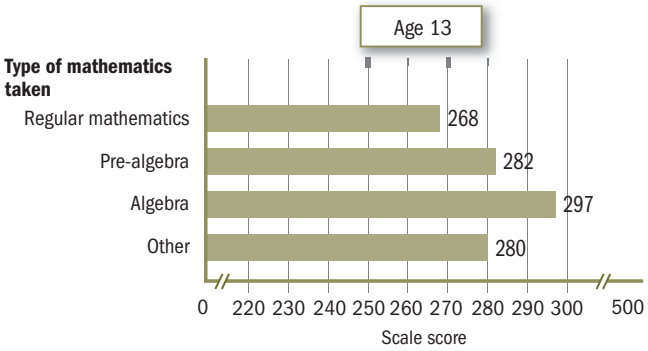
Students at ages 13 and 17 responded to questions about the mathematics courses they were currently taking or had taken. Responses for age 13 are available beginning in 1986 and for age 17 in 1978.

At age 13, students were asked, "What kind of mathematics are you taking this year?" They chose from the following options:

- I am not taking mathematics this year
- Regular mathematics
- Pre-algebra
- Algebra
- Other

Taking higher-level mathematics courses was associated with higher scores on the long-term trend mathematics assessment in 2008 (figure 14). Students at age 13 who were enrolled in algebra classes scored higher on average than those in pre-algebra, and students in pre-algebra scored higher than their counterparts taking regular mathematics courses.

**FIGURE 14.** Average scores in NAEP mathematics for 13-year-old students, by type of mathematics they have taken during the school year: 2008




NOTE: An average score is not shown for students who selected the "not taking mathematics" response because the sample size was insufficient to permit a reliable estimate.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

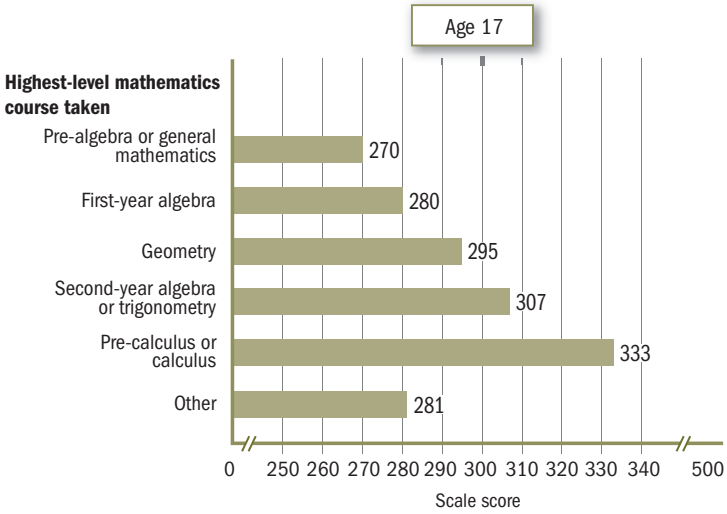
At age 17, students were asked, "Counting what you are taking now, have you ever taken any of the following mathematics courses?"

- General, business, or consumer mathematics
- Pre-algebra or introduction to algebra
- First-year algebra
- Second-year algebra
- Geometry
- Trigonometry
- Pre-calculus or calculus

The highest-level mathematics course was determined from the student's responses to the question above.

Higher levels of mathematics coursetaking were associated with higher mathematics scores in 2008 (figure 15). For example, students who had taken pre-calculus or calculus had a higher average score than students who had taken second-year algebra or trigonometry. Students whose highest-level mathematics course was pre-algebra or general mathematics scored lower than students in the other coursetaking categories.

**FIGURE 15.** Average scores in NAEP mathematics for 17-year-old students, by highest-level mathematics course they have ever taken: 2008

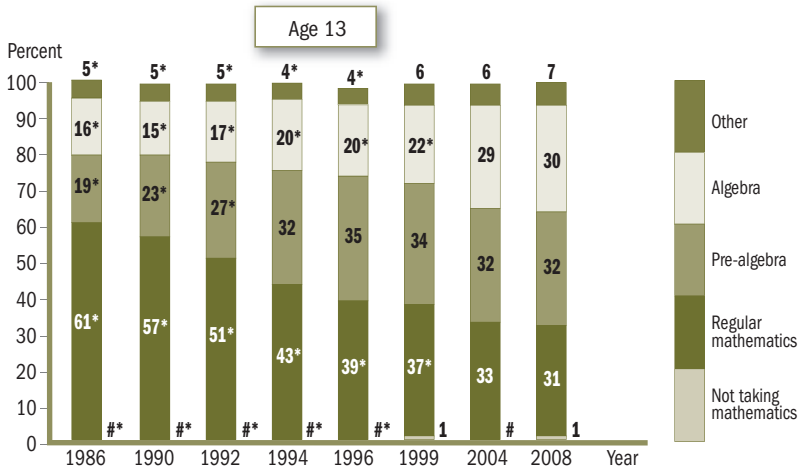



NOTE: The "pre-algebra or general mathematics" response category includes "pre-algebra or introduction to algebra" and "general, business, or consumer mathematics" and students who did not take any of the listed courses. The "other" response category includes students for whom the highest-level mathematics course could not be determined due to missing or inconsistent responses.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

# Increasing percentages of students taking higher-level mathematics

The trend in the coursetaking at age 13 shows that higher percentages of students were taking higher-level mathematics courses in 2008 compared to 1986 (figure 16). The percentage of 13-year-olds taking algebra increased from 16 to 30 percent, and the percentage taking pre-algebra increased from 19 to 32 percent. The percentage of students taking regular mathematics decreased from 61 percent in 1986 to 31 percent in 2008.

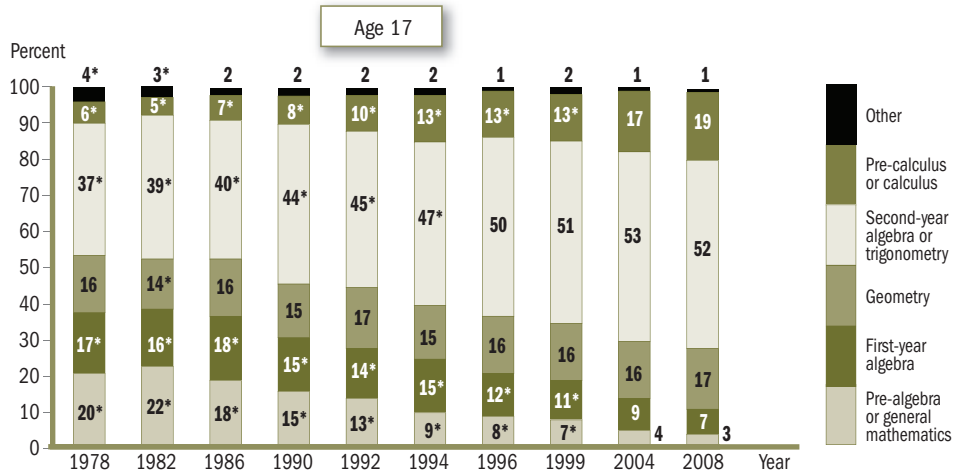
**FIGURE 16.** Trend in percentage of 13-year-old students in NAEP mathematics, by type of mathematics course they have taken during the school year




# Rounds to zero.
* Significantly different ($p < .05$) from 2008.
NOTE: Results for 1986-2004 are from the original assessment format, and results for 2008 are from the revised assessment format (2004 revised assessment format results are not available). 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), various years, 1986–2008 Long-Term Trend Mathematics Assessments.

Similar to the pattern for 13-year-olds, the percentages of 17-year-olds taking higher-level courses increased (figure 17). A comparison of 2008 to 1978 shows that a greater percentage of 17-year-olds indicated that they had taken pre-calculus or calculus. The percentage of 17-year-olds who had taken second-year algebra or trigonometry increased from 37 percent in 1978 to 52 percent in 2008. The percentage of students who indicated that the highest level of mathematics they had taken was pre-algebra or general mathematics, or first-year algebra, decreased over the same time period.

**FIGURE 17.** Trend in percentage of 17-year-old students in NAEP mathematics, by highest-level mathematics course they have ever taken




* Significantly different ($p < .05$) from 2008.
NOTE: The "pre-algebra or general mathematics" response category includes "pre-algebra or introduction to algebra" and "general, business, or consumer mathematics" and students who did not take any of the listed courses. The "other" response category includes students for whom the highest-level mathematics course could not be determined due to missing or inconsistent responses. Results for 1978–2004 are from the original assessment format, and results for 2008 are from the revised assessment format (2004 revised assessment format results are not available). 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), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

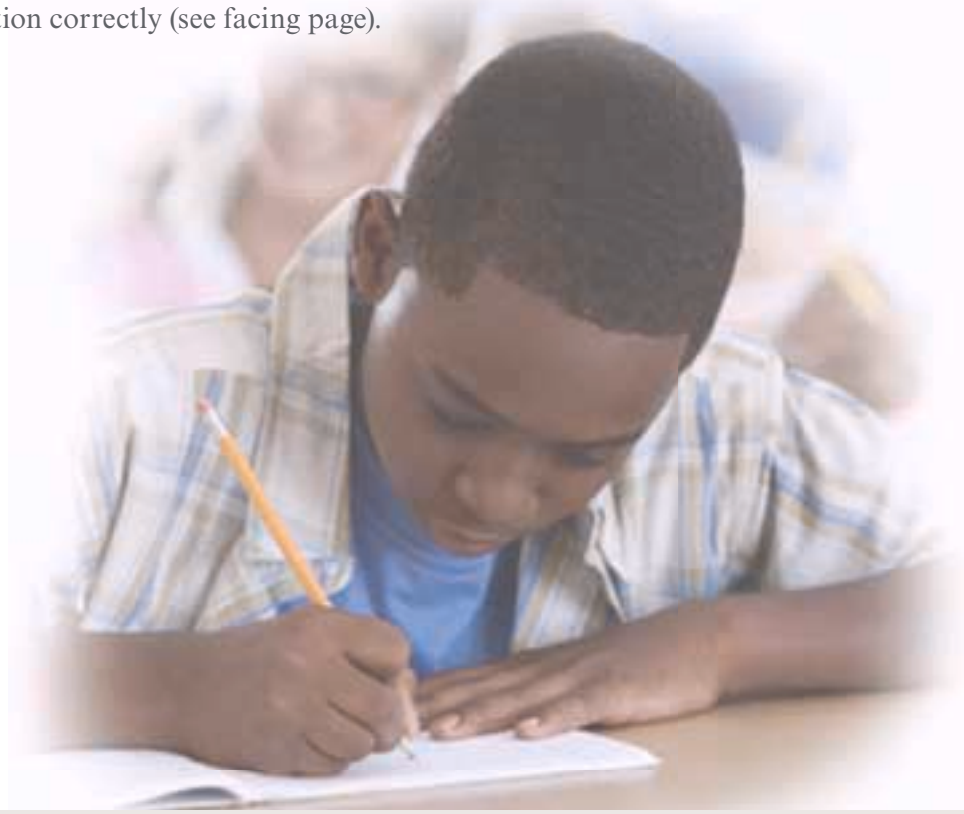
## Sample Questions

Beginning in 2004, as a result of modifications to the long-term trend mathematics assessment, it became possible to share questions with the public. Once again, some of the questions that have been administered to students since the early 1970s are being released. These released questions will not be administered in future NAEP long-term trend assessments.

Topics in the NAEP long-term trend mathematics assessment include numbers and numeration; variables and relationships; shape, size, and position; measurement; and probability and statistics. The distribution of assessment items from these topics differs across the age levels, with more emphasis placed on topics relating to numbers at ages 9 and 13 than at age 17, and more emphasis placed on topics relating to variables at age 17 than at ages 9 and 13.

Three sample mathematics questions for each age group are presented in this section. The response options for multiple-choice questions are provided as the students saw them, and the oval for the correct answer is filled in. All constructed-response questions in the long-term trend mathematics assessment were scored as correct or incorrect, and the correct response is shown on the answer line.

In the sample questions that follow, the percentages of students who answered correctly overall and within each performance level are shown in the tables below each sample. For example, 44 percent of age 9 students answered the first mathematics sample question correctly, while 16 percent of age 9 students at performance level 150 answered the question correctly (see facing page).



## For More Information

Additional sample questions from the 2008 long-term trend assessments can be found at http://nces.ed.gov/nationsreportcard/itmrls.

# Sample Mathematics Questions

## AGE 9

**Sample question 1** required students to demonstrate a conceptual understanding of the relationship between parts and a whole using fraction vocabulary.

**How many fifths are equal to one whole?**

(A) $\frac{1}{5}$

(B) 1

(C) 4

(D) 5

Percentage of correct responses for 9-year-old students at each performance level: 2008

| Overall | Below level 150 | Level 150 | Level 200 | Level 250 |
|---|---|---|---|---|
| 44 | ‡ | 16 | 29 | 65 |

‡ Reporting standards not met.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 2** assessed students' knowledge of operations with whole numbers.

**Add**

$$\begin{array}{r} 38 \\ 74 \\ 66 \\ +\ 75 \\ \hline \end{array}$$

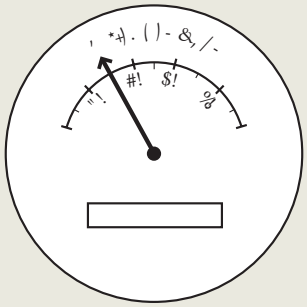
ANSWER: 253

Percentage of correct responses for 9-year-old students at each performance level: 2008

| Overall | Below level 150 | Level 150 | Level 200 | Level 250 |
|---|---|---|---|---|
| 58 | ‡ | 19 | 52 | 74 |

‡ Reporting standards not met.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 3** asked students to read a scale on a number line presented in the context of a bicycle speedometer. To answer the question, the student had to determine the value corresponding to a point halfway between the points marked at 10 and 20 miles per hour.



**The bicycle speedometer above shows about what speed?**

(A) 10 miles per hour

(B) 15 miles per hour

(C) 20 miles per hour

(D) 45 miles per hour

Percentage of correct responses for 9-year-old students at each performance level: 2008

| Overall | Below level 150 | Level 150 | Level 200 | Level 250 |
|---|---|---|---|---|
| 85 | ‡ | 42 | 84 | 96 |

‡ Reporting standards not met.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

# Sample Mathematics Questions

## AGE 13

**Sample question 4** required students to apply multistep arithmetic operations with decimals to a real-world situation.

**Sally bought two tickets to a movie. Each ticket cost $4.25. She paid for the tickets with a $10 bill. How much change did she get?**

(A) $5.75

(B) $5.25

(C) $4.25

(D) $1.75

(E) $1.50

Percentage of correct responses for 13-year-old students at each performance level: 2008

| Overall | Below level 200 | Level 200 | Level 250 | Level 300 |
|---|---|---|---|---|
| 66 | 13 | 31 | 67 | 87 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 5** asked students to demonstrate the ability to find a decimal representation of a number equivalent to a given fractional representation.

**Write as a decimal.**

$\frac{136}{100}$ = 1.36

Percentage of correct responses for 13-year-old students at each performance level: 2008

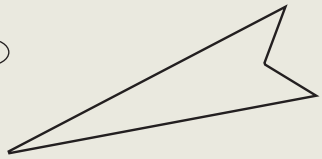
| Overall | Below level 200 | Level 200 | Level 250 | Level 300 |
|---|---|---|---|---|
| 47 | 7 | 14 | 38 | 81 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 6** required students to demonstrate knowledge and understanding of the definition of a polygon. A polygon is a "closed" plane figure consisting of line segments.

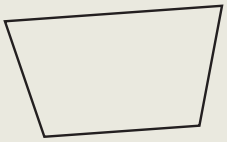
**Which figure is NOT a POLYGON?**

(A)

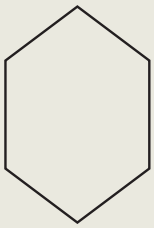


(B)

(C)



(D)



Percentage of correct responses for 13-year-old students at each performance level: 2008

| Overall | Below level 200 | Level 200 | Level 250 | Level 300 |
|---|---|---|---|---|
| 85 | 50 | 76 | 83 | 94 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

## Sample Mathematics Questions

### AGE 17

**Sample question 7** required students to demonstrate the ability to order and compare real numbers.

**Which number is between 1.8 and 1.9?**

(A) 0.189

(B) 0.198

(C) 1.83

(D) 1.93

Percentage of correct responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 83 | 52 | 75 | 90 | 93 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 8** asked students to demonstrate procedural knowledge by evaluating a function for a given value.

**If $f(z) = z + 8$, what is the value of $f(6)$?**

ANSWER: 14

Percentage of correct responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 65 | 16 | 41 | 78 | 98 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

**Sample question 9** asked students to solve a multistep problem involving the perimeter and area of a square.

**The perimeter of a square is 36 centimeters. What is the area of the square?**

(A) 6 square cm

(B) 9 square cm

(C) 18 square cm

(D) 81 square cm

Percentage of correct responses for 17-year-old students at each performance level: 2008

| Overall | Below level 250 | Level 250 | Level 300 | Level 350 |
|---|---|---|---|---|
| 59 | 11 | 29 | 79 | 98 |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2008 Long-Term Trend Mathematics Assessment.

# Technical Notes

## Sampling and Weighting

The target population for the 2008 NAEP long-term trend assessments consisted of 9-, 13-, and 17-year-old students enrolled in public and private schools nationwide. Eligibility for the age 9 and age 13 samples was based on the calendar year: students in the age 9 sample were 9 years old on January 1, 2008, with birth months January 1998 through December 1998, and students in the age 13 sample were 13 years old on January 1, 2008, with birth months January 1994 through December 1994. Students eligible for the age 17 sample had to be 17 years old on October 1, 2008, with birth months October 1990 through September 1991.

The national samples for students at ages 9, 13, and 17 were chosen using a multistage design that involved drawing students from the sampled public and private schools across the country. Within each age, the results from the assessed students were combined to provide accurate estimates of the overall performance of students in the nation.

Each school that participated in the assessment, and each student assessed, represents a portion of the population of interest. Results are weighted to make appropriate inferences between the student samples and the respective populations from which they are drawn. Sampling weights account for the disproportionate representation of some groups in the selected sample. This includes the oversampling of schools with high concentrations of students from certain minority groups and the lower sampling rates of students who attend very small private schools.

## Scaling Interpretation

Although the reading and mathematics long-term trend assessments were initially scaled across the three ages the first time each subject was reported on a 0–500 scale, the results for subsequent years were scaled within each age group. Over the years, as the current assessment data are further removed from the base year, cross-age comparisons become weaker because the number of test questions initially used to link the three ages are relatively small and some have been released to the public, and the performance patterns among racial/ethnic and other student groups upon which the original scale was based may have changed over time. Therefore, even though comparing results between the three ages may be appropriate for the overall results, comparisons for subgroups are not as strongly supported by the data and are discouraged.

## School and Student Participation Rates

To ensure unbiased samples and to meet reporting requirements established by the National Center for Education Statistics (NCES) and the National Assessment Governing Board, school participation rates need to be at least 85 percent before substitute schools are added. The weighted national school participation rates for ages 9, 13, and 17 were 96, 95, and 90 percent, respectively. Student participation rates were 95, 94, and 88 percent, respectively, for each of the three age samples in both reading and mathematics.

Initial participation rates needed to be 70 percent or higher to report results separately for private schools. While the school participation rate for private schools met the standards in 2008 for reporting at ages 9 and 13 (72 and 79 percent, respectively), it fell below the standard at age 17 (61 percent). Participation rates were high enough for reporting results in 2008 for Catholic school students at all three ages (88, 94, and 76 percent at ages 9, 13, and 17, respectively); therefore, separate results for Catholic schools are included in this report.

## The 1973 Mathematics Results

The mathematics trend scale was developed in 1986 and included previous mathematics trend assessments. However, because the 1973 mathematics assessment had too few questions in common with the assessments that followed, results from the 1973 assessment were placed on the same 0 to 500 mathematics scale using mean proportion correct extrapolation. Estimates were extrapolated from the data so that average mathematics scores could be reported for the nation and by race/ethnicity and gender at all three ages in 1973.

The extrapolated estimates were obtained by assuming that, within a given age level, the relationship between the logit transformation of a student group's average percentage of correct responses for common questions and its scale score average was linear, and that the same linear relationship held for all assessment years and for all student groups within that age level. Because of the need to extrapolate the average scale scores, caution should be used in interpreting the pattern of trends across those assessment years. For more information, see Appendix A of *NAEP 2004 Trends in Academic Progress: Three Decades of Student Performance in Reading and Mathematics*, available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005464.

## Accommodations and Exclusions

Prior to 2004, no testing accommodations were allowed for students with disabilities (SD) and English language learners (ELL) selected to participate in the long-term trend assessments. One of the changes introduced as part of the 2004 assessments was the use of accommodations, such as extra testing time or individual rather than group administration for students who needed such accommodations to participate in the assessments. The results for the 2008 long-term trend assessments are based on administration procedures that also allowed accommodations. Appropriate accommodations were determined by having the school official most knowledgeable about the student identified as requiring an accommodation complete a questionnaire guided by a decision tree. This procedure has been used in NAEP since 2005. Some accommodations allowed in the mathematics assessment were not allowed for reading, such as bilingual booklets and reading the test aloud to students.

Exclusion rates were generally lower when accommodations were permitted. In 2004, between 7 and 8 percent of students selected to take the original format of the long-term trend assessments were excluded when accommodations were not permitted, and between 3 and 5 percent selected to take the revised format were excluded when accommodations were permitted (see appendix table A-3). In 2008, when accommodations were also available, the percentages of SD and/or ELL students excluded were 4 percent in reading and 3 to 4 percent in mathematics (see appendix table A-4).

## Race/Ethnicity

Results are presented for students in different racial/ethnic groups according to the following mutually exclusive categories: White, Black, and Hispanic. (Note that reading results for Hispanic students were not available prior to 1975.) Because results for Asian/Pacific Islander students were not reportable for some of the previous assessment years, they have not been included in the long-term trend reports. Results for those years in which they could be reported are available in the NAEP Data Explorer at http://www.nces.ed.gov/nationsreportcard/naepdata/. Results for American Indian (including Alaska Native) students are not reported separately because there were too few students sampled in this group for the results to be statistically reliable. Data for all students, regardless of whether their racial/ethnic group was reported separately, were included in computing the overall national results.

Results by students' race/ethnicity are presented in this report based on information collected from two different sources:

***Observed Race/Ethnicity.*** Prior to 2004, students participating in the long-term trend assessment were assigned to a racial/ethnic category based on the assessment administrator's observation. The results for the 2004 original assessment format and all previous assessment years are based on observed race/ethnicity.

***School-Reported Race/Ethnicity.*** Data about students' race/ethnicity from school records were collected in 2004 but were not collected for any of the previous NAEP long-term trend assessments. The results presented in this report for the 2004 revised assessment format and for 2008 are based on school-reported race/ethnicity.

## Parents' Education Level

Students were asked to indicate the extent of schooling for each of their parents, choosing among the following options:

- Did not finish high school
- Graduated from high school
- Had some education after high school
- Graduated from college
- I don't know

The response indicating the highest level of education for either parent was selected for reporting. The questions were presented only to the students in the age 13 and age 17 samples.

While students in previous long-term trend assessments were asked about their parents' education level, the wording of the question in the revised format of the reading assessments administered in 2004 and 2008 was different from previous years. Consequently, trend results are reported only for the mathematics assessment.

## Interpreting Statistical Significance

Comparisons over time or between groups are based on statistical tests that consider both the size of the differences and associated variability (i.e., standard errors). Standard errors are margins of error, and estimates based on smaller groups are likely to have larger margins of error. The size of the standard errors may also be influenced by other factors such as how representative the students assessed are of the entire population. When an estimate has a large standard error, a numerical difference that seems large may not be statistically significant. Differences of the same magnitude may or may not be statistically significant depending upon the size of the standard errors of the statistics. Standard errors for the NAEP scores and percentages presented in this report are available at http://nces.ed.gov/nationsreportcard/lttdata/.

The usual test for the statistical significance of a difference assumes that only one comparison is being made. A small chance necessarily exists that the test mistakenly identifies a difference as real. When several comparisons are made concurrently, the likelihood of finding results that are mistakenly considered significant increases. The Benjamini-Hochberg False Discovery Rate procedure controls the rate of false discoveries and reduces the chance that a set of statistical tests indicates a difference while no actual difference exists.

The reader is cautioned against making simple causal inferences between student performance and the other educational variables discussed in this report. A statistically significant relationship between a variable and measures of student performance does not imply that the variable causes differences in how well students perform. The relationship may be influenced by a number of other variables not accounted for in this report, such as family income, parental involvement, or students' attitudes.

## Setting the Performance Levels

To aid the interpretation of the NAEP long-term trend results, the reading and mathematics scales were divided into five successive levels of performance, and a "scale anchoring" process was used to define what it meant to score at each of these levels. The levels for each scale were set at 150, 200, 250, 300, and 350. For each of these five levels, questions were identified that were likely to be answered correctly by students performing at that level on the scale and much less likely to be answered correctly by students performing at the next lower level. The guidelines used to select these questions were as follows: students at a given level must have at least a specified probability of success with the questions (usually 65 to 80 percent), while students at the next lower level must have a much lower probability of success (that is, the difference in probabilities between adjacent levels must exceed 30 percent). Content specialists for each subject examined these empirically selected question sets and used their professional judgment to characterize each level. The reading scale anchoring was conducted on the basis of the 1984 assessment, and the scale anchoring for mathematics trend reporting was based on the 1986 assessment.

More information on the long-term trend assessment can be found at http://nationsreportcard.gov/ltt_2008/.

# Appendix Tables

**TABLE A-1.** Percentage of students assessed in NAEP reading, by age group and selected student and school characteristics: Various years, 1971–2008

| Age group and characteristics | 1971 | 1975 | 1980 | 1984 | 1988 | 1990 | 1992 | 1994 | 1996 | 1999 | 2004[1] | 2004[2] | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age 9** | | | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | | | |
| White | 84* | 80* | 79* | 75* | 75* | 74* | 74* | 76* | 71* | 69* | 59 | 59 | 56 |
| Black | 14 | 13 | 14 | 16 | 16 | 16 | 16 | 15 | 17 | 18 | 17 | 16 | 16 |
| Hispanic | — | 5* | 6* | 7* | 6* | 6* | 7* | 6* | 8* | 9* | 17 | 17 | 20 |
| Other | 2* | 2* | 1* | 2* | 3* | 4* | 3* | 4* | 4* | 4* | 7 | 7 | 7 |
| **Gender** | | | | | | | | | | | | | |
| Male | 50 | 50 | 50 | 50 | 50 | 51 | 51 | 50 | 49 | 49 | 50 | 51 | 50 |
| Female | 50 | 50 | 50 | 50 | 50 | 49 | 49 | 50 | 51 | 51 | 50 | 49 | 50 |
| **Type of school** | | | | | | | | | | | | | |
| Public | — | — | 89 | 88 | 88 | 92 | 88 | 89 | 86* | 88 | 89 | 89 | 90 |
| Private | — | — | 11 | 12 | 12 | 8 | 12 | 11 | 14* | 12 | ‡ | ‡ | 10 |
| Catholic | — | — | 9* | 9* | 8 | 5 | 9* | 6 | 7 | 6 | 6 | 6 | 5 |
| **Age 13** | | | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | | | |
| White | 84* | 81* | 80* | 77* | 76* | 73* | 73* | 74* | 71* | 70* | 64* | 63* | 57 |
| Black | 15 | 13 | 13 | 14 | 15 | 15 | 16 | 15 | 15 | 16 | 15 | 16 | 16 |
| Hispanic | — | 5* | 6* | 7* | 6* | 8* | 7* | 8* | 9* | 10* | 16* | 16* | 21 |
| Other | 1* | 2* | 1* | 2* | 2* | 3* | 3* | 3* | 5 | 3* | 5* | 5 | 7 |
| **Gender** | | | | | | | | | | | | | |
| Male | 50 | 50 | 49* | 51 | 50 | 50 | 49 | 51 | 49* | 49 | 49 | 51 | 51 |
| Female | 50 | 50 | 51* | 49 | 50 | 50 | 51 | 49 | 51* | 51 | 51 | 49 | 49 |
| **Type of school** | | | | | | | | | | | | | |
| Public | — | — | 88 | 89 | 89 | 88 | 86 | 89 | 89 | 87 | 92 | 90 | 90 |
| Private | — | — | 12 | 11 | 11 | 12 | 14 | 11 | 11 | 13 | ‡ | ‡ | 10 |
| Catholic | — | — | 9* | 9* | 9 | 7 | 7 | 9* | 6 | 7 | 5 | 5 | 5 |
| **Age 17[3]** | | | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | | | |
| White | 87* | 84* | 83* | 77* | 77* | 74* | 75* | 73* | 72* | 72* | 68* | 70* | 59 |
| Black | 11 | 11* | 12 | 14 | 15 | 16 | 15 | 15 | 15 | 14 | 12 | 12* | 15 |
| Hispanic | — | 3* | 4* | 7* | 6* | 7* | 8* | 8* | 9* | 9* | 14* | 13* | 18 |
| Other | 1* | 1* | 1* | 2* | 2* | 4* | 3* | 3* | 4* | 4* | 5* | 6* | 7 |
| **Gender** | | | | | | | | | | | | | |
| Male | 49 | 49 | 51 | 51 | 48 | 50 | 52 | 50 | 51 | 52 | 49 | 50 | 50 |
| Female | 51 | 51 | 49 | 49 | 52 | 50 | 48 | 50 | 49 | 48 | 51 | 50 | 50 |
| **Type of school** | | | | | | | | | | | | | |
| Public | — | — | 93 | 90 | 88 | 93 | 92 | 89 | 92 | 90 | 91 | 90 | 92 |
| Catholic | — | — | 6 | 6 | 11 | 3 | 6 | 7 | 5 | 7 | ‡ | ‡ | 4 |

— Not available.
‡ Reporting standards not met.
* Significantly different ($p < .05$) from 2008.
[1] Original assessment format. Results prior to 2004 are also from the original assessment format.
[2] Revised assessment format. Results after 2004 are also from the revised assessment format.
[3] For students at age 17, results are not shown for private schools under the type of school category because the minimum participation guidelines for reporting were not met.
NOTE: Black includes African American, Hispanic includes Latino, and "other" includes Asian, Native Hawaiian or other Pacific Islander, American Indian/Alaska Native, and unclassified. Race categories exclude Hispanic origin. 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), various years, 1971–2008 Long-Term Trend Reading Assessments.

**TABLE A-2.** Percentage of students assessed in NAEP mathematics, by age group and selected student and school characteristics: Various years, 1978–2008

| Age group and characteristics | 1978 | 1982 | 1986 | 1990 | 1992 | 1994 | 1996 | 1999 | 2004[1] | 2004[2] | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age 9[3]** | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | |
| White | 79* | 79* | 77* | 74* | 75* | 75* | 72* | 70* | 60 | 59* | 54 |
| Black | 14 | 14 | 15 | 16 | 16 | 15 | 16 | 18 | 15 | 16 | 16 |
| Hispanic | 5* | 5* | 6* | 5* | 6* | 6* | 8* | 8* | 18 | 18* | 23 |
| Other | 1* | 2* | 2* | 4* | 3* | 4* | 5 | 4* | 7 | 7 | 7 |
| **Gender** | | | | | | | | | | | |
| Male | 50 | 49 | 50 | 49 | 49* | 49 | 50 | 49 | 49 | 50 | 50 |
| Female | 50 | 51 | 50 | 51 | 51* | 51 | 50 | 51 | 51 | 50 | 50 |
| **Type of school** | | | | | | | | | | | |
| Public | 89 | 86 | 85 | 89 | 87* | 88 | 87* | 88 | 88 | 90 | 90 |
| Private | 11 | 14 | 15 | 11 | 13* | 12 | 13* | 12 | ‡ | ‡ | 10 |
| Catholic | 10* | 9* | 12* | 7 | 9* | 7 | 9* | 8 | 6 | 5 | 5 |
| **Age 13** | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | |
| White | 80* | 79* | 77* | 73* | 74* | 73* | 71* | 71* | 66* | 62 | 58 |
| Black | 13 | 14 | 14 | 16 | 16 | 15 | 15 | 15 | 15 | 16 | 15 |
| Hispanic | 6* | 5* | 7* | 7* | 7* | 8* | 9* | 10* | 15* | 17 | 21 |
| Other | 1* | 2* | 2* | 4* | 3* | 4* | 4 | 4* | 4* | 5 | 6 |
| **Gender** | | | | | | | | | | | |
| Male | 50 | 50 | 50 | 50 | 50 | 49 | 48 | 50 | 48 | 49 | 50 |
| Female | 50 | 50 | 50 | 50 | 50 | 51 | 52 | 50 | 52 | 51 | 50 |
| **Parents' highest education level** | | | | | | | | | | | |
| Did not finish high school | 12* | 11* | 8 | 8 | 6 | 6 | 6* | 6 | 7 | 7 | 7 |
| Graduated from high school | 33* | 34* | 31* | 27* | 23* | 23* | 23* | 21* | 19* | 18 | 17 |
| Some education after high school | 14 | 14 | 16 | 17* | 18* | 17* | 17* | 17* | 15 | 15 | 14 |
| Graduated from college | 26* | 32* | 38* | 41* | 44 | 46 | 45 | 48 | 47 | 47 | 48 |
| Unknown | 15 | 9* | 8* | 8* | 8* | 8* | 10* | 9* | 12* | 13 | 14 |
| **Type of school** | | | | | | | | | | | |
| Public | 91 | 89 | 96* | 90 | 88 | 88 | 89 | 88 | 91 | 92 | 90 |
| Private | 9 | 11 | 4* | 10 | 12 | 12 | 11 | 12 | ‡ | ‡ | 10 |
| Catholic | 9 | 8 | 3 | 7 | 8 | 9* | 7 | 7 | 6 | 4 | 5 |
| **Age 17[4]** | | | | | | | | | | | |
| **Race/ethnicity** | | | | | | | | | | | |
| White | 83* | 81* | 78* | 73* | 75* | 73* | 71* | 72* | 69* | 69* | 59 |
| Black | 12 | 13 | 14 | 16 | 15 | 15 | 15 | 15 | 13 | 12 | 14 |
| Hispanic | 4* | 5* | 5* | 7* | 7* | 9* | 9* | 10* | 14* | 14* | 19 |
| Other | 1* | 2* | 3* | 4* | 3* | 3* | 4* | 4* | 5* | 5* | 7 |
| **Gender** | | | | | | | | | | | |
| Male | 49* | 49* | 49 | 49 | 51 | 49 | 50 | 48 | 48 | 50 | 50 |
| Female | 51* | 51* | 51 | 51 | 49 | 51 | 50 | 52 | 52 | 50 | 50 |
| **Parents' highest education level** | | | | | | | | | | | |
| Did not finish high school | 13* | 14* | 8 | 8 | 8 | 7* | 6* | 7* | 9 | 8 | 9 |
| Graduated from high school | 33* | 33* | 28* | 26* | 21* | 22* | 21 | 20 | 19 | 19 | 19 |
| Some education after high school | 16* | 18* | 24 | 24 | 25* | 24 | 24 | 23 | 22 | 22 | 22 |
| Graduated from college | 32* | 32* | 37* | 39* | 43 | 44 | 46 | 48 | 47 | 47 | 46 |
| Unknown | 5 | 4 | 3* | 3* | 2* | 3* | 2* | 3* | 3* | 4* | 5 |
| **Type of school** | | | | | | | | | | | |
| Public | 94 | 92 | 96* | 93 | 91 | 88 | 91 | 89 | 91 | 91 | 92 |
| Catholic | 4 | 6 | 2* | 3 | 6 | 8 | 5 | 6 | ‡ | ‡ | 4 |

‡ Reporting standards not met.
* Significantly different ($p < .05$) from 2008.
[1] Original assessment format. Results prior to 2004 are also from the original assessment format.
[2] Revised assessment format. Results after 2004 are also from the revised assessment format.
[3] For students at age 9, results are not shown for the parental education level category because research indicates that these students are less likely to report this information accurately.
[4] For students at age 17, results are not shown for private schools under the type of school category because the minimum participation guidelines for reporting were not met.
NOTE: Black includes African American, Hispanic includes Latino, and "other" includes Asian, Native Hawaiian or other Pacific Islander, American Indian/Alaska Native, and unclassified. Race categories exclude Hispanic origin. 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), various years, 1978–2008 Long-Term Trend Mathematics Assessments.

**TABLE A-3.** Percentage of students identified as students with disabilities and/or English language learners excluded in NAEP reading and mathematics, as a percentage of all students, by subject and age group: Various years, 1990–2004

| Subject and age group | 1990 | 1992 | 1994 | 1996 | 1999 | 2004[1] | 2004[2] |
|---|---|---|---|---|---|---|---|
| **Reading** | | | | | | | |
| Age 9 | 5.5 | 6.6 | 7.4 | 8.1 | 7.9 | 8.1 | 5.2 |
| Age 13 | 5.3 | 5.7 | 6.1 | 6.9 | 6.5 | 8.3 | 4.9 |
| Age 17 | 4.5 | 5.3 | 5.2 | 7.3 | 6.0 | 6.7 | 3.7 |
| **Mathematics** | | | | | | | |
| Age 9 | 5.3 | 6.7 | 7.8 | 7.8 | 7.4 | 7.0 | 2.9 |
| Age 13 | 5.3 | 6.0 | 6.2 | 6.5 | 6.1 | 7.9 | 3.2 |
| Age 17 | 4.5 | 5.4 | 5.3 | 7.4 | 6.1 | 7.3 | 3.2 |

[1] Original assessment format. Results prior to 2004 are also from the original assessment format.
[2] Revised assessment format.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1990–2004 Long-Term Trend Reading and Mathematics Assessments.

**TABLE A-4.** Percentage of 9-, 13-, and 17-year-old students with disabilities (SD) and/or English language learners (ELL) identified, excluded, and assessed in NAEP reading and mathematics, as a percentage of all students, by SD/ELL category: 2008

| | Reading | | | Mathematics | | |
|---|---|---|---|---|---|---|
| SD/ELL category | Age 9 | Age 13 | Age 17 | Age 9 | Age 13 | Age 17 |
| **SD and/or ELL** | | | | | | |
| Identified | 21 | 18 | 16 | 20 | 18 | 15 |
| Excluded | 4 | 4 | 4 | 3 | 3 | 4 |
| Assessed | 16 | 14 | 12 | 18 | 15 | 12 |
| Without accommodations | 9 | 6 | 5 | 8 | 5 | 4 |
| With accommodations | 8 | 8 | 8 | 10 | 9 | 8 |
| **SD** | | | | | | |
| Identified | 11 | 13 | 12 | 11 | 13 | 11 |
| Excluded | 3 | 3 | 3 | 2 | 3 | 3 |
| Assessed | 8 | 10 | 9 | 9 | 10 | 8 |
| Without accommodations | 2 | 3 | 2 | 2 | 2 | 2 |
| With accommodations | 6 | 7 | 7 | 7 | 8 | 7 |
| **ELL** | | | | | | |
| Identified | 10 | 6 | 5 | 10 | 6 | 5 |
| Excluded | 2 | 1 | 1 | 1 | # | 1 |
| Assessed | 9 | 5 | 4 | 10 | 5 | 4 |
| Without accommodations | 6 | 4 | 3 | 6 | 4 | 2 |
| With accommodations | 2 | 2 | 1 | 4 | 2 | 2 |

# Rounds to zero.
NOTE: Students identified as both SD and ELL were counted only once under the combined SD and/or ELL category, but were counted separately under the SD and ELL categories. 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), 2008 Long-Term Trend Reading and Mathematics Assessments.

## U.S. DEPARTMENT OF EDUCATION

*The National Assessment of Educational Progress (NAEP) is a congressionally authorized project sponsored by the U.S. Department of Education. The National Center for Education Statistics, a department within the Institute of Education Sciences, administers NAEP. The Commissioner of Education Statistics is responsible by law for carrying out the NAEP project.*


Arne Duncan
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### NAEP 2008 Trends in Academic Progress

April 2009

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### SUGGESTED CITATION

Rampey, B.D., Dion, G.S., and Donahue, P.L. (2009). *NAEP 2008 Trends in Academic Progress* (NCES 2009–479). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, Washington, D.C.

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