Chapter 2

Achievement in Science and Mathematics

Achievement tests provide key information about trends in science and mathematics education—such as how students are doing in mathematics and science, whether student performance is improving, whether students of all races and ethnic origins are scoring equally well, and whether any differences exist between the scores of males and females. This information provides a useful measure of educational progress, even though the tests examine only a fraction of students' knowledge and tend to reflect older notions of mathematics and science, such as recitation of fact rather than demonstration of performance.

This chapter examines academic achievement in science and mathematics of various groups of students—whites and minorities, males and females, students in various states, and students from other countries—as a basis for discussion of elementary and secondary science and mathematics education in Chapter 3.

Data Sources for this Chapter

The National Assessment of Educational Progress (NAEP) tests are the primary source of information about educational achievement in the United States. NAEP tests have tracked student achievement in science, mathematics, reading, writing, and other subjects for more than 25 years. The advantages of NAEP tests are that they are administered to a representative national sample of students and allow for comparisons over time on comparable test items. The disadvantages are that the test items, which remain consistent over time to show trends, may not adequately capture current classroom experiences and that the tests use small sample sizes, especially for black, Hispanic, and Asian students.

Longitudinal measures of student achievement complement the conclusions drawn from NAEP results. The National Education Longitudinal Study (NELS) program is a continuing long-term project designed to study the educational, vocational, and personal development of students at various grade levels. NELS and the High School and Beyond Study provide data that are not available from NAEP, including information on student background and detailed and reliable measures of family background. The drawback of these longitudinal surveys is that the measures of student performance are much shorter, hence less reliable, than those in NAEP. ■

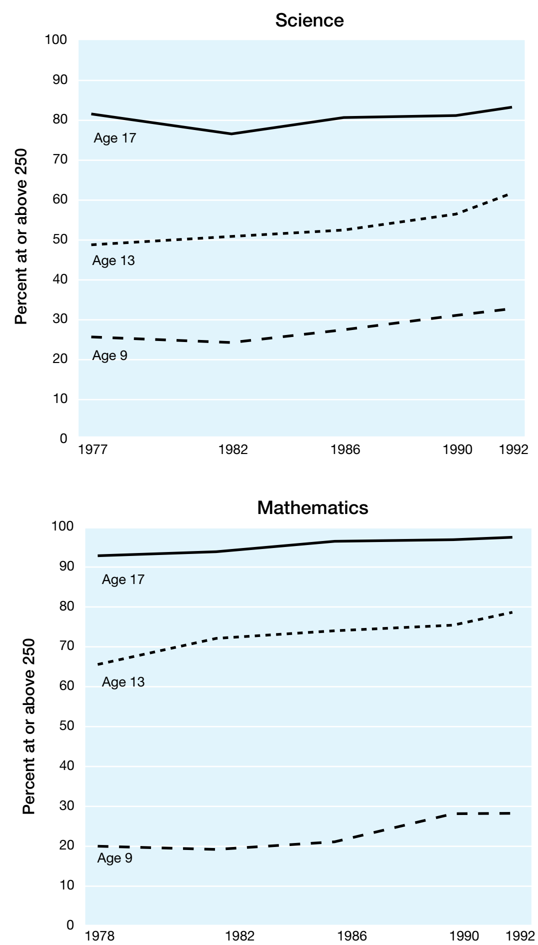
Achievement of Students by Race and Ethnic Origin

Over the past 15 years, student achievement on the National Assessment of Educational Progress (NAEP) science and mathematics tests (see sidebar on data sources) has improved slightly for all ages and racial and ethnic groups. (See figures 2-1 and 2-2 and appendix tables 2-1 and 2-2.)

The percentage of white students who scored at or above "basic performance" levels, at all ages and for both

FIGURE 2–1

NAEP science and mathematics proficiency, by percent of students at or above anchor point 250 and age: 1977 to 1992



SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics. See appendix tables 2-1 and 2-2.

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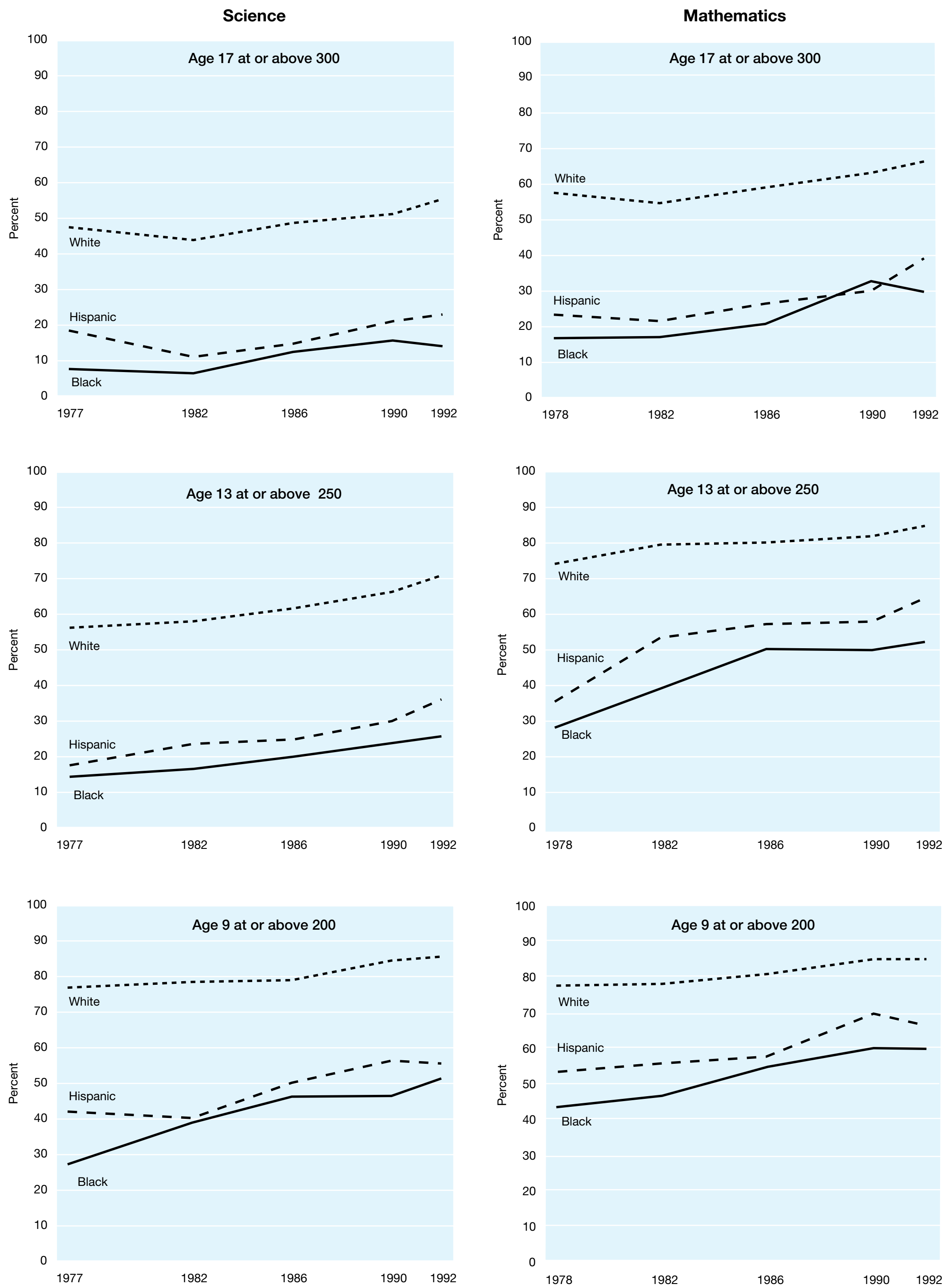
FIGURE 2–2

NAEP science and mathematics proficiency, by percent of students at or above selected anchor points, age, and race or ethnic origin: 1977 to 1992



SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.
See appendix tables 2-1 and 2-2.

science and mathematics, increased somewhat less between 1977 and 1992 than the percentage of black and Hispanic students scoring that well. Results of the 1992 NAEP science test showed that

- the percent of 9-year-old students who scored at 200 or above increased by 24 percentage points for black students, 14 percentage points for Hispanic students, and 9 percentage points for white students since 1977;
- the percent of 13-year-old black students scoring at 250 or above increased more slowly between 1977 and 1992 than the percent of white or Hispanic students scoring at this level; and
- the scores of 17-year-old students of all races and ethnic groups increased more slowly since 1977 than the scores of younger students.

Results of the 1992 NAEP mathematics test showed that

- the percent of 9-year-old students who scored at 200 or above increased by 18 percentage points for black students, 11 percentage points for Hispanic students, and 11 percentage points for white students since 1978;
- the percent of 13-year-old students who scored at 250 or above increased by 22 percentage points for black students, 27 percentage points for Hispanic students, and 12 percentage points for white students since 1978; and
- the percent of 17-year-olds who scored at 300 or above increased by 13 percentage points for black students, 16 percentage points for Hispanic students, and 9 percentage points for white students since 1978.

The increases between 1977 and 1992 represent a large change for significant proportions of the student population. While considerable differences in achievement remain among white students and students of other races and ethnic groups, those differences are narrowing over time.

NELS Scores Supporting NAEP Data

Increases in mean scores of all students on the National Education Longitudinal Study (NELS) tests generally support this upward trend in the achievement of all students and the narrowing of the gap in achievement scores of students from various races and ethnic groups. Among all eighth graders, from all races and ethnic groups, NELS mathematics test scores rose significantly between 1980 and 1990—from 33 in 1980 to 36 in 1990. The mean scores of black and Hispanic students increased 4 points. The mean scores of white students increased 3 points; the mean scores of Asians increased 1 point.

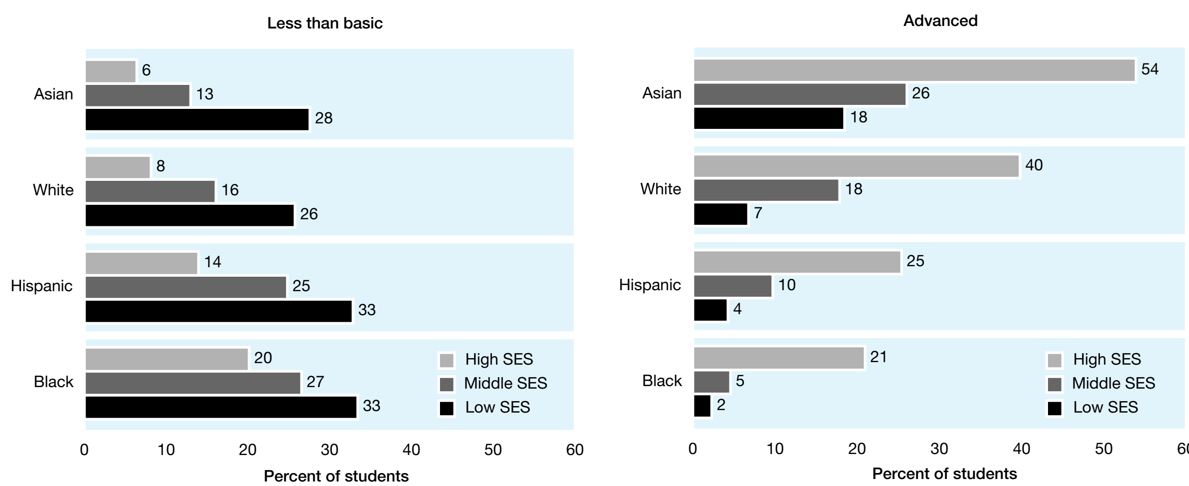
Even among students of the same socioeconomic status, large differences remain between the scores of Asian and white students and scores of students of other races and ethnic origins. (See figure 2-3 and appendix table 2-3.) Attempts to explain why these gaps persist, even among students of the same socioeconomic status, generate a great deal of controversy. Some authors cite cultural differences; others point out the difficulty and imprecision entailed in applying measures of socioeconomic status across ethnic groups or the effects of barriers erected by a majority society (Ogbu, 1994).

Locus of Improvements

Most of the progress in average achievement scores can be attributed to an increase in the scores of the lowest

FIGURE 2–3

NELS mathematics proficiency levels in eighth grade, by race or ethnic origin and socioeconomic status (SES): 1988



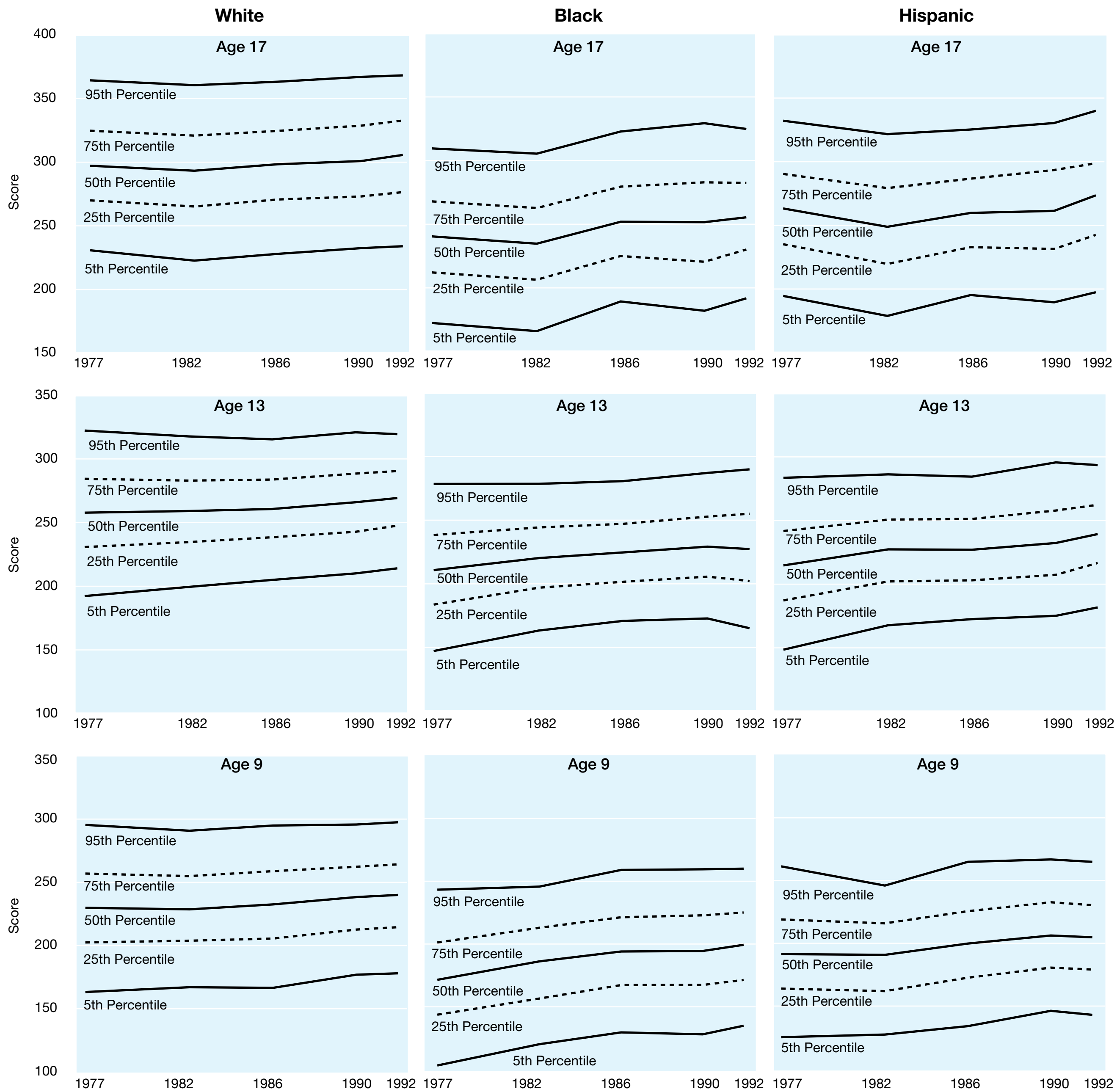
SOURCE: Rock, D.A., Pollack, J.M., & Hafner, A. (1991). *The tested achievement of the national education longitudinal study of the 1988 eighth grade class* (NCES 91-460). Washington, DC: U.S. Department of Education.
See appendix table 2-3.

scoring students. Both science and mathematics achievement scores of black and Hispanic students in the 5th and 25th percentiles increased significantly between the late 1970s and 1992. For example, the achievement level of 13-year-old black students scoring at the 5th percentile in mathematics increased 17 percent between 1978 and 1992. Similarly, the achievement level of 13-year-old Hispanic students scoring at the 5th percentile increased 18 percent during the same period, and the achievement level of 13-year-old white students scoring at the 5th percentile increased 9 percent. (See figures 2-4 and 2-5.)

The achievement level of all students, of every race or

FIGURE 2–4

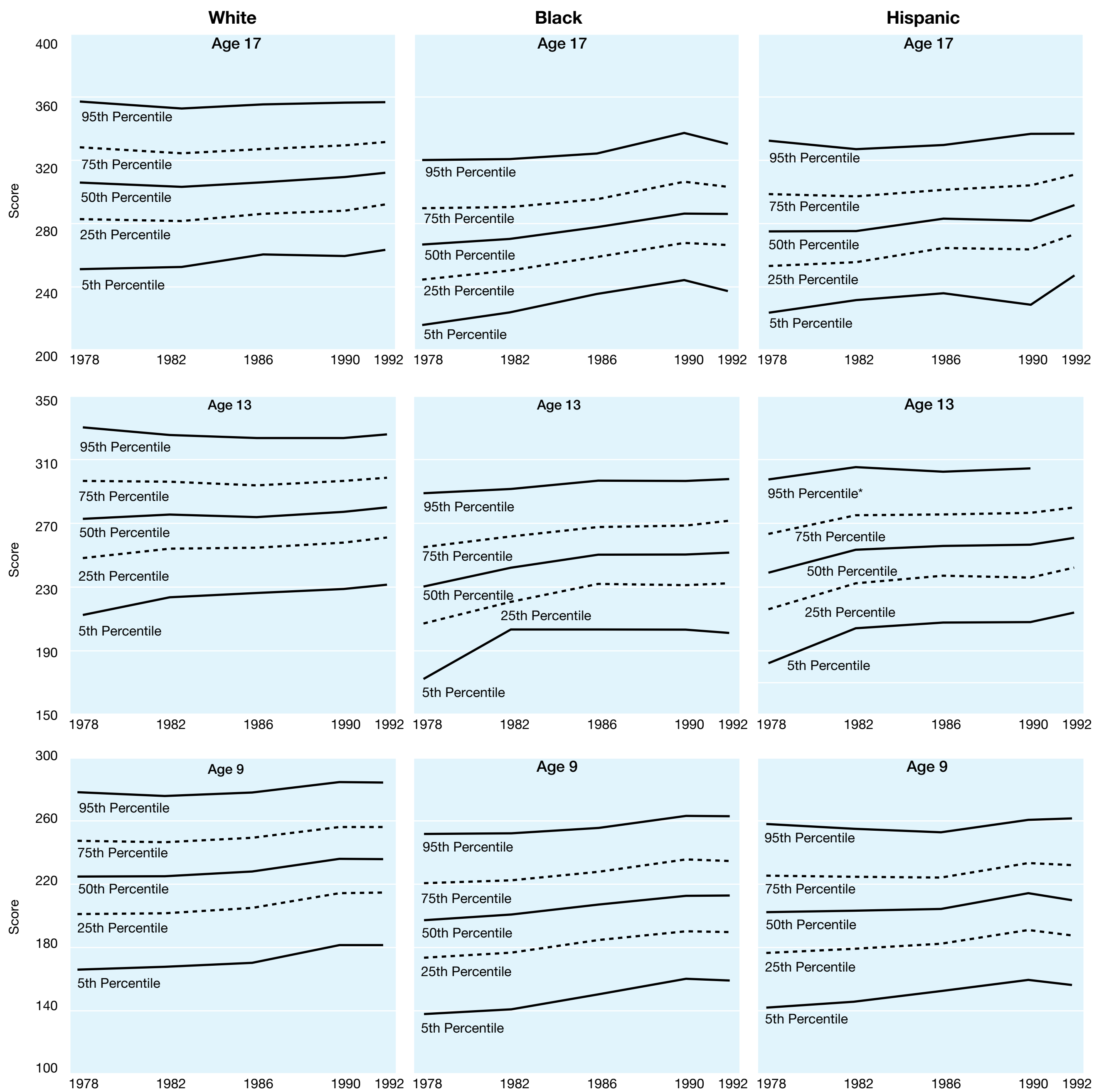
NAEP mean science score percentile distributions: 1977 to 1992



SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.

FIGURE 2–5

NAEP mean mathematics score percentile distributions: 1978 to 1992



*Data are unavailable for 1992.
SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.

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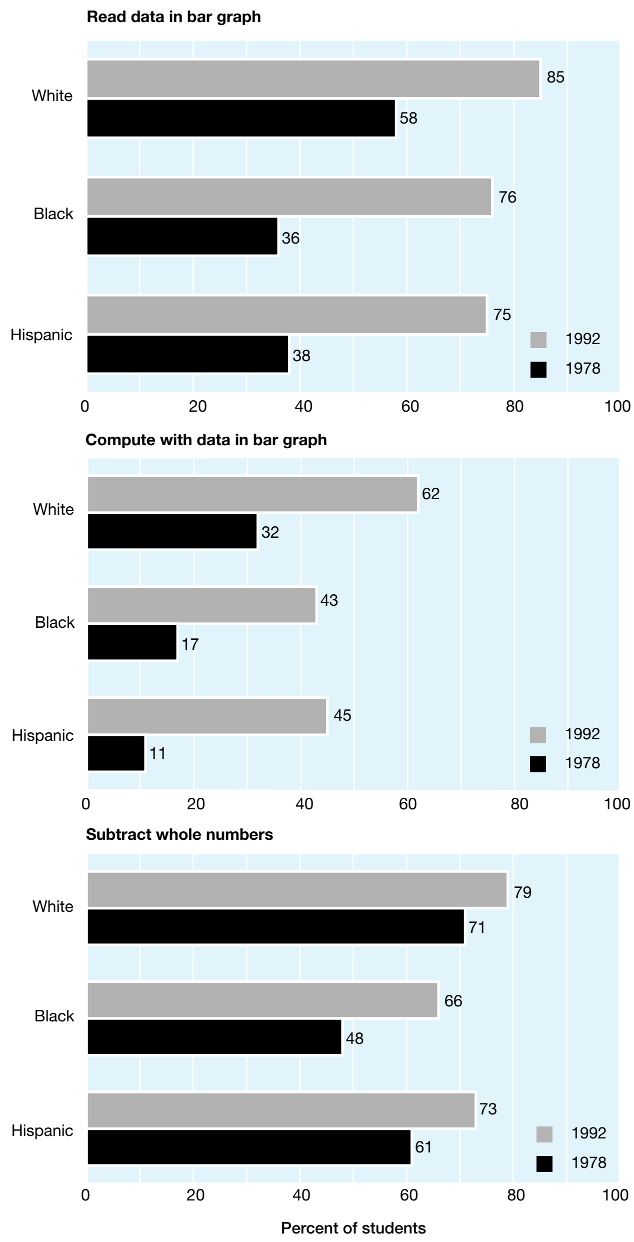
ethnic origin, scoring at the 75th and 95th percentiles did not increase as much or at all during the same period. For example, the achievement level of 13-year-old black students scoring at the 95th percentile in mathematics increased only 3 percent between 1978 and 1992; for Hispanic students, it increased only 4 percent; and the achievement level of white students actually declined 1 percent during the same period.

FIGURE 2–6

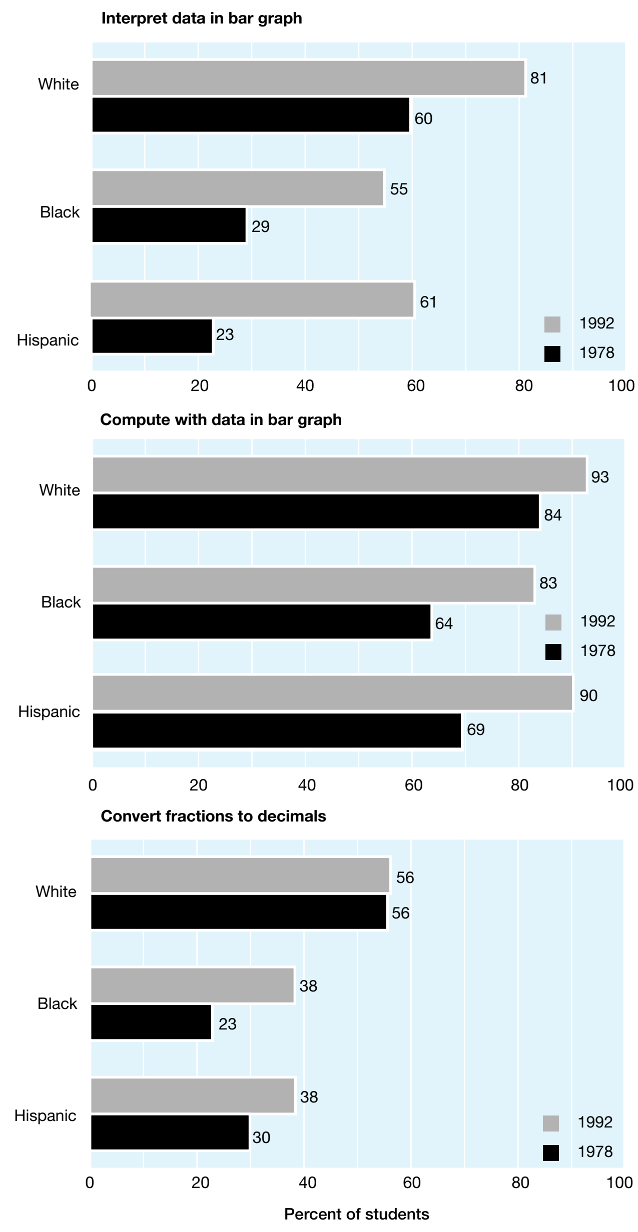
Percent of age 9 students answering NAEP mathematics questions correctly, by race or ethnic origin: 1978 and 1992



NOTE: Numbers shown are rounded to the nearest whole number.
SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.

FIGURE 2–7

Percent of age 13 students answering NAEP mathematics questions correctly, by race or ethnic origin: 1978 and 1992



NOTE: Numbers shown are rounded to the nearest whole number.
SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.

Analysis of Individual NAEP Items

An examination of student performance on individual NAEP mathematics test items provides a detailed look at trends in student achievement. Between 1978 and 1992, students made dramatic progress on some kinds of test items. (See figures 2-6 and 2-7.) In particular, 9- and 13-year-old black and Hispanic students significantly improved their scores on items that required reading and interpreting data from a chart, table, or graph.

For example, on a test item requiring students to read data in a bar graph, more than twice as many black and Hispanic students at age 9 gave correct answers in 1992 as in 1978. A recent emphasis on graphing and charting in elementary schools could help account for these gains.

Among all students, achievement also increased significantly on items involving the use of computational skills, such as subtracting whole numbers and converting fractions to decimals, and knowledge of basic geometry. Between 1978 and 1992, NAEP mathematics achievement declined on only a few items (10 percent of the published items), such as solving number sentences, relating parts to the whole, estimating metric measures, and applying the concept of inequality (Mullis et al., 1994).

Student Achievement in Mathematical Problem Solving

Problem solving is a critical skill in mathematics. To tap students' achievement in this area, the 1992 NAEP included two types of question format, in addition to multiple-choice items:

- short constructed-response questions that asked students to carry out a calculation and write an answer, examine a situation and describe why one alternative or another was correct, or measure or draw a geometric figure given some boundary conditions; or
- extended constructed-response questions that provided students the opportunity to express mathematical ideas and demonstrate the depth of their understanding of a problem (Dossey, Mullis, & Jones, 1993).

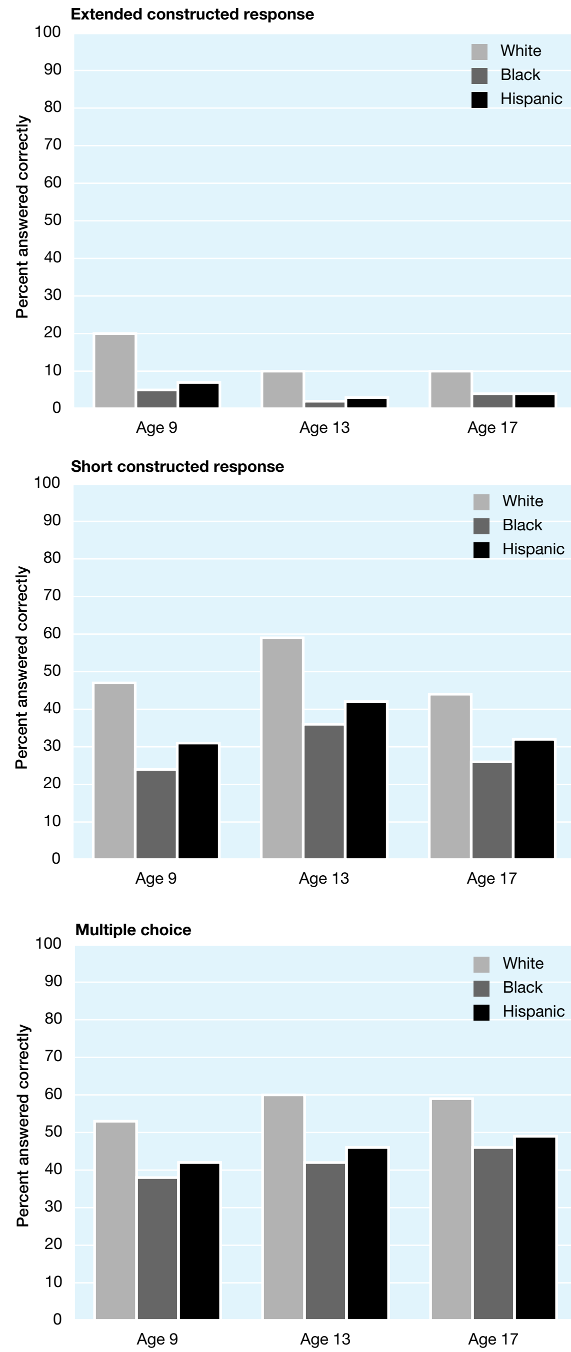
Few students of any race or ethnic origin demonstrated proficiency in mathematical problem solving by correctly answering the more challenging, extended constructed-response questions of NAEP. (See figure 2-8 and appendix table 2-4.) Black and Hispanic students' scores were lower than white students on all of these questions, especially on questions that required sophisticated kinds of problem solving skills. The gap was most pronounced on questions that emphasized application to real-life settings.

Performance of College-Bound Students

Although the population of 18-year-olds declined between 1987 and 1993, the number of students taking college preparation tests remained about the same. (See sidebar about entrance examinations and figure 2-9.) One reason was that increasing numbers of female and minority students took the examinations. Females took more than half of the Scholastic Aptitude Tests (SAT) and American College Tests (ACT) administered during the past few years. In 1993, 27 percent of SAT test takers were minorities, compared with 21 percent in 1987 (College Board, 1987 & 1993). About 30 percent of students taking the ACT in 1994 were minorities (American College Testing, 1994).

FIGURE 2–8

Average percent of NAEP mathematics questions answered correctly, by type of question, race or ethnic origin, and age: 1992



SOURCE: Dossey, J.A., Mullis, I.V.S., & Jones, C.O. (1993). *Can students do mathematical problem solving? Results from constructed-response questions in NAEP's 1992 mathematics assessment.* Washington, DC: U.S. Department of Education.
See appendix table 2-4.

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Science

On the 1993 ACT science reasoning section, the mean scores of students from various races and ethnic groups ranged widely. The mean score of Asian students was considerably higher than the mean score of white students, and the mean score of all other minority groups was considerably lower than the mean score of white students. (See figure 2-10.) The ACT's science reasoning section is designed to measure students' interpretation, analysis, evaluation, reasoning, and problem-solving skills in the natural sciences. The SAT does not have a science section.

Mathematics

Between 1987 and 1993, the mean scores on the mathematics section of the SAT and ACT increased for students from all races and ethnic groups. For example, the mean score of all students taking the SAT increased 2 points during this period, while the mean score of black students increased 11 points (College Board, 1987 & 1993). With the exception of Asian students, the gains on both tests within each race or ethnic group represent a decrease in the percent of students scoring at the lowest levels and little or no change in the percent of students scoring at the highest levels. (See figure 2-11.) This finding is consistent with the pattern for NAEP scores.

Large gaps remain between the SAT and ACT mathematics scores of students from various races and ethnic groups. Asian students score considerably higher than white students on both tests, and all other minority groups score considerably lower than either Asian or white students.

In 1993, black students had the lowest mean score (388) on the mathematics section of the SAT, with the largest percentage of students scoring below 400 (57 percent) and the smallest percentage scoring above 600 (4 percent). In fact, only 0.5 percent of black students (479 students) scored above 700, and only 0.1 percent (103 students) scored above 750. As low as these percentages are, they represent improvement—in 1987, 63 percent of black students scored below 400 (College Board, 1987 & 1993). The trends among Hispanic students are similar.

The scores of Asian students improved between 1987 and 1993, especially among top-scoring students. In 1993, Asian students' mean score on the mathematics section of the SAT was 535, up from 521 in 1987. The proportion of Asian students scoring above 600 increased from 32 percent in 1987 to 36 percent in 1993. The percentage of Asian students with scores over 750 increased from 3.3 percent (1,945 students) to 5.4 percent (4,276 students) in this same period. The scores of white students changed very little between 1987 and 1993.

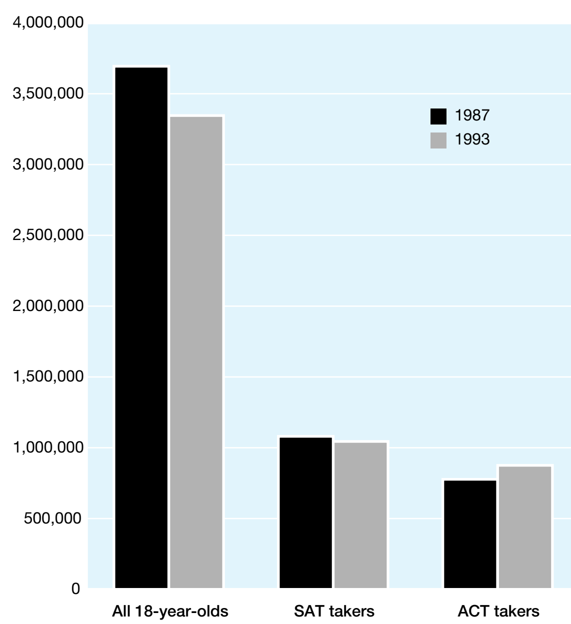
College Entrance Exams Reveal Trends on College-Bound Youth

The Scholastic Aptitude Test (SAT) is a rich source of background data on college-bound youth and a predictor of college success. However, any interpretations about SAT data must be tempered because students who take the SAT are not representative of the Nation's students. This chapter examines SAT scores from 1987 (the first year extensive information on the performance of various ethnic groups across the distribution of scores was available) and 1993.

The American College Test (ACT) is another predictor of college success. As with the SAT, students taking the ACT are not representative of all students. This chapter draws from data on the population of students who took the ACT. Because a new mathematics test was introduced in 1990 and a new science test in 1991, comparisons with earlier years are impossible. ■

FIGURE 2–9

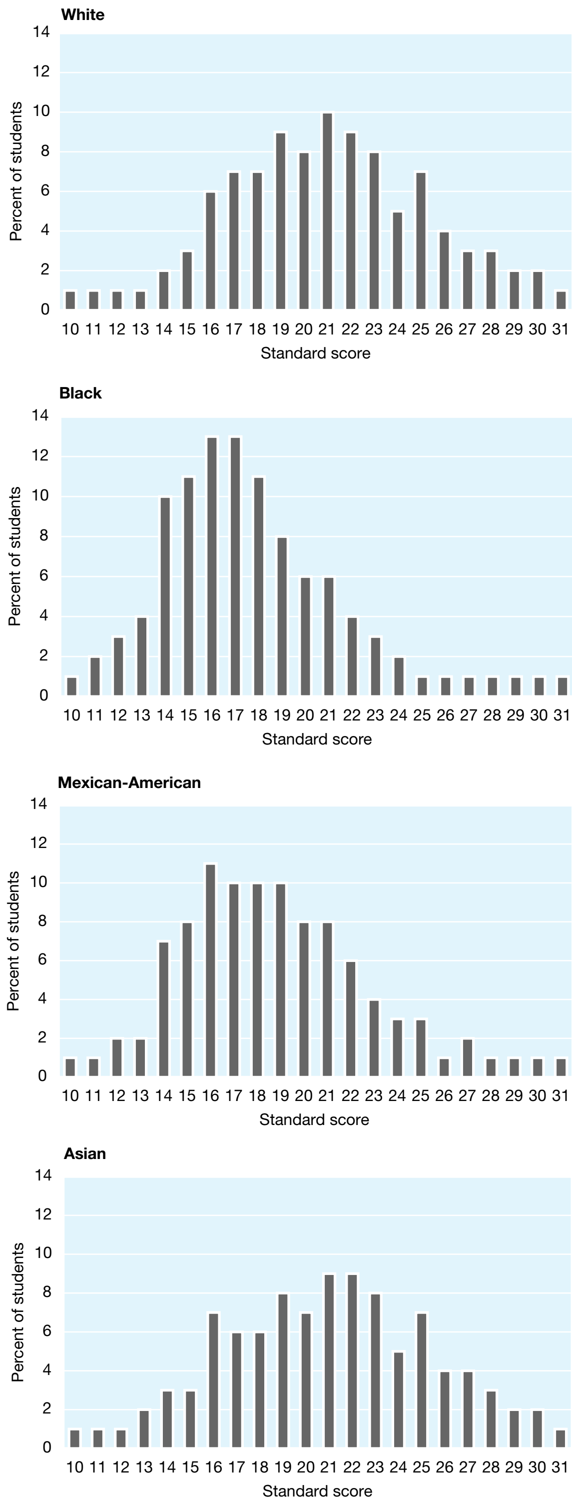
18-year-old population compared with number of college preparation test takers: 1987 and 1993



SOURCES: U.S. Department of Commerce. (1987). *Projections of the population of the United States, by age, sex, and race: 1983 to 2080* (Current Population Report Series P-25, No. 952). Washington, DC: U.S. Bureau of Census; U.S. Department of Commerce. (1993). *Projections of the population of the United States, by age, sex, and race: 1988 to 2080* (Current Population Report Series P-25, No. 1018). Washington, DC: U.S. Bureau of Census; National Center for Education Statistics. (1993). *Digest of education statistics 1993* (NCES 93-292). Washington, DC: U.S. Government Printing Office; College Board. (1987). *National college-bound seniors: 1987 SAT profile.* New York: College Board; College Board. (1993). *National college-bound seniors: 1993 SAT profile.* New York: College Board.

FIGURE 2–10

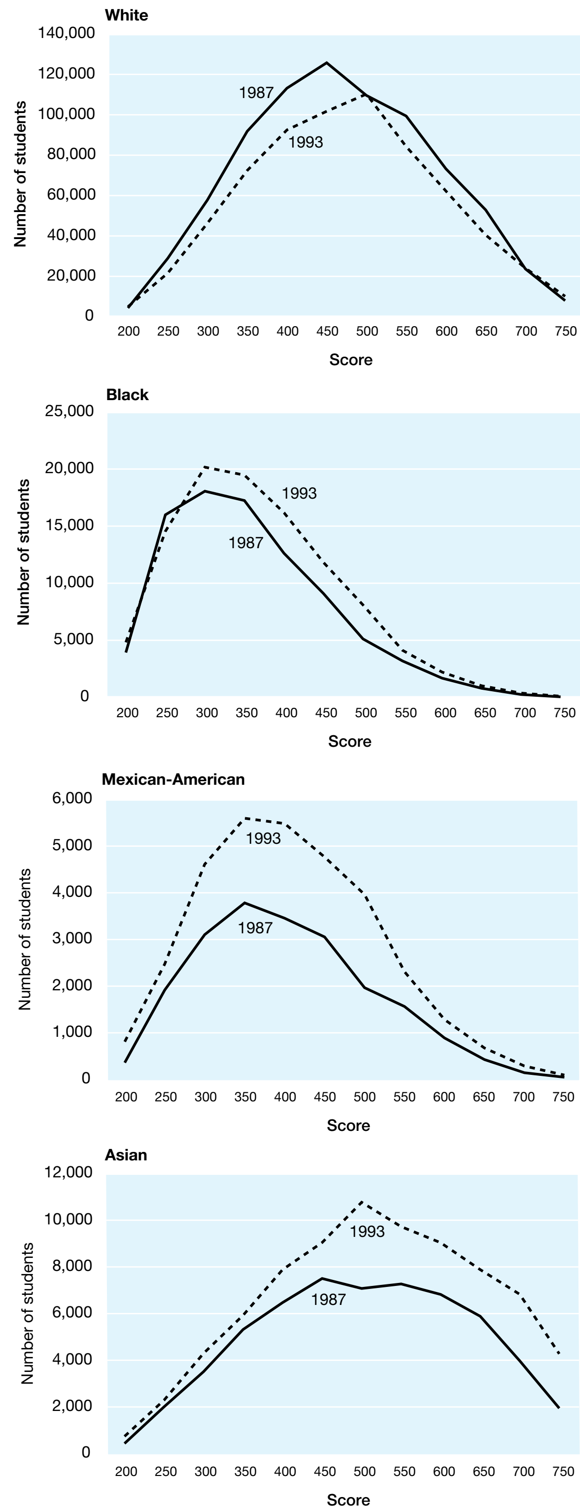
Percent of students earning each standard score in science reasoning on the ACT, by race or ethnic origin: 1993



SOURCE: American College Testing (ACT). (1993). *Reference norms for spring 1993 ACT tested H.S. graduates.* Iowa City, IA: ACT.

FIGURE 2–11

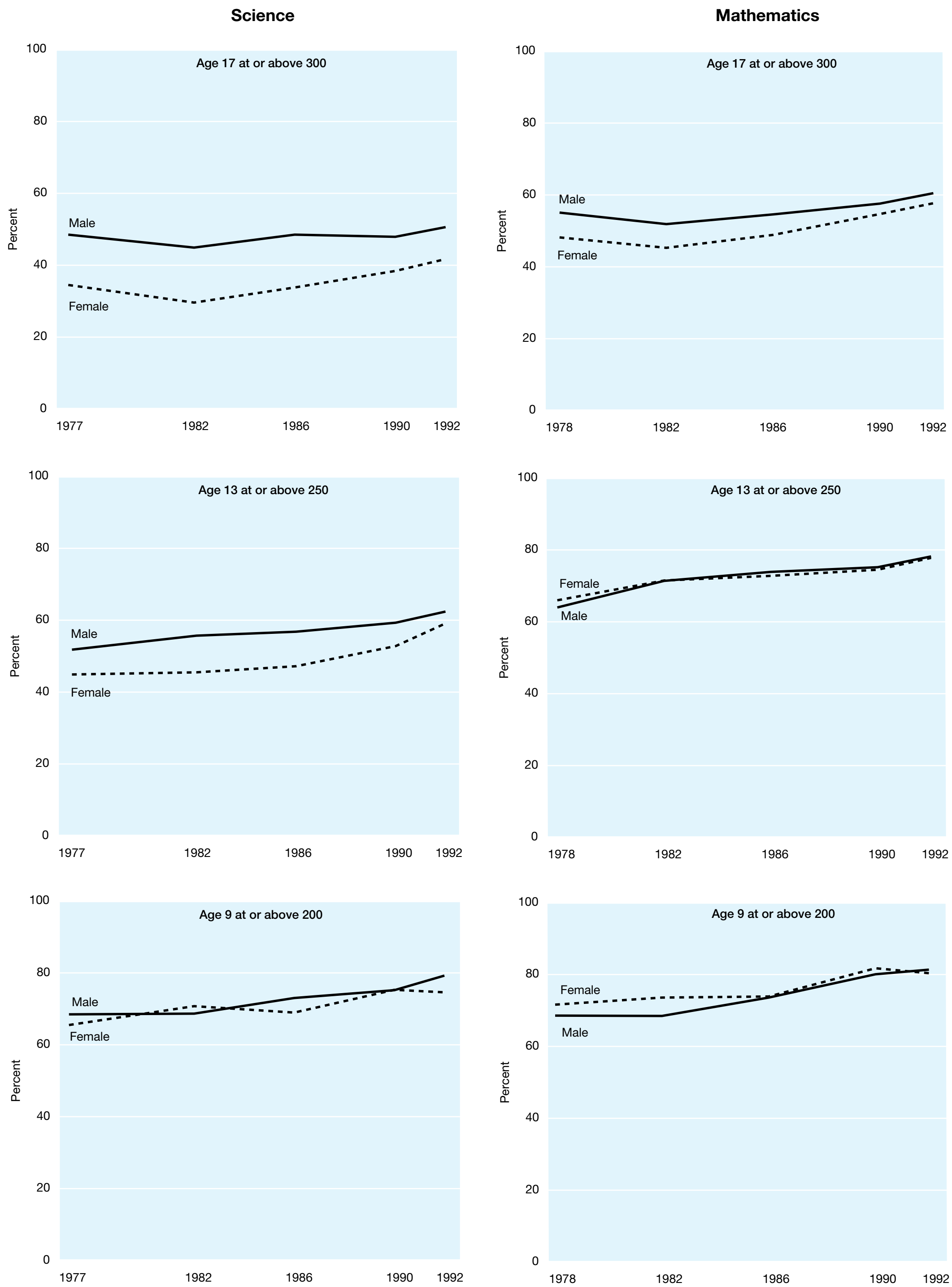
Distribution of SAT mathematics scores, by race or ethnic origin: 1987 and 1993



SOURCES: College Board. (1987). *National college-bound seniors: 1987 SAT profile.* New York: College Board; College Board. (1993). *National college-bound seniors: 1993 SAT profile.* New York: College Board.

FIGURE 2–12

NAEP science and mathematics proficiency, by percent of students at or above selected anchor points, age, and sex: 1977 to 1992



SOURCE: Mullis, I.V.S., et al. (1994). *NAEP 1992 trends in academic progress* (Report No. 23-TR01). Washington, DC: National Center for Education Statistics.
See appendix tables 2-5 and 2-6.

Achievement of Students by Sex

Between 1977 and 1992, little difference existed between the NAEP science scores of elementary males and females; however, during that period, males in middle and high schools outscored females. (See figure 2-12 on page 23 and appendix table 2-5.) For example, 9 percent more 17-year-old males than 17-year-old females scored 300 or more on the 1992 NAEP science test. Notably, this difference was less than in 1977, when 14 percent more 17-year-old males than 17-year-old females scored 300 or more.

Between 1978 and 1992, males and females in elementary and middle schools scored equally well on NAEP and NELS mathematics tests. (See figure 2-12 on page 23 and appendix table 2-6.) During that period, the difference between the NAEP mathematics scores of males and females in high schools narrowed considerably.

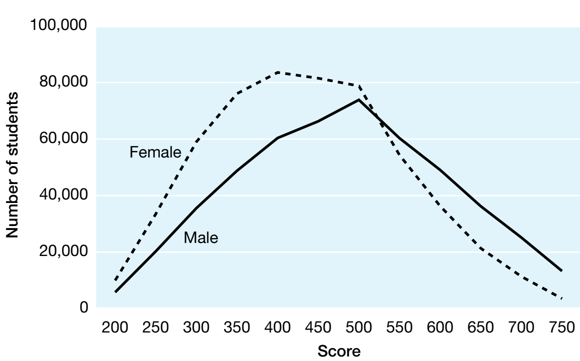
In contrast to the performance of male and female students on NAEP and NELS mathematics tests, females score significantly lower than their male counterparts on the mathematics portion of the SAT. (See figure 2-13.) For example, in 1987, the mean score for all females taking the SAT was 47 points lower than the mean score for males—453 versus 500. Although the mean score of females rose slightly by 1993, it was still 45 points lower than the mean score of men—457 versus 502.

Furthermore, females are overrepresented in the lower end of the scale and underrepresented in the high end of the scale. In 1993, while only 22 percent of males scored below 400, 32 percent of females did. Conversely, while 25 percent of males scored over 600, only 13 percent of females did. That same year, less than 0.1 percent of minority females scored over 750.

On the ACT science reasoning test, males scored 6 percent higher than females in both 1991 and 1994. On the ACT mathematics test, males scored 6 percent higher than females in 1994 and 7 percent higher in 1990 (American College Testing, 1994).

FIGURE 2–13

Distribution of SAT mathematics scores, by sex: 1993



SOURCE: College Board. (1993). *National college-bound seniors: 1993 SAT profile.* New York: College Board.

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State, Regional, and International Achievement

NAEP mathematics scores for white students in some southern states and Appalachia are significantly lower than scores for similar students in the rest of the country (See sidebar on state NAEP scores.) For example, the mean NAEP mathematics scores of 13-year-old white students range from 260 in West Virginia to 284 in North Dakota, Minnesota, and Iowa. (See figure 2-14.) The scores of 9-year-olds follow the same pattern. The pattern for the mean scores of Hispanic students is also similar. (See figure 2-15.)

The mean scores of black students do not vary regionally in the same pattern as the mean scores for white students; indeed, few statistically significant differences exist among scores of black students in different parts of the country. (See figure 2-16.) The mean scores of 13-year-old black students in states where white students attain above-average scores, such as New York, California, and Michigan, are about the same as the mean scores of 13-year-old black students in states where whites show below-average achievement, such as Mississippi and Tennessee. None of the average scores of black or Hispanic students is as high as the lowest average scores for white students.

On the International Assessment of Educational Progress (IAEP), which was administered in 1991, U.S. students scored rather poorly. (See sidebar on IAEP.) Most alarming were striking differences between the scores of 9- and 13-year-old students, especially in science, which suggest that U.S. students do not receive the same type of science and mathematics education between ages 9 and 13 as their foreign counterparts.

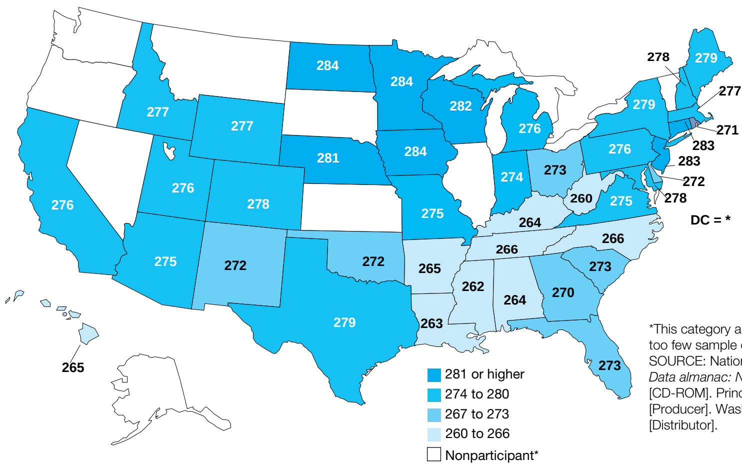
Although 9-year-old students in the United States earned competitive scores on the IAEP science test,

State NAEP Scores Allow Regional Comparisons

NAEP began a Trial State Assessment Program of eighth-grade students in 1990; the program expanded in 1992 to include both fourth- and eighth-grade students. In 1992, the NAEP Trial State Assessments produced data on the mathematics performance of students from 37 states. Although the data have limited value for comparisons across time and do not lend themselves to direct comparisons among the various states' education systems, they reveal interesting regional patterns of achievement. Unfortunately, few researchers have examined the existence or absence of regional differences in NAEP scores; certainly, social, economic, and cultural factors need to be examined. ■

FIGURE 2–14

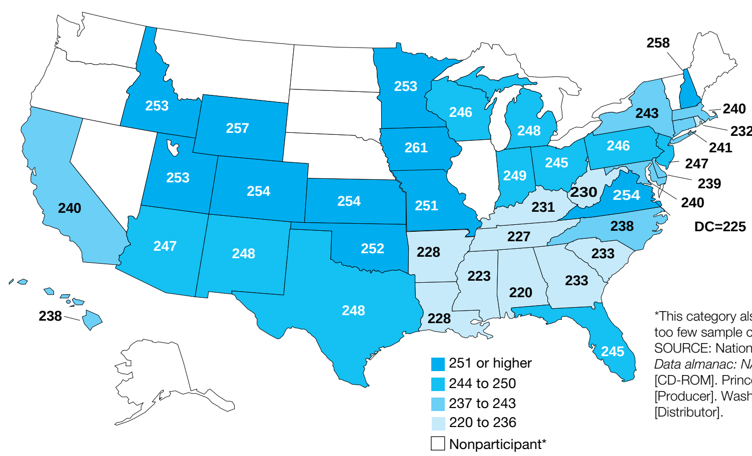
Mean scores of 13-year-old public school white students on NAEP mathematics test: 1992



*This category also includes states where there were too few sample cases for a reliable estimate.
SOURCE: National Center for Education Statistics. (1993). *Data almanac: NAEP's 1992 assessment in mathematics* [CD-ROM]. Princeton, NJ: Education Testing Service [Producer]. Washington, DC: U.S. Department of Education [Distributor].

FIGURE 2–15

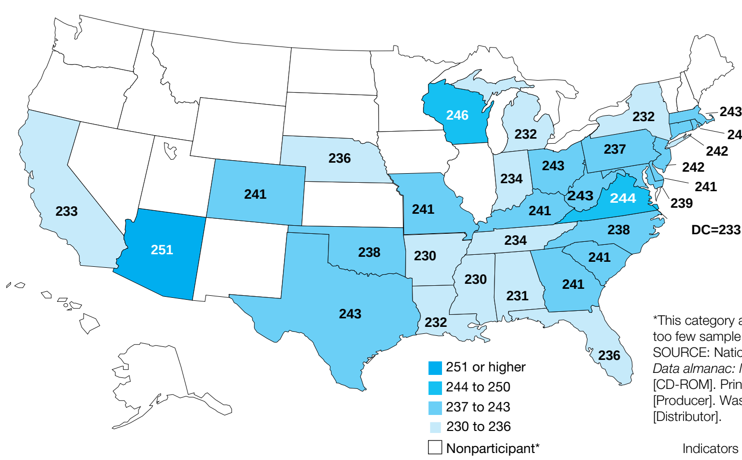
Mean scores of 13-year-old public school Hispanic students on NAEP mathematics test: 1992



*This category also includes states where there were too few sample cases for a reliable estimate.
SOURCE: National Center for Education Statistics. (1993). *Data almanac: NAEP's 1992 assessment in mathematics* [CD-ROM]. Princeton, NJ: Education Testing Service [Producer]. Washington, DC: U.S. Department of Education [Distributor].

FIGURE 2–16

Mean scores of 13-year-old public school black students on NAEP mathematics test: 1992



*This category also includes states where there were too few sample cases for a reliable estimate.
SOURCE: National Center for Education Statistics. (1993). *Data almanac: NAEP's 1992 assessment in mathematics* [CD-ROM]. Princeton, NJ: Education Testing Service [Producer]. Washington, DC: U.S. Department of Education [Distributor].

IAEP Allows International Comparisons

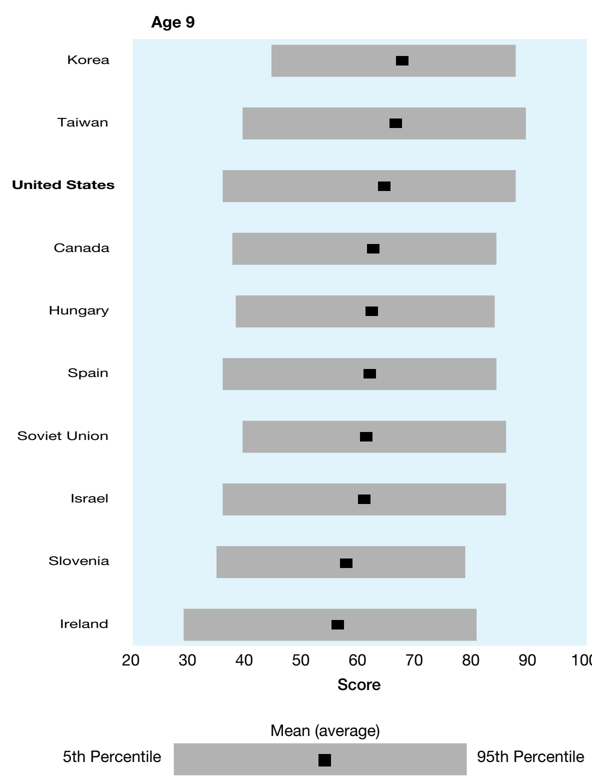
The International Assessment of Educational Progress, conducted in 1991, was an international comparison study of mathematics and science achievement—20 countries assessed science and mathematics achievement of 13-year-old students; 14 countries assessed science and mathematics achievement of 9-year-olds. The data in this chapter for 9-year-olds are based on a subset of 10 countries and for 13-year-olds on a subset of 14 countries. The countries selected for comparison are those "that assessed comprehensive target populations and that represent important political and economic collaborators" (Dossey et al., 1994). International data must be interpreted with particular caution, given differences in student samples, curricula, languages, translations, and testing practices (Bracey, 1991). ■

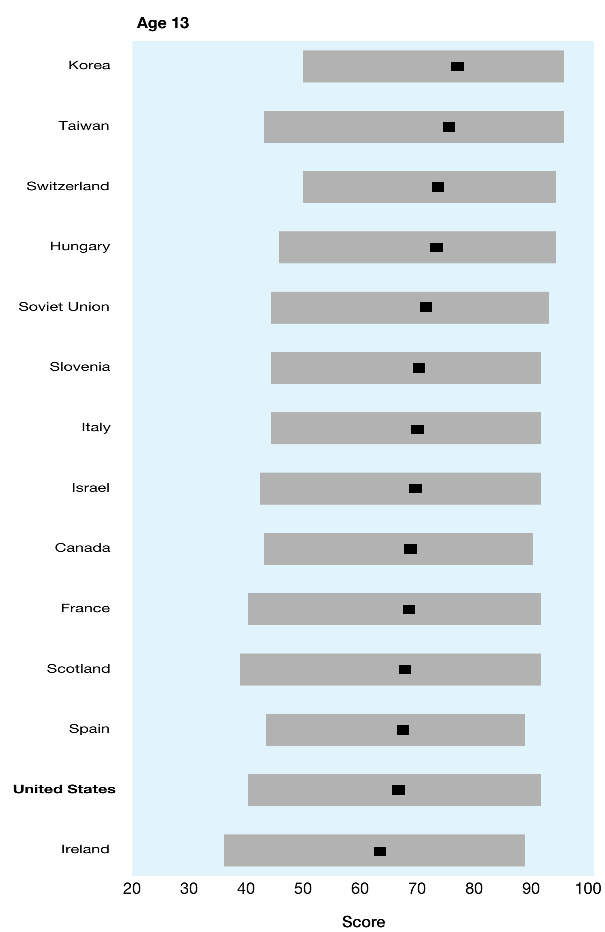
13-year-old students performed poorly relative to those in other countries. (See figure 2-17 and appendix table 2-7.) Overall, 9-year-old students ranked third, with an average of 65 percent of questions answered correctly. Korea, the top-scoring country, answered an average of 68 percent correctly. The mean score of U.S. 9-year-olds at the 95th percentile was identical to the score of Korean students at the 95th percentile; only students in Taiwan averaged higher scores. U.S. 9-year-olds scored above the international average in each of the content areas measured by the test, including life science, earth and space science, and the nature of science, except physical science.

Among 13-year-olds, the United States had the second lowest mean score. U.S. students answered an average of 67 percent of questions correctly. Top students in five countries outperformed U.S. students who scored at the 95th percentile, and 10 of the 13 other countries outperformed U.S. students who scored at the 5th percentile. U.S. 13-year-olds scored below the international average in each of the content areas measured by the test, except the nature of science.

FIGURE 2–17

IAEP science scores for selected countries at 5th percentile, mean, and 95th percentile, by age: 1991





SOURCE: Bybee, R.W., et al. (1994). *Science: Measuring U.S. students' success.* Princeton, NJ: Educational Testing Service.
See appendix table 2-7.

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On the IAEP mathematics test, 9- and 13-year-old students in the United States scored lower than students from most other countries. (See figure 2-18 and appendix table 2-8.) Of all countries in the sample, 9-year-olds in the United States scored second lowest. They answered only 58 percent of questions correctly; Korean students—who were the top performers—answered an average of 75 percent of questions correctly. Moreover, U.S. students who scored at the 95th percentile scored 3 to 5 percentage points lower than their counterparts in the top-scoring countries. U.S. students in the 5th percentile performed worse than students in all countries except Ireland. U.S. 13-year-olds scored worse than students in any other country on the mathematics portion of the IAEP; they answered only 55 percent of questions correctly.

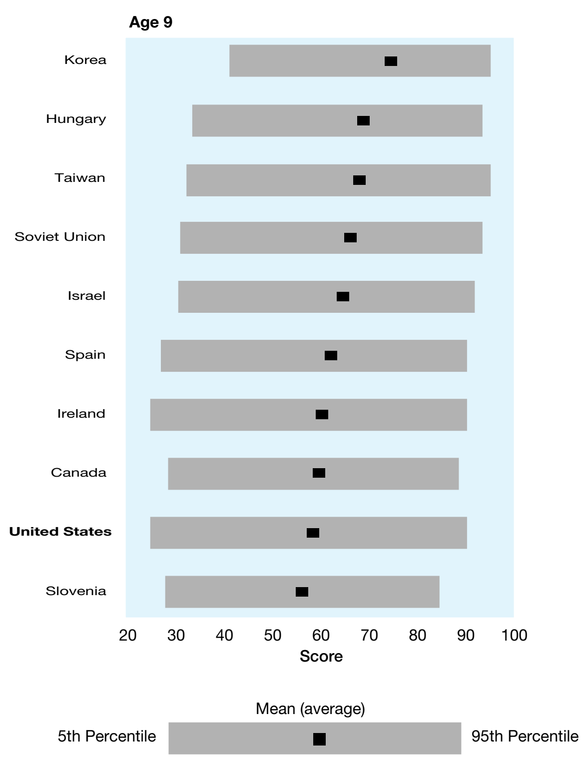
U.S. 9-year-olds performed below the international average in all areas except data analysis, statistics, and probability. U.S. 13-year-old students performed below the international average on most of the areas measured by the test, including numbers and operations; measurement; geometry; data analysis, statistics, and probability; and algebra and functions.

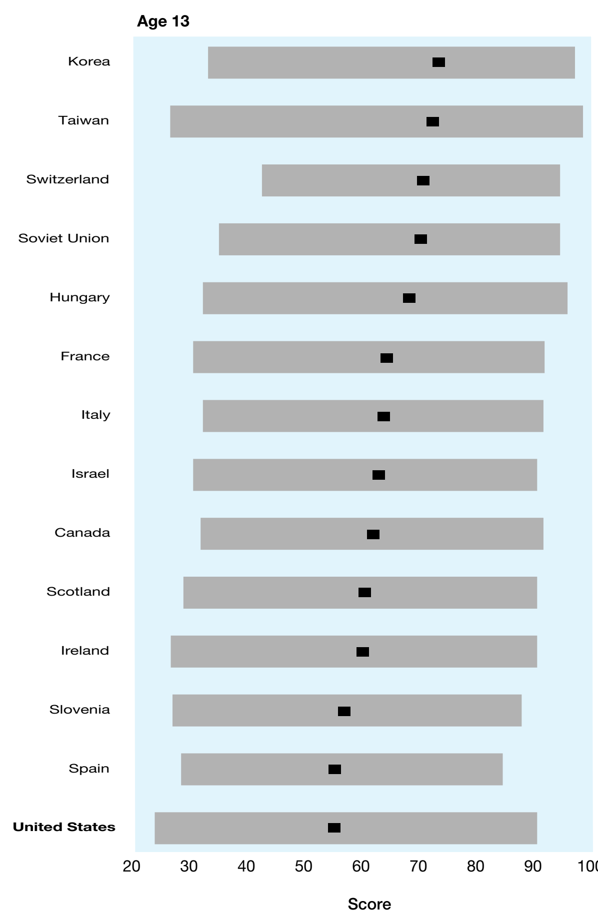
When a special study ranked NAEP and IAEP mathematics scores together, a startling picture of the diversity within the United States emerged. (See figure 2-19.) Students in the highest performing states—Iowa, North Dakota, Minnesota, Maine, and New Hampshire—performed at the same level as students in the top-performing countries—Taiwan, Korea, Soviet Union, and Switzerland. Furthermore, the students in the lowest performing states—Alabama, Louisiana, and Mississippi—performed at the same level as students in the lowest performing country—Jordan.

Moreover, the range of scores within each state was greater than the range of scores within most countries. Thus, the top-performing students within some states score higher than the top-performing students in many countries, and the lowest performing students score lower than the lowest performing students in many countries.

FIGURE 2–18

IAEP mathematics scores for selected countries at 5th percentile, mean, and 95th percentile, by age: 1991

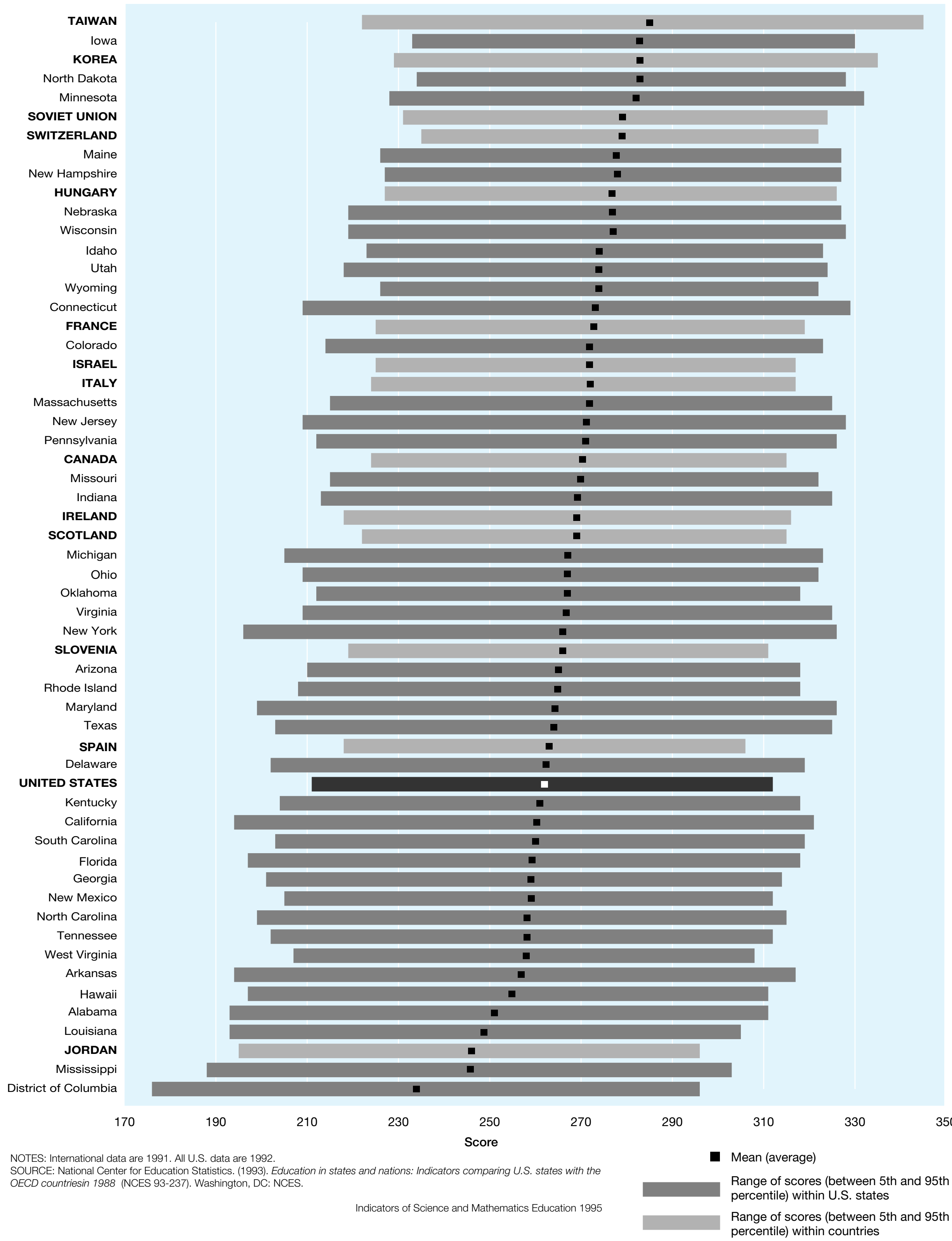




SOURCE: Dossey, J.A., et al. (1994). *Mathematics: How do U.S. students measure up?* Princeton, NJ: Educational Testing Service.
See appendix table 2-8.

FIGURE 2-19

Mathematics proficiency scores for 13-year-olds in countries and public school eighth-grade students in U.S. states: 1991 or 1992



NOTES: International data are 1991. All U.S. data are 1992.
SOURCE: National Center for Education Statistics. (1993). *Education in states and nations: Indicators comparing U.S. states with the OECD countriesin 1988* (NCES 93-237). Washington, DC: NCES.

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Conclusion

This chapter discusses science and mathematics performance of students by race and ethnic origin and sex as a basis for discussion of the science and mathematics learning environment in Chapter 3. Over the past 15 years, U.S. students have received higher scores on a variety of science and mathematics achievement tests. During the same period, the differences among the scores of students from various races and ethnic groups have narrowed; however, black and Hispanic students continue to score significantly lower than white and Asian students. In addition, although few differences exist among the achievement scores of males and females on NAEP and NELS tests, males score significantly higher than females on science and mathematics college entrance examinations.

In the international arena, U.S. elementary school students compete favorably on science tests with students from other countries, but U.S. middle school students have some of the lowest mathematics scores in the world. Nevertheless, a direct comparison between the mathematics performance of countries and individual states shows as much diversity within the country as worldwide—generally, states in the Midwest rank as high as the highest performing countries, and states in the South and Appalachia rank as low as the lowest performing countries.

These trends in student achievement remain unexplained. Educators could make some progress toward explanation if NAEP tests differentiated racial and ethnic groups more finely and used larger sample sizes; still, many questions would linger. NAEP and NELS offer a very narrow window on the complexities of student achievement. They measure just a small portion of what students learn in school, and they measure it imperfectly.

The next generation of assessments should measure students' cognitive skills in a way that will illuminate how education reform efforts under way across the United States affect what students learn. In addition, they ought to measure students' ability to apply concepts and solve problems. Finally, educators should explore how economic and cultural values affect students' achievement. ■

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