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ABSTRACT

The National Assessment of Educational Progress (NAEP) has served as the only ongoing monitor of student achievement in the United States across time. This report summarizes major findings from 10 administrations of the long-term reading assessment since 1971, 9 administrations of the long-term trend mathematics assessment since 1973, and 10 administrations of the long-term trend science assessment since 1969 and 1970. Generally, the trends in mathematics and science are characterized by declines in the 1970s followed by increases during the 1980s and early 1990s and mostly stable performance since then. Some gains are evidenced in reading, but they are modest. Overall improvement across the assessment years is most evidenced in mathematics. National trends are reported in the three subject areas, by quartiles, and in the attainment of performance levels. Trends in academic achievement among student subgroups are reported for racial and ethnic groups and for males and females and by parents' educational level, and for public and nonpublic students. Trends are also reported for students' school and home experiences as they have reported them over the years. Appendixes contain an overview of the procedures used in the NAEP trend assessments and a review of NAEP data. (Contains 59 figures.) (SLD)

NATIONAL CENTER FOR EDUCATION STATISTICS

NAEP 1999

TRENDS IN ACADEMIC PROGRESS

Three Decades of Student Performance

SCIENCE, 1969–1999

READING, 1971–1999

MATHEMATICS, 1973–1999

U.S. Department of Education
Office of Educational Research and Improvement
NCES 2000-469

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The National Assessment Governing Board

NATIONAL CENTER FOR EDUCATION STATISTICS

NAEP 1999

TRENDS IN ACADEMIC PROGRESS

Three Decades of Student Performance

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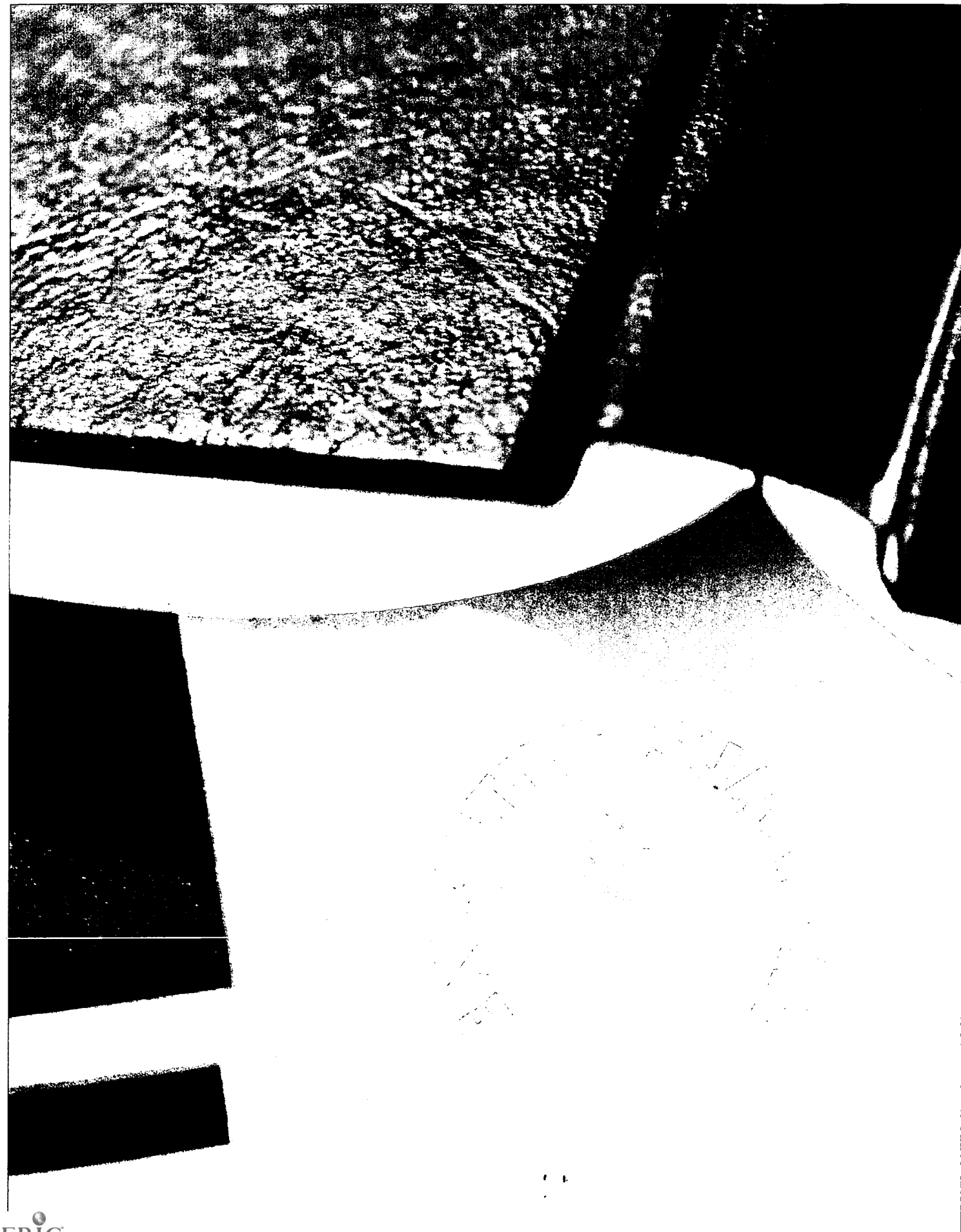


EXECUTIVE SUMMARY

Amid the social, political, and technological changes of the last 30 years, interest in the education of America's children has remained high. During the 1970s and 1980s, concern for educational achievement prompted a "back to basics" movement followed by a call for learning expectations beyond minimum competency. In the 1990s, the desire that all students attain high levels of academic achievement was expressed through the establishment of challenging national education goals and state academic standards.

Against this backdrop, the National Assessment of Educational Progress (NAEP) has served as the nation's only ongoing monitor of student achievement across time. As a project of the National Center for Education Statistics (NCES) of the U.S. Department of Education, NAEP has regularly administered assessments in a variety of subject areas to nationally representative samples of students since 1969. Among the many components of the NAEP program, the long-term trend assessments have provided a gauge of student achievement over time by administering the same assessments periodically across NAEP's 30-year history.

In 1999, the long-term trend assessments in reading, mathematics, and science were administered for the final time in the twentieth century. This report presents the results of those assessments, and examines the trends in 9-, 13-, and 17-year-olds' achievement in these three subjects since the first administration of each assessment. A long-term trend writing assessment was also administered in 1999; however, the results of that assessment are undergoing evaluation.

This executive summary provides an overview of major findings from 10 administrations of the long-term trend reading assessment since 1971, 9 administrations of the long-term trend mathematics assessment since 1973, and 10 administrations of the long-term trend science assessment (since 1970 for 9- and 13-year-olds, and since 1969 for 17-year-olds). It should be noted that these long-term trend assessments are different from more recently developed assessments in the same subjects that make up NAEP's "main" assessment program. Because the instruments and methodologies of the two assessment programs are different, comparisons between the long-term trend results presented in this report and the main assessment results presented in other NAEP reports are not possible.

Three Decades of Efforts to Improve Student Achievement

1969
First administration of the National Assessment of Educational Progress (NAEP) science assessment

The *First International Science Study* studies science achievement among students from 18 countries

Sesame Street, the children's educational television program, first airs

1970
White House Conference on Children

1971
First administration of the NAEP reading assessment

Pennsylvania State Supreme Court rules that the educational needs of mentally disabled children cannot be ignored

11

1972
Educational Amendments of 1972 institutes Education Division in U.S. Department of Health, Education, and Welfare, and the National Institute of Education

Title IX is enacted to prohibit gender discrimination in educational institutions that receive federal funds

1973
First administration of the NAEP mathematics assessment

Rehabilitation Act prohibits exclusion of otherwise qualified disabled individuals from participation in programs or activities receiving federal financial assistance

1974
Educational Amendments of 1974 establishes the National Center for Education Statistics (NCES)

Equal Educational Opportunities Act provides that no state shall deny equal educational opportunity to an individual based on his or her race, color, sex, or national origin

Women's Educational Equity Act provides programs and materials to encourage full educational opportunities for girls and women

National Trends in Reading, Mathematics, and Science Achievement

Generally, the trends in mathematics and science are characterized by declines in the 1970s, followed by increases during the 1980s and early 1990s, and mostly stable performance since then. Some gains are also evident in reading, but they are modest. Overall improvement across the assessment years is most evident in mathematics. National trends in average reading, mathematics, and science scores are depicted in Figure 1.

Reading Scores

- ***17-year-olds.*** Average scores from 1984 to 1992 were higher than in 1971. The slight increase between 1971 and 1999, however, was not statistically significant.
- ***13-year-olds.*** Average scores increased during the 1970s. Since 1980 scores have fluctuated; however, the average score in 1999 was higher than that in 1971.
- ***9-year-olds.*** Average scores increased during the 1970s. Since 1980 there has been no further improvement in scores; however, the average score in 1999 was higher than that in 1971.

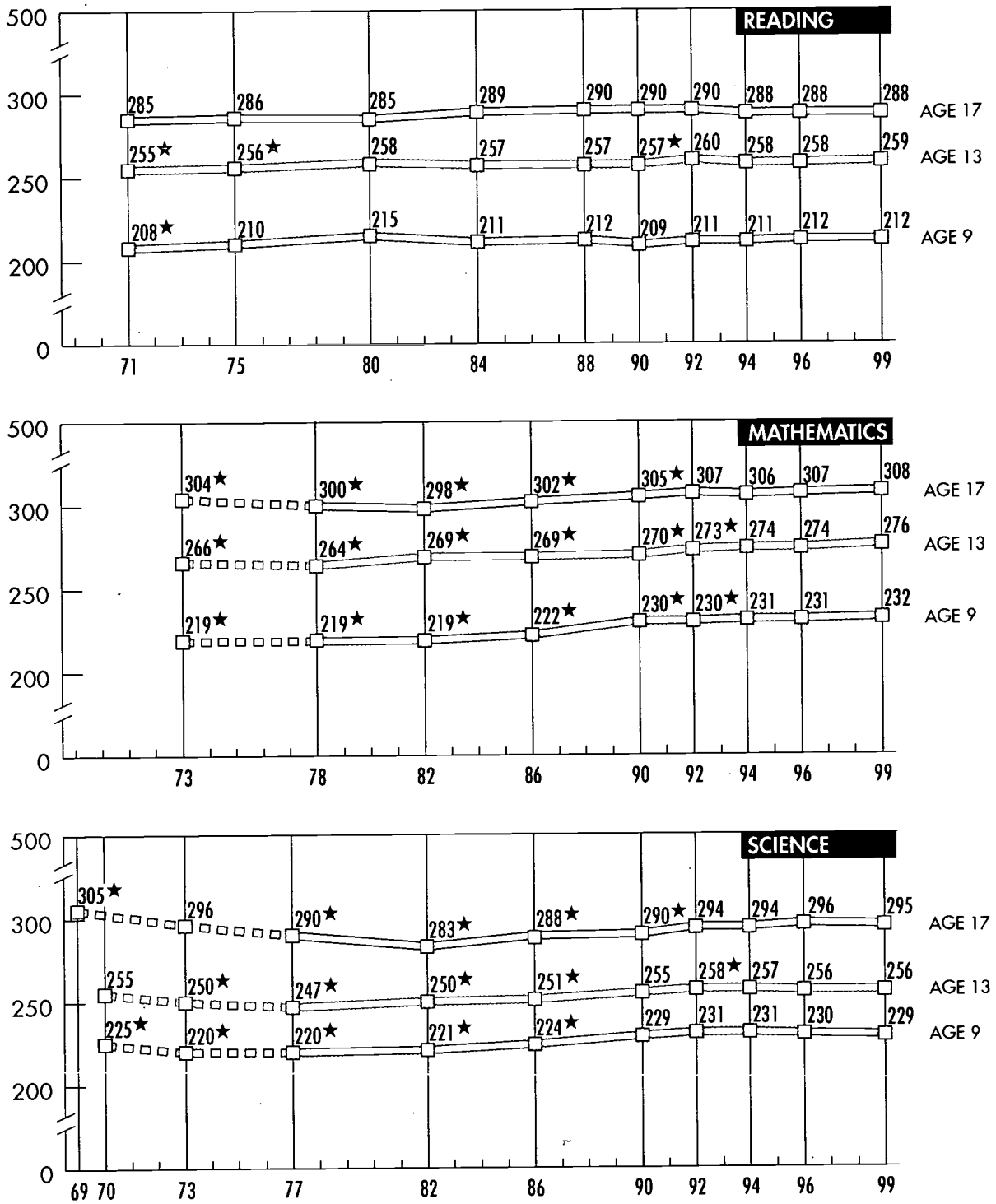
Mathematics Scores

- ***17-year-olds.*** After declining between 1973 and 1982, average scores increased during the 1980s, and more modestly in the 1990s. The average score in 1999 was higher than that in 1973.
- ***13-year-olds.*** An increase in scores between 1978 and 1982, followed by additional increases in the 1990s, resulted in an average score in 1999 that was higher than that in 1973.
- ***9-year-olds.*** After a period of stable performance in the 1970s, average scores increased in the 1980s. Additional modest gains were evident in the 1990s, and the 1999 average score was higher than that in 1973.

Science Scores

- ***17-year-olds.*** After declining between 1969 and 1982, average scores increased until 1992. Although the average score in 1999 was higher than those from 1977 through 1990, it remained lower than the average score in 1969.
- ***13-year-olds.*** After declining between 1970 and 1977, average scores increased until 1992. A slight decline since 1992, however, resulted in an average score in 1999 that was similar to that in 1970.
- ***9-year-olds.*** After declining between 1970 and 1973, average scores remained relatively stable until 1982. Increases between 1982 and 1990, followed by relatively stable performance in the 1990s, resulted in an average score in 1999 that was higher than that in 1970.

Figure 1
Trends in Average Scale Scores for the Nation in Reading, Mathematics, and Science



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

1975
Education for all Handicapped Children Act requires public schools to provide free and appropriate public education in least restrictive environment to all eligible handicapped children

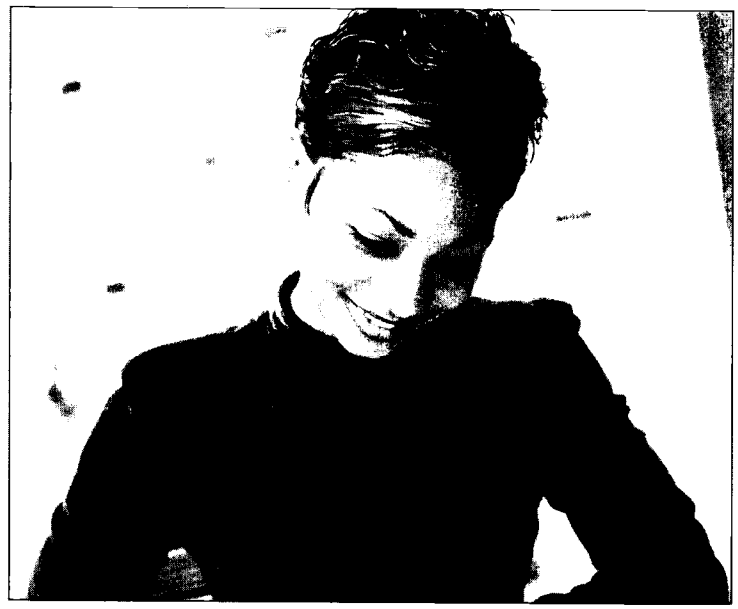
Trends in Average Scores by Quartiles

Examining student performance within different ranges of the score distribution provides some indication of whether or not overall trends in average scores are reflected in trends for lower, middle-, or higher performing students. The summary of results presented here examines trends in the scores attained by students in the lower quartile (lower 25 percent), middle two quartiles (middle 50 percent), and upper quartile (upper 25 percent) of the score distribution. Quartile results are available back to 1971 for reading, 1978 for mathematics, and 1977 for science.

- ***Reading Quartiles***. Among 9-year-olds, the average reading scores of students in each quartile range in 1999 were higher than in 1971. Among 13-year-olds, overall gains are evident mostly for students in the upper quartile and, to a lesser extent, in the middle two quartiles. Among 17-year-olds, overall improvement is evident only among students in the lower quartile.

1977
On Further Examination investigates observable decline in SAT scores over 14 years (Advisory Panel on the Scholastic Aptitude Test Score Decline)

- ***Mathematics Quartiles.*** The overall gains that were seen for each age group in the national average mathematics scores are also evident in each quartile range. For 9-, 13-, and 17-year-olds, the 1999 average score in each quartile range was higher than in 1978.
- ***Science Quartiles.*** Among 9- and 13-year-olds, overall gains in science since 1977 are evident in each quartile range. Among 17-year-olds, scores increased between 1977 and 1999 in the upper and middle two quartiles, but not in the lower quartile.



1979
Department of Education Organization Act establishes cabinet-level U.S. Department of Education

1980
National Education Longitudinal Studies program of NCES begins preparation for *High School and Beyond* survey among national sample of high school sophomores and seniors to examine educational experience in high school

Trends in Average Scores for Racial/Ethnic Subgroups

The racial/ethnic subgroups measured in this assessment were white, black, and Hispanic students. Other racial/ethnic subgroups are not reported, as the samples collected were of insufficient size to analyze and report separately. Results for Hispanic students are not available for the first assessment year in reading (1971) and for the first two assessment years in science (1969/1970 and 1973).

Reading Scores by Race/Ethnicity

- Among white students, gains in average reading scores are mostly evident across the assessment years for 9- and 13-year-olds. Among black and Hispanic students, overall gains are evident at each age.
- In 1999, white students had higher average reading scores than their black and Hispanic peers. The gap between white and black students in reading narrowed between 1971 and 1999 in each age group. Since 1988 it has widened somewhat at ages 13 and 17. The gap between white and Hispanic students narrowed between 1975 and 1999 at age 17 only.

Mathematics Scores by Race/Ethnicity

- Students in each racial/ethnic group and at all three ages showed gains in mathematics scores across the assessment years.
- In 1999, white students had higher average mathematics scores than their black and Hispanic peers. The gap between white and black students in mathematics narrowed between 1973 and 1999 in each age group. Some widening is evident since 1986 at age 13, and since 1990 at age 17. The gap between white and Hispanic 13- and 17-year-olds narrowed between 1973 and 1999, but has widened since 1982 among 9-year-olds.

Science Scores by Race/Ethnicity

- Among white and black students, overall gains in science are evident for 9- and 13-year-olds. Hispanic students at each age show overall gains across the assessment years.
- In 1999, white students had higher average science scores than their black and Hispanic peers. The gap between white and black students in science generally narrowed since 1970 for 9- and 13-year-olds, but not for 17-year-olds. The gap between white and Hispanic students at any age in 1999 was not significantly different from 1977. It has widened somewhat among 13-year-olds since 1992.

1982
Second International Mathematics Study assesses math achievement among students in 13 countries

1983
A Nation at Risk: The Imperative for Educational Reform (National Commission on Excellence in Education)

1984
Education for Economic Security Act supports new science and math programs for elementary, secondary, and post-secondary education

1985
Becoming a Nation of Readers: The Report of the Commission on Reading (National Academy of Education)

Project 2061 is launched by American Association for the Advancement of Science (AAAS) to improve K-12 science, math, and technology education

1986
Students from 17 countries are assessed in *Second International Science Study*

Drug-Free Schools and Communities Act establishes programs for drug abuse education and prevention

1987
The National Board for Professional Teaching Standards is created

1988
NAEP Improvement Act authorizes state NAEP assessments and establishes independent, bipartisan National Assessment Governing Board (NAGB)

The *First International Assessment of Educational Progress* evaluates math and science achievement, educational and cultural factors associated with achievement, and student attitudes among 13-year-olds from 6 countries

National Education Longitudinal Study (NELS:88) begun by NCES to track cohort of eighth graders every two years from 1988 to 1994

Trends in Average Scores for Males and Females

The long-term trend results for male and female students are summarized below.

Reading Scores by Gender

- Among male students, overall gains in reading are evident across the assessment years for 9- and 13-year-olds. Among female students, only 13-year-olds show a significant increase between the first and last assessment year.
- In 1999, female students had higher average reading scores than male students in each age group. Among 9-year-olds, the gap between males and females narrowed between 1971 and 1999.

Mathematics Scores by Gender

- Among male students, 9- and 13-year-olds show overall gains in mathematics between 1973 and 1999. Among female students, overall gains across the years are evident at each age.
- In 1999, the apparent difference between male and female students' average mathematics scores was not significant at any age. Among 17-year-olds, the score gap that had favored male students in the 1970s ultimately disappeared, and by 1999 the difference was no longer statistically significant.

Science Scores by Gender

- Among male and female students, score declines in the 1970s and early 1980s have reversed, and scores generally increased during the 1980s and early 1990s; however, the 1999 average score of 17-year-olds in both groups remained lower than in 1969. For female 9-year-olds, score gains resulted in a 1999 average score that was higher than that in 1970.
- In 1999, males outperformed females in science at ages 13 and 17, but the average score for male students was not significantly higher than that of female students at age 9. Among 17-year-olds, the score gap between males and females has narrowed since 1969.

Trends in Average Scores by Parental Education Level

Students in the long-term trend assessments are asked to identify the highest level of education attained by each of their parents. The highest education level of either parent, as reported by students, is used in these analyses. In each subject area and each age group, students who reported higher parental education levels tended to have higher average scores. Results by parental education level are available back to 1971 in reading, 1978 in mathematics, and 1977 in science. Trends in average scores for students who indicated different levels of parental education are summarized on the following page. It should be noted that 9-year-olds' reports of their parents' education levels may not be as reliable as those of older students. As such, results for 9-year-olds are not included in this executive summary.

Reading Scores by Parental Education

- Among students with at least one parent who pursued education after high school, average reading scores in 1999 were lower than in 1971 for 17-year-olds.
- Among students whose parents' highest level of education was high school graduation, overall declines in performance are evident at ages 13 and 17.
- Among students whose parents did not graduate from high school, scores in 1999 were similar to those in 1971 at age 13, and the apparent increase at age 17 was not statistically significant.

Mathematics Scores by Parental Education

- Among students at the highest level of parental education—college graduation—scores in 1999 were similar to those in 1978 at ages 13 and 17.
- Among students whose parents' highest education level was some education after high school, 13-year-olds show overall gains across the assessment years.
- Among students whose parents did not go beyond high school graduation, score increases across the years are evident for 17-year-olds.
- Among students whose parents did not complete high school, overall gains in mathematics are evident at ages 13 and 17.

Science Scores by Parental Education

- Among students who reported that at least one parent had graduated from college, scores have increased since 1982 for 13- and 17-year-olds; however, 1999 and 1977 scores were similar at both ages.
- Among students whose parents' highest level of education was some education after high school, scores have increased since 1982 for 17-year-olds; however, 1999 and 1977 scores were similar for both 13- and 17-year-olds.
- Among students whose parents did not go beyond high school graduation, scores have increased for 17-year-olds since 1982; however, the apparent difference between 1977 and 1999 at ages 13 and 17 was not statistically significant.
- Among students whose parents did not finish high school, 1999 and 1977 scores were similar at age 17, and the apparent increase at age 13 was not statistically significant.

1989

The President and governors set national education goals at First National Summit on Education

Curriculum and Evaluation Standards for School Mathematics (NCTM)

Science for All Americans outlines standards of basic science, math, and technological literacy (Project 2061 of AAAS)

1990

First administration of NAEP state-by-state assessments

Formation of the National Educational Goals Panel

The *Excellence in Mathematics, Science, and Engineering Act* promotes excellence in American math, science, and engineering education

Educating America: State Strategies for Achieving the National Education Goals (National Governors Association)

1991

NAGB sets first achievement levels for NAEP mathematics assessment

America 2000 plan is announced by the President

Professional Standards for Teaching Mathematics (NCTM)

National Literacy Act establishes National Institute for Literacy, National Institute Board, and Interagency Task Force on Literacy

The *Second International Assessment of Educational Progress* evaluates math and science skills of 9- and 13-year-olds from 20 countries

1992
Raising Standards for American Education (National Education Goals Panel)

1993
Benchmarks for Science Literacy specifies learning goals (Project 2061 of AAAS)

National and Community Service Trust Act creates AmeriCorps and the Corporation for National Service to expand opportunities for Americans to serve their communities

1994
GOALS 2000: Educate America Act establishes national education goals for year 2000 and encourages development of state standards

Improving America's Schools Act reauthorizes Title I federal aid for students in low-income schools and encourages state standards

Trends in Average Scores by Type of School

The NAEP long-term trend assessment has examined public and nonpublic school students' performance separately since 1980 in reading, 1978 in mathematics, and 1977 in science. In 1999, nonpublic school students outperformed their public school peers in each subject area and at each age. Trends in the performance of both groups of students are summarized below.

Reading Scores by Type of School

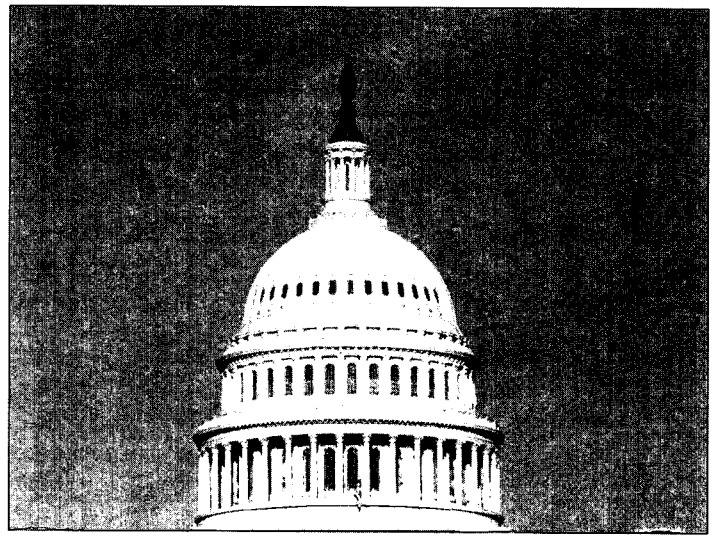
- Among public school students, the average reading score of 9-year-olds was lower in 1999 than in 1980.
- Among nonpublic school students, apparent increases between 1980 and 1999 at ages 13 and 17 were not statistically significant. At age 9, 1980 and 1999 average scores were similar.

Mathematics Scores by Type of School

- Among public school students, overall gains in mathematics are evident for 9-, 13-, and 17-year-olds since 1978.
- Among nonpublic school students, overall gains are evident at ages 9 and 13; however, the apparent increase at age 17 was not statistically significant.

Science Scores by Type of School

- Among public school students, overall gains in science are evident for 9-, 13-, and 17-year-olds since 1977.
- Among nonpublic school students, the apparent slight increase between 1977 and 1999 average scores at each age was not statistically significant.



Trends in School and Home Experiences

Students in the NAEP long-term trend assessment are asked several questions about school and home experiences considered to be related to achievement. Trends in students' responses to some of the questions are summarized below.

Course-Taking Patterns

- A greater percentage of 13-year-olds was taking prealgebra or algebra, and a smaller percentage was taking regular math in 1999 than in 1986.
- A greater percentage of 17-year-olds had taken precalculus/calculus and algebra II in 1999 than in 1978.
  - Similar increases in advanced mathematics course-taking were seen for male and female 17-year-olds.
  - A greater percentage of black and Hispanic 17-year-olds, as well as white students, were taking algebra II in 1999 than in 1978; however, only white students showed a significant increase in the percentage taking precalculus/calculus.
- A greater percentage of 13-year-olds in 1999 than in 1986 reported that the content of their science class was general, rather than focused on earth, physical, or life science.
- Science course-taking among 17-year-olds increased between 1986 and 1999 at all levels of course work—general science, biology, chemistry, and physics.
  - A greater percentage of male and female 17-year-olds had taken biology and chemistry in 1999 than in 1986.
  - The percentage of white 17-year-olds taking courses at each level of science course work increased between 1986 and 1999. The percentage of black and Hispanic 17-year-olds taking chemistry, and the percentage of blacks taking biology, also increased.

Technology and Scientific Equipment in the Classroom

- A greater percentage of 13- and 17-year-olds in 1999 than in 1978 had access to a computer to learn mathematics, studied mathematics through computer instruction, and used a computer to solve mathematics problems.
- A greater percentage of 9-year-olds in 1999 than in 1977 used the following equipment while learning science: meter stick, telescope, thermometer, compass, balance, and stopwatch.

1995

National Science Education Standards (National Research Council)

Third International Mathematics and Science Study (TIMSS) is administered to fourth-, eighth-, and twelfth-grade students in 41 countries

1996

America Reads Challenge increases tutors and mentors available to young children to foster reading achievement

What Matters Most: Teaching for America's Future (National Commission on Teaching and America's Future)

National Science Education Standards (National Research Council)

Standards for the English Language Arts (National Council of Teachers of English and International Reading Association)

1997

Amendments to the Individuals with Disabilities Education Act (IDEA) requires the inclusion of nearly all students with disabilities in educational reform initiatives

The President proposes voluntary national tests, based on NAEP, in fourth-grade reading and eighth-grade mathematics

1998

Reading Excellence Act (REA) is enacted to advance childhood literacy

National Reading Summit is hosted by U.S. Department of Education to focus on the urgent need to increase child literacy in America

Homework

- Homework was more likely to be assigned in 1999 than in 1984 for 9-year-olds, and more likely to be assigned in 1999 than in 1980 for 13- and 17-year-olds. The amount of time students spend doing homework each day, however, has not changed significantly.
- A greater percentage of 9- and 13-year-olds read more than 20 pages each day for school or for homework in 1999 than in 1984. There was no significant change, however, in the pages read per day by 17-year-olds.
- A greater percentage of 17-year-olds said they do homework in mathematics classes often in 1999 than in 1978.

Home Experiences

- The number of different types of reading materials in the home has decreased at all three ages between 1971 and 1999.
- A smaller percentage of 13- and 17-year-olds read for fun daily in 1999 than in 1984. There was no significant change in frequency of reading for fun among 9-year-olds.
- A smaller percentage of 17-year-olds saw adults reading in their homes in 1999 than in 1984.
- A greater percentage of 17-year-olds were watching three or more hours of television each day in 1999 than in 1978. A smaller percentage of 9- and 13-year-olds were watching six or more hours of television each day in 1999 than in 1978.

INTRODUCTION

INTRODUCTION

Our progress as a nation can be no swifter than our progress in education.

—John Fitzgerald Kennedy

As a nation, Americans have long valued education as a foundation for democracy, a resource for economic prosperity, and a means of realizing personal goals and individual potential. Throughout the nation's history, the commitment to educate children has grown stronger, and expectations for the next generation's accomplishments exceed those of the past. The end of a century evokes a sense of reflection and a desire to evaluate achievements. It is an opportune moment to pause and consider the progress that has been made in meeting the nation's educational goals.

The National Assessment of Educational Progress (NAEP) is one of the most important resources for monitoring the outcomes of America's education system. Since 1969, NAEP has conducted ongoing nationwide assessments of student achievement in various subject areas. One of NAEP's primary objectives is to track trends in student performance over time. This report presents the results of NAEP's long-term trend assessments in reading, mathematics, and science that were administered in 1999 to students aged 9, 13, and 17. Because these same assessments have been administered at different times during NAEP's 30-year history, it is possible to chart educational progress back to 1969 in science, 1971 in reading, and 1973 in mathematics. Although long-term trend writing assessments have also been administered since 1984, the results from these assessments are undergoing evaluation.

The three decades of student performance examined in this report were marked by an intense interest in the academic achievement of our nation's children. Prior to the first NAEP assessment, the public's concern for education had already been galvanized in the 1950s by such events as the Soviet Union's launching of Sputnik and the publication of *Why Johnny Can't Read.*[1] In addition, the civil rights movement in the 1960s questioned the equity of America's education system, and the advent of a "baby boom" generation entering school challenged its capacity.

By the 1970s, Americans' concern over dropping test scores brought about a back-to-basics movement and a call for students to demonstrate at least minimum competency in core subject areas. In the early 1980s, with the publication of *A Nation at Risk*,[2] emphasis was placed on achieving excellence in education and on raising learning expectations beyond a minimal level of performance. At the beginning of the 1990s, the nation's commitment to

student achievement was most evident in the establishment of specific and challenging national goals by the President and the nation's governors. A National Education Goals Panel was formed, and a standards-based reform movement was ignited that, by 1999, resulted in 40 states having adopted statewide standards in English, mathematics, science, and social studies.[3]

The concerted efforts of parents, educators, and policy makers during the last several decades to improve student achievement underscore the relevance of the NAEP long-term trend assessment results presented in this report. As attention turns to student achievement in the twenty-first century, the performance of students in the past and in the present can inform efforts to increase student performance in the future.

NAEP's Long-Term Trend Assessments

The National Assessment of Educational Progress is a project of the National Center for Education Statistics within the U.S. Department of Education. The National Assessment Governing Board (NAGB), an independent bipartisan body, provides policy direction for NAEP. Since its inception in 1969, NAEP has served the important function of measuring our nation's educational progress by regularly administering various subject-area assessments to nationally representative samples of students. The NAEP long-term trend assessments in reading, mathematics, and science that were first administered around 1970 are different from more recently developed assessments in the same subject areas, referred to as NAEP's main assessments.

The existence of the two national assessment programs—long-term trend and main—makes it possible for NAEP to meet two important objectives. First, in order to measure student progress over time, it is necessary to use the same assessment instrument in each administration year. Second, as educational priorities change, it is also necessary to develop new assessment instruments periodically that reflect current educational content and assessment methodology. The long-term trend assessments have remained substantially the same since their first administration, and thus make it possible to meet the first objective of measuring progress over time. NAEP's main assessments are periodically revised or updated to remain current and to meet the second objective of addressing contemporary educational priorities. For example, while the long-term trend reading assessment dates back to 1971, the current main reading assessment recently administered in 1998 was first administered in 1992.[4]

The results presented in this report are based solely on the most recent administration of NAEP's long-term trend reading, mathematics, and science assessments in 1999. Because the long-term trend assessments use different instruments from those used in the main assessments, and because students are sampled by age for the long-term trend assessments rather than by grade as in the main assessments, it is not possible to compare results from the two assessment programs. A brief description of the long-term trend instruments is provided below. (More detailed information about the instruments and methodology is provided in Appendix A.)

The Long-Term Trend Reading Assessment

The NAEP long-term trend reading assessment contains a range of reading materials, from simple narrative passages to complex articles on specialized topics.[5] The selections include stories, poems, essays, reports, and passages from textbooks, as well as a sample train schedule, telephone bill, and advertisements. Students' comprehension of these materials is assessed with both multiple-choice questions and constructed-response questions, in which students are asked to provide a written response.

The Long-Term Trend Mathematics Assessment

The long-term trend mathematics assessment measures students' knowledge of basic facts, ability to carry out numerical algorithms using paper and pencil, knowledge of basic measurement formulas as they are applied in geometric settings, and the ability to apply mathematics to daily-living skills (such as those related to time and money). The

computational focus of the long-term trend assessment provides a unique opportunity to determine how our students are measuring up to traditional procedural skills, even as the calculator plays an increasingly greater role in today's mathematics curriculum. Calculators are permitted for a few questions on the long-term assessment, but most questions are multiple-choice and are completed without the use of a calculator.

The Long-Term Trend Science Assessment

The long-term trend assessment in science contains a content dimension and a cognitive dimension.[6] The content dimension assesses students' knowledge of life science, physical science, and earth and space science. The cognitive dimension assesses students' ability to conduct inquiries, solve problems, and know science. The assessment also measures students' understanding of the nature of science within the context of both the content and cognitive dimensions. The long-term trend assessment uses only multiple-choice questions to assess what students know and can do in science.

The Long-Term Trend Background Questionnaires

In addition to assessing students' progress in reading, mathematics, and science, the NAEP long-term trend assessments included questions about students' home and school experiences that are thought to be related to educational achievement. For example, students are asked about the courses they have taken, activities in their classrooms, the amount of time they spend on homework, and educationally relevant uses of their time out of school. Their responses to these questions provide an informative context for interpreting the assessment results.

The Student Sample

The NAEP long-term trend assessments measure the progress of students in three age groups—9, 13, and 17. Because the NAEP assessments measure the achievement of students nationally and do not provide a measure of individual student performance, not every student in the nation is assessed. Rather, a nationally representative sample of students is selected so that the achievement of groups and subgroups of students can be assessed and reported. In each assessment year, a small percentage of students are excluded if it is determined by their schools that they cannot be meaningfully assessed without accommodations. (See Appendix A for information regarding exclusion criteria and exclusion rates.) This report contains results representing the performance of all 9-, 13-, and 17-year-olds in the nation who are capable of being meaningfully assessed without accommodations for disability or limited English proficiency. In addition, the performance of subgroups of students, such as males and females, in each age group is described. In 1999, over 15,000 students were assessed in each subject area, including both public and nonpublic school students. (See Appendix A for more information on sampling procedures.)

Analysis of Student Performance

Students' performance on the long-term trend assessments is summarized on a 0-to-500 scale for each subject area. For each year in which the assessments were administered, achievement in a particular subject area is described by the average scale score for a group or subgroup of students. Trends in student achievement are determined by examining and comparing the average scale scores attained by students across the assessment years.

In addition to reporting average scores, student performance is described in terms of the percentages of students attaining specific levels of performance. These performance levels correspond to five points on the reading, mathematics, and science scales—150, 200, 250, 300, and 350. For each subject area, the performance levels from lowest to highest are associated with increasingly more advanced skills and knowledge. Examining the percentages of students in each year who attained each performance level provides additional insight into student achievement.

Because the results presented in this report are based on a sample of students, they are considered estimates of all students' average performance (excluding students who would require accommodations to be meaningfully assessed). As such, the results are subject to a degree of uncertainty, which is reflected in the standard errors of the estimates. The standard errors for all of the scale scores and percentages presented in this report are provided in Appendix B. Statistical tests that take into account these standard errors were conducted to determine whether the changes or differences that seem apparent in the results are statistically significant. The term "significant" does not imply a judgment about the absolute magnitude or educational relevance of changes in student performance. Rather, it is used to indicate that the observed changes are not likely to be due to chance factors associated with sampling and measurement error. Throughout this report, changes across time in student performance or differences between student subgroups are discussed only if they are statistically significant, unless otherwise noted. In addition, descriptions of student performance as generally increasing or decreasing over time are based on analyses of linear and quadratic trends. (See Appendix A for additional information on analysis procedures.)

This Report

This report describes trends in 9-, 13-, and 17-year-olds' achievement in reading, mathematics, and science during the last three decades. Chapter 1 presents overall scale score and performance level trends for the nation. Chapter 2 examines trends in average scale scores for subgroups of students by race/ethnicity, gender, parental education level, and type of school (public and nonpublic). In Chapter 3, the focus shifts to results from the NAEP long-term trend background questionnaires. In this chapter, students' school and home experiences, as portrayed in their responses to the background questions, are examined in relation to students' assessment scores.

Interpreting the Long-Term Trend Results

The reader is cautioned against using the long-term trend results in this report to make simple causal inferences related to student performance, to the relative effectiveness of public and nonpublic schools, or to other educational variables discussed in this report. Differences in student performance may reflect a range of socioeconomic and educational factors not discussed in this report. For example, differences between public and nonpublic schools may be better understood by considering such factors as composition of the student body and parental involvement.

Note:

Additional data from the 1999 long-term trend assessments not included in this report, and other NAEP assessment reports and data, are available on the Internet at *http://nces.ed.gov/nationsreportcard*

Endnotes for Introduction

1 Flesch, R. (1985). *Why Johnny can't read and what you can do about it*. New York, NY: Harper & Row Publishers. (Originally published by Harper & Brothers in 1955.)

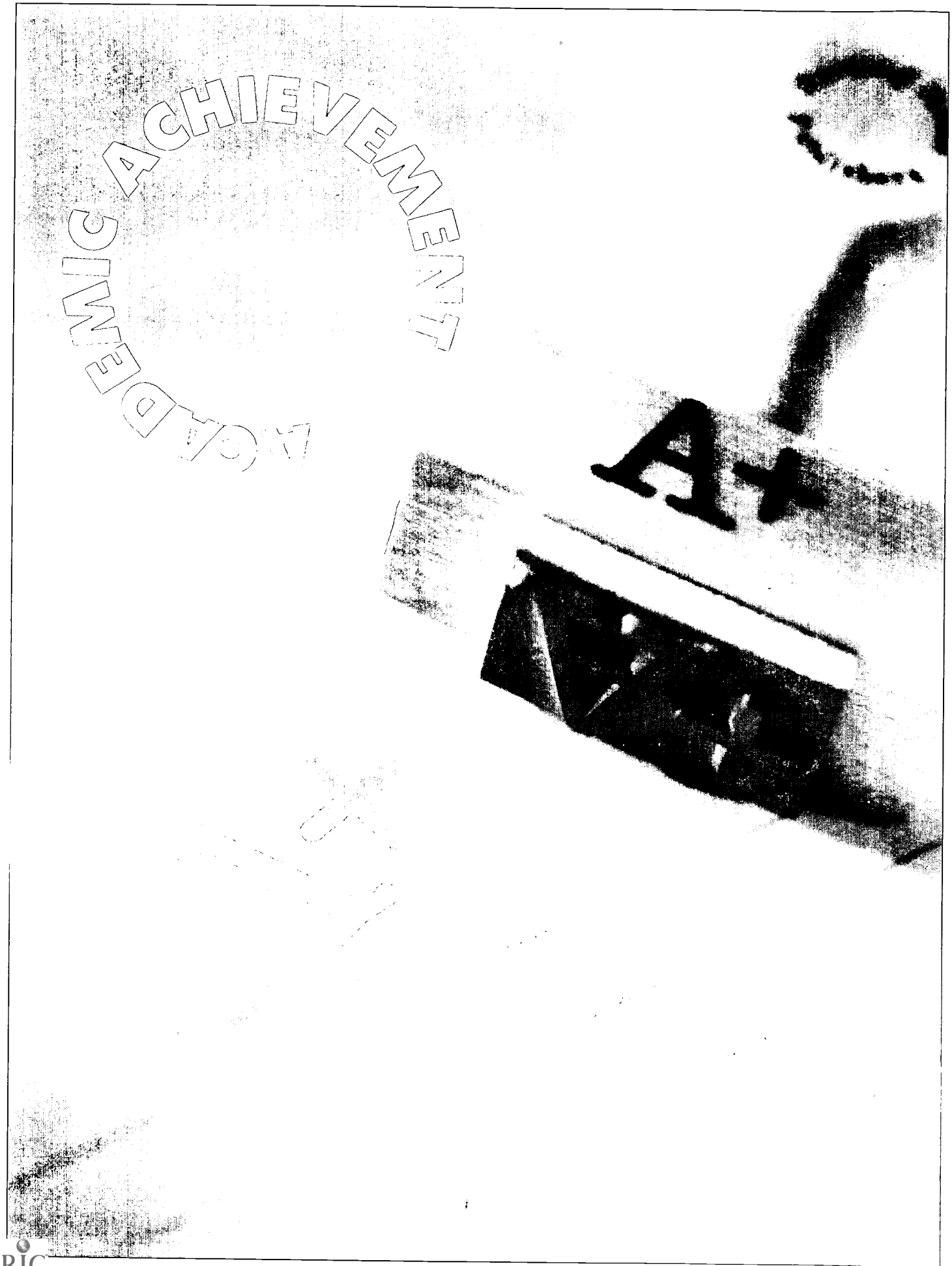
2 National Commission on Excellence in Education. (1983). *A nation at risk: The report of the national commission on excellence in education*. Washington, DC: U.S. Department of Education.

3 National Education Goals Panel. (1999). *The national education goals report: Building a nation of learners, 1999*. Washington, DC: U.S. Government Printing Office.

4 Donahue, P. D., Voelkl, K. R., Campbell, J. R., & Mazzeo, J. (1999). *NAEP's 1998 reading report card for the nation and the states*. National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

5 *Reading objectives, 1983–84*. (1985). Princeton, NJ: Educational Testing Service.

6 *Science objectives, 1985–86*. (1986). Princeton, NJ: Educational Testing Service.


ACADEMIC ACHIEVEMENT
A+

CHAPTER 1

NATIONAL TRENDS IN ACADEMIC ACHIEVEMENT

For over 30 years, documenting trends in the academic achievement of America's students has been one of the primary goals of the National Assessment of Educational Progress (NAEP). The reading, mathematics, and science long-term trend assessments have been administered and reported on many times during the last three decades. Past reports have shown moderate gains in some subject areas, and declines in others. At the turn of the century, we are at a unique vantage point for examining the progress being made by the nation's students. From this vantage point, the results presented in this chapter on national trends in 9-, 13-, and 17-year-olds' academic achievement may be viewed as an educational profile of America's past and present—and as a starting point for its future.

The trend lines for each subject area in the NAEP long-term trend assessment begin in different years, depending on the first year in which that subject-area assessment was administered. In addition, the three subject-area assessments were administered in different years until the 1990s and were not all administered the same number of times. There have been 10 administrations of the reading assessment since 1971, 9 administrations of the mathematics assessment since 1973, and 10 administrations of the science assessment since 1970 (for 9- and 13-year-olds) or 1969 (for 17-year-olds). Results from the seven administrations of the long-term trend writing assessment since 1984 are undergoing evaluation.

On the following pages, line graphs are provided to depict the progress being made by students in the three subject areas. Student performance in each subject area is summarized as an average score on a 0-to-500 scale. For each year in which the assessment was administered, the average scale score attained by students in that year is indicated on the graph. The average scores for years prior to 1999 are highlighted with a star (★) when that score is significantly higher or lower than the average score in 1999. Throughout this chapter, differences between years or overall trends are discussed only if they are statistically significant. (See Appendix A for information on the statistical tests conducted.)

National Trends in Reading, Mathematics, and Science

The trend lines displayed in Figure 1.1 represent the average national performance of 9-, 13-, and 17-year-olds in reading, mathematics, and science across the 30-year period in which long-term trend assessments have been conducted. Results from the first two assessment years in science, and the first assessment year in mathematics, are extrapolated from previous analyses of NAEP data. They are represented by dashed lines on the graphs. (See Appendix A for information regarding extrapolated data.) The trends depicted here show some gains in student achievement during the three decades, although there are inconsistencies across the subject areas. Furthermore, no significant changes in national average scores are evident in any subject since 1994. It should be noted, however, that significant changes in the average performance of an entire population are more likely to occur over more extended time periods.

Generally, the trends in mathematics and science are characterized by declines in the 1970s, followed by increases during the 1980s and early 1990s, and mostly stable performance since that time. In mathematics, students in each age group were scoring higher on average in 1999 than in the first assessment year, 1973. In science, however, only 9-year-olds had attained an average science score in 1999 that exceeded the first year's. Some gains are also evident in the reading trend lines. Nine- and 13-year-olds' reading scores in 1999 were higher, on average, than in 1971; however, the modest improvement in 17-year-olds' reading performance that was evident from the mid-1980s through the early 1990s did not continue through the remainder of the decade. The following sections provide a more detailed description of trends in each subject area.

Trends in Reading Scores

For both 9- and 13-year-olds, average scores in reading increased during the 1970s, so that by 1980, average scores for both age groups were higher than in 1971. Since that time, however, no further improvements in average reading scores have been evident. For 9-year-olds, the average score fell four points in 1984 and has shown little subsequent change. For 13-year-olds, average scores since 1980 have shown no consistent pattern, fluctuating within a three-point range. Although neither group has shown steady progress during the last two decades, the average scores of 9- and 13-year-olds in 1999 remained higher than those in 1971.

For 17-year-olds, average scores from 1984 to 1992 were higher than the average score in 1971. In the last three assessments since 1994, however, these gains have not been maintained. The apparent slight increase between 1971 and 1999 was not statistically significant.

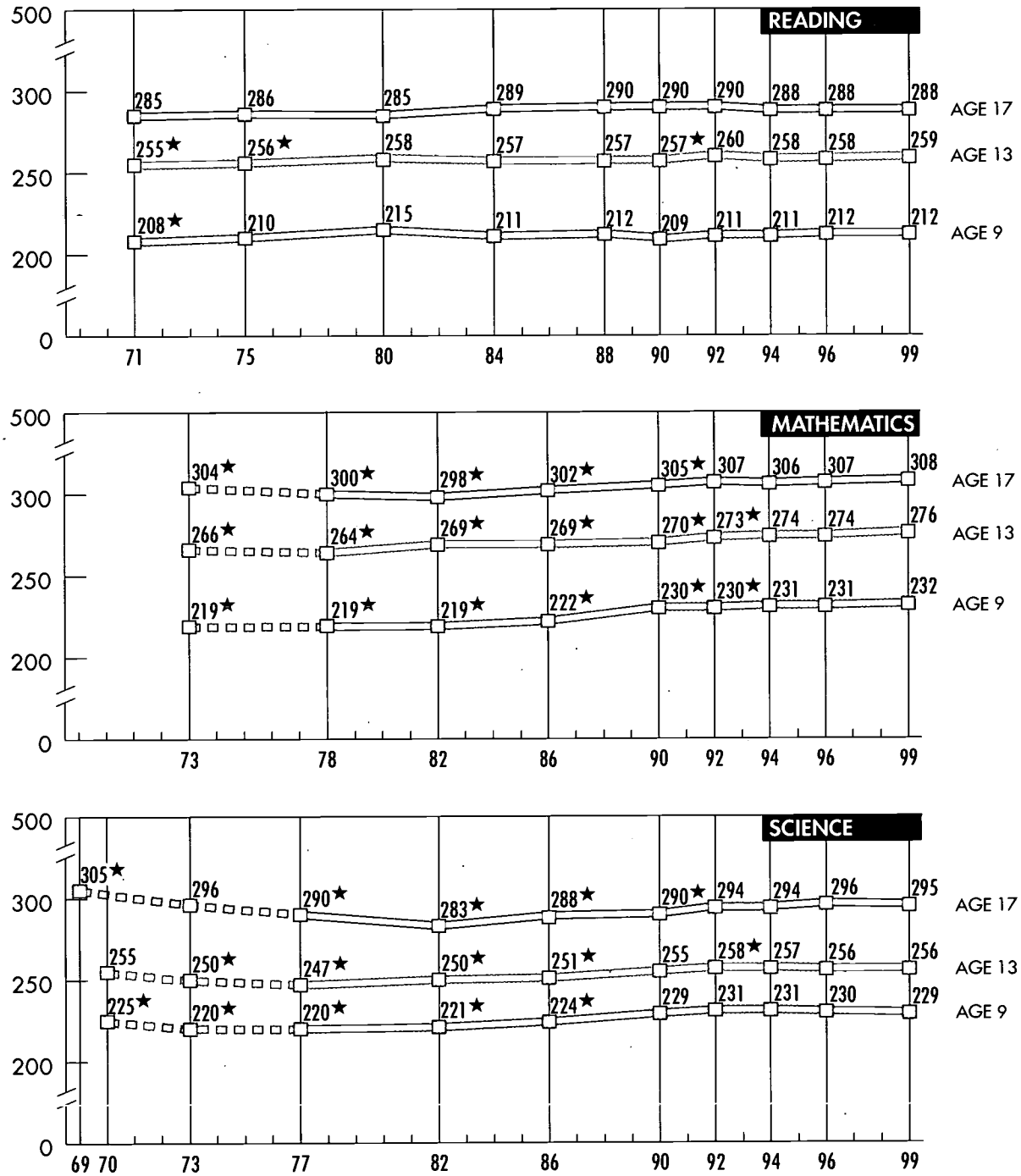
Trends in Mathematics Scores

In mathematics, positive trends in the assessment results are evident for all three age groups. For 9-year-olds, a period of stable performance during the 1970s was followed by an 11-point increase in average scores from 1982 to 1990, most of which occurred between 1986 and 1990. Since 1990, some additional modest increases have been evident. As a result, the average score of 9-year-olds in 1999 was 2 points higher than in 1990 and 13 points higher than average scores from 1973 to 1982.

For 13-year-olds, an increase in average scores between 1978 and 1982, followed by additional increases during the 1990s, has resulted in a pattern of overall progress. The average score in 1999 was 6 points higher than it was at the beginning of the decade and 10 points higher than it was in 1973, when the trend line began.

The average score of 17-year-olds declined between 1973 and 1982. Since that time, however, a 10-point gain in average scores is evident, most of which occurred between 1982 and 1992. Because average scores have remained at or about their 1992 level, the average mathematics score of 17-year-olds in 1999 was higher than it was in 1973.

Figure 1.1
Trends in Average Scale Scores for the Nation in Reading, Mathematics, and Science



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Science Scores

For 9-year-olds, science scores declined between 1970 and 1973, then remained stable through 1982. Average scores rose 10 points between 1982 and 1992, but the trend line has stabilized in more recent assessments. As a result, the average score of 9-year-olds is four points higher than it was at the beginning of the trend line, but similar to that at the beginning of the decade.

The average science score for 13-year-olds declined by eight points from 1970 to 1977. The period from 1982 to 1992 was one of relatively steady increases, resulting in a total increase of 11 points between 1977 and 1992. A slight decline since 1992, however, resulted in a 1999 average score that was similar to that in 1970.

Results for 17-year-olds show an initial 22-point decline extending over a 12-year period. In the decade from 1982 to 1992, increases in average scores erased about half of that decline. Since 1992, the average science scores of 17-year olds have remained essentially unchanged. On average, 17-year-olds in 1999 had higher science scores than their counterparts in 1990. However, the average science scores of 17-year-olds in this most recent trend assessment remain 10 points lower than they were when the trend line was initiated.

National Trends by Quartiles

In addition to examining trends in scores representing the average performance of all students during the last three decades, it is informative to examine trends in the performance of lower, middle-, and upper performing students. This section provides such information by examining the average scores of students who were in the lower quartile (lower 25 percent), middle two quartiles (middle 50 percent), and upper quartile (upper 25 percent) of the score distribution in each year. Examining student performance in this manner provides some indication of whether or not the overall trends in average scores are reflected in trends for students within all ranges, or whether they were concentrated in specific ranges of the performance distribution.

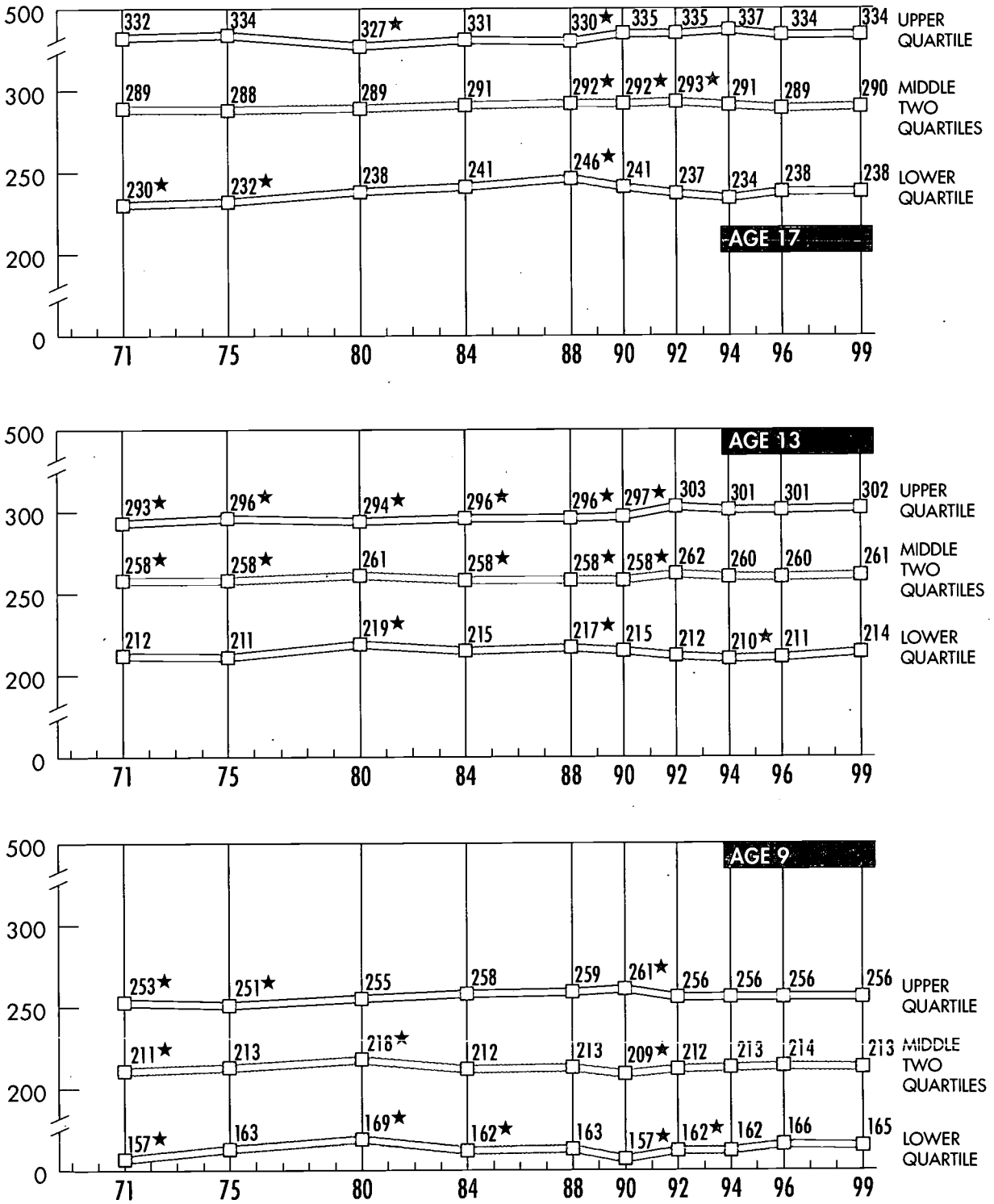
Trends in Reading Scores by Quartile

In Figure 1.2, trends in average reading scores for 9-, 13-, and 17-year-old students in the three performance ranges are displayed. At age 9, the average scores of students in each performance range in 1999 were higher than those in 1971. At age 13, overall gains are evident in the upper quartile and, to a lesser extent, in the middle two quartiles. The apparent slight increase in the lower quartile was not statistically significant. At age 17, overall improvement is evident only among the lower performing students. Seventeen-year-olds in the middle two and upper quartiles had average scores in 1999 that were similar to those in 1971. A more detailed examination of the trends in each age group follows.

Among 9-year-olds, a slightly different pattern is seen for students in the middle two and lower quartiles than is evident at the upper quartile. For the lower and middle-performing students, score increases in the 1970s were followed by declines in the 1980s. Since that time, however, their average reading scores have increased so that their 1999 average scores were higher than those in 1990, and once again were higher than scores in 1971. Nine-year-olds in the upper quartile showed a 10-point score gain between 1975 and 1990. Their average score declined in 1992 and remained the same since that time; however, their 1999 average score was higher than that in 1971.

Among 13-year-olds, overall gains are evident for students in the upper quartile. Their average reading score in 1999 was higher than that of their counterparts from 1971 through 1990. This overall improvement was mostly the result of a six-point increase between 1990 and 1992. Despite some fluctuation, modest improvement overall is evident for 13-year-olds in the middle two quartiles. Since a four-point increase between 1990 and 1992, their average scores have fluctuated, but remained higher than the 1971 average. In the lower quartile, an eight-point increase between 1975 and 1980 led to higher average scores throughout the 1980s. This higher performance was not maintained in the 1990s, however, and the apparent slight difference between 1971 and 1999 was not statistically significant.

Figure 1.2
Trends in Average Reading Scale Scores by Quartile



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Among 17-year-olds, only students in the lower quartile had a 1999 average reading score that was higher than that in 1971. However, their performance had been even higher in 1988, after increasing 16 points between 1971 and 1988. In the middle two quartiles, 17-year-olds' average scores increased modestly until 1992, but have declined since that time. The average scores of students in the upper quartile fluctuated during the 1970s and 1980s. Although their average scores in the early 1990s were higher than that in 1971, by 1999 their average score had returned to a level similar to that in the first assessment year.

Trends in Mathematics Scores by Quartile

Trends in mathematics scores for students within different performance ranges are displayed in Figure 1.3. Note that these trends are not available back to 1973 since only the overall average scores were extrapolated for earlier years. The overall gains that were seen for each age group in average mathematics scores are also evident in each performance range. Students in each age group and each quartile range had average scores in 1999 that were higher than those in 1978. In addition, 9- and 13-year-olds in the middle two and upper quartiles scored higher, on average, than their counterparts from 1978 through 1992. Among 13-year-olds, students in the upper quartile made gains between 1996 and 1999, resulting in the highest average score of any year. And at age 17, students in each performance range attained an average score in 1999 that was higher than scores from 1978 through 1990. The trends for each age group are described in more detail below.

At age 9, average mathematics scores for each quartile range showed gains between 1982 and 1990, increasing 10 points in the upper and middle two quartiles, and 12 points in the lower quartile. In the lower quartile, performance has remained essentially the same since that time. In the middle two and upper quartiles, performance increased slightly since 1990, and the average scores of students in these quartile ranges were higher in the most recent assessment than in 1990 and 1992.

At age 13, gains are most notable for students in the lower quartile between 1978 and 1982, when the average mathematics score increased nine points. Since that time, some additional increase is evident for students in the lower quartile. Gains across the assessment years are evident for students in the middle two quartiles, resulting in a pattern of overall growth. Thirteen-year-olds in the upper quartile showed little change in performance until the early 1990s, when their average scores increased. Their most recent gain between 1996 and 1999 resulted in an average score that was higher than that in any previous assessment year since 1978.

At age 17, average mathematics scores declined in the middle two and upper quartiles, and remain unchanged in the lower quartile between 1978 and 1982, but then rose in the 1980s and early 1990s. Although students' performance in each quartile range has fluctuated or increased only slightly in the 1990s, their average scores in 1999 were higher than those for students from 1978 through 1990.

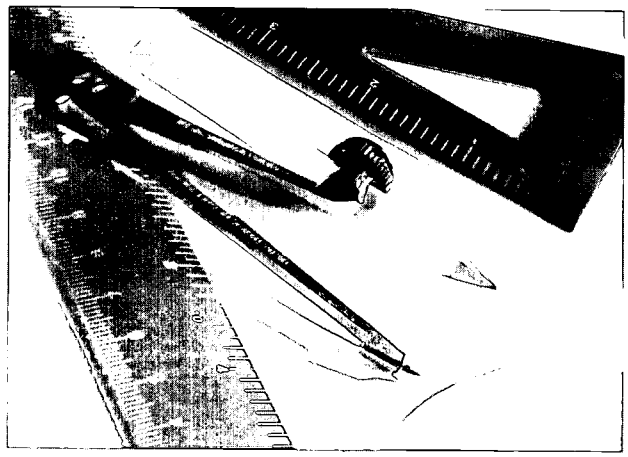
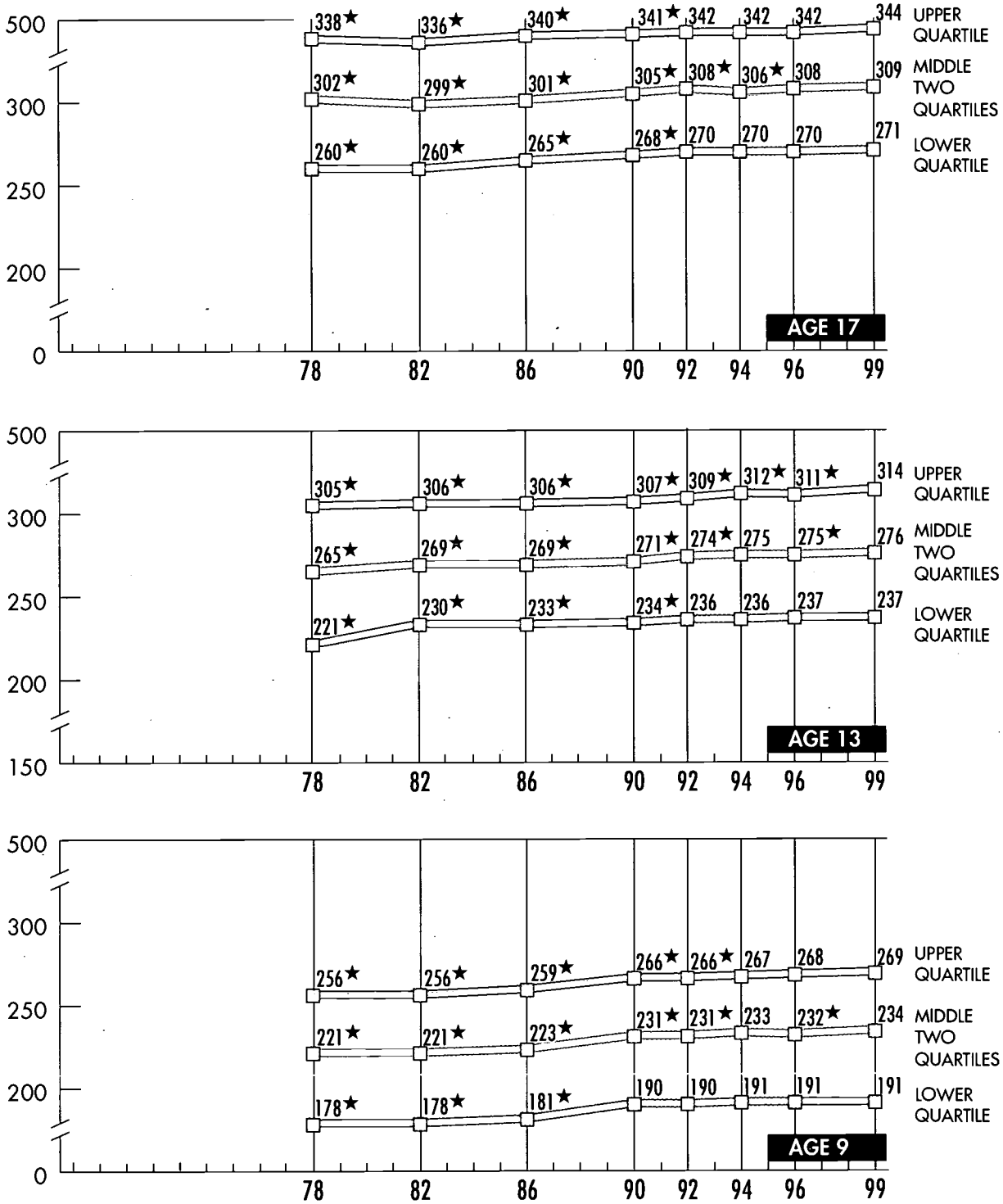


Figure 1.3
Trends in Average Mathematics Scale Scores by Quartile



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Science Scores by Quartile

The trend lines displayed in Figure 1.4 show how the average science scores of students in each quartile range have changed since 1977. Note that these trends are not available back to 1970 or 1969, since only the overall average scores were extrapolated for earlier years. For 9- and 13-year-olds, increases in performance were seen for students in each quartile range from 1977 until the early 1990s. Since that time, scores have fluctuated nonsignificantly or decreased somewhat within most performance ranges. Among 17-year-olds, early declines in each quartile range between 1977 and 1982 were followed by some improvement, particularly for students in the upper quartile. The trends for each age group are described in more detail below.

At age 9, the notable gains in average science scores for lower and middle-performing students came between 1982 and 1990—a 9-point increase in the middle two quartiles and an 11-point increase in the lower quartile. This pattern of improvement did not continue into the 1990s; however, average scores in 1999 remained higher than those from 1977 to 1986. Students in the upper quartile showed modest but steady gains across the assessment years until 1996. Despite a four-point decrease between the last two assessments, the 1999 average score for students in the upper quartile remained higher than that in 1977.

At age 13, average scores increased for students in each quartile between 1977 and 1992. Since that time, their scores have fluctuated somewhat, but remained consistently higher than in 1977.

At age 17, the average score of students in each quartile range decreased between 1977 and 1982. For students in the middle two and upper quartiles, scores rebounded, and by 1992 they had reached a level higher than that in 1977. Although increases were not steady during the 1990s, their average scores in 1999 were higher than those in 1977. After the decline in 1982, scores for students in the lower quartile did not increase significantly until 1992. Their scores fluctuated throughout the 1990s, and by 1999 remained at a level similar to that in 1977.

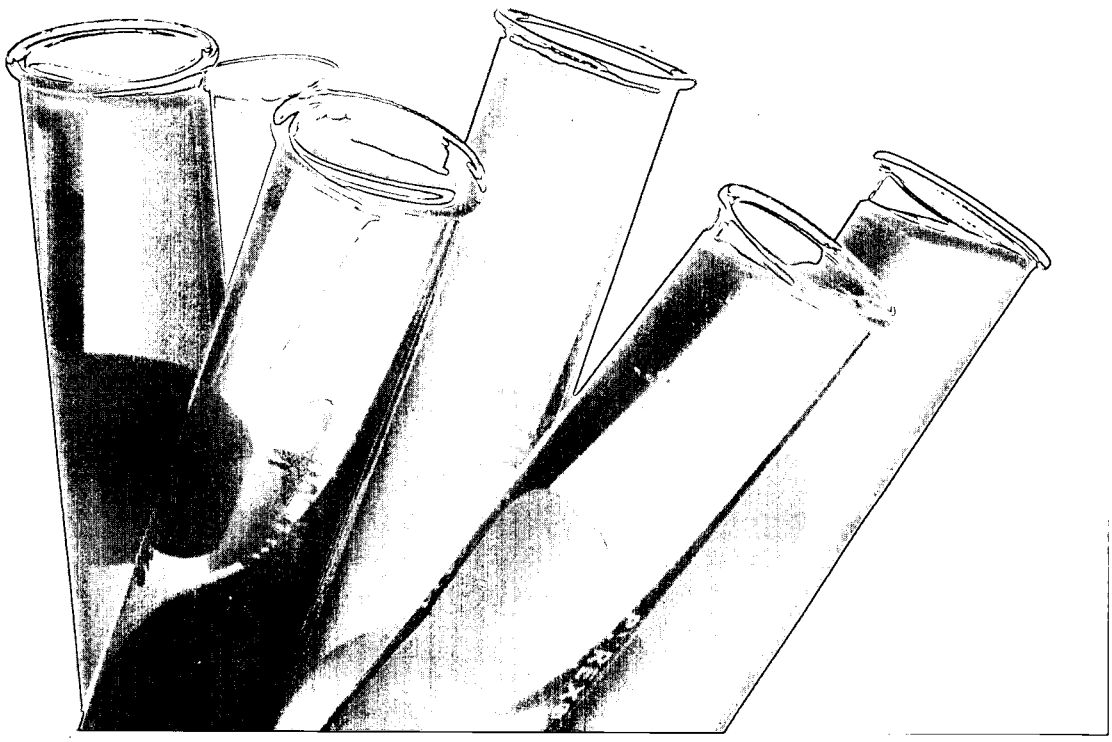
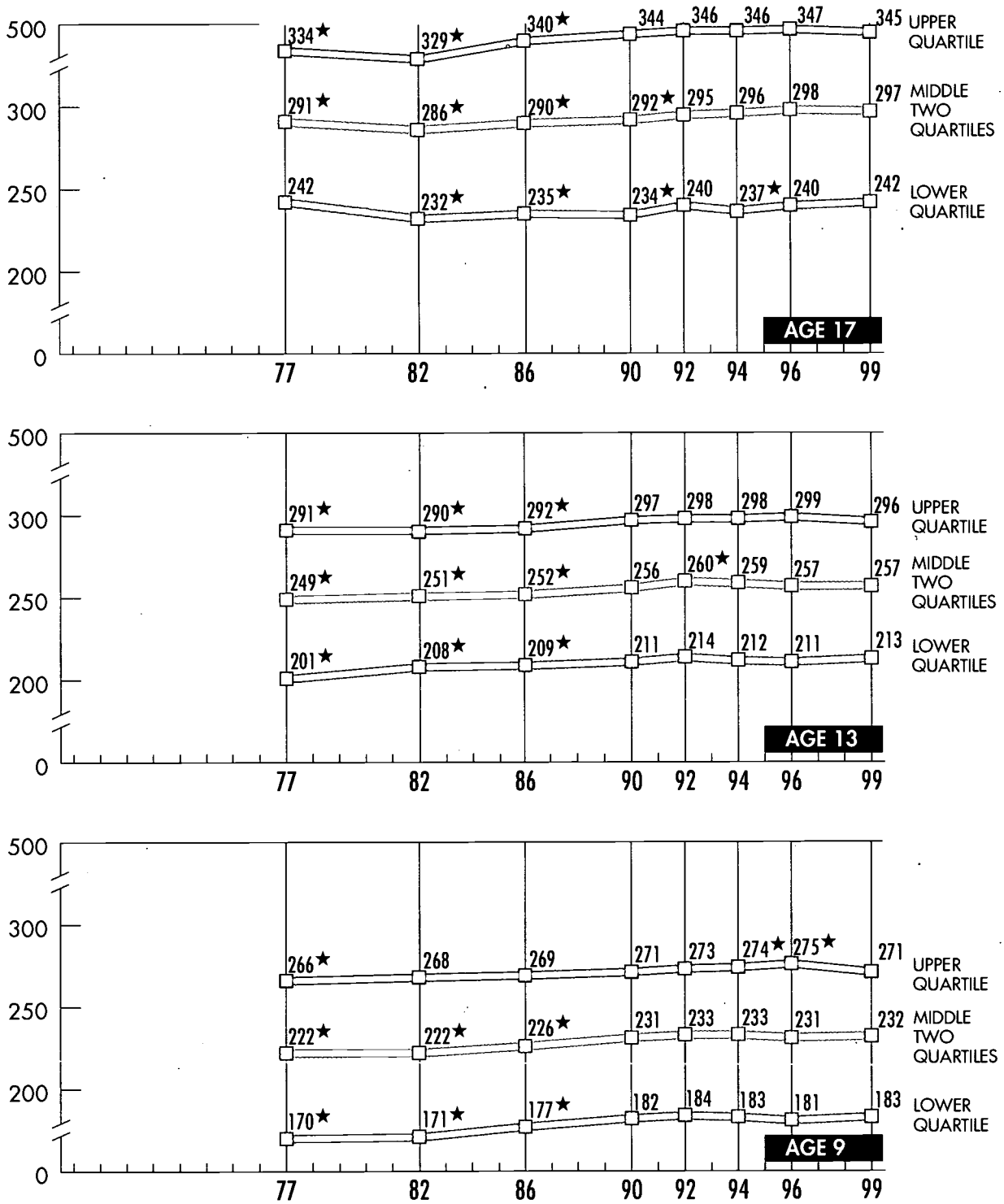


Figure 1.4
Trends in Average Science Scale Scores by Quartile



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

National Trends in Attainment of Performance Levels

More detailed information about what students know and can do in each subject area can be gained by examining their attainment of specific performance levels in each assessment year. For each of the subject area scales, performance levels were set at 50-point increments from 150 through 350. The five performance levels—150, 200, 250, 300, and 350—were then described in terms of the knowledge and skills likely to be demonstrated by students who reached each level. In order to develop these descriptions, assessment questions were identified that students at a particular level were more likely to answer successfully than students at lower levels. The descriptions of what students know and can do at each level are based on these sets of questions. (The procedures for describing the performance levels are described in more detail in Appendix A.)

The performance levels identified and described for the long-term trend assessments are different from the achievement levels more recently developed for the main NAEP assessments by the National Assessment Governing Board. The five long-term trend performance levels presented in this report were arbitrarily set at 50-point intervals on the three subject-area scales and are purely descriptive in nature—the goal being to provide a description of student performance at different points on the scale. In contrast, the main NAEP achievement levels are judgmental in nature. They are established based on the recommendations of panels of experts who determine within which scale ranges students demonstrate three levels of achievement—Basic, Proficient, and Advanced.

The long-term trend performance level descriptions for reading, mathematics, and science are presented on the following three pages. Trends in performance level results for the three most relevant levels in each age group follow the descriptions. These performance levels are used to describe students' knowledge and skills at all three ages. It is important to keep in mind that the likelihood of attaining higher performance levels is directly related to a student's age, since older students have completed more education in the respective subject areas. For example, while many 17-year-olds can and do perform at or above level 300, no more than four percent of 9-year-olds reached level 300 and almost none of the students at this age reached level 350 in any subject area across the assessment years. The performance level results displayed for each age group are those that are most likely to show significant change across the assessment years. The levels not shown here are those that nearly all or almost no students could attain at a particular age in each year. (Data for all five performance levels at each age are provided in Appendix B.)

The percentages presented in the figures in this section are cumulative, in that the percentage of students at a particular performance level includes students who may have attained even higher levels of performance. Performance level results for mathematics and science are not available for the first assessment years with extrapolated results (1973 for mathematics, and 1969/1970 and 1973 for science), since only the overall average scores were extrapolated for these earlier years.

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 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:
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:
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.

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.

Science Performance Level Descriptions

LEVEL 350:
Integrates Specialized Scientific Information
Students at this level can infer relationships and draw conclusions using detailed scientific knowledge from the physical sciences, particularly chemistry. They can also apply basic principles of genetics and interpret the social implications of research in this field.

LEVEL 300:
Analyzes Scientific Procedures and Data
Students at this level can evaluate the appropriateness of the design of an experiment. They have more detailed scientific knowledge and the skill to apply their knowledge in interpreting information from text and graphs. These students also exhibit a growing understanding of principles from the physical sciences.

LEVEL 250:
Applies General Scientific Information
Students at this level can interpret data from simple tables and make inferences about the outcomes of experimental procedures. They exhibit knowledge and understanding of the life sciences, including a familiarity with some aspects of animal behavior and of ecological relationships. These students also demonstrate some knowledge of basic information from the physical sciences.

LEVEL 200:
Understands Simple Scientific Principles
Students at this level are developing some understanding of simple scientific principles, particularly in the life sciences. For example, they exhibit some rudimentary knowledge of the structure and function of plants and animals.

LEVEL 150:
Knows Everyday Science Facts
Students at this level know some general scientific facts of the type that could be learned from everyday experiences. They can read simple graphs, match the distinguishing characteristics of animals, and predict the operation of familiar apparatuses that work according to mechanical principles.

Trends in Reading Performance Levels

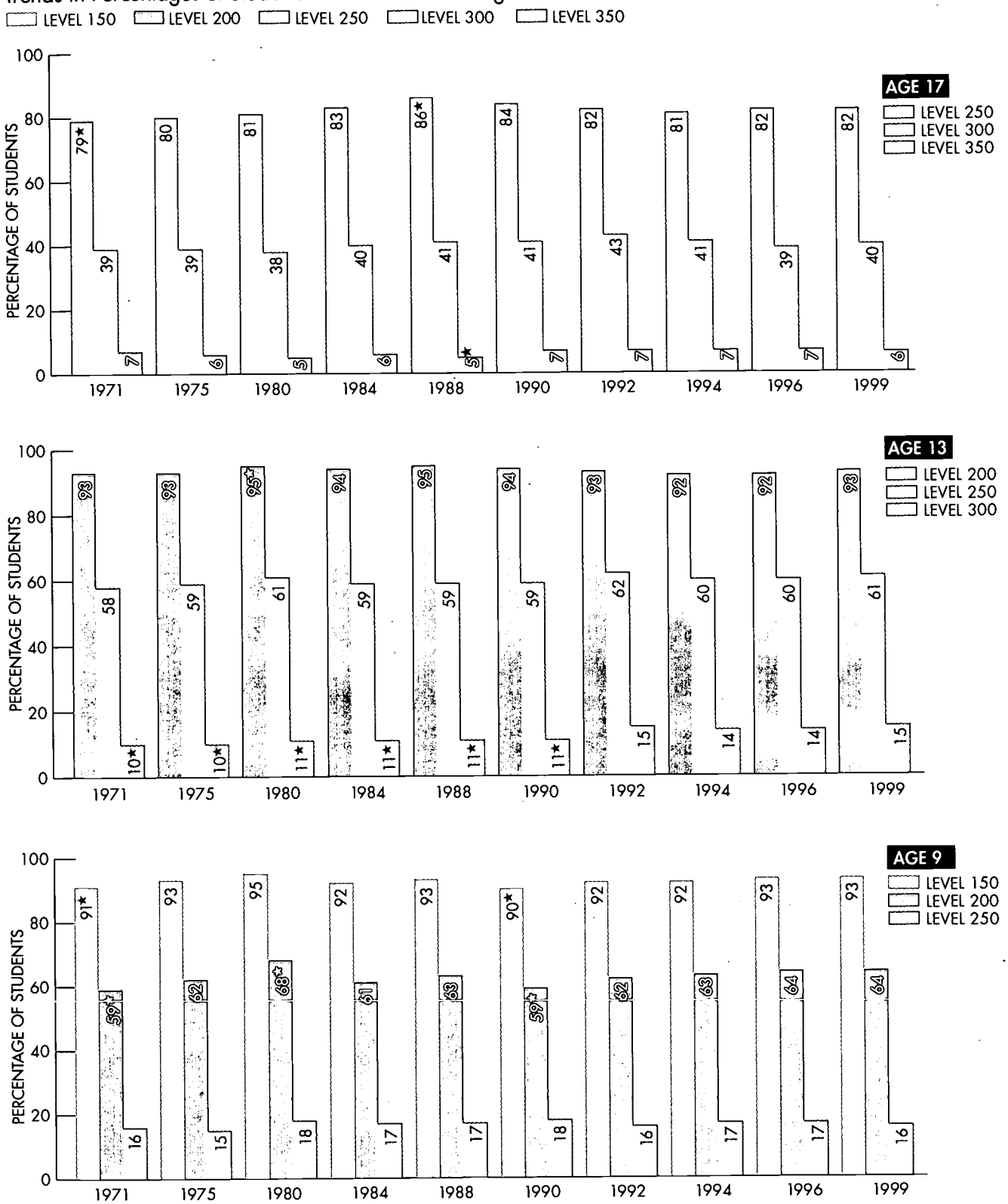
The skills and abilities demonstrated by students at each reading performance level are described on the following page. At the lowest level described, level 150, students were successful at simple, discrete reading tasks, but had difficulty making inferences. Partially developed skills and understanding were evident at level 200, as students were able to make inferences based on short, uncomplicated passages. At level 250, students were able to infer and generalize information from relatively lengthy passages. Students performing at level 300 could understand complicated literary and informational passages. At the highest level of performance, level 350, students demonstrated the ability to make connections between and extend ideas in specialized and complex texts.

Nine-Year-Olds. Trends in the percentage of 9-year-olds at or above reading performance levels 150, 200, and 250 are shown in the lower part of Figure 1.5. In each assessment year, at least 90 percent of 9-year-olds could perform the simple, discrete reading tasks described at level 150. The partially developed skills and understanding associated with level 200 were demonstrated by nearly two-thirds (64 percent) of 9-year-olds in 1999. Between 1971 and 1980, the percentage of students at or above this level rose nine percentage points. During the 1980s, however, these gains were reversed. In the 1990s, some increase at this level was evident once again, and the 1999 percentage was higher than that in 1971. The ability to interrelate ideas and make generalizations (level 250) was demonstrated by 16 percent of 9-year-olds in 1999. Although the percentage of students at or above this level had increased somewhat between 1975 and 1980, by 1999 it had returned to a level similar to that in 1971.

Thirteen-Year-Olds. The middle part of Figure 1.5 displays trends in the percentage of 13-year-olds performing at or above reading performance levels 200, 250, and 300. At least 92 percent of 13-year-old students performed at or above level 200 in each assessment year, demonstrating at least partially developed skills and understanding. The ability to interrelate ideas and make generalizations (level 250) was demonstrated by 61 percent of 13-year-olds in 1999. Despite some fluctuation, there has been little change across the assessment years in the percentages of students at or above this level of performance. Gains in the percentage of students reaching at least level 300 are evident. At this level, students demonstrate the ability to understand complicated information. In 1992, the percentage of students at or above this level increased from 11 to 15 percent. The percentage has been relatively stable since that time and has remained higher than the percentage in 1971.

Seventeen-Year-Olds. Trends in the percentage of 17-year-olds at or above reading performance levels 250 and 300 and at level 350 are shown in the upper part of Figure 1.5. The ability to interrelate ideas and make generalizations (level 250) was demonstrated by 82 percent of 17-year-olds in 1999. Between 1971 and 1988, the percentage of students at or above this level increased seven percentage points. Although additional gains were not made during the 1990s, the percentage of students at or above level 250 in 1999 remained higher than that in 1971. Performance at or above level 300 was demonstrated by 40 percent of 17-year-olds in 1999. These students could understand complicated literary and informational passages. The percentage of students at or above this level increased slightly between 1971 and 1992; however, by 1999 the percentage returned to a level similar to that in 1971. Across all of the assessment years, only five to seven percent of 17-year-olds demonstrated performance at level 350—the ability to learn from and synthesize specialized reading materials.

Figure 1.5
Trends in Percentages of Students At or Above Reading Performance Levels:



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Mathematics Performance Levels

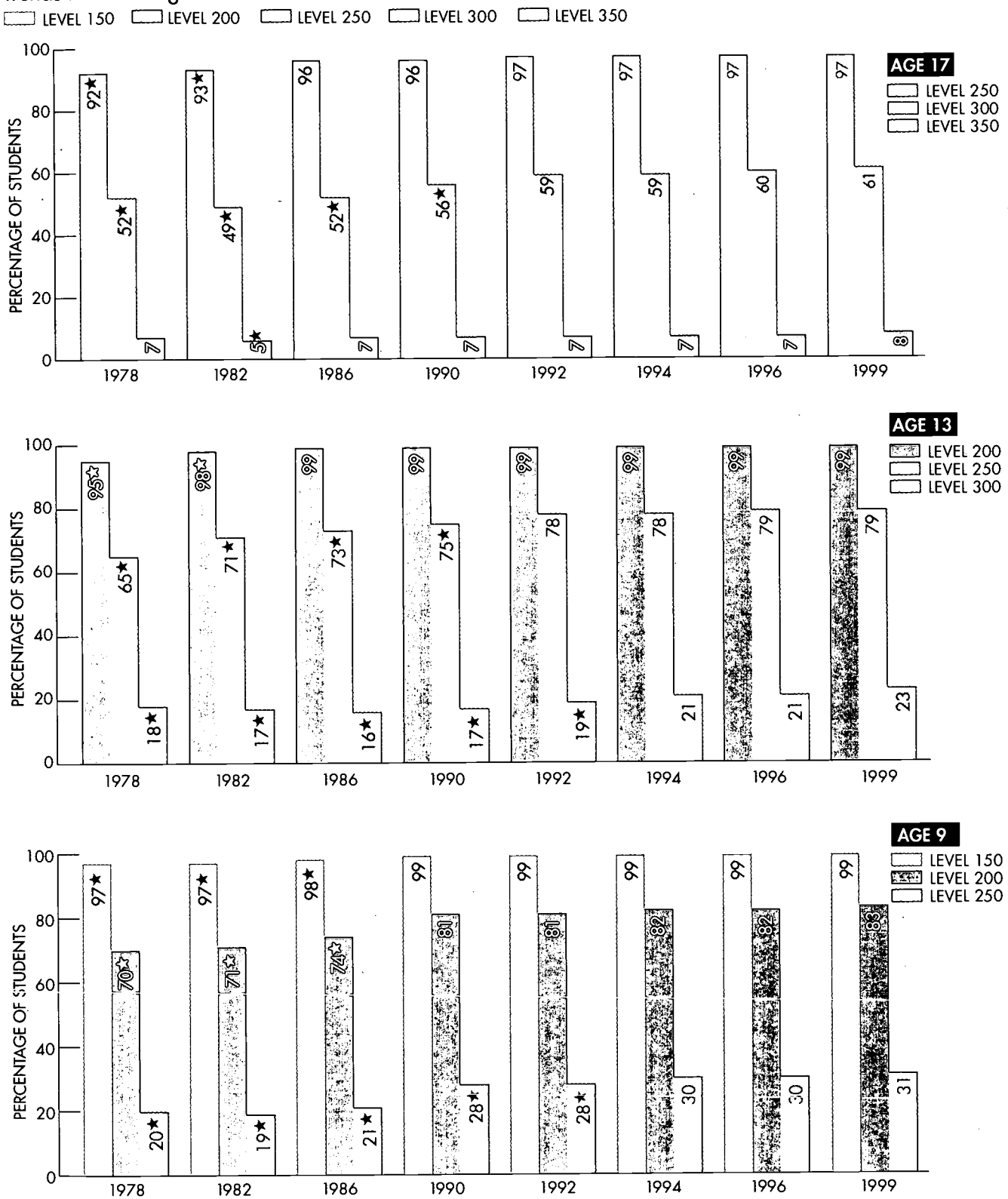
The skills and abilities demonstrated by students at each mathematics performance level are described on the following page. At the lowest level of performance, level 150, students knew simple arithmetic facts, such as basic addition and subtraction without regrouping. By level 200, students had considerable understanding of two-digit numbers and some basic multiplication and division facts. At level 250, students had at least an initial understanding of the four basic operations and could solve one-step word problems. The ability to deal with moderately complex procedures and reasoning was characteristic of performance at level 300. At the highest level of performance, level 350, students could apply a range of reasoning skills to solve multistep problems.

Nine-Year-Olds. Trends in the percentage of 9-year-olds attaining mathematics performance levels 150, 200, and 250 are displayed in the lower part of Figure 1.6. In each assessment year, nearly all 9-year-olds (at least 97 percent) demonstrated understanding of simple arithmetic facts associated with level 150. The beginning skills and understandings characteristic of level 200 were demonstrated by 83 percent of 9-year-olds in 1999. Between 1986 and 1990, the percentage of 9-year-olds at or above this performance level increased seven percentage points. Although the percentage has been relatively stable since that time, it has remained higher than the percentage in 1978. In 1999, nearly one-third of 9-year-olds (31 percent) could perform the numerical operations and beginning problem solving associated with level 250. The percentage of students at or above this performance level has generally increased across the assessment years, most notably, a seven percentage point increase between 1986 and 1990. Through the 1990s, the percentage has remained higher than that in 1978.

Thirteen-Year-Olds. The percentage of 13-year-old students at or above mathematics performance levels 200, 250, and 300 across the assessment years are displayed in the middle part of Figure 1.6. Since 1986, nearly all 13-year-olds (99 percent) demonstrated the beginning skills and understandings associated with level 200. In 1999, 79 percent were at or above level 250, demonstrating the ability to perform numerical operations and beginning problem solving. Between 1978 and 1992, the percentage of students at or above this performance level increased steadily, from 65 to 78 percent. Since 1992, the percentages have varied by only one point, while remaining higher than the 1978 percentage. Overall gains are also evident at level 300, where students could perform moderately complex procedures and reasoning. The percentage of students at or above this level increased from 18 percent in 1978 to 23 percent in 1999.

Seventeen-Year-Olds. Trends in the percentage of 17-year-olds at or above mathematics performance levels 250 and 300 and at level 350 are displayed in the upper part of Figure 1.6. Since 1986, at least 96 percent of 17-year-olds have performed at or above level 250, demonstrating the ability to perform numerical operations and beginning problem solving. The percentage of 17-year-olds who could perform moderately complex procedures and reasoning (level 300) generally increased across the assessment years, and by 1999, 61 percent of students were at or above this performance level. Most of the gains occurred between 1982 and 1992—an increase of 10 percentage points. Although significant increases were not evident during the 1990s, the percentage in 1999 was higher than percentages from 1978 through 1990. Little change is evident at the highest level of performance, level 350, in which students could apply a range of reasoning skills to solve multistep problems. Across the assessment years, between five and eight percent of students performed at or above this level.

Figure 1.6
Trends in Percentages of Students At or Above Mathematics Performance Levels:



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Science Performance Levels

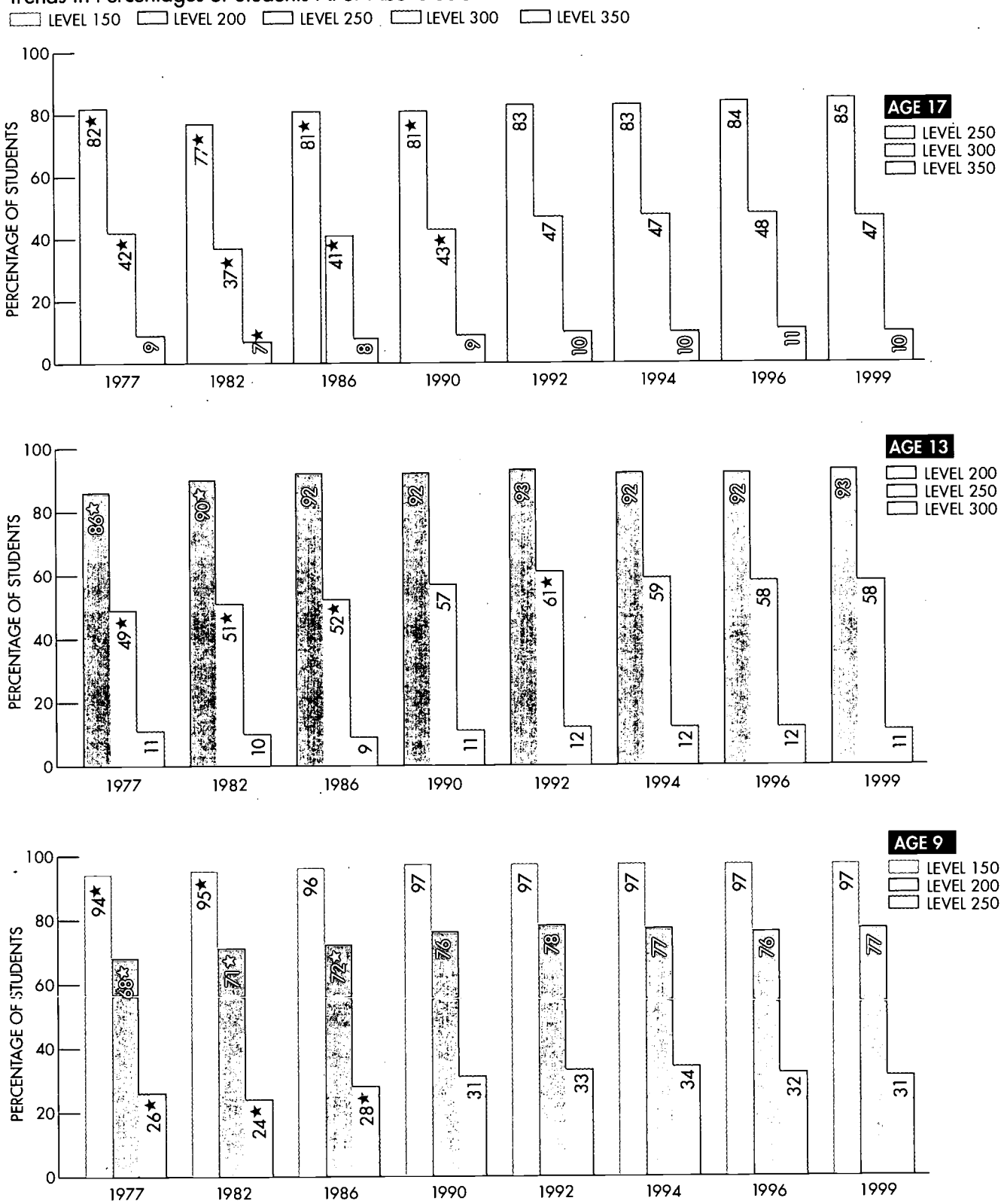
The knowledge and skills demonstrated by students at each science performance level are described on the following page. At level 150, students knew the kinds of general scientific facts that could be learned through everyday experiences. Students performing at level 200 were developing some understanding of simple scientific principles. By level 250, they could apply general scientific information, and they exhibited knowledge and understanding of the life sciences, as well as basic knowledge of the physical sciences. Performance at level 300 was characterized by the ability to analyze scientific procedures and data and a growing understanding of principles from the physical sciences. At the highest level of science performance, level 350, students could integrate specialized scientific information, including chemistry and genetics.

Nine-Year-Olds. Trends in percentages of 9-year-olds attaining science performance levels 150, 200, and 250 are displayed in the lower part of Figure 1.7. Nearly all 9-year-olds across the assessment years demonstrated the knowledge of everyday science facts associated with level 150. Between 1977 and 1990, the percentage of students performing at or above this level rose from 94 to 97 percent and has remained unchanged since that time. In 1999, 77 percent of 9-year-olds understood simple scientific principles (level 200). The percentage of students at or above this level increased from 68 to 78 percent between 1977 and 1992. There was little change during the 1990s, and the percentage in 1999 remained higher than that in 1977. In 1999, 31 percent of 9-year-olds performed at or above level 250, demonstrating the ability to apply general scientific information. The percentage of students at or above this level increased from 24 percent in 1982 to 34 percent in 1994. Although no further increases occurred during the last two assessments, the percentage in 1999 performing at or above this level was higher than that in 1977.

Thirteen-Year-Olds. The percentages of 13-year-olds attaining science performance levels 200, 250, and 300 across the assessment years are presented in the middle part of Figure 1.7. After increasing six percentage points between 1977 and 1986, the percentage of 13-year-olds at or above level 200 has remained at either 92 or 93 percent during the late 1980s and 1990s. The vast majority of 13-year-olds in each assessment have understood the simple scientific principles associated with this level. The percentage of 13-year-olds able to apply general scientific information, as described at level 250, increased 12 percentage points between 1977 and 1992. During the 1990s, a slight decrease in the percentage was evident; however, the 58 percent of students at or above level 250 in 1999 was higher than the percentage in 1977. In 1999, 11 percent of 13-year-olds were able to analyze scientific procedures and data (level 300). Across the assessment years, the percentage of students at or above this level has varied only slightly—between 9 and 12 percent.

Seventeen-Year-Olds. Trends in 17-year-olds' attainment of science performance levels 250, 300, and 350 are shown in the upper part of Figure 1.7. The percentage of students who could apply general scientific information as described at level 250 decreased five percentage points between 1977 and 1982. Since that time, the percentage of 17-year-olds at or above this level has generally increased. By 1999, 85 percent of students attained at least this level of performance—a higher percentage than that from 1977 through 1990. A similar decrease between 1977 and 1982 was evident in the percentage of 17-year-olds performing at or above level 300, the level associated with analyzing scientific procedures and data. After dropping to 37 percent in 1982, the percentage increased until the early 1990s and has remained relatively stable since then. In 1999, the 47 percent of students who were at or above this level was higher than the percentage in 1977. Performance at level 350, which was characterized by the ability to integrate specialized scientific information, was attained by 10 percent of 17-year-olds in 1999. This represents a gain since 1982, when 7 percent of students performed at this level.

Figure 1.7
Trends in Percentages of Students At or Above Science Performance Levels:



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Summary

The results presented in this chapter provide an overall view of national trends in reading, mathematics, and science achievement. National average scores, attainment of specific performance levels, and average scores for students in three different ranges of the performance distribution were discussed. Looking across the 30 years, upward trends are most noticeable in mathematics, although some positive results are also evident for reading and science.

The following figures provide an overview of the major findings presented in this chapter by comparing students' performance in 1999 to that of their counterparts in the first year data were collected. In addition, 1999 and 1990 results are compared, providing a summary of trends across the last decade.

Arrows pointing upward (↑) indicate significant improvement, horizontal arrows(→) indicate no significant change in performance, and arrows pointing downward (↓) indicate significant declines. For example, the first line of the display indicates that the national average reading score for 9-year-olds was higher in 1999 than it was in 1971; however, it was not significantly different from the 1990 average score.

Figure 1.8
Summary of Trends in National Average Scores

Reading

↑ 9-year-olds' average scores since 1971 ..... (→ since 1990)
↑ 13-year-olds' average scores since 1971 ..... (↑ since 1990)
→ 17-year-olds' average scores since 1971 ..... (→ since 1990)

Mathematics

↑ 9-year-olds' average scores since 1973 ..... (↑ since 1990)
↑ 13-year-olds' average scores since 1973 ..... (↑ since 1990)
↑ 17-year-olds' average scores since 1973 ..... (↑ since 1990)

Science

↑ 9-year-olds' average scores since 1970 ..... (→ since 1990)
→ 13-year-olds' average scores since 1970 ..... (→ since 1990)
↓ 17-year-olds' average scores since 1969 ..... (↑ since 1990)

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 1.9
Summary of Trends in Average Scores by Quartiles

Reading

9-year-olds
- ↑ upper quartile since 1971 ..... (↓ since 1990)
- ↑ middle two quartiles since 1971 ..... (↑ since 1990)
- ↑ lower quartile since 1971 ..... (↑ since 1990)

13-year-olds
- ↑ upper quartile since 1971 ..... (↑ since 1990)
- ↑ middle two quartiles since 1971 ..... (↑ since 1990)
- → lower quartile since 1971 ..... (→ since 1990)

17-year-olds
- → upper quartile since 1971 ..... (→ since 1990)
- → middle two quartiles since 1971 ..... (↓ since 1990)
- ↑ lower quartile since 1971 ..... (→ since 1990)

Mathematics

9-year-olds
- ↑ upper quartile since **1978** ..... (↑ since 1990)
- ↑ middle two quartiles since **1978** ..... (↑ since 1990)
- ↑ lower quartile since **1978** ..... (→ since 1990)

13-year-olds
- ↑ upper quartile since **1978** ..... (↑ since 1990)
- ↑ middle two quartiles since **1978** ..... (↑ since 1990)
- ↑ lower quartile since **1978** ..... (↑ since 1990)

17-year-olds
- ↑ upper quartile since **1978** ..... (↑ since 1990)
- ↑ middle two quartiles since **1978** ..... (↑ since 1990)
- ↑ lower quartile since **1978** ..... (↑ since 1990)

Science

9-year-olds
- ↑ upper quartile since **1977** ..... (→ since 1990)
- ↑ middle two quartiles since **1977** ..... (→ since 1990)
- ↑ lower quartile since **1977** ..... (→ since 1990)

13-year-olds
- ↑ upper quartile since **1977** ..... (→ since 1990)
- ↑ middle two quartiles since **1977** ..... (→ since 1990)
- ↑ lower quartile since **1977** ..... (→ since 1990)

17-year-olds
- ↑ upper quartile since **1977** ..... (→ since 1990)
- ↑ middle two quartiles since **1977** ..... (↑ since 1990)
- → lower quartile since **1977** ..... (↑ since 1990)

NOTE: Years are shown in boldface when the comparison year is different from the initial assessment year because earlier data are not available.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 1.10
Summary of Trends in Performance Level Results

Reading

Level 150—*Simple, discrete reading tasks*
↑ percentage of 9-year-olds since 1971 ..... (↑ since 1990)

Level 200—*Partially developed skills and understanding*
↑ percentage of 9-year-olds since 1971 ..... (↑ since 1990)
→ percentage of 13-year-olds since 1971 ..... (→ since 1990)

Level 250—*Interrelate ideas and make generalizations*
→ percentage of 13-year-olds since 1971 ..... (→ since 1990)
↑ percentage of 17-year-olds since 1971 ..... (→ since 1990)

Level 300—*Understand complicated information*
→ percentage of 17-year-olds since 1971 ..... (→ since 1990)

Mathematics

Level 150—*Simple arithmetic facts*
↑ percentage of 9-year-olds since **1978**..... (99% since 1990)

Level 200—*Beginning skills and understandings*
↑ percentage of 9-year-olds since **1978**..... (→ since 1990)
↑ percentage of 13-year-olds since **1978**..... (99% since 1990)

Level 250—*Numerical operations and beginning problem solving*
↑ percentage of 13-year-olds since **1978**..... (↑ since 1990)
↑ percentage of 17-year-olds since **1978** ..... (at least 96% since 1990)

Level 300—*Moderately complex procedures and reasoning*
↑ percentage of 17-year-olds since **1978**..... (↑ since 1990)

Science

Level 150—*Knows everyday science facts*
↑ percentage of 9-year-olds since **1977**..... (97% since 1990)

Level 200—*Understands simple scientific principles*
↑ percentage of 9-year-olds since **1977** ..... (→ since 1990)
↑ percentage of 13-year-olds since **1977** ..... (→ since 1990)

Level 250—*Applies general scientific information*
↑ percentage of 13-year-olds since **1977**..... (→ since 1990)
↑ percentage of 17-year-olds since **1977**..... (↑ since 1990)

Level 300—*Analyzes scientific procedures and data*
↑ percentage of 17-year-olds since **1977**..... (↑ since 1990)

NOTE: Years are shown in boldface when the comparison year is different from the initial assessment year because earlier data are not available.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.


STUDENT SUBGROUPS

CHAPTER 2

TRENDS IN ACADEMIC ACHIEVEMENT AMONG STUDENT SUBGROUPS

One of the objectives of the long-term trend assessments in NAEP is to monitor the achievement of various subgroups of students, in addition to overall national trends in performance. Differential achievement in academic performance among student subgroups has been at the root of many of the educational reform efforts that have arisen over the last 30 years. The focus has generally been on efforts to reduce the performance gaps between subgroups, while increasing the achievement of all students. The assessment results presented in this chapter provide one source of information useful in monitoring progress toward these goals.

The subgroups measured in this assessment include race/ethnicity, gender, parental education level, and type of school (public or nonpublic). The performance of students in each of these subgroups is described in this chapter. Line graphs are used to display the average reading, mathematics, and science scale scores attained by students in each subgroup across the assessment years. The average score of each subgroup and age level (9-, 13-, and 17-year-olds) is placed on a 0-to-500 scale in each subject area to provide a numeric summary of students' performance.

Trends in Academic Achievement Among Racial/Ethnic Subgroups

The performance of three racial/ethnic subgroups are reported in this section—white, black, and Hispanic students. Other racial or ethnic subgroups are not reported, as the samples collected were of insufficient size to analyze and report separately.

Trends in Reading Scores by Race/Ethnicity

The reading scores of the three racial/ethnic subgroups, as measured by the NAEP long-term trend assessment, show increases in performance at most ages for each subgroup. There are varying patterns of change in performance across time and specific subgroup, but the cumulative performance gains from the initial year to the current year are mostly significant. Figure 2.1 displays the average scores across assessment years in reading by race/ethnicity.

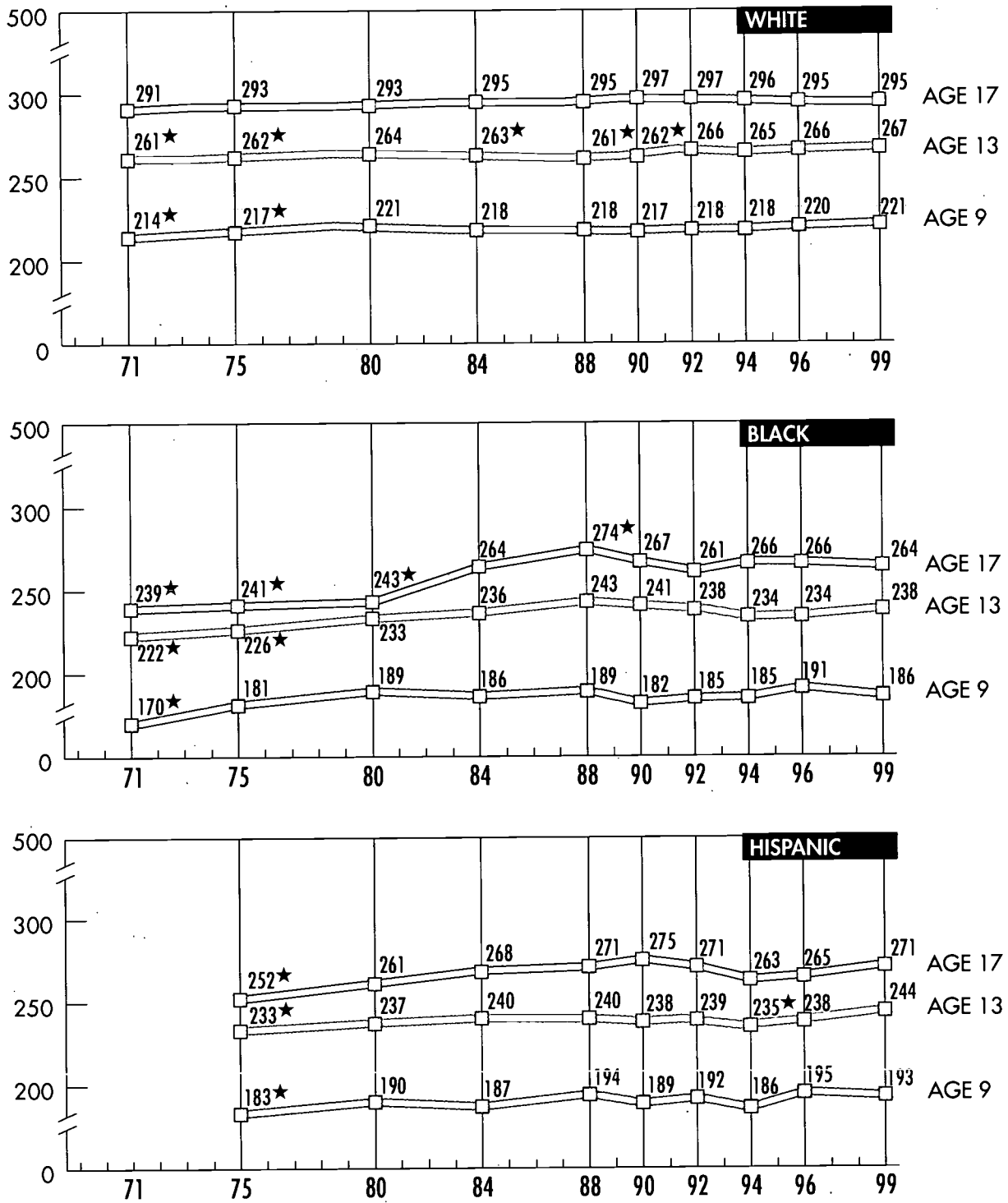
Trends in the average reading scores of white students for all ages appear to be that of slow but overall gains across the assessment years. For all ages, the scores in 1992 through 1996 were higher than in 1971, and for ages 9 and 13, the 1999 scores were also higher than

in 1971. Since the samples of white students tended to be larger than that of black or Hispanic students, relatively small numeric changes in scores (such as the four-point change at age 17 between 1971 and 1996) are more likely to be statistically significant.

The reading scores of black students do not show quite such smooth trends as those of white students. However, the overall pattern across age groups is reasonably consistent, beginning with low scores that increased across the assessment years. For all ages of black students in reading, average scores in 1999 were higher than in 1971, although the scores between 1992 and 1999 fluctuated within a four- to six-point range, with no significant changes. All three age groups have a noticeable upswing period in which the bulk of the increase occurred, with limited changes afterward. For example, there is a noticeable increase in the average reading scores for black students at age 17 between 1980 and 1988. Unfortunately, not all of this gain was maintained, and scores decreased in 1990 and 1992 to approximately 1984 levels.

The average reading scores of Hispanic students also generally show gains across the assessment years, with some variations. (Note that scores for the Hispanic students are not available back to 1971.) Nine-year-olds' average scores show an alternation between moderate gains and small losses across consecutive assessments, with only the 1975 to 1980 increase being statistically significant. The gains have been somewhat larger than the losses, resulting in an overall upward trend, and the average score in 1999 was higher than that in 1975. The trend at age 13 is generally a slow but steady gain in reading scores, again with no individual changes of note between consecutive years. At age 17, a general trend of increasing scores was lost between 1990 and 1994, when scores decreased, although neither the increases nor the decreases were significant between adjacent years. On a positive note, there appears to be a recovery of a positive trend over the last two assessments. At age 17, the average scores in 1996 and 1999 were higher than those in 1975.

Figure 2.1
Trends in Average Reading Scale Scores by Race/Ethnicity



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Mathematics Scores by Race/Ethnicity

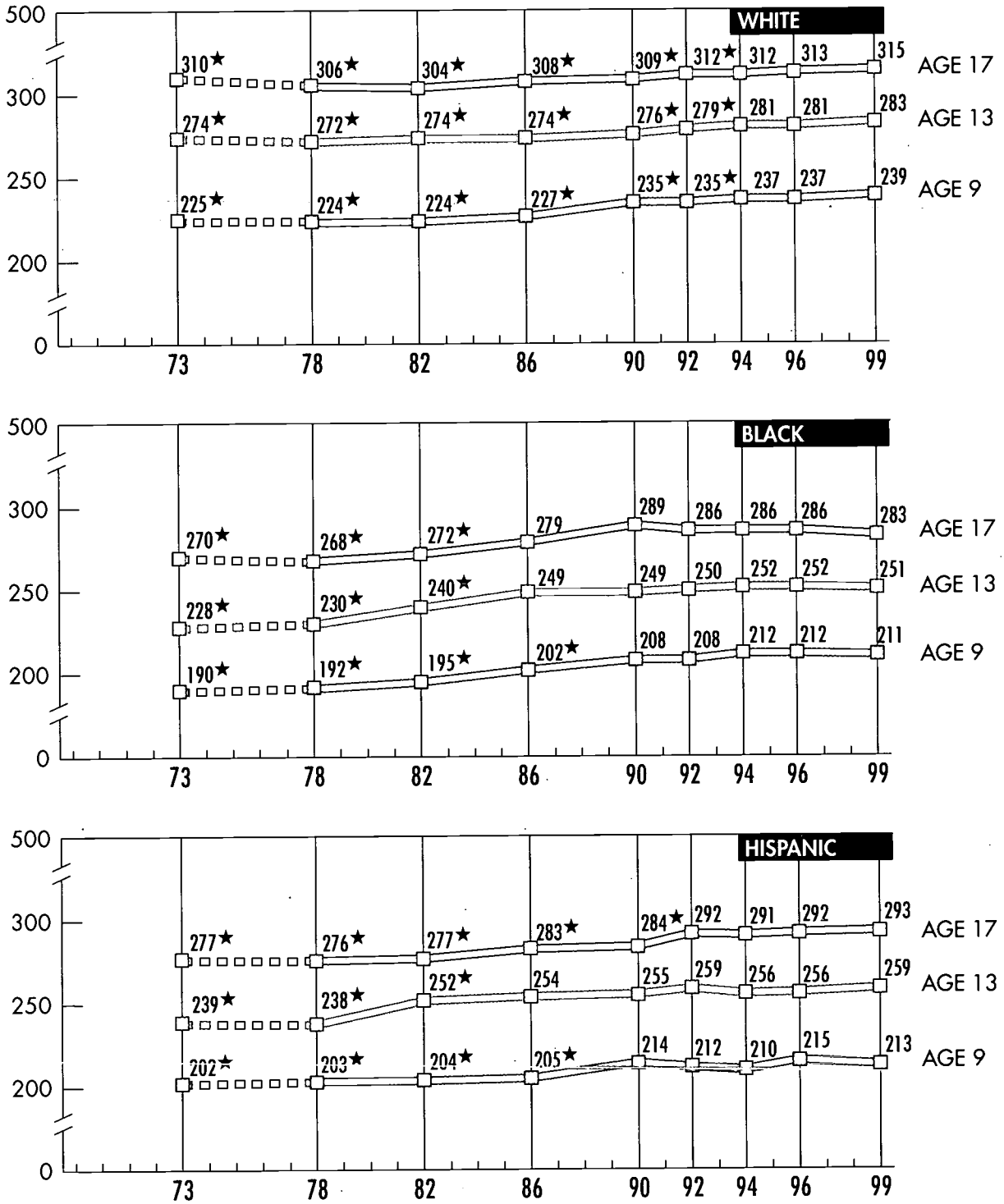
Overall, the mathematics scores of all racial/ethnic subgroups, as measured by the NAEP long-term trend assessment, show increases in performance at all ages. The trends for white students tend to be smoother than those for black or Hispanic students, whose scores demonstrate more abrupt changes. As the samples of black and Hispanic students are smaller than that of white students, it is to be expected that more variability in the smaller subgroups' scores will be seen. Figure 2.2 displays the average scores across assessment years in mathematics for 9-, 13-, and 17-year-old students.

In mathematics, the scores for all white students declined or remained relatively stable between 1973 and 1982, with an increasing trend between 1982 and 1999. An initial decline is most apparent at age 17, where the average score decreased by four points between 1973 and 1978. Average mathematics scores at all ages were lower in all assessment years from 1973 through 1992 than in 1999.

In contrast, the average scores for black students at all ages generally show increases from 1973 through approximately 1990, with the increases throughout most of the 1980s being statistically significant. Very limited, nonsignificant fluctuations are evident since 1990. At age 17, there was a six-point score decline between 1990 and 1999, although the change is not significant. The average mathematics scores for black students at all ages were higher in 1999 than from 1973 through 1982.

Hispanic students' performance in mathematics was also higher at all three ages in 1999 than from 1973 through 1982. The patterns of increase are different from those seen for white and black students, however. At all ages, there was only one pair of adjacent assessment years when a significant increase occurred. At age 17, an 8-point increase occurred between 1990 and 1992; at age 13, a 14-point increase occurred between 1978 and 1982; and at age 9, a 9-point increase occurred between 1986 and 1990.

Figure 2.2
Trends in Average Mathematics Scale Scores by Race/Ethnicity



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Science Scores by Race/Ethnicity

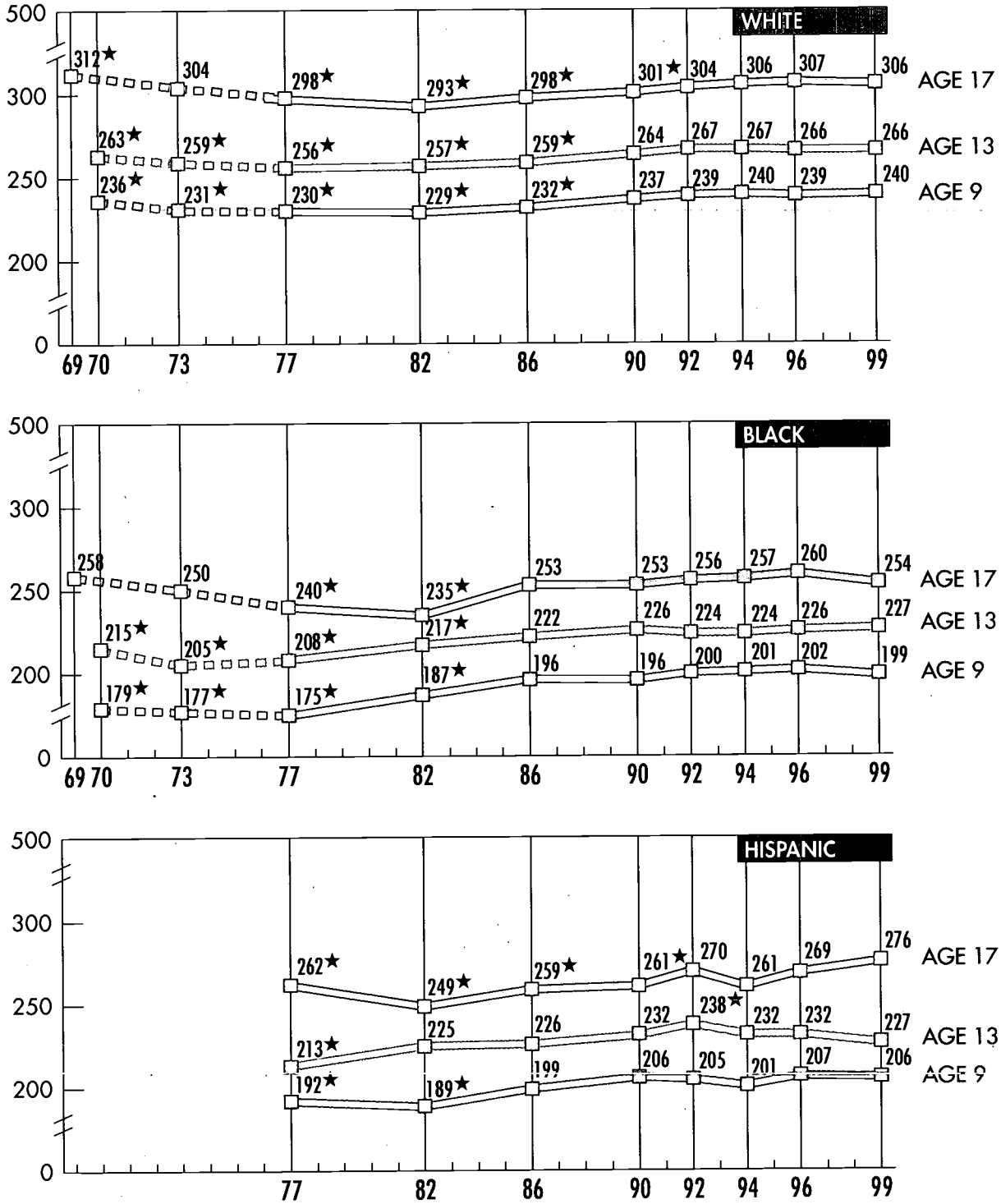
Overall, the average science scores of all racial/ethnic subgroups, as measured by the NAEP long-term trend assessment, show increases in performance at most ages. The most common pattern is one of initial score decreases over a few assessments followed by generally increased scores in more recent years. Figure 2.3 displays the average scores across assessment years in science for all age groups.

In science, the pattern of results for white students bears some resemblance to the mathematics results for white students. There was an initial decline in student scores at all ages: at age 9 between 1970 and 1973; at age 13 from 1970 through 1977; and at age 17 from 1969 through 1982. The decline at age 17 is the most pronounced, at 19 points over the first four assessments, and the 1969 average score for 17-year-olds was higher than scores in all subsequent assessments. Nine- and 13-year-olds' average scores increased past the 1970 level by 1992. The scores at the lowest points in the declines, 1977 through 1986, were lower than the 1999 science scores for all age groups.

For black students, score changes in science are more visible, although the pattern is similar to that of white students. For all ages, there was a decline followed by an increase in scores. At age 9, the decline was gradual and not statistically significant, occurring between 1970 and 1977, followed by increases in the 1980s; however, apparent changes since that time have not been statistically significant. At age 13, the decline occurred between 1970 and 1973, with score increases through 1990. Since 1990, scores have fluctuated only slightly. Age 17 scores involve the most dramatic decline, taking place between 1969 and 1982. Between 1982 and 1986, 17-year-olds made a dramatic recovery—an 18-point increase. From 1986 to 1999, average scores show only nonsignificant fluctuations.

Hispanic students have varied patterns of score change across age levels. Students at all ages attained an average score in 1999 that was higher than that in 1977. (Note that data for Hispanic students are not extrapolated back to 1969/1970.) None of the adjacent year changes at age 9 were statistically significant, and most of the overall score increase took place between 1982 and 1990. The average score for 13-year-olds increased 25 points from 1977 to 1992, with an 11-point decline since that time. At age 17, there was a 13-point decline between 1977 and 1982, with an almost complete recovery in 1986. Seventeen-year-olds' average score in 1999 was higher than scores between 1977 and 1990.

Figure 2.3
Trends in Average Science Scale Scores by Race/Ethnicity



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Score Differences Between Racial/Ethnic Subgroups

Differences between racial/ethnic subgroups are evident in terms of performance on the NAEP long-term trend assessments. Score differences between all racial/ethnic subgroups of students across the three subject areas are displayed in Figures 2.4 and 2.5.

Score Differences Between Black and White Students

As shown in Figure 2.4, the differences in scores for white and black students at all ages have generally decreased between the first and the most recent assessments across subject areas, although white students continued to outperform black students in each subject area and at each age in 1999. These decreases in the score gaps, however, are a positive indication of efforts to reduce performance differences between black and white students.

In reading, the gap in scores between white and black students has narrowed between the first and the most recent assessments at all ages. At age 9, a sharp decrease in the score gap between 1971 and 1975 has been mostly maintained through 1999, although there were no additional decreases. At ages 13 and 17, there were sharp drops in the size of the gap between 1980 and 1988. Unfortunately, the gaps widened between 1988 and 1992, and have shown nonsignificant fluctuations since then.

In mathematics, a pattern of narrowing score gaps is apparent for all ages from 1973 through 1986. At age 13, the gap narrowed by 22 points between 1973 and 1986; at age 17, sharp drops occurred in 1982 and 1990. Since that time, the gap has widened somewhat. During the 1990s, however, the apparent changes in the size of the gap between white and black students were not statistically significant.

In science, there are points at which abrupt decreases in the score gaps between adjacent years occur at each age. At age 9, a 13-point drop occurred in 1982, at age 13, an 8-point drop in 1982, and at age 17, a 13-point drop in 1986. Throughout the 1990s score gaps have remained relatively stable. For 9- and 13-year olds, however, the gap in 1999 was smaller than in 1970.

Score Differences Between Hispanic and White Students

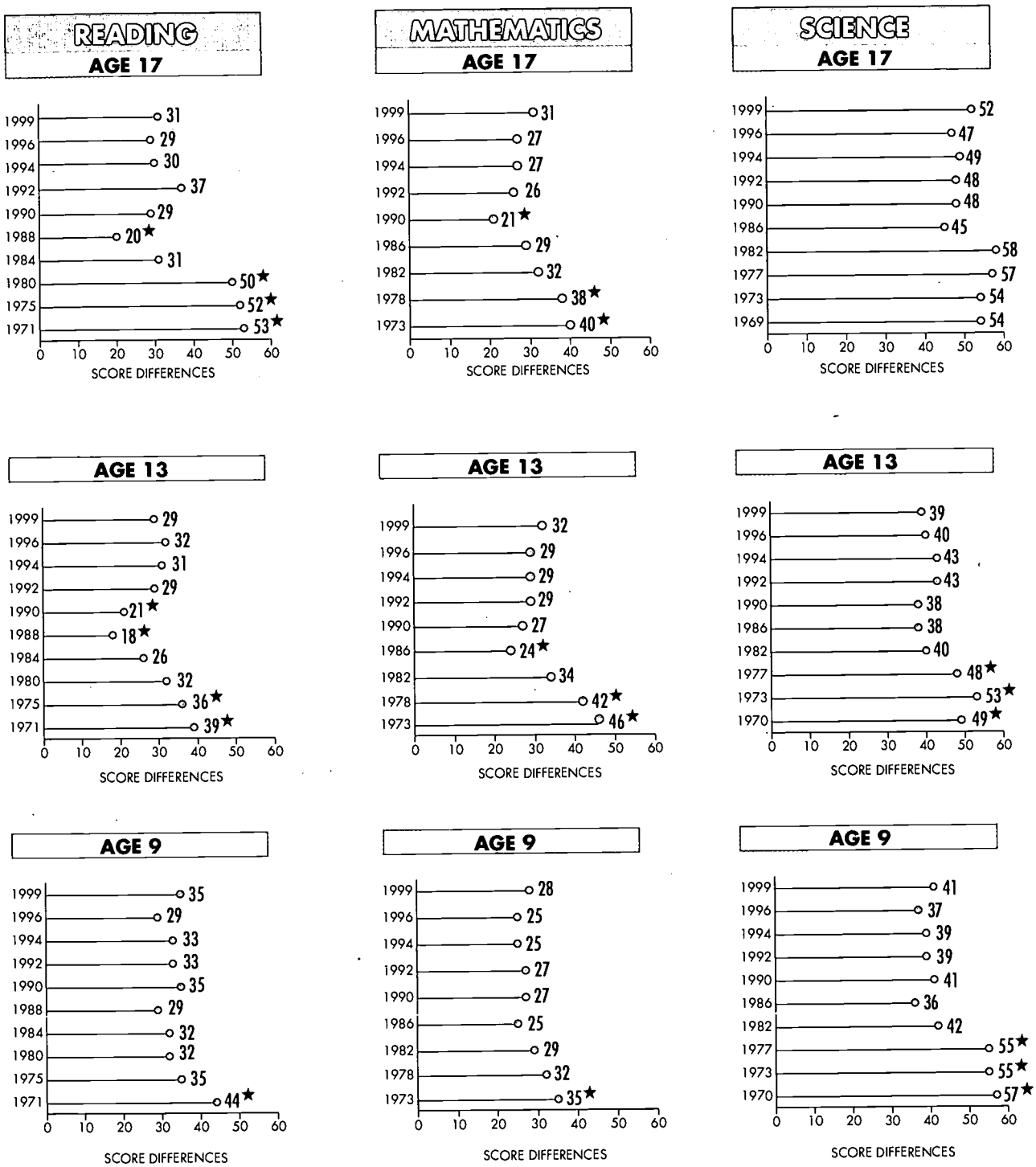
There were score differences between white and Hispanic students; in terms of performance on the NAEP long-term trend assessments—white students outperformed their Hispanic peers in each subject area and at each age in 1999. As shown in Figure 2.5, there are few consistent trends across the subject areas in the magnitude of the gap between these two student subgroups. (Note that results for Hispanic students are not available for the first assessment year in reading (1971) and the first two assessment years in science (1969/1970 and 1973).)

In reading at age 9, the score gap has not changed significantly, except in 1988 and 1996, when it was significantly smaller than in 1975. At age 13, the apparent changes across assessment years in the size of the score gap between white and Hispanic students were not statistically significant. At age 17, the reading score gap between white and Hispanic students in 1975 was 41 points, larger than in 1984 through 1992, and in 1999.

In mathematics, there is a general trend of narrowing score gaps across the assessment years for 13- and 17-year-olds. At age 13, the score gap decreased 12 points in 1982, but has been more stable since that time. At age 17, score gaps in the 1990s were smaller than in 1973. For 9-year-olds, some widening of the score gap is evident since 1982.

In science, the apparent changes in the size of the score gap over all assessment years at age 9 were not statistically significant. At age 13, the gap narrowed by 11 points between 1977 and 1982, and the score gaps from 1982 through 1996 were smaller than in 1977. At age 17, the gap widened between 1977 and 1982; however, by 1999, the score gap was smaller than it had been in 1982, although the apparent difference between 1977 and 1999 was not statistically significant.

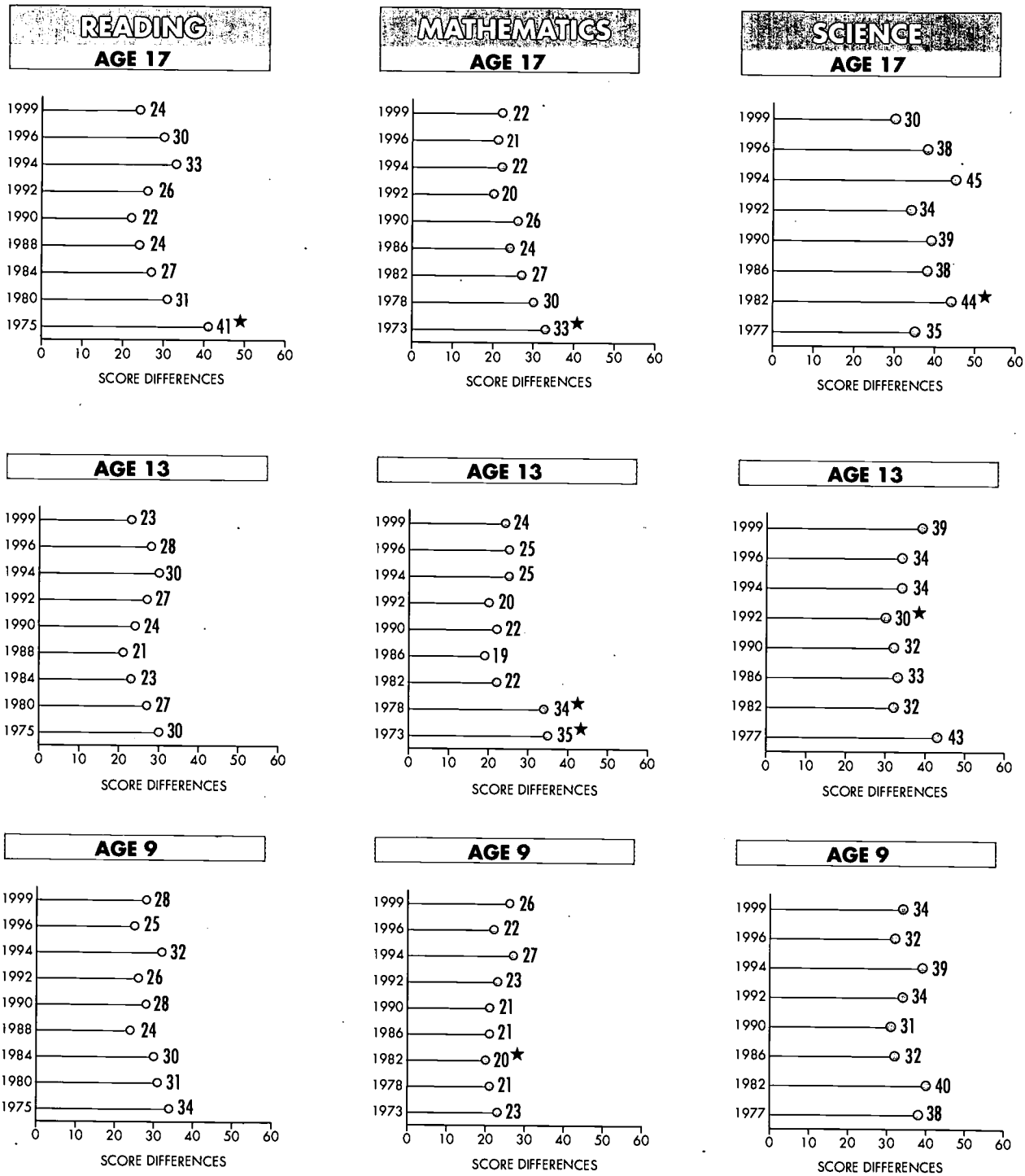
Figure 2.4
Trends in Differences Between White and Black Students' Average Scores Across Years (White Minus Black)



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 2.5
Trends in Differences Between White and Hispanic Students' Average Scores Across Years (White Minus Hispanic)



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Academic Achievement for Male and Female Students

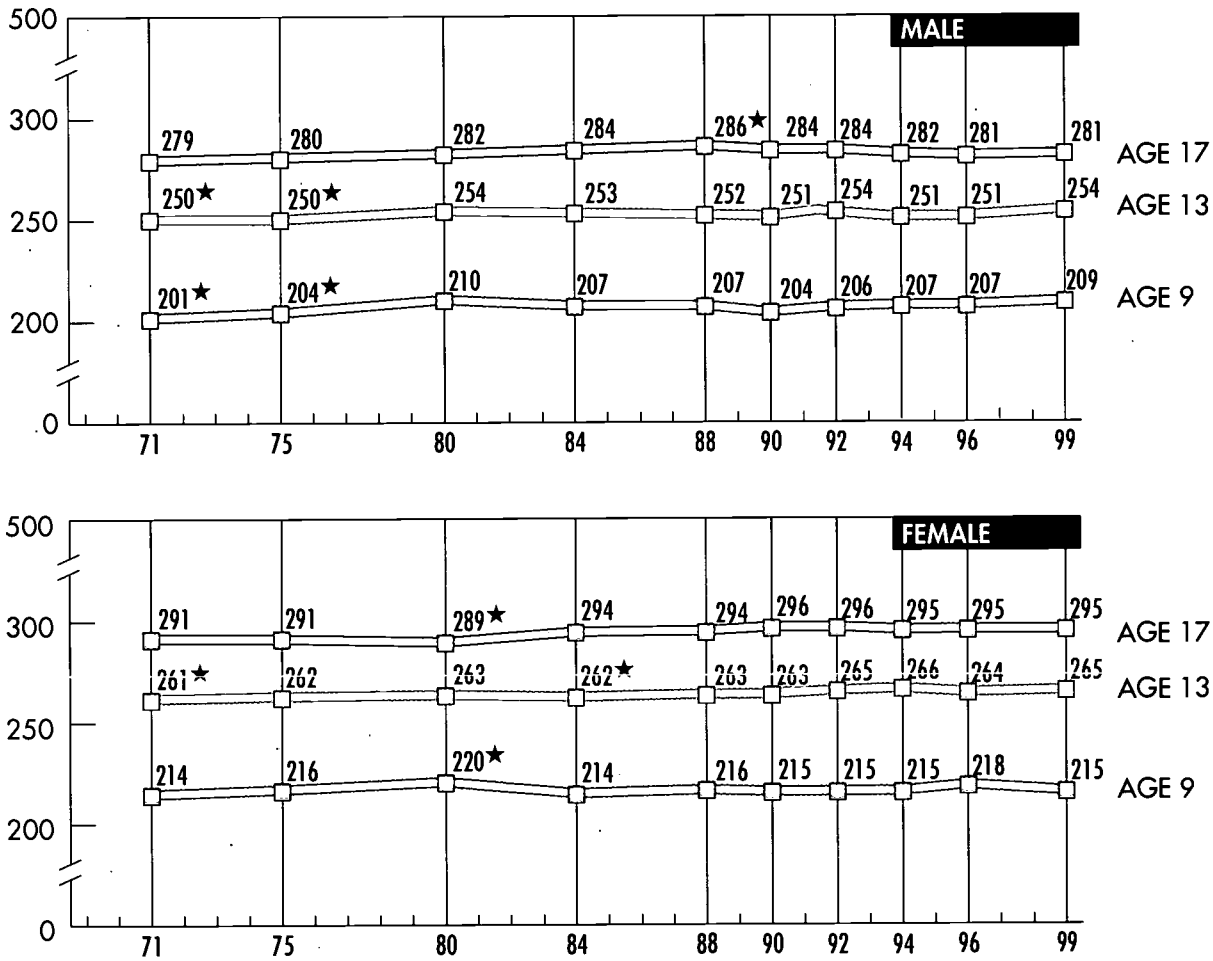
Trends in male and female students' average reading, mathematics, and science scores are presented in this section. For most subject areas and ages, males and females demonstrate similar trends across the assessment years.

Trends in Reading Scores by Gender

Trends in reading scores for both male and female students are shown in Figure 2.6. Among males, 9- and 13-year-olds' average reading scores in 1971 and 1975 were lower than in 1999. At age 17, the 1988 average score was five points higher than in 1999. That change from 1988 at age 17 was the only significant change in male reading scores at all ages during the 1980s and 1990s. Scores have generally increased somewhat from 1971, but only at ages 9 and 13 were the 1999 average scores significantly higher than they were in 1971.

The female reading trends are similar. The general trend is one of slow changes in scores across a long period of time. Only at age 13 was the female students' average reading score significantly higher in 1999 than in 1971. At age 17, the 1999 average score was higher than that in 1980. There were significant changes within the entire assessment

Figure 2.6
Trends in Average Reading Scale Scores by Gender



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

period (see, for example, the five-point jump at age 17 between 1980 to 1984, or the four-point increase at age 9 between 1975 to 1980), but these increased score levels were not maintained over time, except for the increase since 1980 at age 17.

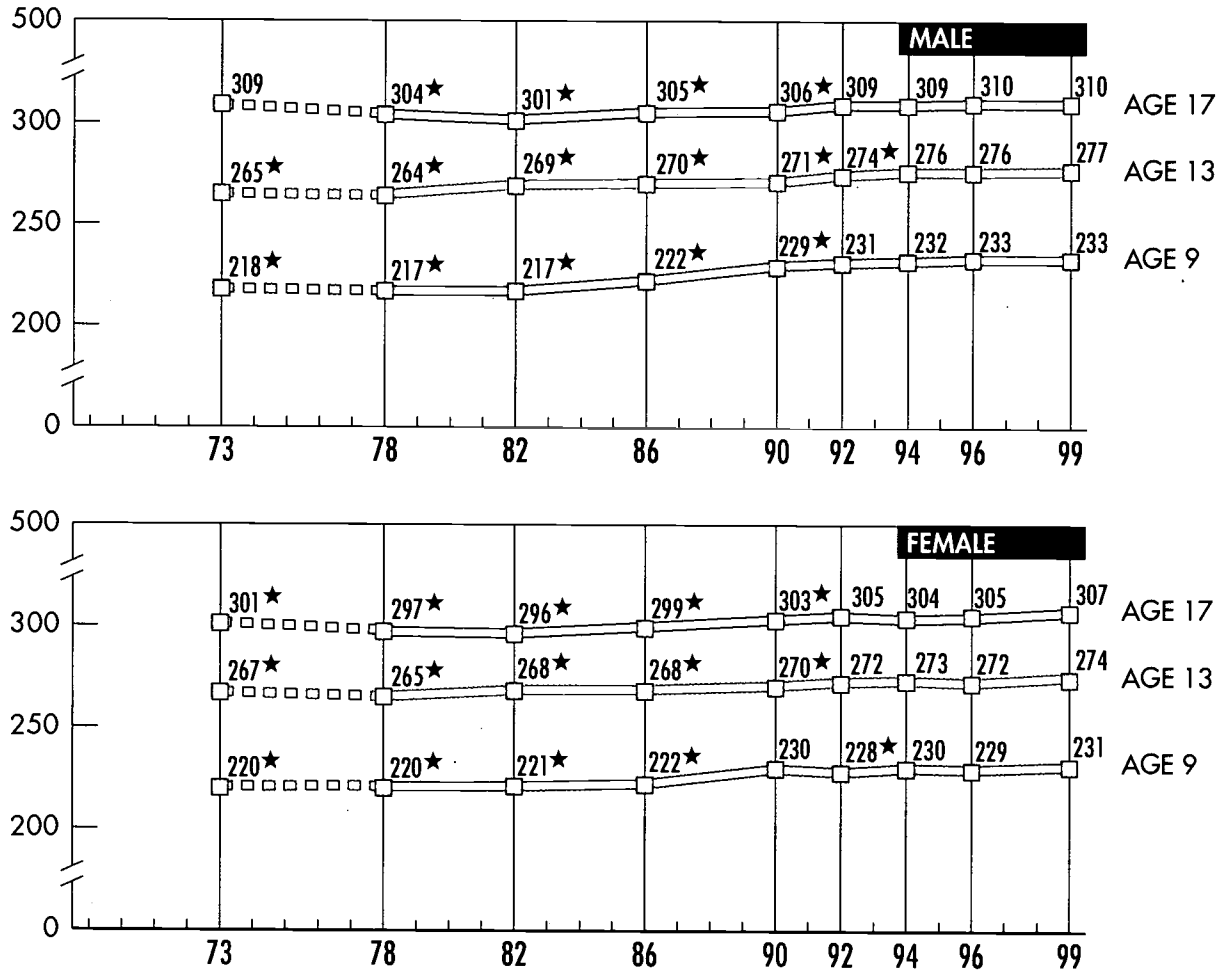
Trends in Mathematics Scores by Gender

In mathematics, there is some more variability in male and female student trends across the three age levels, as seen in Figure 2.7. For males, the scores at ages 9 and 13 were higher throughout the 1990s than in the first assessment year, 1973. Most of the age 9 increase occurred between 1982 and 1990, while the age 13 increase was spread over the entire three decades. At age 17, the scores were higher in 1999 than in 1978 through 1990, after a decline of five points between 1973 and 1978.

For female students, average scores from the 1970s through the 1980s were lower than in the last assessment year, 1999. Score increases for 9-year-olds occurred mostly between 1986 and 1990, while the other ages saw much more gradual changes.

Figure 2.7

Trends in Average Mathematics Scale Scores by Gender



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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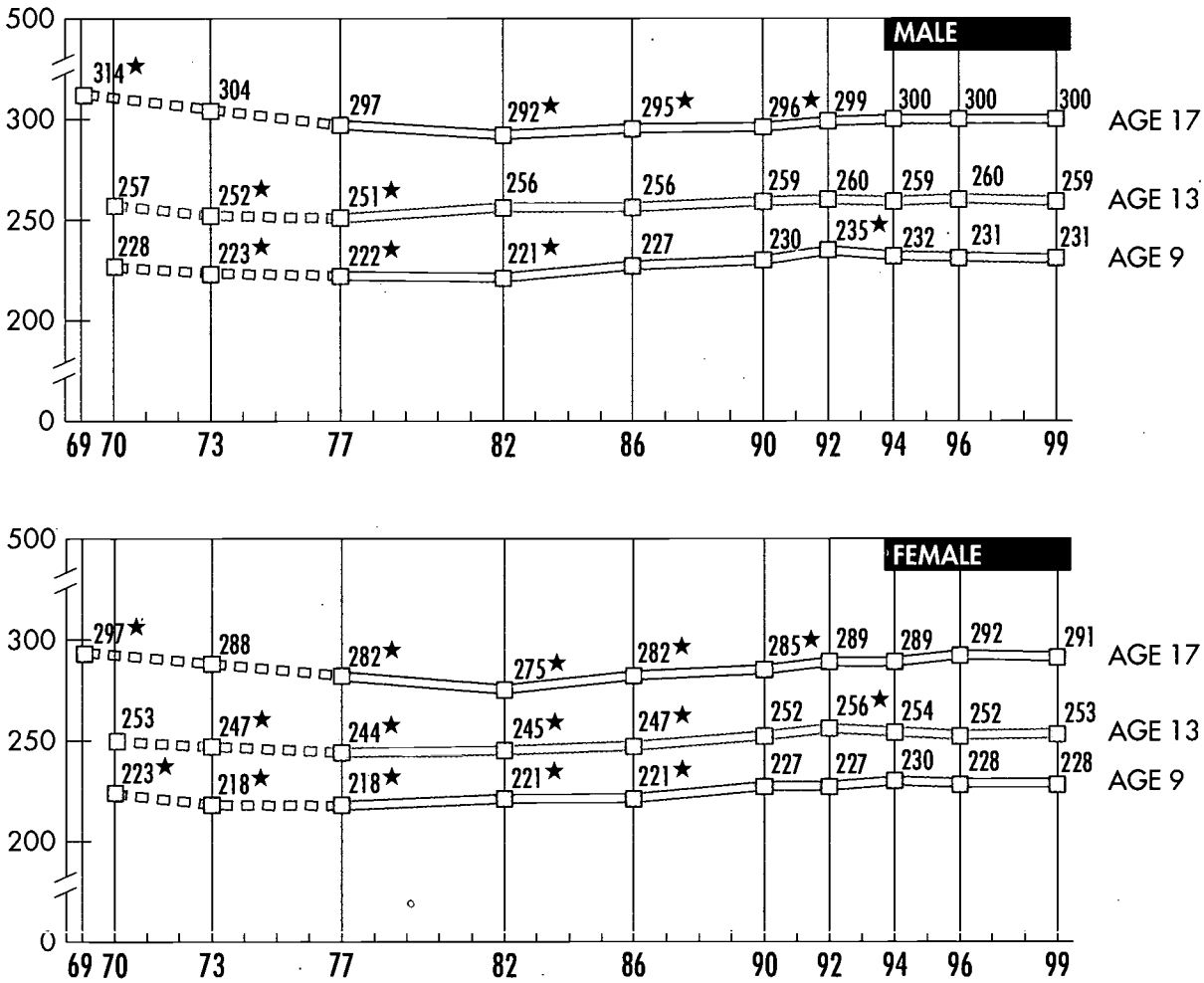
Trends in Science Scores by Gender

In science, the overall picture for both male and female students shows a decrease in scores through the 1970s and early 1980s, followed by small, generally positive changes since that time. These trends can be seen in Figure 2.8. For males and females, the scores were successively lower through the 1970s at most ages, particularly at age 17. As a result of gains since that time, the average scores at the bottom of the dip were lower than scores in 1999. At age 17, the score achieved by both males and females in 1969 has not yet been equaled, as all science scores after the first year are lower than in 1969. However, both male and female 17-year-olds have made gains since 1990.

Figure 2.8

Trends in Average Science Scale Scores by Gender



★Significantly different from 1999.

NOTE: Dashed lines represent extrapolated data.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Score Differences Between Male and Female Students

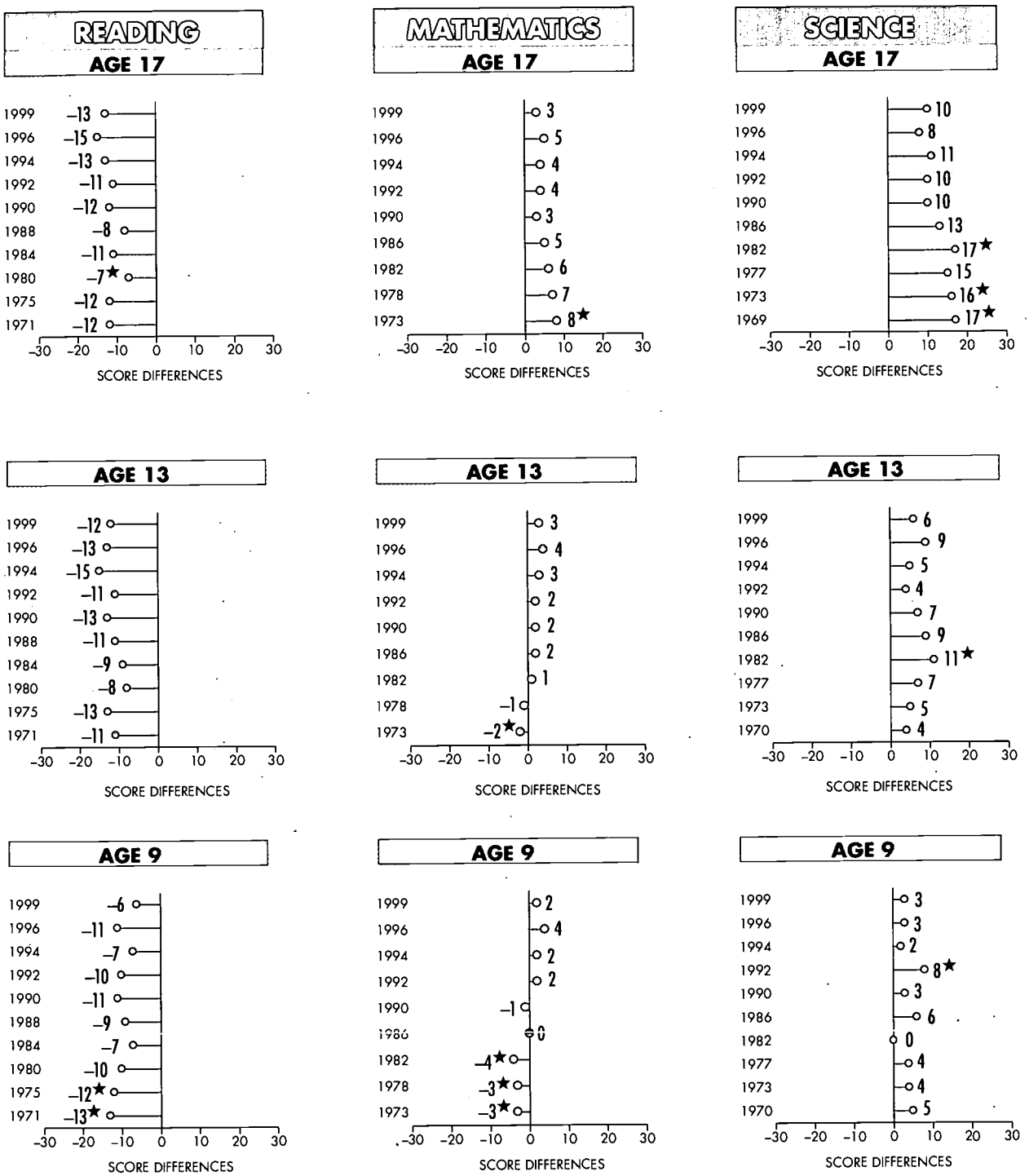
Trends in the score gaps between male and female students across the assessment years are displayed in Figure 2.9. It is worth noting that the score gaps between male and female students are generally smaller than those seen between racial/ethnic subgroups.

All reading score differences favor the female students. For all assessment years and ages, the score gaps have remained relatively constant, with the exception of the age 9 gap, which was smaller in 1999 than in 1971.

The most interesting changes in male and female score gaps occurred in mathematics. For 9- and 13-year-olds, score differences favoring females in the 1970s have shifted to score differences favoring males in the 1990s. At age 17, the score difference favored male students across the assessment years, although the gap was smaller in 1999 than it had been in 1973. The apparent difference between males' and females' average mathematics scores in 1999 was not statistically significant at any age.

In science, the score gaps at each age favor male students, although in 1999, the apparent difference between male and female students' average science scores was not statistically significant at age 9. For 9- and 13-year-olds, there has been little variation in the gaps across the years. Among 17-year-olds, the score gap narrowed so that the gaps in the 1990s were smaller than those in the 1970s and early 1980s.

Figure 2.9
Trends in Differences Between Male and Female Students' Average Scale Scores Across Years (Male Minus Female)



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Academic Achievement by Parents' Level of Education

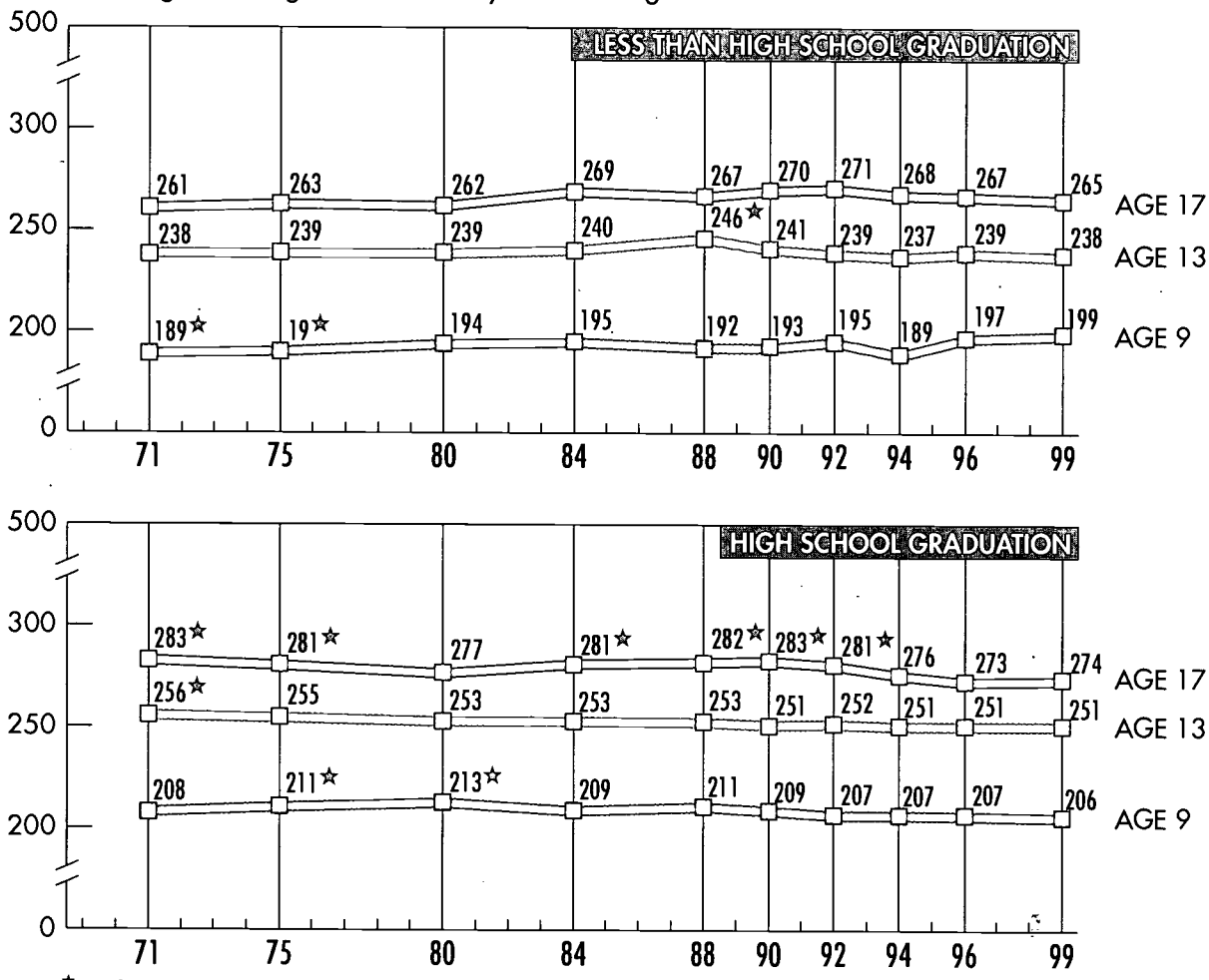
In the long-term trend assessment background questionnaires, students are asked to identify the highest level of education attained by their parents. The highest education level of either parent is used in these analyses. Based on their responses, the subgroups formed for reading are as follows: less than high school graduation, graduated high school, some education after high school, and unknown. For math and science a different question was used that included another level, graduated college.

Parental education may influence student performance in school and on assessments such as NAEP in a variety of ways, including ability to assist with homework and attitude toward formal education. Across all ages and subject areas, students who reported higher parental education levels tended to have higher assessment scores, on average. It should be noted that 9-year-olds' reports of their parents' education level may not be as reliable as that of older students. Approximately one-third of 9-year-olds responded "I do not know" to this question in 1999. (See Appendix B for exact percentages.)

Trends in Reading Scores by Parents' Education

The average reading scores of students by parental education level across the assessment years are shown in Figure 2.10. Among students whose parents had a less than high school education, 9-year-olds attained an average reading score in 1999 that was higher than in

Figure 2.10
Trends in Average Reading Scale Scores by Parents' Highest Level of Education



★Significantly different from 1999.

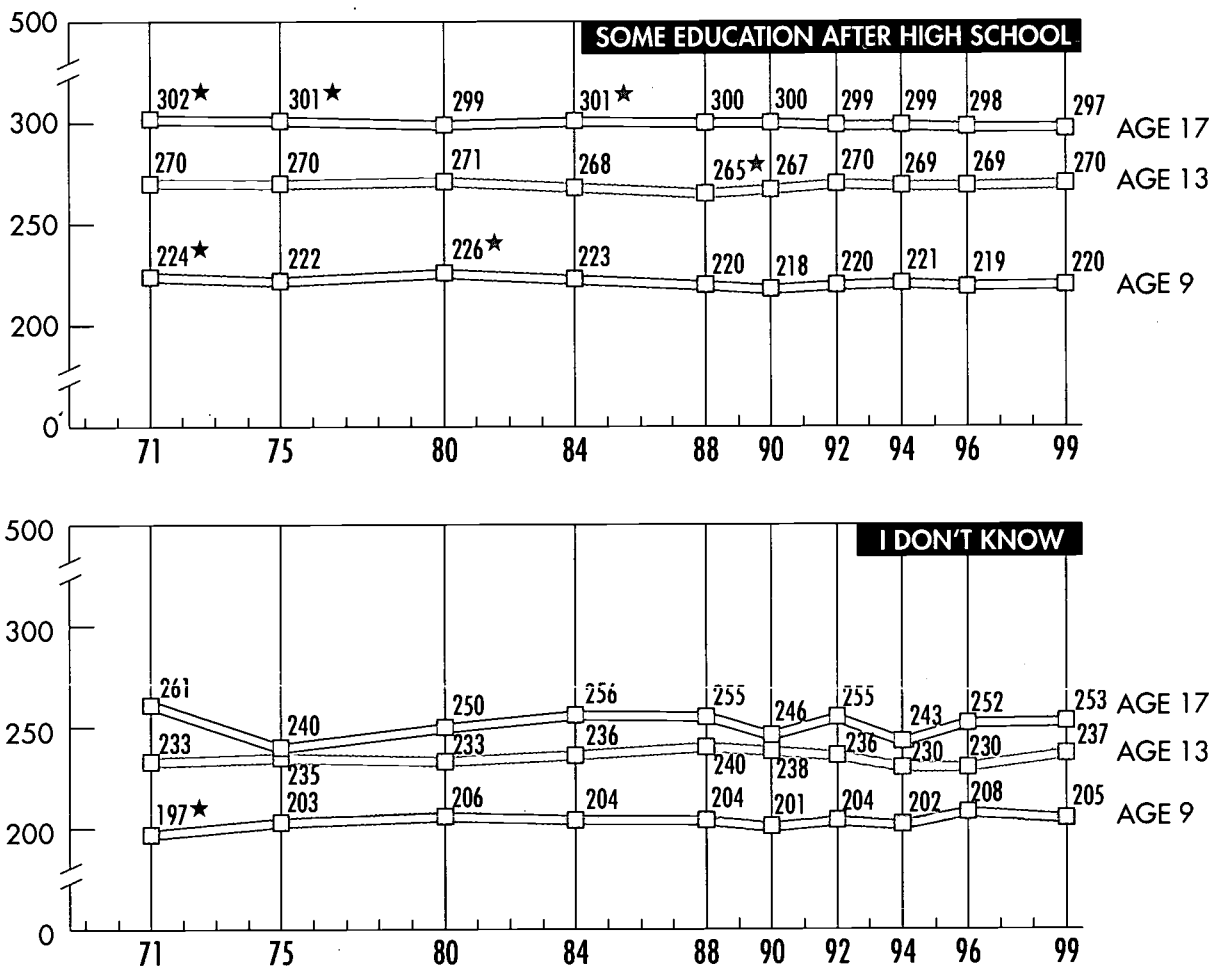
1971 and 1975. At ages 13 and 17, the trend shows nonsignificant fluctuations, except for a peak in 1988 at age 13.

Students at age 9 with parents whose highest education level was high school graduation had attained a higher average score in 1980 than in 1999. At age 13, the trend line shows slowly decreasing scores in reading, with average scores in the last three assessments unchanged, and lower than in 1971. At age 17, the average reading score was lower in 1999 than it had been in the 1970s, most of the 1980s, and the early 1990s.

The overall trend lines for students with at least one parent who had some education after high school are relatively flat or show slight decreases in performance. At ages 9 and 17, the 1999 average score was lower than in 1971.

The only strong variability in average reading scores is evident for students who did not know their parents' level of education. Since this group is quite likely to include students from all of the other groups and to be fairly small, this variability is not unexpected. The age 9 trend is up, with all scores from 1975 on higher than in 1971. The trend line for 13-year-olds shows no significant changes. The age 17 trend line shows fluctuations across the years, but none of the changes are significant. This is probably due to the fact that few 17-year-old students do not know their parents' level of education, leading to a small sample size and more error of measurement as a result.

Figure 2.10 (continued)
Trends in Average Reading Scale Scores by Parents' Highest Level of Education



★Significantly different from 1999.

NOTE: "Graduated College" is not available as a separate category for reading results.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Mathematics Scores by Parents' Education

Average mathematics scores by level of parental education are shown in Figure 2.11. (Note that results by parental education level are not extrapolated back to 1973.) Students at all three ages who reported that their parents had less than a high school education show overall gains since 1978 at all ages.

For students whose parents' highest education level was high school graduation, the trend is generally one of improved performance at ages 9 and 17. The average scores for 9- and 17-year-olds in 1999 were higher than scores in 1978 through 1986.

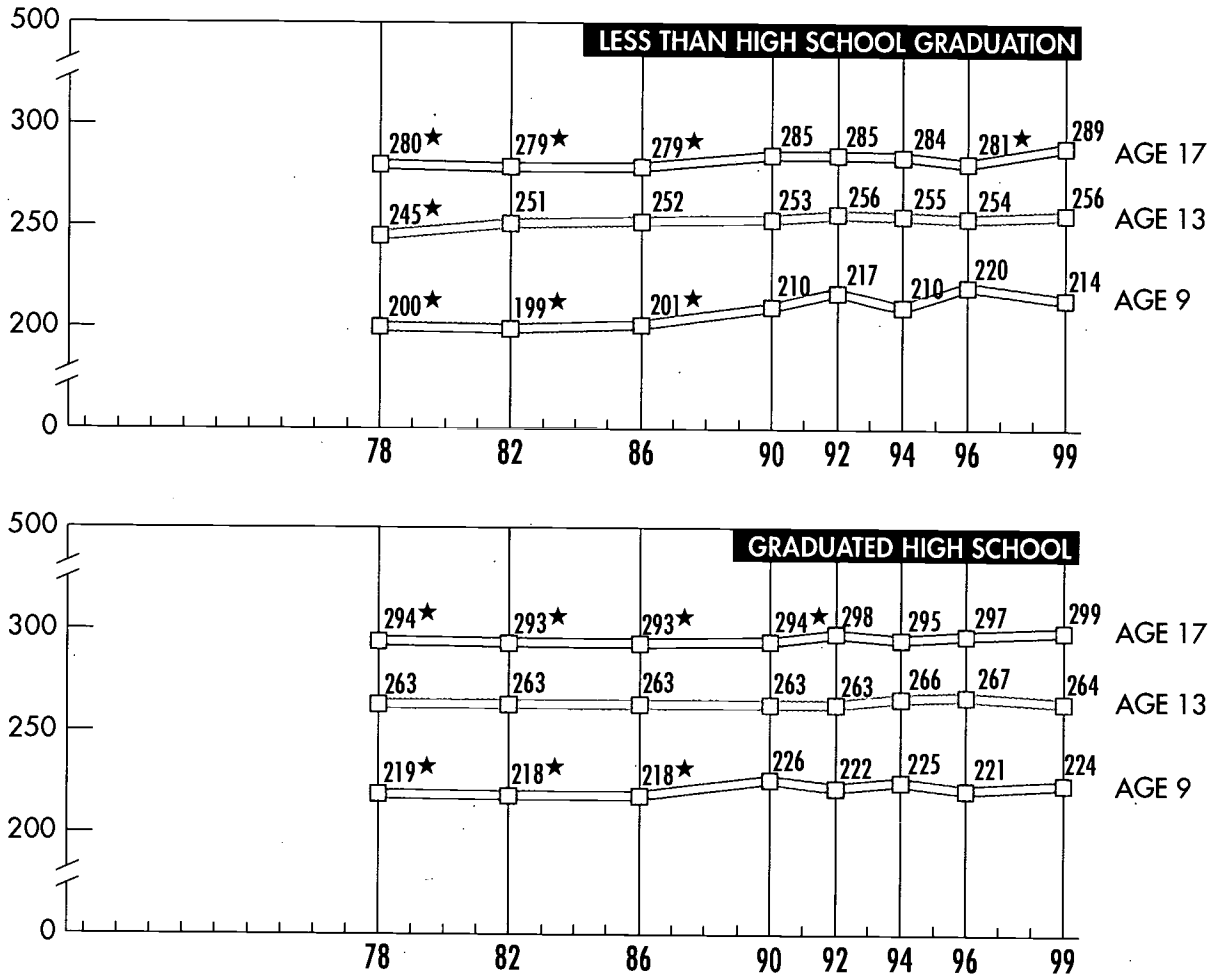
Students who reported that at least one parent had some education after high school also demonstrated overall score increases at ages 9 and 13. The apparent change between the 1978 and 1999 average scores at age 17, however, was not significant, as it was in the other ages.

For students with at least one parent who graduated from college, scores have increased since the 1980s. However, only 9-year-olds had an average score in 1999 that was significantly higher than in 1978.

Among students who did not know their parents' education level, the scores show more tendency to vary between years. Nevertheless, their average scores in 1999 were higher than in 1978.

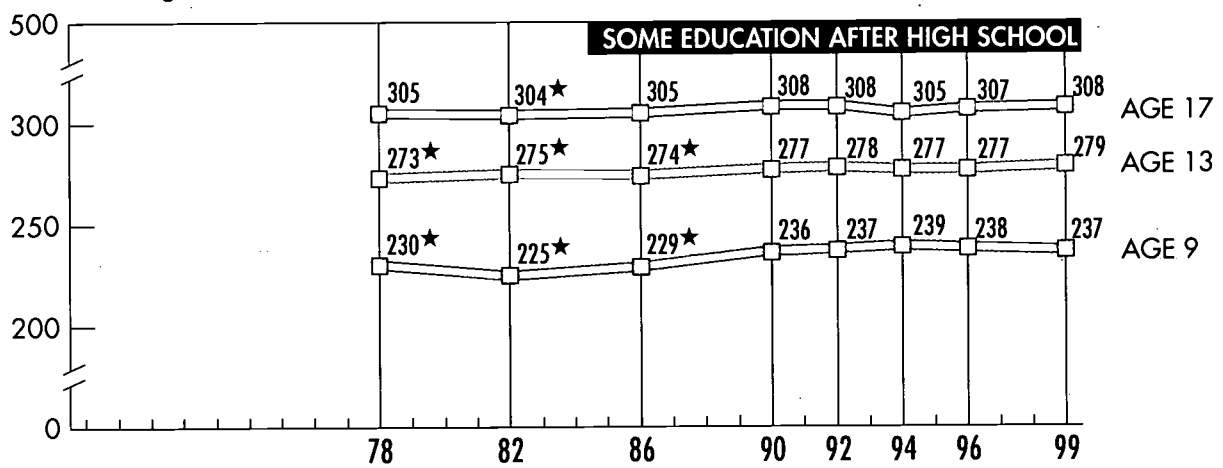
Figure 2.11

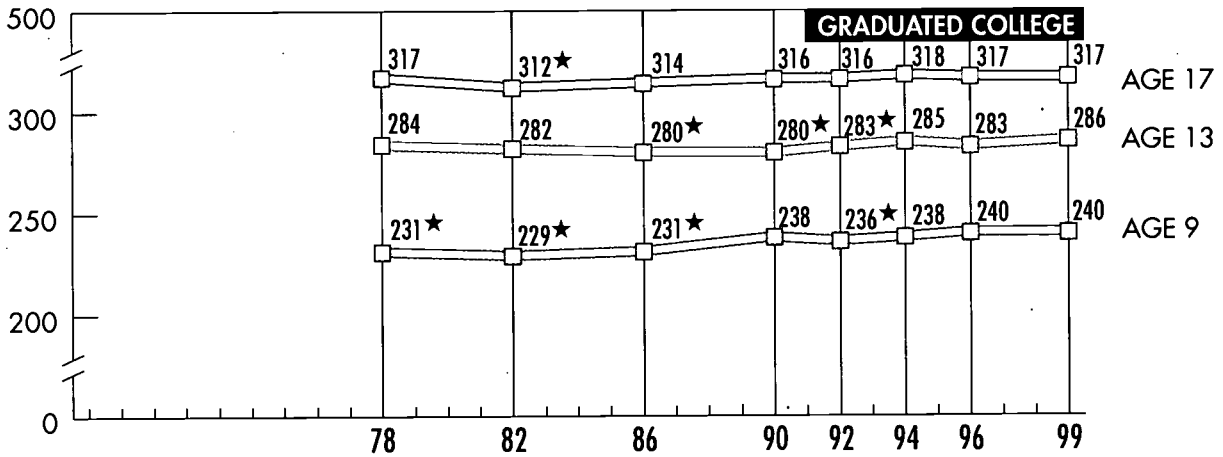
Trends in Average Mathematics Scale Scores by Parents' Highest Level of Education

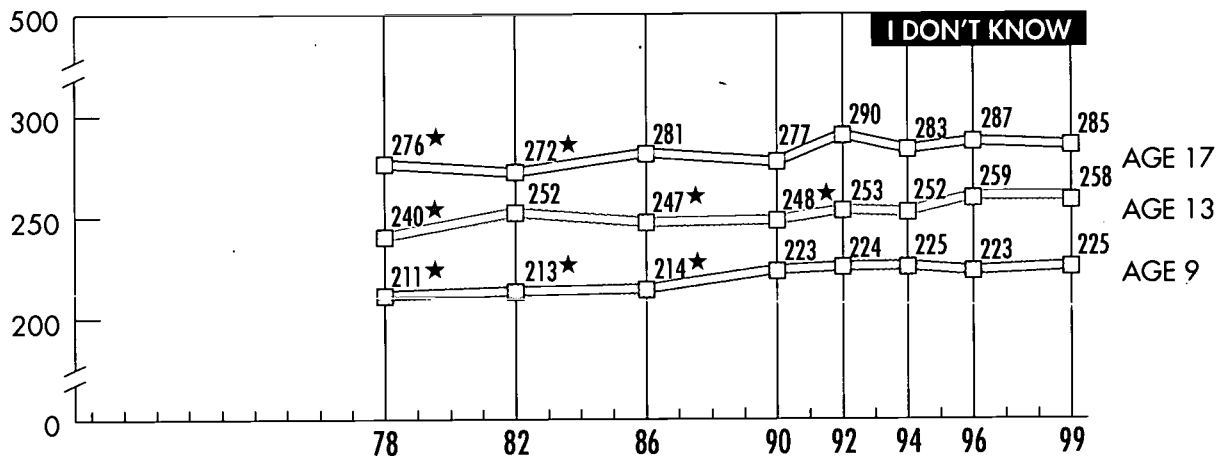


★Significantly different from 1999.

Figure 2.11 (continued)
Trends in Average Mathematics Scale Scores by Parents' Highest Level of Education







★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Trends in Science Scores by Parents' Education

Average science scores by level of parental education are shown in Figure 2.12. (Note that results by parental education level are not extrapolated back to 1969/1970.)

For students who reported that their parents had less than a high school education, only 9-year-olds' average scores were higher in 1999 than in 1977. The other ages show only nonsignificant fluctuations across the assessment years.

For those students with at least one parent who graduated from high school, scores decreased slowly over the assessment years; however, only scores of 9-year-olds were significantly lower in 1999 than in 1977.

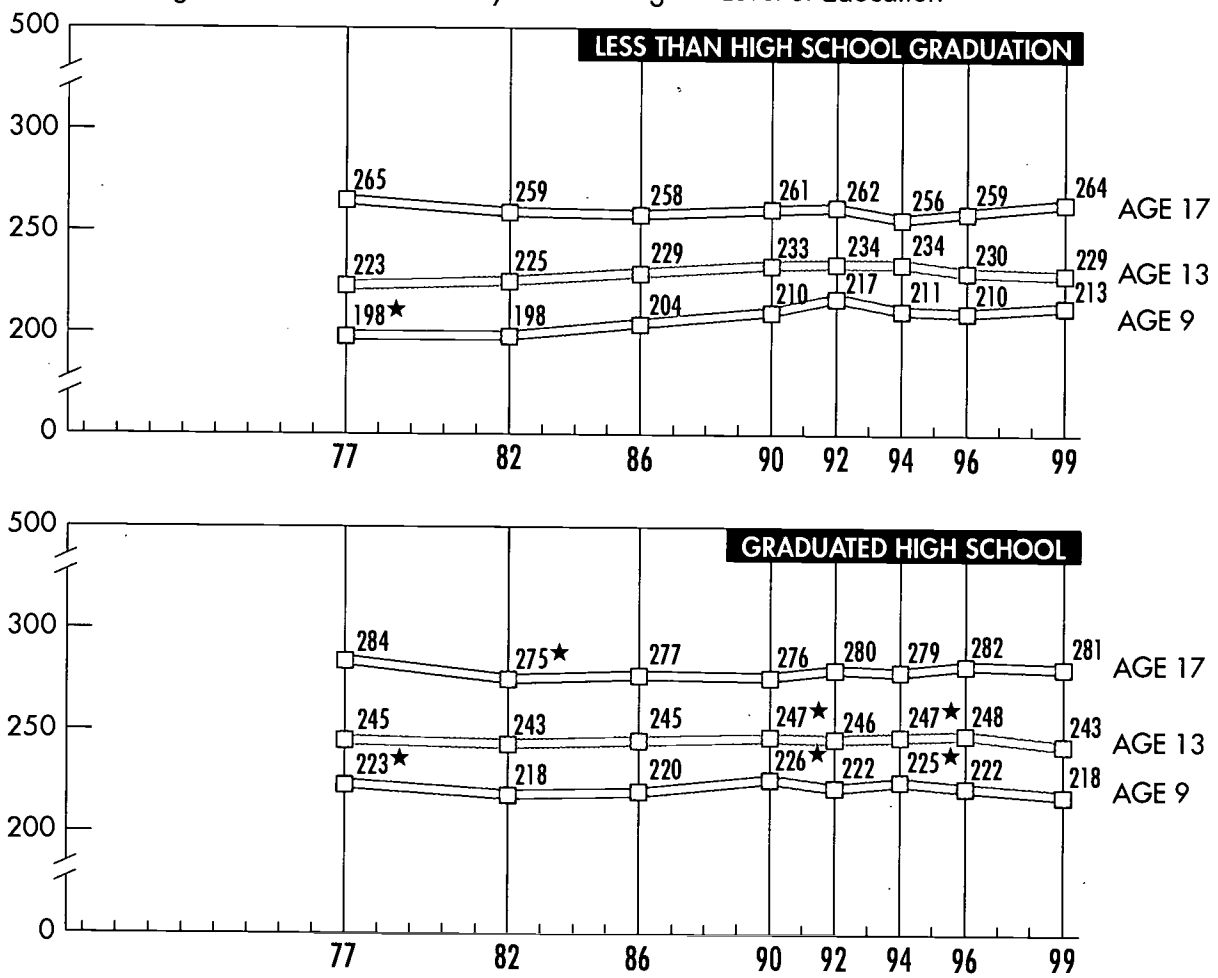
Few significant changes are evident for those students who reported that at least one of their parents had some education after high school. The average score of these students in 1999 did not differ significantly from that in 1977 at any age.

For students with at least one parent who graduated from college, only the increase between 1977 and 1999 among 9-year-olds was statistically significant. Generally, the trend lines show few meaningful changes.

As seen in the other subject areas, the students who did not know their parents' education levels show the most variability. The overall increases from 1977 to 1999 at ages 9 and 13 were statistically significant, while the apparent increase at age 17 was not.

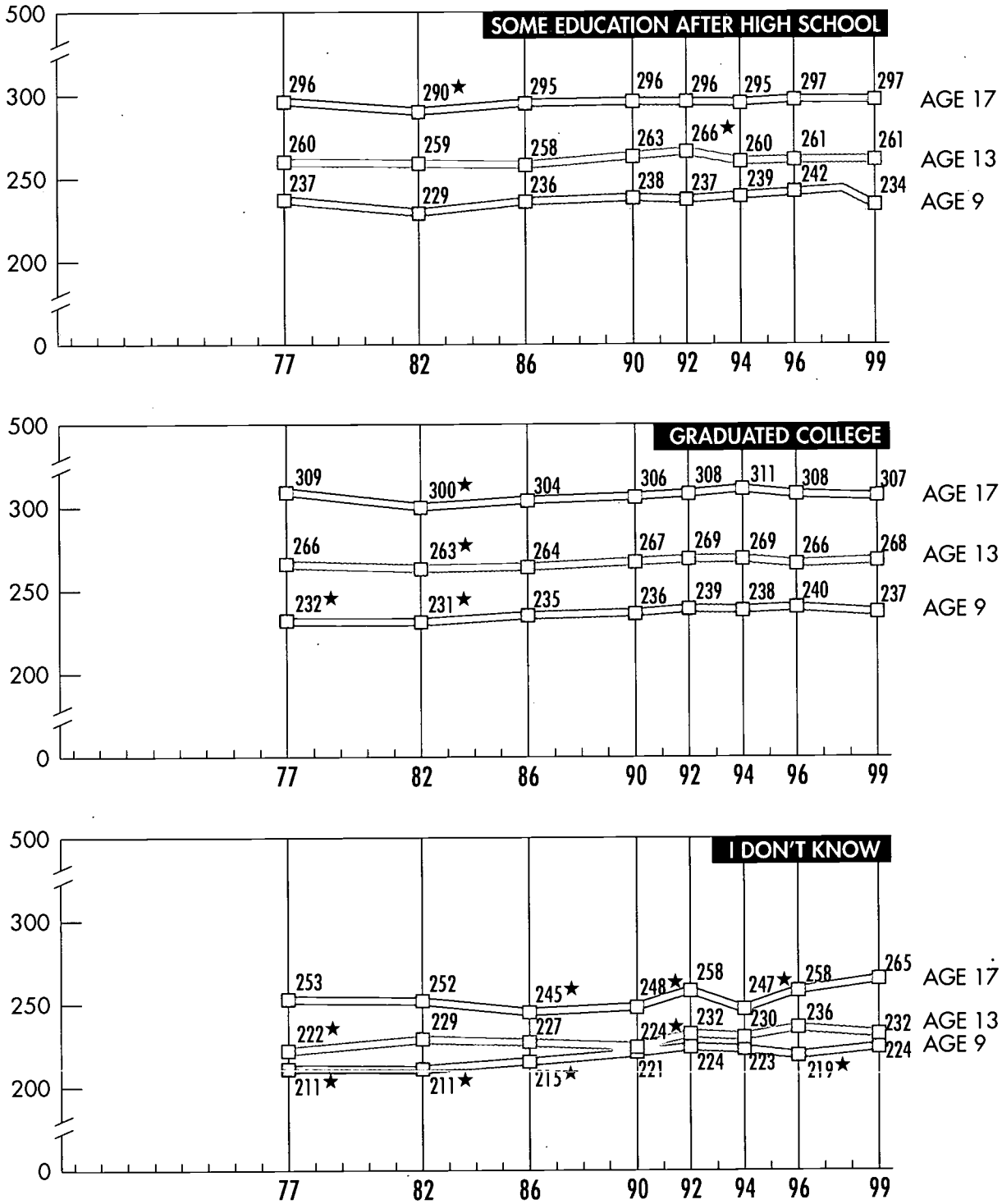
Figure 2.12

Trends in Average Science Scale Scores by Parents' Highest Level of Education



★Significantly different from 1999.

Figure 2.12 (continued)
Trends in Average Science Scale Scores by Parents' Highest Level of Education



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Trends in Academic Achievement for Public and Nonpublic School Students

Differences between the performance of public and nonpublic school students have been the focus of much discussion within the education community during the last two decades. Past NAEP reports and other research have shown that students attending nonpublic schools typically perform higher, on average, than their peers attending public schools.[1] Many educators and researchers, however, have suggested that performance differences between the two groups of students may be related to a variety of socioeconomic and sociological factors, including per-pupil spending, academic curricula, course-taking patterns, school climate, and the level of parental aspirations and involvement.[2] A close examination of past NAEP data has, in fact, shown that performance differences between public and nonpublic school students are minimal when certain factors are controlled such as parental attitudes, student body stability, level of course work, and general school climate.[3]

The NAEP long-term trend assessment has examined public and nonpublic school students' performance separately since 1980 in reading, 1978 in mathematics, and 1977 in science. This section examines these long-term trend results. It should be noted that the smaller sample size of nonpublic school students, as compared to that of public school students, makes it less likely that changes across time will be determined to be statistically significant.

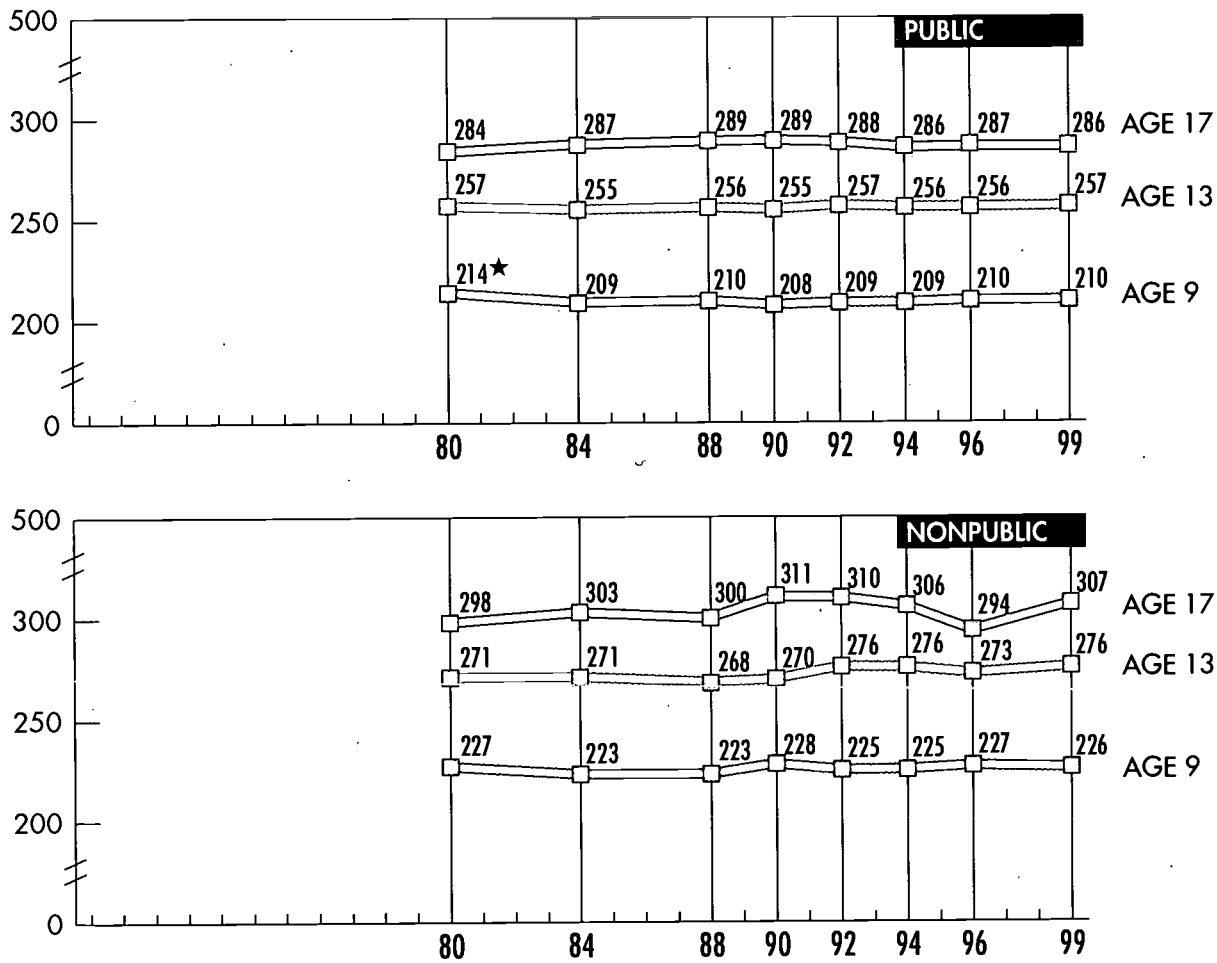
Trends in Reading Scores by Type of School

As shown in Figure 2.13, a decline in the average score for 9-year-old public school students between 1980 and 1984 was followed by relatively stable performance. The average score in 1999 for these students was lower than that in 1980. Only slight fluctuations are seen in the average scores for 13-year-old public school students across the assessment years. None of the apparent differences between years were statistically significant. At age 17, public school students' average reading scores were higher in the late 1980s and early 1990s than in 1980. Similar to results for the nation, however, their scores during the remainder of the 1990s returned to a level similar to that in 1980.

At age 9, the reading scores for nonpublic school students show no consistent trends across the years. Among nonpublic school 13-year-olds, some gains appear evident. However, the gains are somewhat modest, and the apparent difference between 1999 and 1980 scores was not statistically significant. At age 17, some increase in performance was evident in 1990 and 1992, as compared with 1980; however, the apparent difference between 1999 and 1980 was not statistically significant.

In 1999, nonpublic school students at all ages had higher average reading scores than their public school peers.

Figure 2.13
Trends in Average Reading Scale Scores by Type of School



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

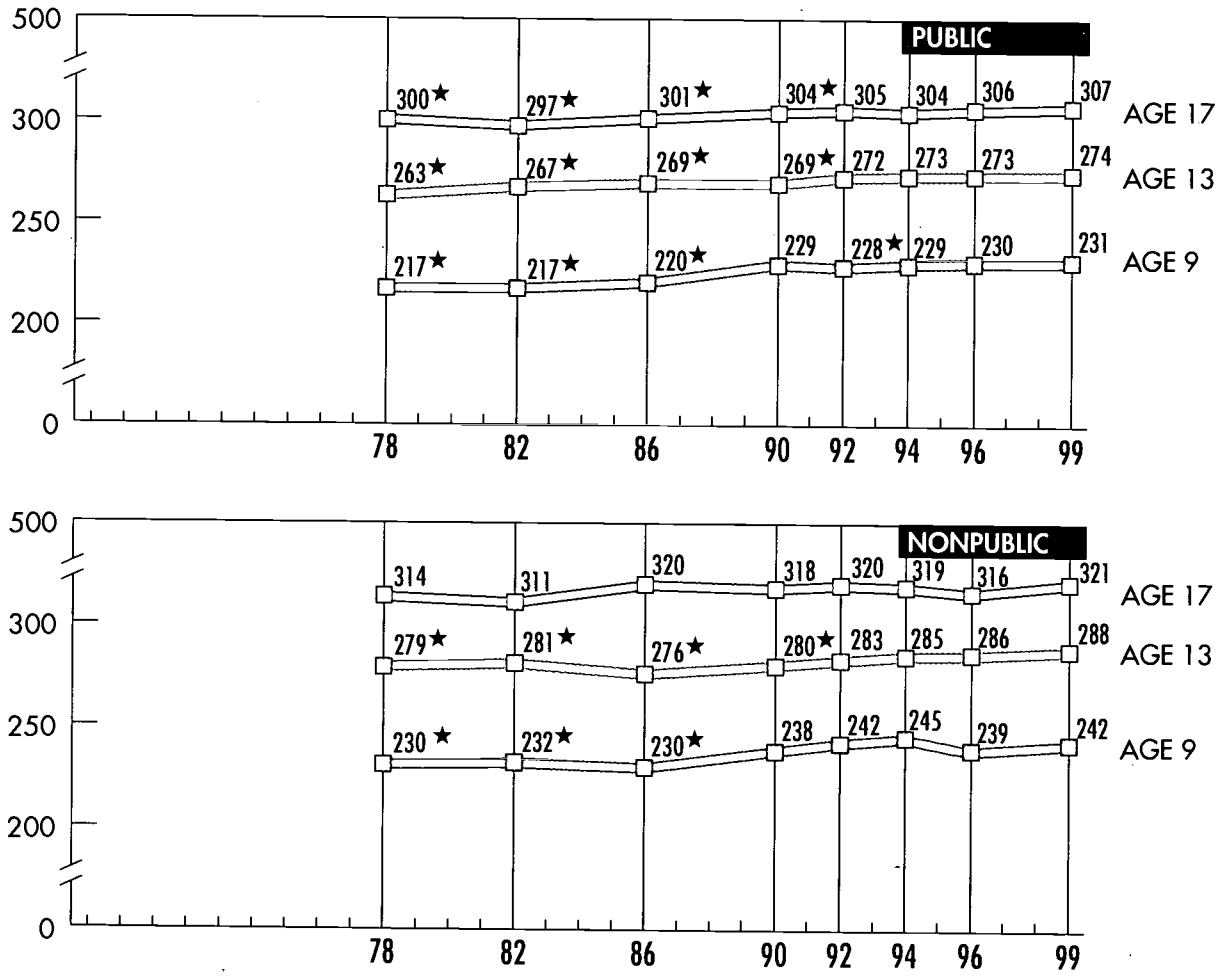
Trends in Mathematics Scores by Type of School

Figure 2.14 displays trends in mathematics scores since 1978 for public and nonpublic school students. Among students attending public schools, 9-year-olds showed significant progress between 1986 and 1990—similar to that seen in the national average results—and the 1999 average score was higher than scores from 1978 through 1986. An overall pattern of increased performance is also evident among 13- and 17-year-old public school students. In 1999, their average scores were higher than scores from 1978 through 1990.

The average score of 9-year-old nonpublic school students, like that of public school students, increased in 1990. Despite some fluctuation in the 1990s, their average score in 1999 was higher than scores from 1978 through 1986. The trend for 13-year-old nonpublic school students is one of overall growth. In 1999, these students attained an average score that was higher than scores from 1978 through 1990. At age 17, the trend line shows some fluctuation across the assessment years, but the apparent gains were not statistically significant.

In 1999, nonpublic school students at all ages had higher average mathematics scores than their public school peers.

Figure 2.14
Trends in Average Mathematics Scale Scores by Type of School



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

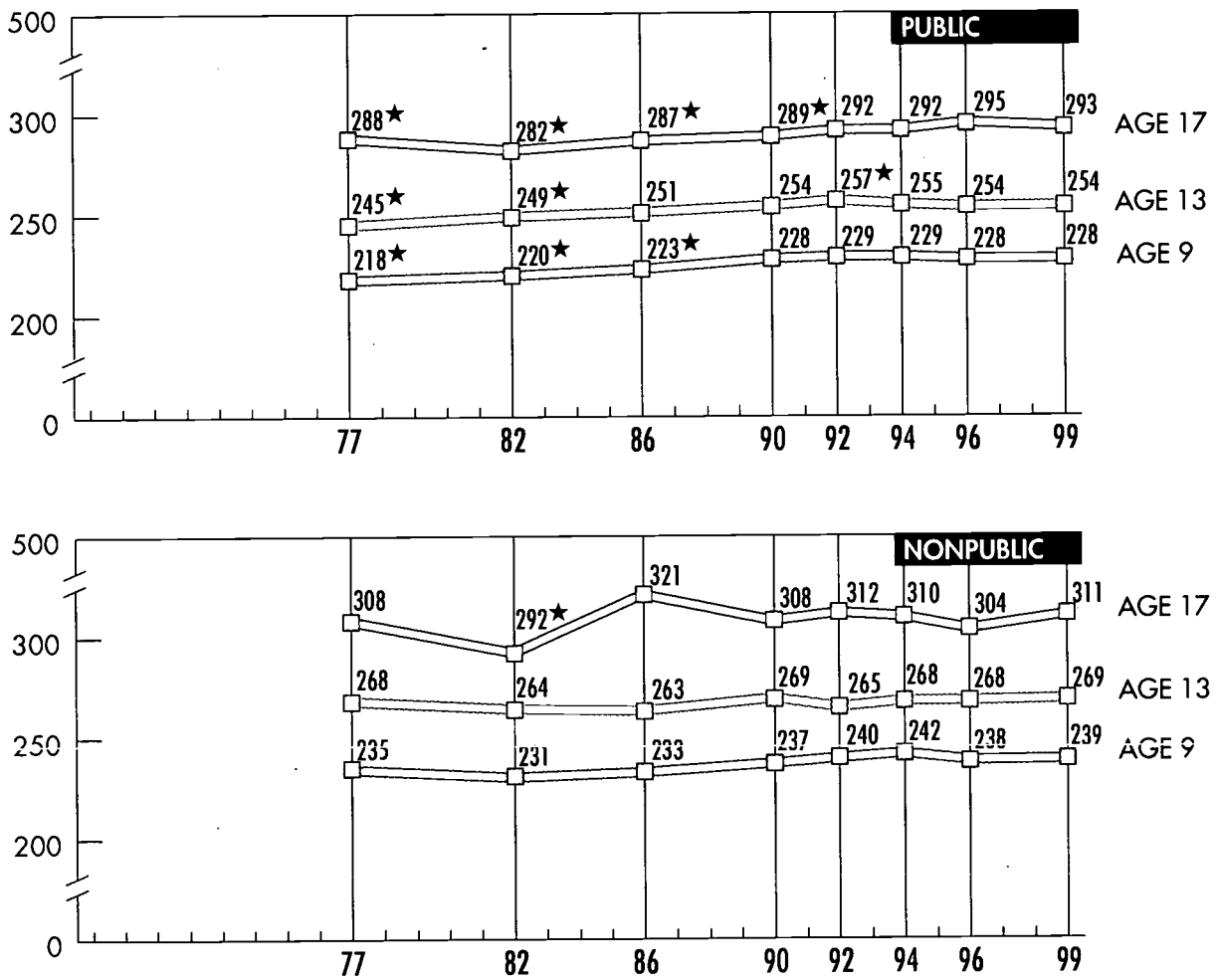
Trends in Science Scores by Type of School

As shown in Figure 2.15, the overall increase in science performance for 9- and 13-year-old public school students occurred, for the most part, between 1977 and 1992. Since that time, scores have remained relatively stable for 9-year-olds and declined slightly for 13-year-olds. Nevertheless, average scores for 9- and 13-year-olds throughout the 1990s remained higher than in 1977. Since 1982, the performance of 17-year-old public school students shows overall gains. Their average scores in 1996 and 1999 were higher than the 1977 average.

Among nonpublic school students, few statistically significant changes can be reported. At age 9, modest gains seem evident, although the apparent difference between 1977 and 1999 was not statistically significant. Performance among 13- and 17-year-olds has fluctuated to the extent that a clear positive or negative overall trend is not evident.

In 1999, nonpublic school students at all ages had higher average science scores than their public school peers.

Figure 2.15
Trends in Average Science Scale Scores by Type of School



★Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Summary

This chapter presented results from the NAEP reading, mathematics, and science long-term trend assessments for students in different subgroups. The subgroups examined were race/ethnicity, gender, level of parental education, and type of school (public or nonpublic).

The following figures provide an overview of the major findings presented in this chapter. In each line of the display, the average score for a particular group of students in 1999 is compared to that in the first assessment year in which data are available, and to that in 1990. Arrows pointing upward (↑) indicate significant increases, horizontal arrows (→) indicate no significant change, and arrows pointing downward (↓) indicate significant decreases. For example, the first line of the display indicates that the average reading score for white 9-year-olds in 1999 was higher than in 1971, but it was not significantly different from 1990.

Figure 2.16
Summary of Trends in Average Scores for Racial/Ethnic Subgroups

Reading Scores

↑ White 9-year-olds since 1971 ..... (→ since 1990)
↑ White 13-year-olds since 1971 ..... (↑ since 1990)
→ White 17-year-olds since 1971 ..... (→ since 1990)

↑ Black 9-year-olds since 1971 ..... (→ since 1990)
↑ Black 13-year-olds since 1971 ..... (→ since 1990)
↑ Black 17-year-olds since 1971 ..... (→ since 1990)

↑ Hispanic 9-year-olds since **1975** ..... (→ since 1990)
↑ Hispanic 13-year-olds since **1975** ..... (→ since 1990)
↑ Hispanic 17-year-olds since **1975** ..... (→ since 1990)

Mathematics Scores

↑ White 9-year-olds since 1973 ..... (↑ since 1990)
↑ White 13-year-olds since 1973 ..... (↑ since 1990)
↑ White 17-year-olds since 1973 ..... (↑ since 1990)

↑ Black 9-year-olds since 1973 ..... (→ since 1990)
↑ Black 13-year-olds since 1973 ..... (→ since 1990)
↑ Black 17-year-olds since 1973 ..... (→ since 1990)

↑ Hispanic 9-year-olds since 1973 ..... (→ since 1990)
↑ Hispanic 13-year-olds since 1973 ..... (→ since 1990)
↑ Hispanic 17-year-olds since 1973 ..... (↑ since 1990)

Science Scores

↑ White 9-year-olds since 1970 ..... (→ since 1990)
↑ White 13-year-olds since 1970 ..... (→ since 1990)
↓ White 17-year-olds since 1969 ..... (↑ since 1990)

↑ Black 9-year-olds since 1970 ..... (→ since 1990)
↑ Black 13-year-olds since 1970 ..... (→ since 1990)
→ Black 17-year-olds since 1969 ..... (→ since 1990)

↑ Hispanic 9-year-olds since **1977** ..... (→ since 1990)
↑ Hispanic 13-year-olds since **1977** ..... (→ since 1990)
↑ Hispanic 17-year-olds since **1977** ..... (↑ since 1990)

NOTE: Years are shown in boldface when the comparison year is different from the initial assessment year because earlier data are not available.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 2.17
Summary of Trends in Average Scores for Males and Females

Reading Scores

↑ Male 9-year-olds since 1971 ..... (→ since 1990)
↑ Male 13-year-olds since 1971 ..... (→ since 1990)
→ Male 17-year-olds since 1971 ..... (→ since 1990)

→ Female 9-year-olds since 1971 ..... (→ since 1990)
↑ Female 13-year-olds since 1971 ..... (→ since 1990)
→ Female 17-year-olds since 1971 ..... (→ since 1990)

Mathematics Scores

↑ Male 9-year-olds since 1973 ..... (↑ since 1990)
↑ Male 13-year-olds since 1973 ..... (↑ since 1990)
→ Male 17-year-olds since 1973 ..... (↑ since 1990)

↑ Female 9-year-olds since 1973 ..... (→ since 1990)
↑ Female 13-year-olds since 1973 ..... (↑ since 1990)
↑ Female 17-year-olds since 1973 ..... (↑ since 1990)

Science Scores

→ Male 9-year-olds since 1970 ..... (→ since 1990)
→ Male 13-year-olds since 1970 ..... (→ since 1990)
↓ Male 17-year-olds since 1969 ..... (↑ since 1990)

↑ Female 9-year-olds since 1970 ..... (→ since 1990)
→ Female 13-year-olds since 1970 ..... (→ since 1990)
↓ Female 17-year-olds since 1969 ..... (↑ since 1990)

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 2.18
Summary of Trends in Average Scores by Parents' Highest Education Level

Reading Scores

↑ "less than high school" 9-year-olds since 1971 ..... (→ since 1990)
→ "less than high school" 13-year-olds since 1971 ..... (→ since 1990)
→ "less than high school" 17-year-olds since 1971 ..... (→ since 1990)

→ "graduated high school" 9-year-olds since 1971 ..... (→ since 1990)
↓ "graduated high school" 13-year-olds since 1971 ..... (→ since 1990)
↓ "graduated high school" 17-year-olds since 1971 ..... (↓ since 1990)

↓ "post high school" 9-year-olds since 1971 ..... (→ since 1990)
→ "post high school" 13-year-olds since 1971 ..... (→ since 1990)
↓ "post high school" 17-year-olds since 1971 ..... (→ since 1990)

Mathematics Scores

↑ "less than high school" 9-year-olds since **1978** ..... (→ since 1990)
↑ "less than high school" 13-year-olds since **1978** ..... (→ since 1990)
↑ "less than high school" 17-year-olds since **1978** ..... (→ since 1990)

↑ "graduated high school" 9-year-olds since **1978** ..... (→ since 1990)
→ "graduated high school" 13-year-olds since **1978** ..... (→ since 1990)
↑ "graduated high school" 17-year-olds since **1978** ..... (↑ since 1990)

↑ "some ed. after high school" 9-year-olds since **1978** ..... (→ since 1990)
↑ "some ed. after high school" 13-year-olds since **1978** ... (→ since 1990)
→ "some ed. after high school" 17-year-olds since **1978** ... (→ since 1990)

↑ "graduated college" 9-year-olds since **1978** ..... (→ since 1990)
→ "graduated college" 13-year-olds since **1978** ..... (↑ since 1990)
→ "graduated college" 17-year-olds since **1978** ..... (→ since 1990)

Science Scores

↑ "less than high school" 9-year-olds since **1977** ..... (→ since 1990)
→ "less than high school" 13-year-olds since **1977** ..... (→ since 1990)
→ "less than high school" 17-year-olds since **1977** ..... (→ since 1990)

↓ "graduated high school" 9-year-olds since **1977** ..... (↓ since 1990)
→ "graduated high school" 13-year-olds since **1977** ..... (↓ since 1990)
→ "graduated high school" 17-year-olds since **1977** ..... (→ since 1990)

→ "some ed. after high school" 9-year-olds since **1977** ..... (→ since 1990)
→ "some ed. after high school" 13-year-olds since **1977** ... (→ since 1990)
→ "some ed. after high school" 17-year-olds since **1977** ... (→ since 1990)

↑ "graduated college" 9-year-olds since **1977** ..... (→ since 1990)
→ "graduated college" 13-year-olds since **1977** ..... (→ since 1990)
→ "graduated college" 17-year-olds since **1977** ..... (→ since 1990)

NOTE: Years are shown in boldface when the comparison year is different from the initial assessment year because earlier data are not available.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 2.19
Summary of Trends in Average Scores by Type of School

Reading Scores

↓ Public school 9-year-olds since **1980** ..... (→ since 1990)
→ Public school 13-year-olds since **1980** ..... (→ since 1990)
→ Public school 17-year-olds since **1980** ..... (→ since 1990)

→ Nonpublic school 9-year-olds since **1980** ..... (→ since 1990)
→ Nonpublic school 13-year-olds since **1980** ... (→ since 1990)
→ Nonpublic school 17-year-olds since **1980** ... (→ since 1990)

Mathematics Scores

↑ Public school 9-year-olds since **1978** ..... (→ since 1990)
↑ Public school 13-year-olds since **1978** ..... (↑ since 1990)
↑ Public school 17-year-olds since **1978** ..... (↑ since 1990)

↑ Nonpublic school 9-year-olds since **1978** ..... (→ since 1990)
↑ Nonpublic school 13-year-olds since **1978** ... (↑ since 1990)
→ Nonpublic school 17-year-olds since **1978** ... (→ since 1990)

Science Scores

↑ Public school 9-year-olds since **1977** ..... (→ since 1990)
↑ Public school 13-year-olds since **1977** ..... (→ since 1990)
↑ Public school 17-year-olds since **1977** ..... (↑ since 1990)

→ Nonpublic school 9-year-olds since **1977** ..... (→ since 1990)
→ Nonpublic school 13-year-olds since **1977** ... (→ since 1990)
→ Nonpublic school 17-year-olds since **1977** ... (→ since 1990)

NOTE: Years are shown in boldface when the comparison year is different from the initial assessment year because earlier data are not available.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

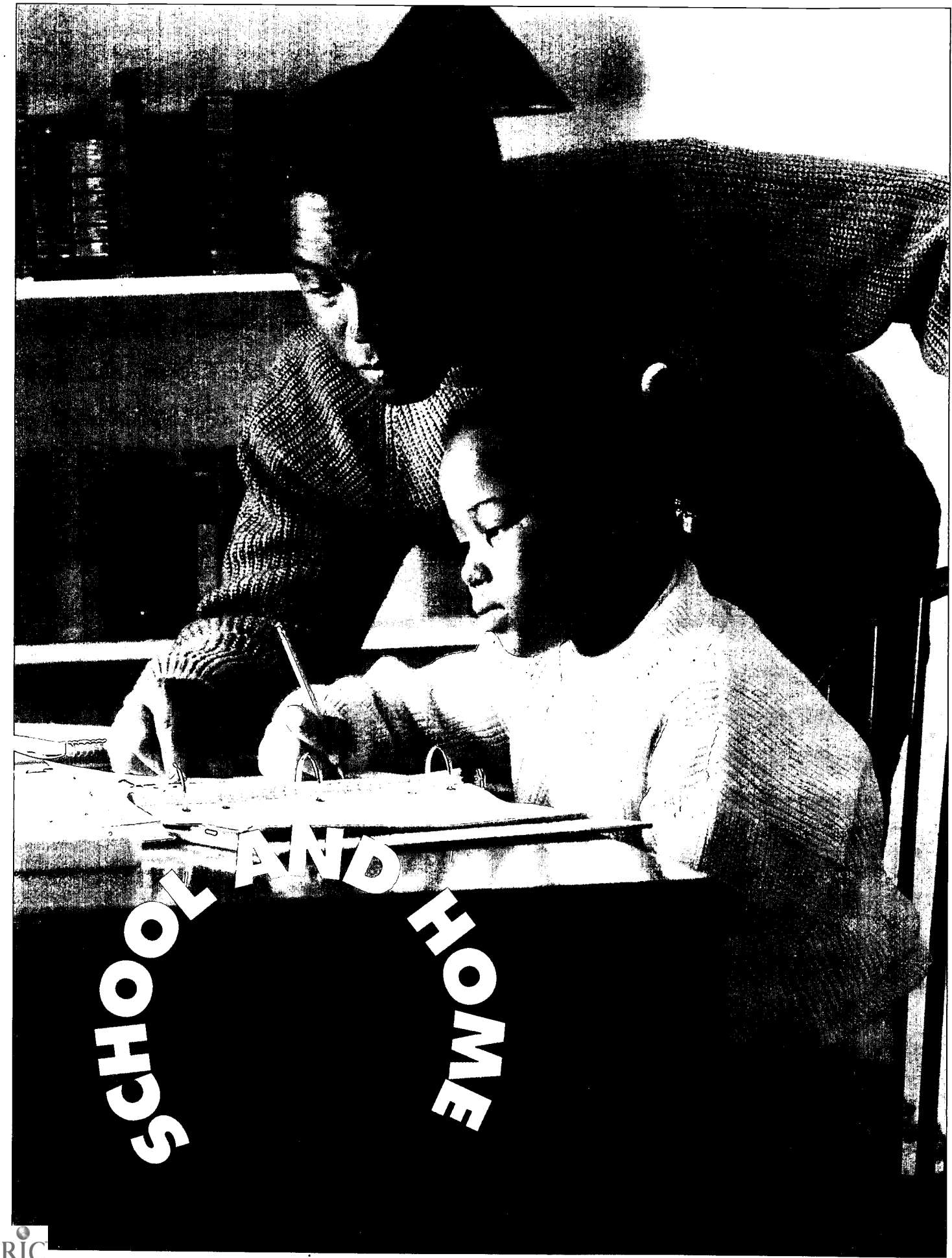
Endnotes for Chapter 2

1 Coleman, J. S., Hoffer, T., & Kilgore, S. (1982). *High school achievement: Public, Catholic, and private schools compared.* Basic Books.

Campbell, J. R., Voelkl, K. E., & Donahue, P. L. (2000). *NAEP 1996 trends in academic progress.* (NCES 97-985r) National Center for Education Statistics. Washington, DC: National Center for Education Statistics.

2 Berliner, D., & Biddle, B. (1996). In defense of schools. *Vocational Education Journal, (71)*3, 36-38.

3 Mullis, I. V. S., Jenkins, F., & Johnson, E. G. (1994). *Effective schools in mathematics: Perspectives from the NAEP 1992 assessment.* National Center for Education Statistics. Washington, DC: U. S. Government Printing Office.


SCHOOL AND HOME

CHAPTER 3

TRENDS IN STUDENTS' SCHOOL AND HOME EXPERIENCES

At the beginning of the twenty-first century, it is evident that the context in which students learn is quite different from that of their parents three decades ago. Since the first administration of NAEP's long-term trend assessments, six different U.S. Presidents have been in office, dramatic political and economic shifts have changed the face of the globe, and computer technology has moved out of the laboratory and onto our desks, into our homes, and inside our backpacks.

As society and its tools have changed, shifts in educational priorities and methods can be observed as well. Increased expectation for all students to achieve academic excellence has led to expanded offerings of advanced courses.[1] Concern for students' preparedness to succeed in a technology-based economy has brought computers into classrooms and homes and has led to an emphasis on hands-on learning with technological tools.[2] Also, the recognition that accessing, using, and communicating information are now central to the work environment has increased our long-standing concern for students' literacy skills.[3]

Throughout the 30 years of NAEP's long-term trend assessments, students have responded to a variety of questions about their school and home experiences. The information gained from students' responses provides insight into the activities and experiences that form the context in which students learn. This chapter highlights students' responses to NAEP background questions about several key factors often associated with student achievement.

In the following sections, data are presented to show each factor's relationship to scores on the 1999 NAEP mathematics, science, or reading long-term trend assessment. The scale scores examined in relation to each factor vary according to the subject-area assessment in which the question was asked. It should be noted, however, that a relationship between NAEP scores and students' responses to certain questions does not establish a causal relationship between a particular factor and student achievement. The relationship may be influenced by a number of other variables not accounted for in this report.

In order to illustrate changes in students' school and home experiences, responses given by students in the 1999 assessment are compared with those from the first assessment in which the questions were asked. (The comparison year varies by question.) These comparisons demonstrate, in some cases vividly, how the context of education has changed during the last three decades of the twentieth century.

Mathematics Course-Taking

Students' achievement in mathematics is very much related to their opportunities to learn mathematics. One important aspect of their opportunity to learn is the number and type of mathematics courses students take. Clearly, advanced learning is facilitated by taking increasingly advanced course work.[4] This section examines the relationship between the types of mathematics courses taken by 13- and 17-year-olds and their average scores on the 1999 long-term trend mathematics assessment. In addition, changes in course-taking patterns are discussed for 13-year-olds since 1986, and for 17-year-olds since 1978—the first years in which students were asked about mathematics course-taking.

Mathematics Course-Taking at Age 13

Most 13-year-olds are required to take some type of mathematics class. The courses offered to these students often range from regular mathematics to algebra, with prealgebra as an intermediate level. Assuming that most 13-year-olds are preparing to enter secondary education, their ability to move directly into high school algebra instruction may be enhanced by the algebra or prealgebra instruction they are currently receiving.[5] As shown in Figure 3.1, the type of mathematics course taken by 13-year-olds in 1999 did bear a relationship to students' mathematics scores on the NAEP long-term trend assessment. Students who were taking algebra scored higher, on average, than students taking prealgebra, who in turn scored higher than students taking regular mathematics.

Changes in the mathematics course-taking patterns of 13-year-olds are illustrated in Figure 3.2. In 1986, the majority of 13-year-olds (61 percent) were taking a regular mathematics course. By 1999, this percentage had decreased to 37 percent. This drop in regular mathematics course-taking resulted mostly from an increase in the percentage of students taking prealgebra or algebra. Increasing 13-year-olds' exposure to prealgebra and algebra is consistent with the recommendations of many mathematics educators, and reflects the

Figure 3.1
Average Mathematics Scores by Type of Mathematics Course at Age 13, 1999

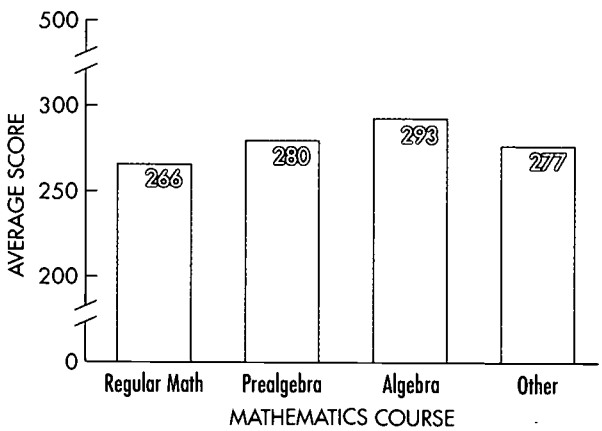
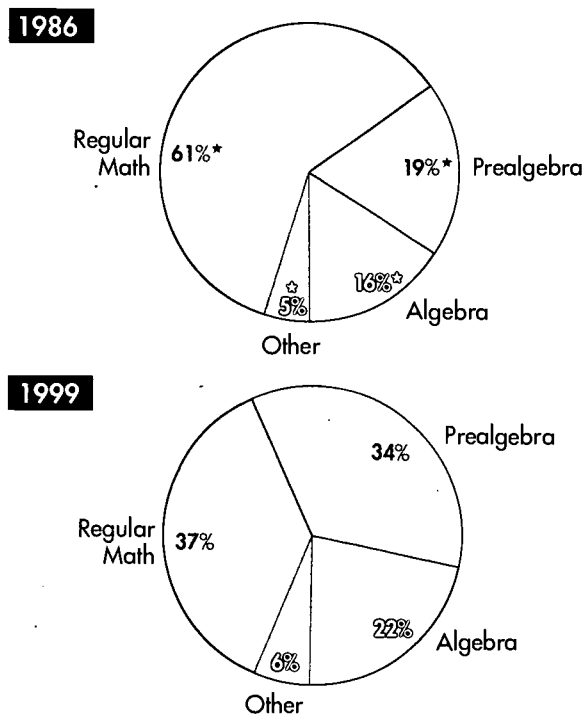


Figure 3.2
Percentage of 13-Year-Olds by Type of Mathematics Course, 1986 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

efforts made by many schools during the last decade to introduce algebraic concepts earlier into the mathematics curriculum.[6]

Mathematics Course-Taking at Age 17

Although mathematics course-taking is typically compulsory for 13-year-olds, this is not necessarily the case for 17-year-olds. By age 17, many students have fulfilled their mathematics course-taking requirements and are not currently enrolled in a mathematics course.[7] Therefore, 17-year-olds in the NAEP long-term trend assessment are asked to identify the highest level of mathematics course they have taken, rather than the course in which they are currently enrolled.

If students have continuously been enrolled in progressively more advanced mathematics courses throughout high school, it would be expected that they would eventually reach a second-year algebra course or higher (calculus or precalculus).[8] It may also be expected that students in more advanced courses are likely to attain higher scores on the NAEP long-term trend assessment than students in less advanced courses. Figure 3.3 displays data from the 1999 assessment that confirm this expectation. The results indicate that more advanced course work was associated with higher average mathematics scores.

Increasing students' opportunities for advanced course work in the high school curriculum has been a stated goal of educators and policy makers for many years.[9] The data presented in Figure 3.4 provide some indication that progress has been made in achieving this goal. In 1978, less than half of 17-year-olds had taken algebra II or precalculus/calculus. By 1999, nearly two-thirds of 17-year-olds reported that they had taken one of these more advanced mathematics courses. At the algebra II level, the percentage increased from 37 to 51 percent; and at the precalculus/calculus level, the percentage had more than doubled—from 6 to 13 percent.

Figure 3.3
Average Mathematics Scores by Highest Mathematics Course Taken at Age 17, 1999

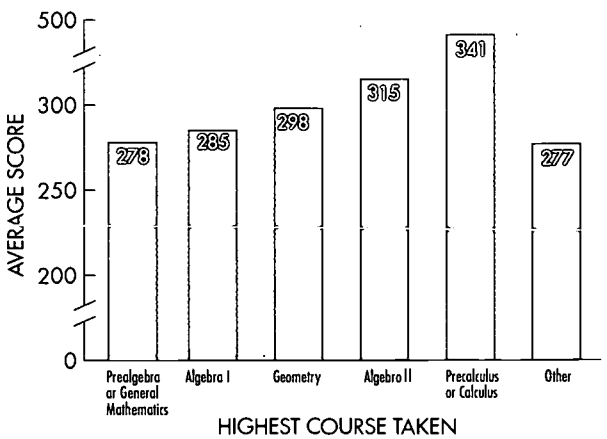
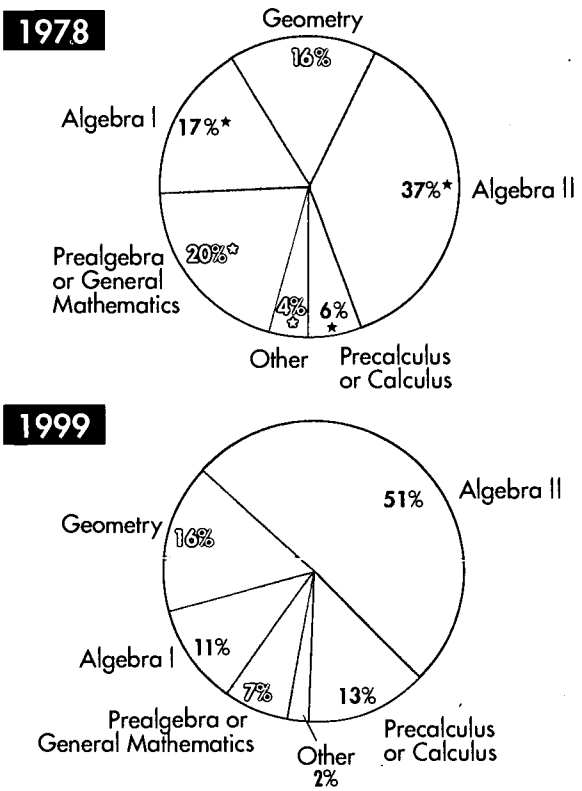


Figure 3.4
Percentage of 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999

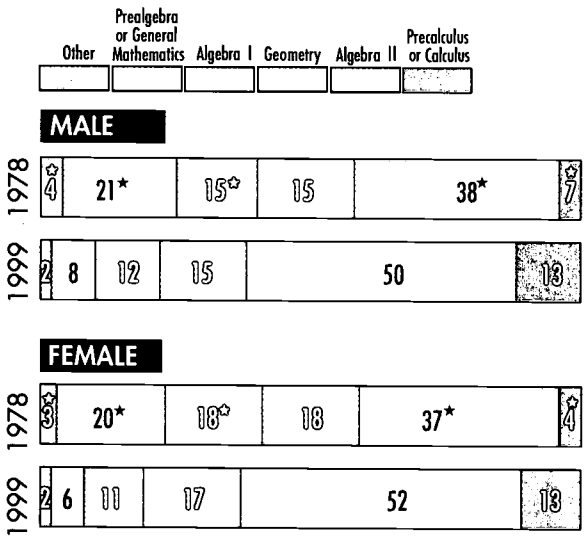


★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

In reaching the goal of increased opportunities for advanced course work, one concern is that all students, regardless of gender or racial/ethnic background, be afforded similar opportunities and be encouraged to pursue them.[10] Figure 3.5 shows that similar increases in taking advanced course work are evident between male and female students. For both groups, increases in the percentage of students reaching the algebra II or precalculus/calculus levels correspond with decreases in the percentage reaching only the prealgebra/general mathematics or algebra I levels. In 1999, males and females were reaching the advanced levels of mathematics study in relatively the same proportions.

Figure 3.5
Percentage of Male and Female 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Changes in mathematics course-taking patterns for white, black, and Hispanic students are displayed in Figure 3.6. Although gains can be seen within each group of students in the percentage reaching more advanced courses, the figure shows that the pattern varies slightly across the three groups.

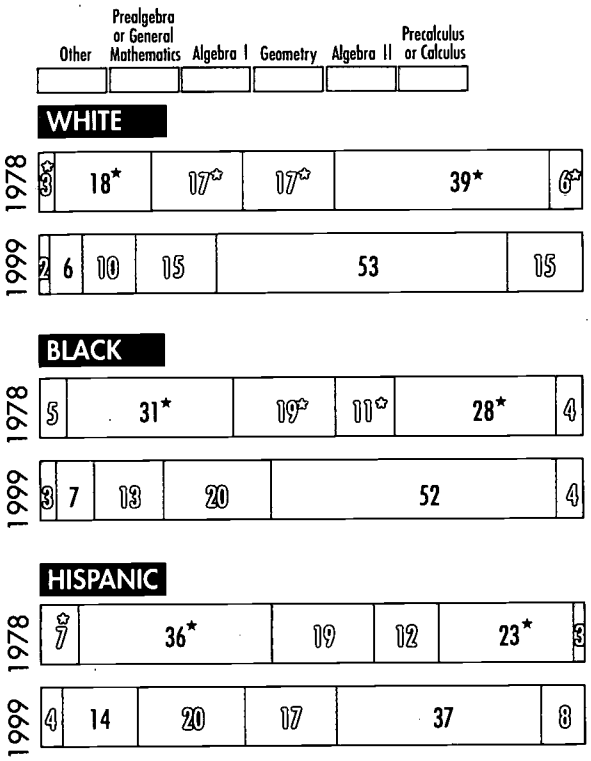
Among white 17-year-olds, increases in the percentage of students reaching algebra II or precalculus/calculus correspond to decreases in the percentages who reached only the prealgebra/general mathematics, algebra I, or geometry levels. In 1978 less than half had reached at least algebra II, compared with approximately two-thirds in 1999.

Among black 17-year-olds, increases in the percentage of students reaching geometry or algebra II correspond to decreases in the percentages who reached only the prealgebra/general mathematics or algebra I levels. Slightly more than half of the black students in 1999 had taken algebra II, compared with only 28 percent in 1978. However, the percentage of black students reaching the highest level, precalculus/calculus in 1999 was similar to that in 1978.

Among Hispanic 17-year-olds, a greater percentage of students had taken algebra II in 1999 than in 1978 (37 percent compared to 23 percent), and a smaller percentage had reached only the prealgebra/general mathematics level. The apparent increase between 1978 and 1999 in the percentage of Hispanic students taking precalculus/calculus was not statistically significant.

Despite significant progress in advanced course-taking across the three racial/ethnic groups, white students continued to take the most advanced courses in higher proportions than black or Hispanic students. In 1999, about two-thirds of white students had taken algebra II or precalculus/calculus; by contrast, 56 percent of black students and 45 percent of Hispanic students had done so.

Figure 3.6
Percentage of White, Black, and Hispanic 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Science Course-Taking

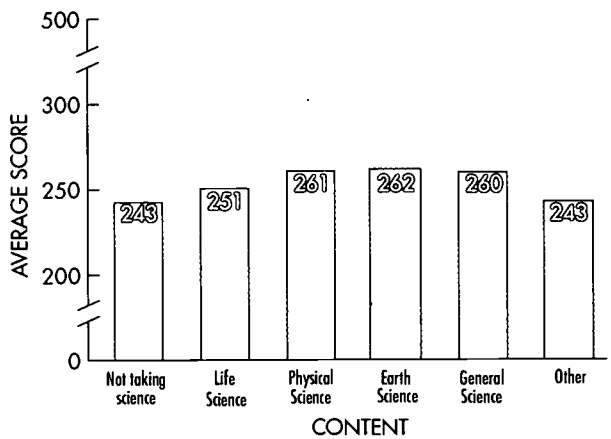
Scientific advances during the last three decades have undoubtedly had an impact on schools' science curricula. The pressure to keep pace with these advances—to ensure that students have the knowledge to pursue higher education and succeed at highly technical careers—has influenced the types and content of science courses offered.[11] This section examines the relationship between students' average scores on the 1999 long-term trend science assessment and the content of 13- and 17-year-olds' science courses. In addition, changes since 1986 in the content of science course work is discussed.

Science Course-Taking at Age 13

At age 13, students are typically required to take a science course. At this level, course content may vary by field, with different fields of science—life science or physical science—receiving particular emphasis. Or, the course may attempt to cover science topics more generally, addressing as broad a range as possible to prepare students for secondary education.

Thirteen-year-old students in the NAEP long-term trend assessment were asked to identify the primary focus of their science class. The relationship between their responses and their average science scores on the assessment are shown in Figure 3.7. Students who indicated that they were mainly studying physical science or earth science, or were taking a more general science course had higher average scores than students who indicated that they were not taking science or were mainly studying life science.

Figure 3.7
Average Science Scores by Content of Science Class at Age 13, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

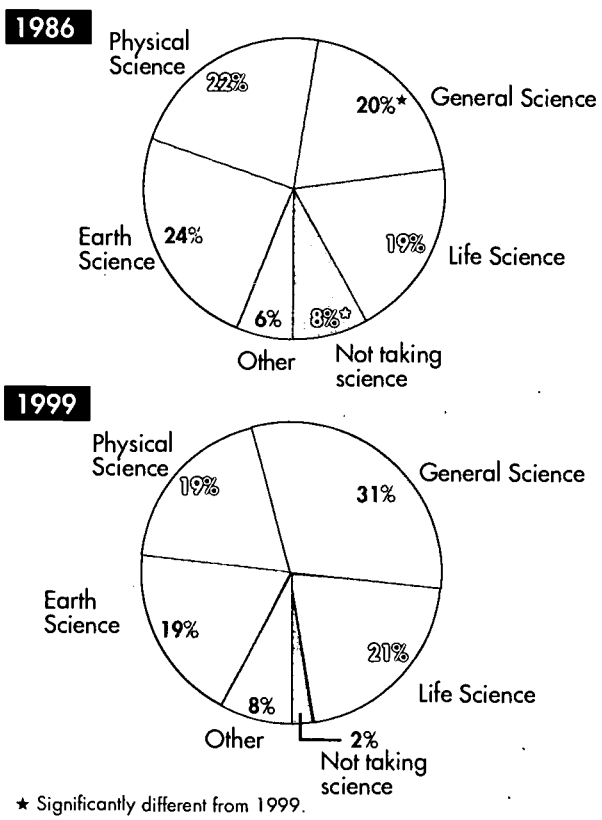
Moderate changes between 1986 and 1999 in students' responses to this question about their science class are seen in Figure 3.8. The most apparent shift in the content of science classes appears to be from a specific focus on one field of science to a more general coverage of science. In 1999, 31 percent of 13-year-olds described the focus of their science class as "general science," compared with only 20 percent in 1986. It may also be worth noting that the percentage of students who indicated that they were not taking a science class fell from eight percent in 1986 to only two percent in 1999.

Science Course-Taking at Age 17

By age 17, students typically have taken at least two or three years of science. In most high schools, the sequence of science classes is biology, chemistry, and then physics.[12] In order to gain admission to postsecondary education institutions, high school seniors typically must have completed science course work that includes at least biology and chemistry and, in many cases, physics as well. As with achievement in mathematics, it is reasonable to assume that students taking more advanced science courses are more likely to attain higher levels of achievement in science.

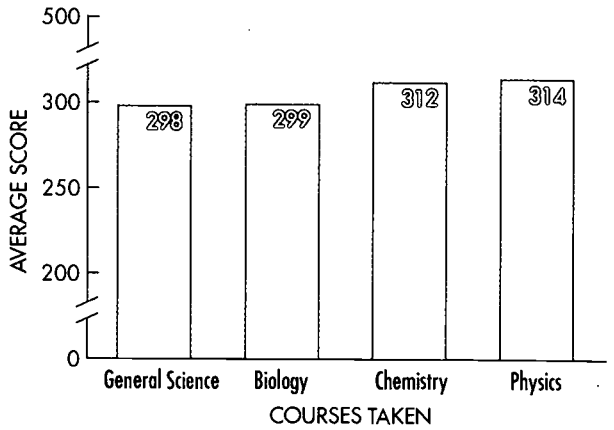
Figure 3.9 shows the relationship between 17-year-olds' responses to a question about the types of science courses they have taken and their average scores on the 1999 NAEP long-term trend science assessment. Students were asked to respond "yes" or "no" for each type of science course. Because these courses are typically offered in the sequence shown in the figure, it should be assumed that students who responded "yes" for biology, chemistry, or physics also responded "yes" to the lower-level courses. The figure indicates that students who had taken a chemistry or physics course scored higher, on average, than students who reported taking general science or biology. It should be noted that, given the typical sequence of high school science course work, students who have taken chemistry and/or physics also have taken the lower-level courses and are included in the estimates for general science and biology. Consequently, the average scores of students who have taken general science or biology are inflated over those taking only these courses.

Figure 3.8
Percentage of 13-Year-Olds by Content of Science Class, 1986 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

Figure 3.9
Average Science Scores by Science Courses Taken at Age 17, 1999

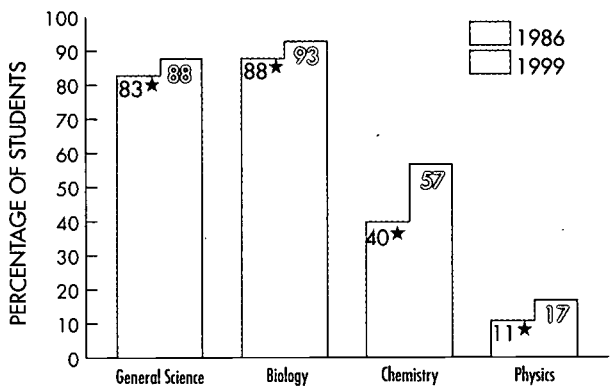


SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

The pattern of science course-taking in 1999 is compared with that of 1986 in Figure 3.10. These data reveal increases in the percentages of 17-year-olds taking science courses at every level. Most notably, the percentage of students taking chemistry increased from 40 percent in 1986 to over half (57 percent) in 1999.

As enrollment in advanced science courses increases, it is important to examine the progress being made across gender and racial/ethnic groups of students. Gender disparities in this area have been a concern for some time, and have motivated numerous programs and initiatives to increase female enrollment in advanced science courses and to encourage female students to pursue careers in science.[13] In addition, increasing minority students' preparedness for and access to more advanced science course work has been a central theme in efforts to achieve greater equity in career and higher education opportunities for all students.[14]

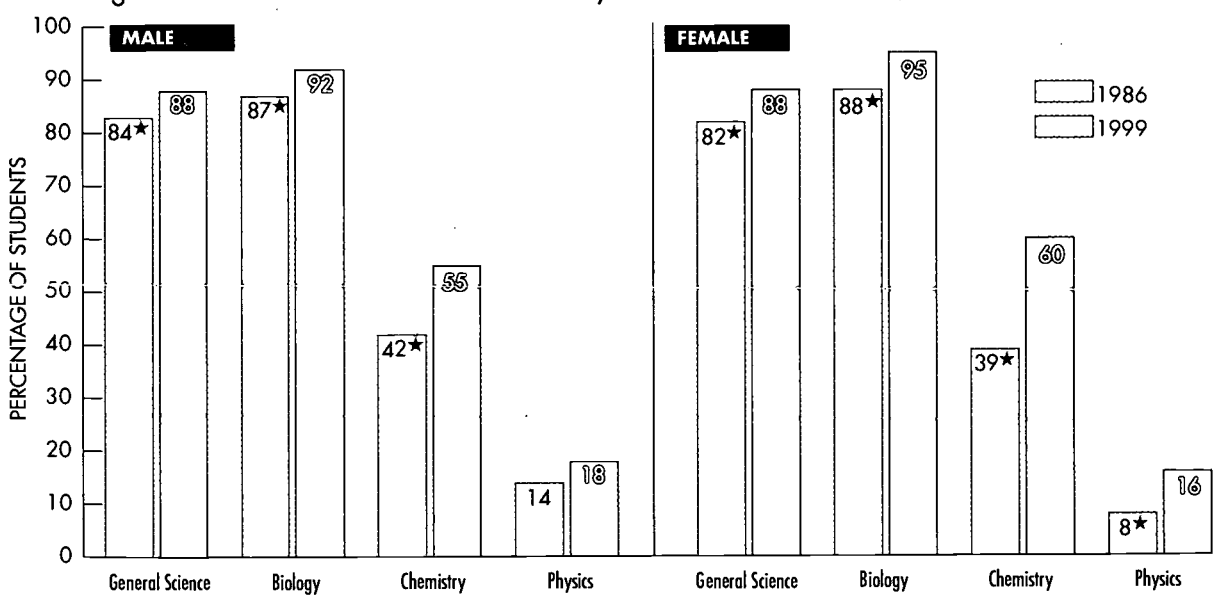
Figure 3.10
Percentage of 17-Year-Olds by Science Courses Taken, 1986 and 1999



★ Significantly different from 1999.

Figure 3.11 displays changes between 1986 and 1999 in science course-taking between male and female students. Increases in the percentage of students taking general science, biology, and chemistry are evident for both groups. Reflecting the overall results shown in the previous figure, the most notable change appears in the percentage of students taking chemistry. Between 1986 and 1999 the percentage of such students increased from 42 to 55 percent for males, and from 39 to 60 percent for females. At the highest level of course work, physics, the percentage of female students doubled during the same time period—from 8 to 16 percent. The apparent slight increase observed among male students

Figure 3.11
Percentage of Male and Female 17-Year-Olds by Science Courses Taken, 1986 and 1999



★ Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

taking physics was not statistically significant. As a result, the significant gender differences in 1986 at the highest level, physics, no longer existed in 1999.

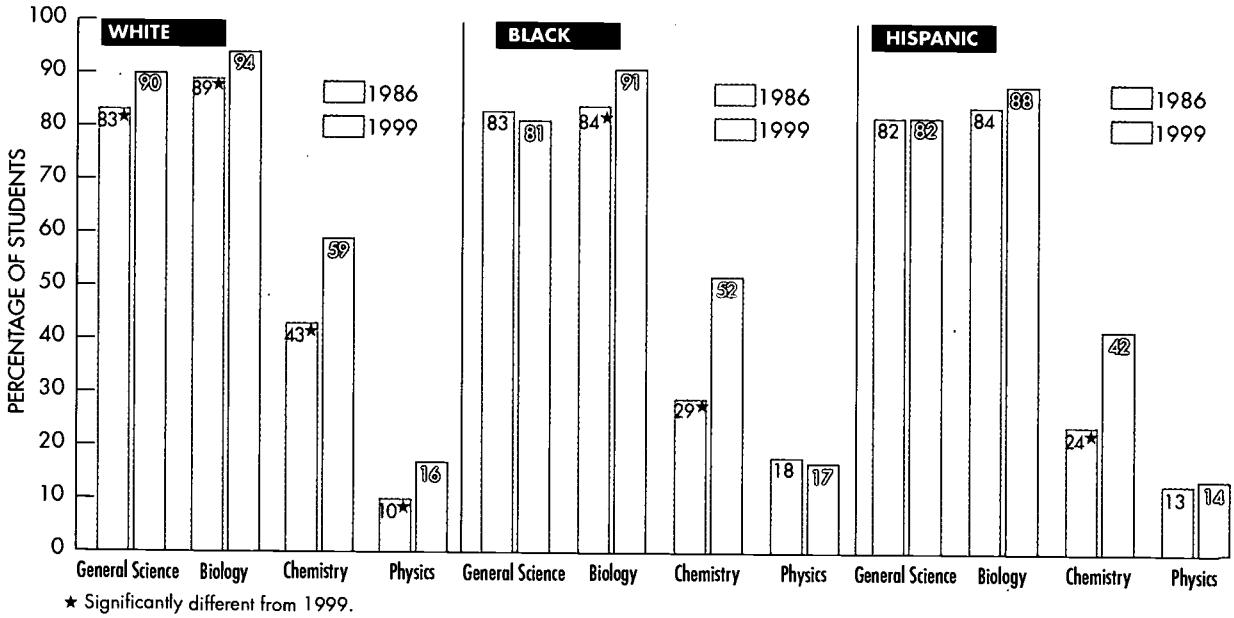
Science course-taking patterns for white, black, and Hispanic students are displayed in Figure 3.12. Between 1986 and 1999, gains can be seen across all three groups in the percentage of students taking chemistry—from 43 to 59 percent for white students, from 29 to 52 percent for black students, and from 24 to 42 percent for Hispanic students. Increases are also seen in the percentage of white and black students taking biology. Although white students also showed gains for the other levels of science course work, none of the other apparent changes for black or Hispanic students was statistically significant.

These data suggest mixed results for achieving greater equity among all students in science course-taking patterns. A greater percentage of white students than black or Hispanic students had taken chemistry in 1986. Since then, increases in chemistry taking by black and Hispanic students have narrowed this gap. By 1999, the apparent difference between white and black students at this level of course work was no longer statistically significant; however, a significant difference remained between the percentages of white and Hispanic students reaching this level. At the highest level of science course work, there was no significant difference in 1999 in the percentage of white, black and Hispanic students who had taken physics. In each group, the percentage was below 20 percent.

Technology and Scientific Equipment in the Classroom

As the expectations for student learning have evolved during the last three decades to include preparation for highly technical careers and more rigorous postsecondary education, the use of technology and scientific equipment in the classroom has also changed. Many educators and parents feel that highly developed skills in working and learning with computers are now a prerequisite for students who will be entering the workforce and pursuing postsecondary education in the twenty-first century.[15] In addition to expanded uses of computers in schools, a variety of other tools and equipment are being utilized to engage young students in hands-on learning activities with the goal of developing the inquiry and research skills they will need for more advanced study.[16] The following section examines

Figure 3.12
Percentage of White, Black, and Hispanic 17-Year-Olds by Science Courses Taken, 1986 and 1999



★ Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

students' responses to questions about the uses of computers and scientific equipment in their classrooms.

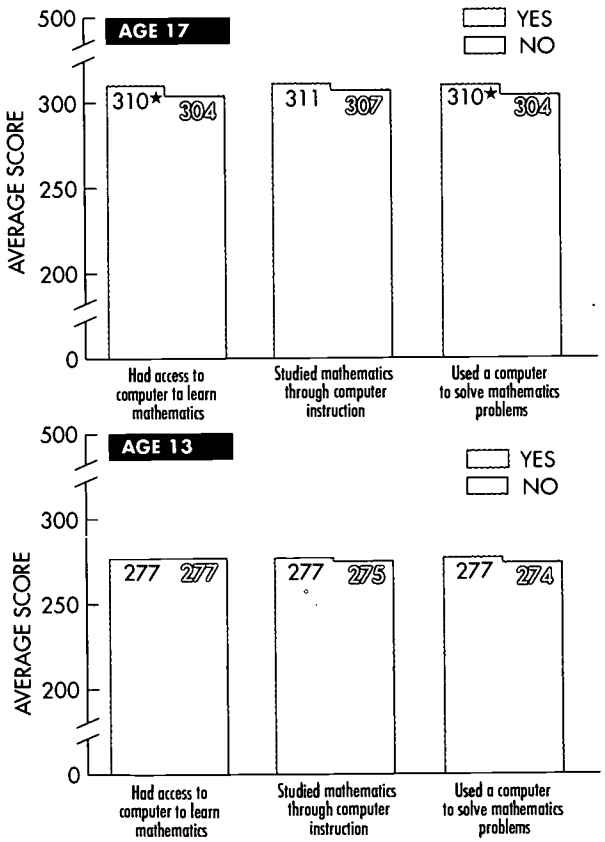
Availability and Use of Computers

One of the most influential technological changes during the last three decades is the development of computers for personal use. During the last two decades, computers have become increasingly common in the nation's classrooms as well. Research into the use of computer technology has shown that it can have a positive impact on student achievement when implemented properly.[17] Figure 3.13 shows the relationship between 17- and 13-year-olds' scores on the 1999 NAEP mathematics long-term trend assessment and their responses to three questions about the availability and use of computers in their classrooms. Students were asked to respond to these questions in terms of any current or past experiences with computers.

At age 17, students who said that they had access to computers to learn mathematics scored higher, on average, than students who said they did not have access. Also, students who said that they had used a computer to solve mathematics problems had higher average scores than students who said they had never done this. Whether or not 17-year-olds had studied mathematics through computer instruction showed no significant relationship with scores on the assessment. At age 13, there were no significant relationships between students' responses to any of the three questions and their average mathematics scores.

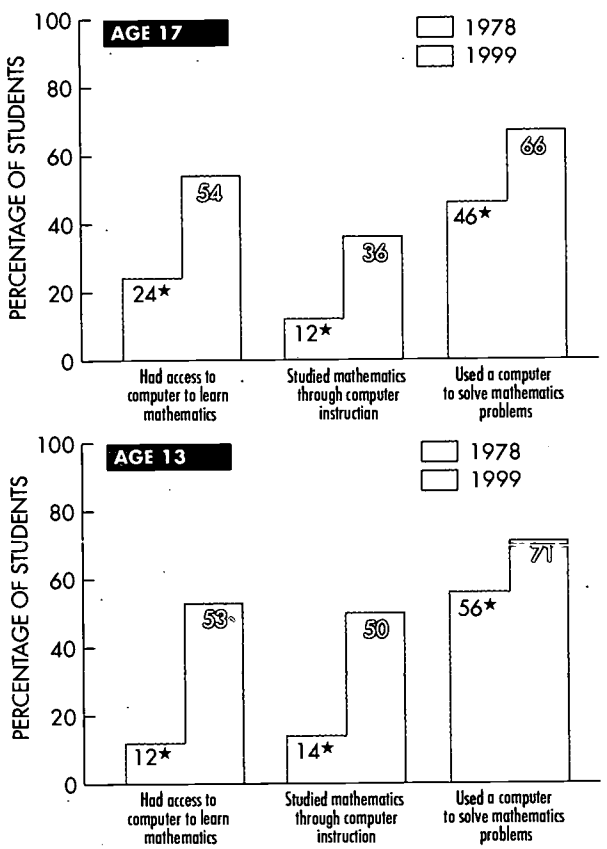
The data presented in Figure 3.14 demonstrate the significant increase in availability

Figure 3.13
Average Mathematics Scores by Availability and Use of Computers at Ages 17 and 13, 1999



★ Significantly different from students who responded "no."

Figure 3.14
Percentage of 17- and 13-Year-Olds by Availability and Use of Computers, 1978 and 1999



★ Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

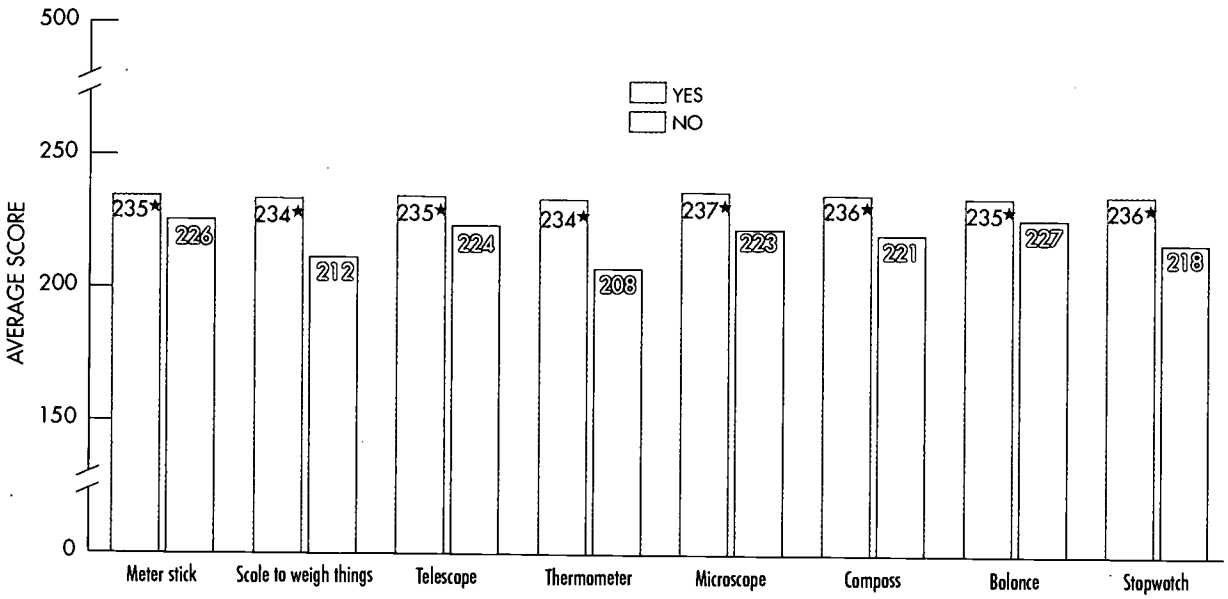
and use of computers for 17- and 13-year-olds since 1978. In both age groups, the proportion of students who had access to computers to learn mathematics rose from less than one-fourth in 1978 to over one-half in 1999.

Use of Scientific Equipment in the Classroom

A desire to engage students in "hands-on" learning is often the impetus for teachers to use a variety of equipment for teaching science. By working with and manipulating such tools as a part of meaningful educational experiences, students can develop the skills of observation, inquiry, and problem-solving that will facilitate learning in science and other subjects as well. This has been the stated objective of several education reform initiatives in recent years.[18]

Nine-year-olds only in the NAEP long-term trend assessment were asked whether or not they had used a variety of scientific equipment while learning science. Figure 3.15 shows that there was a positive relationship between students' use of scientific equipment and their scores on the 1999 science assessment. For each type of equipment, students who had used that item scored higher, on average, than did students who had not used that item.

Figure 3.15
Average Science Scores by Use of Scientific Equipment at Age 9, 1999



★ Significantly different from students who responded "no."

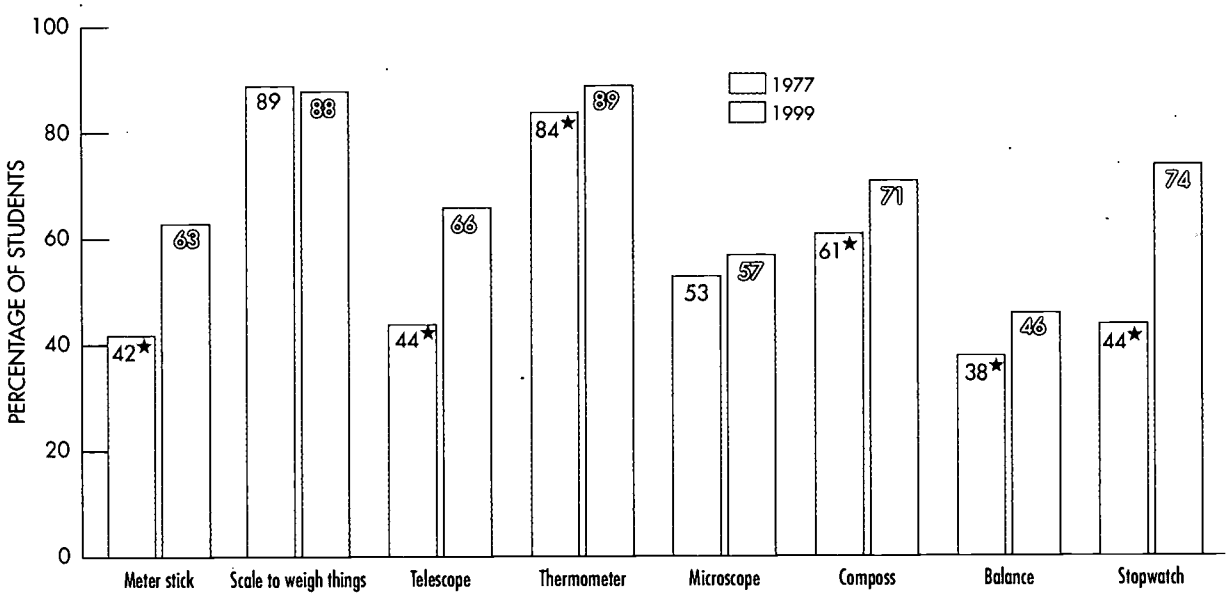
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Between 1977 and 1999, there were increases in the use of several types of scientific equipment in 9-year-olds' classrooms. As shown in Figure 3.16, increasing use of meter sticks, telescopes, and stopwatches is perhaps most notable. In addition, thermometers, compasses, and balances were more likely to be used in 1999 than in 1977.

Homework

Over the past three decades, educators have voiced different opinions on the amount and type of homework that should be assigned to students.[19] As learning expectations increase and course work becomes more advanced or rigorous, it would seem likely that homework demands would also increase. Some research has shown that homework may have a positive effect on older students' achievement, but no discernible effect on the achievement of younger students.[20] This section examines several different factors related to homework assigned to 9-, 13-, and 17-year-old students. The relationship between these factors and students' average scores on the long-term trend assessment is presented, along with changes since the late 1970s or early 1980s in students' homework experiences.

Figure 3.16
Percentage of 9-Year-Olds by Use of Scientific Equipment, 1977 and 1999



★ Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Amount of Time Spent on Homework

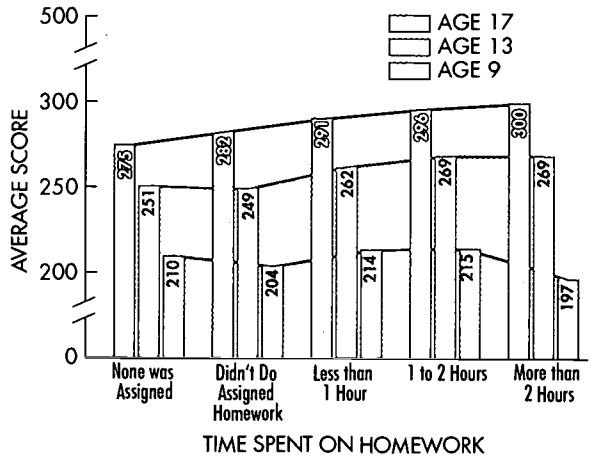
Students who participated in the long-term trend reading assessment were asked how much time they typically spend on homework for all subjects each day. Their responses and average reading scores on the 1999 assessment are presented in Figure 3.17. It is evident from these data that the relationship between the amount of time spent on homework and average reading scores varies across the three age groups.

At age 9, the relationship between homework and average reading scores is mixed. Students who indicated that they typically spend less than one hour or one to two hours on homework each night scored higher, on average, than students who didn't do their assigned homework; however, they also had higher average scores than students who indicated they did more than two hours of homework each night. The fact that 9-year-olds who reported they spent more than two hours doing homework scored lower, on average, than students who spent less time on homework, and lower than students who were not assigned homework, may be related to the learning needs of these students. That is, completing homework for these students may require more time, or teachers may have assigned more homework in response to the students' learning needs. However, this is only one possible interpretation of the data.

At age 13, a slightly stronger relationship between homework and average reading scores is evident. Students who indicated spending any amount of time on homework had higher average reading scores than students who either did not have homework or did not do their assigned homework. There was no statistically significant difference between students' average scores based on the amount of time spent on homework.

At age 17, the amount of time spent on homework generally bore a positive relationship to average reading scores. Those students who spent more than two hours doing homework on a typical day had higher average scores than students who spent less than one hour on homework, had no homework, or didn't do assigned homework. In addition, spending any amount of time on homework was associated with higher average scores than either having no homework or not doing homework that was assigned.

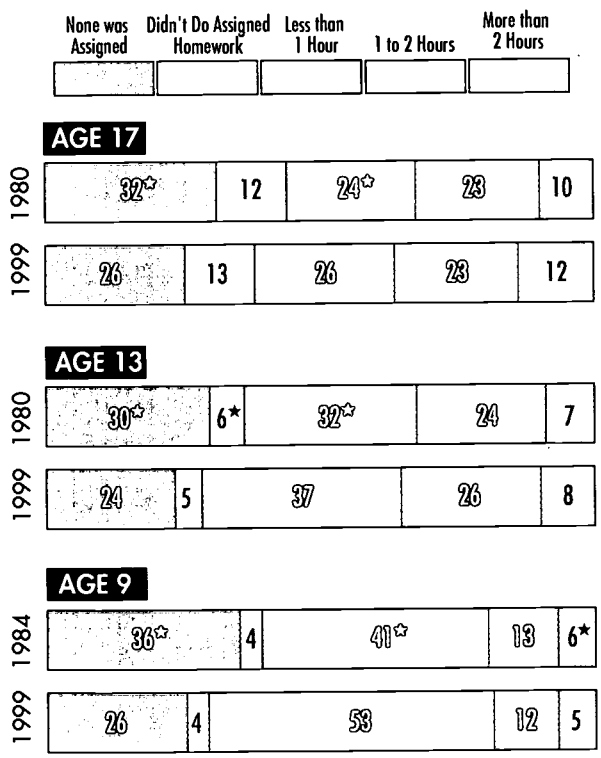
Figure 3.17
Average Reading Scores by Amount of Time Spent on Homework at Ages 17, 13, and 9, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

An increase in the assignment of homework across all subjects since the early 1980s is evident in Figure 3.18. At all three ages, a smaller percentage of students in 1999 than in 1980 or 1984 indicated that they were not assigned homework—dropping from approximately one-third to about one-fourth at each age. This resulted in an increase in the percentage of students in each age group spending less than one hour doing homework on a typical day. A slight, but significant, decrease in the percentage of 9-year-olds doing more than two hours of homework is also evident. These data indicate that, although homework was more likely to be assigned in 1999 than in the early 1980s, the amount of time students are spending on homework has changed little.

Figure 3.18
Percentage of 17-, 13-, and 9-Year-Olds by Amount of Time Spent on Homework, 1980/1984 and 1999



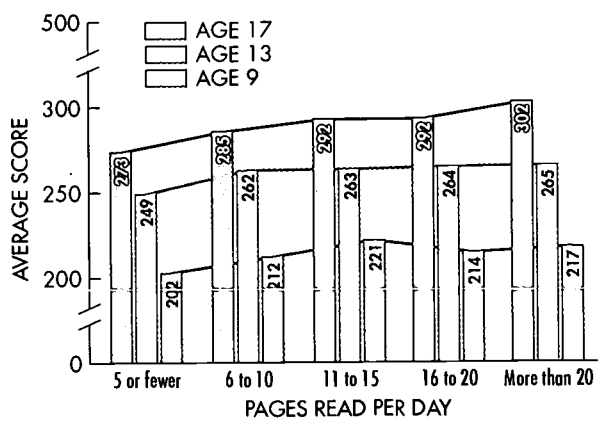
★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

Pages Read Per Day for School and for Homework

The development of reading and literacy skills may be directly related to the extent and variety of students' reading experiences.[21] One factor that influences how much students read is the number of pages they must read for school and homework assignments. Students participating in the NAEP long-term trend assessment are asked to indicate the number of pages they read on a typical day for school and for homework. The relationship between this factor and students' average reading scores on the 1999 assessment is presented in Figure 3.19.

At all three ages, students who said that they typically read six or more pages each day scored higher on average than their peers who read five or fewer pages. By age 17, the highest average score was attained by those students who said they were reading more than 20 pages daily.

Figure 3.19
Average Reading Scores by Pages Read Per Day in School and for Homework at Ages 17, 13, and 9, 1999



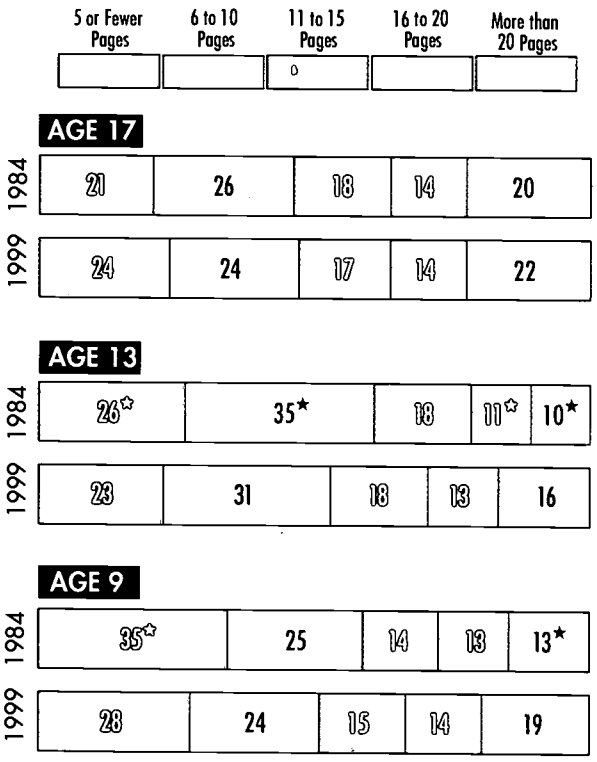
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Some increase since 1984 in the number of pages read per day by 9- and 13-year-olds is evident in Figure 3.20. At both ages, the percentage of students who said they read 20 or more pages for school and for homework on a typical day had increased between 1984 and 1999. At age 13, the percentage who reported reading 16 to 20 pages each day also increased. At both ages, these increases corresponded with a decrease in the percentage who read five or fewer pages. At age 13, there was also a decrease in the percentage who read 6 to 10 pages. For 17-year-olds, however, the number of pages read each day in 1999 was similar to that in 1984.

Frequency of Doing Mathematics Homework

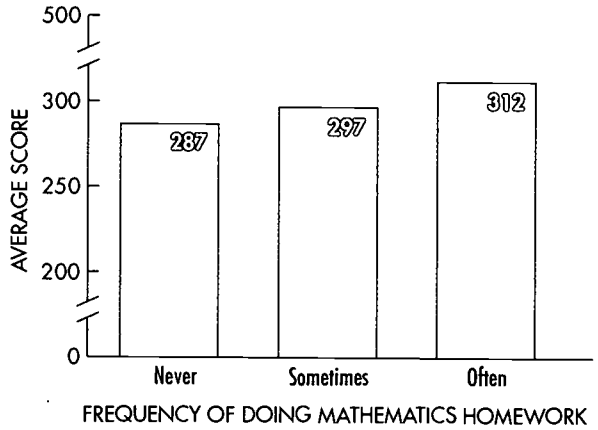
Seventeen-year-olds were asked specifically about the amount of time they spent doing homework when they were taking high school mathematics courses. As might be expected, their responses to this question demonstrated a positive relationship with their average scores on the 1999 long-term trend mathematics assessment. As shown in Figure 3.21, students who indicated doing mathematics homework often scored higher, on average, than students who indicated doing mathematics homework sometimes, who in turn scored higher than students who never did mathematics homework.

Figure 3.20
Percentage of 17-, 13-, and 9-Year-Olds by Pages Read Per Day in School and for Homework, 1984 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

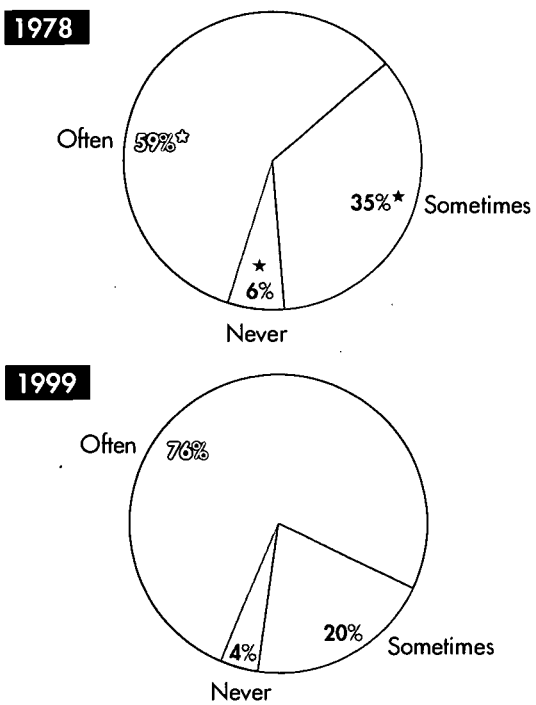
Figure 3.21
Average Mathematics Scores by Frequency of Doing Mathematics Homework at Age 17, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Perhaps it should not be surprising, given increases in advanced mathematics course work described earlier in this chapter, that 17-year-olds reported doing mathematics homework more frequently in 1999 than in 1978. As shown in Figure 3.22, the percentage of students doing mathematics homework often increased from 59 percent to 76 percent during this time period.

Figure 3.22
Percentage of 17-Year-Olds by Frequency of Doing Mathematics Homework, 1978 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Home Experiences Related to Learning

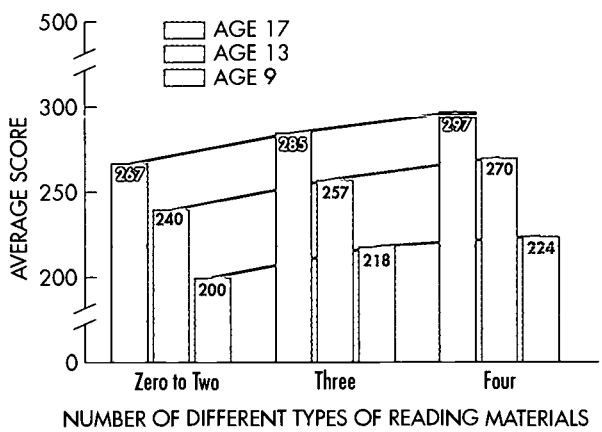
Even as school reform efforts multiply and intensify, the home remains essential to students' achievement. Much research has been devoted to documenting the relationship between student learning and the home environment, and a multitude of home factors have been identified that can support learning and success at school.[22] Students who participated in the NAEP long-term trend assessment were asked several questions about experiences and materials they have at home that are commonly thought to be related to achievement. This section highlights some of their responses to these questions.

Reading Materials in the Home

Having a variety of reading materials in the home can be important simply by exposing children to a selection of literacy experiences. Children are perhaps more likely to engage in reading on their own time when a diverse range of materials is readily available to them.[23] Students participating in the long-term trend assessment were asked a series of questions about whether or not certain types of reading materials were in their homes—newspapers, magazines, books, and an encyclopedia.

Figure 3.23 shows a positive relationship between students' average scores on the 1999 reading assessment and how many of these different types of reading materials they indicated were at home. At all three ages, students who reported they had all four types of materials in their homes scored higher, on average, than students who reported they had only three types, who in turn scored higher than students who said they had two or fewer types.

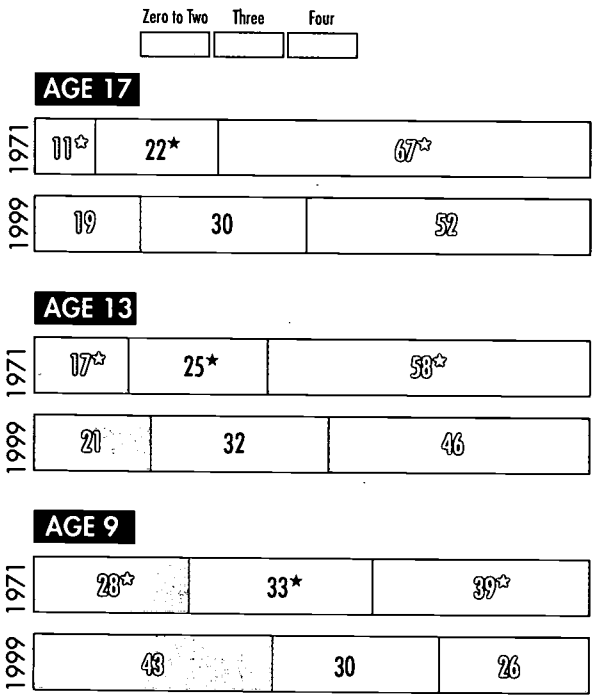
Figure 3.23
Average Reading Scores by Number of Different Types of Reading Materials in the Home at Ages 17, 13, and 9, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Changes in the number of different types of reading materials in the home between 1971 and 1999 are shown in Figure 3.24. At all three ages, there was a shift toward having fewer of the four types of materials in students' homes. In light of this trend, it is worth considering how literacy activities themselves have changed during the last three decades. In the early 1970s, the four types of print materials that were presented to students in the NAEP questionnaire—newspapers, magazines, books, and an encyclopedia—were perhaps among the most common types of resources for information and ideas. By the end of the century, the availability of a wider range of printed literacy materials, in addition to the recent emergence of countless electronic literacy resources, may have influenced how students in 1999 responded to these questions.

Figure 3.24
Percentage of 17-, 13-, and 9-Year-Olds by Number of Different Types of Reading Materials in the Home, 1971 and 1999



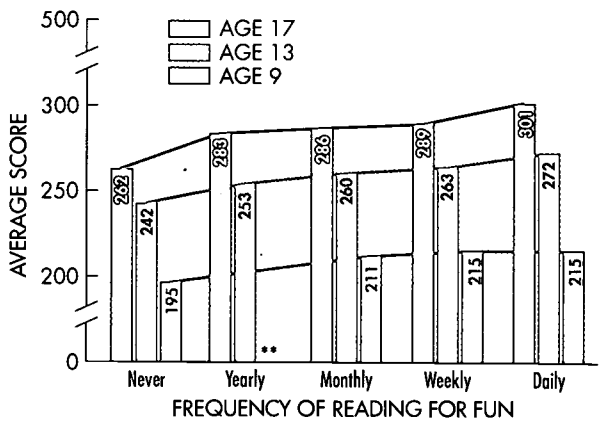
★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

Reading for Fun

Perhaps one of the strongest indications that children are developing the skills and positive attitudes that lead to a lifelong desire to read is the amount of reading they choose to do for fun.[24] Educators and parents encourage children to read as a recreational activity, not only as reinforcement of reading instruction, but also to expand children's literary experiences and to increase their understanding of ideas, people, and the world. The perceived benefits of children's recreational reading are the reason for many school-based programs that encourage and reward independent reading.[25]

As shown in Figure 3.25, reading for fun had a positive relationship to average scores on the 1999 long-term trend reading assessment. At all three ages, students who said that they read for fun at least monthly scored higher on average than their peers who said they never read for fun. Among 13- and 17-year-olds, the highest average reading scores were attained by students who claimed to read for fun on a daily basis.

Figure 3.25
Average Reading Scores by Frequency of Reading for Fun at Ages 17, 13, and 9, 1999

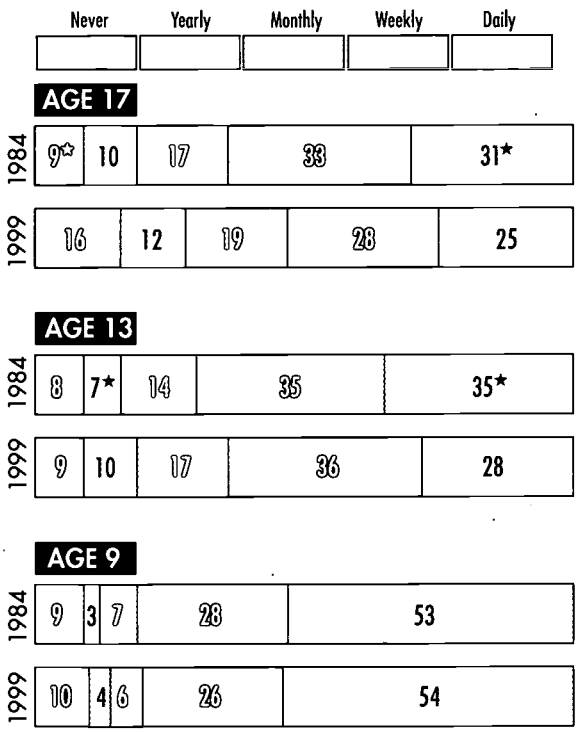


**Sample size too small to permit a reliable estimate.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Between 1984 and 1999, only slight changes were seen in the reported frequency of reading for fun among students at any age. Figure 3.26 shows that the percentage of 17- and 13-year-olds who read for fun on a daily basis decreased during this time period. At age 17, this corresponded with an increase in the percentage of students who said they never read for fun. At age 9, the reported frequency of reading for fun in 1999 was similar to that in 1984.

Figure 3.26
Percentage of 17-, 13-, and 9-Year-Olds by Frequency of Reading for Fun, 1984 and 1999



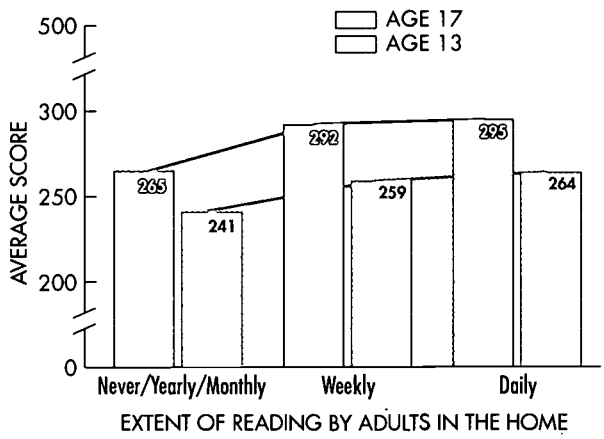
★ Significantly different from 1999.
NOTE: Percentages may not add to100 due to rounding.

Adults Reading at Home

In creating a home environment that values and fosters learning and literacy, parents are one of the most important influences on children's development.[26] One aspect of the home environment that may be directly related to reading development is the extent of reading done by adults in the home. Children who often see the adults they live with reading may be more likely to view it as a satisfying and enjoyable activity, and thus may be more likely to read themselves.

Seventeen- and 13-year-olds participating in the NAEP long-term trend assessment are asked how often they see adults in their homes reading. Figure 3.27 shows that students in both age groups who said that they see adults reading on at least a weekly basis had higher average scores on the 1999 reading assessment than their peers who saw adults reading monthly or less often.

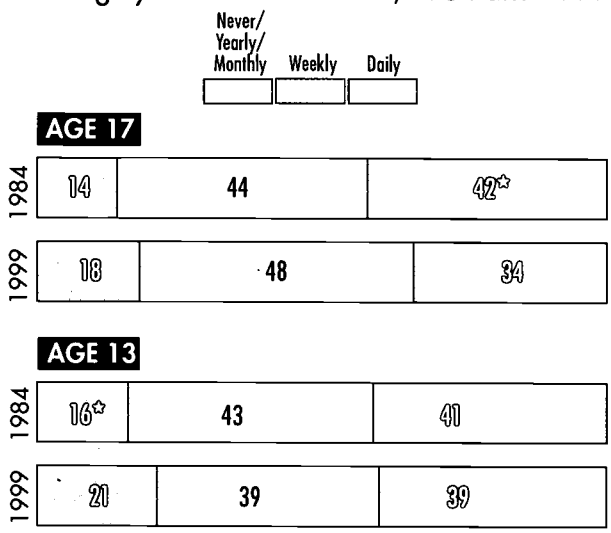
Figure 3.27
Average Reading Scores by Extent of Reading by Adults in the Home at Ages 17 and 13, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Figure 3.28 shows how this aspect of the home environment has changed since 1984. At age 17, the percentage of students who said they saw adults in their homes reading on a daily basis decreased between 1984 and 1999. At age 13, the percentage who reported seeing adults reading only monthly or less often increased during the same time period.

Figure 3.28
Percentage of 17- and 13-Year-Olds by Extent of Reading by Adults in the Home, 1984 and 1999



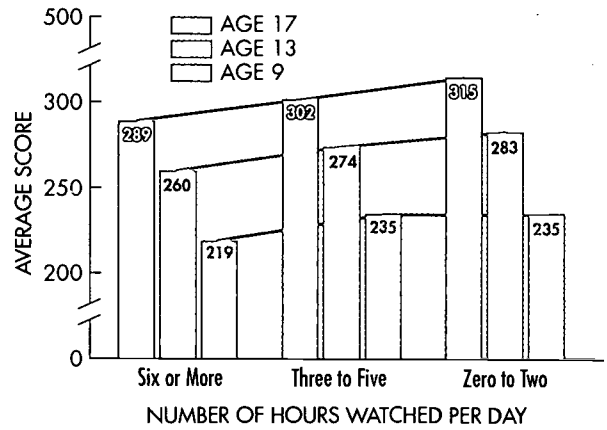
★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.

Television Viewing

The effects of time spent viewing television on students' academic achievement has been a long-standing concern.[27] In recent years, the issue has become somewhat blurred by diverse television programming available through cable and local access channels, as well as the emergence of interactive and internet television programming. Although these developments potentially increase the educational value of television, parents and educators continue to voice concern that excessive television viewing leaves little room for reading or other more intellectually stimulating activities.

The relationship between time spent watching television and students' scores on the 1999 long-term trend mathematics assessment is shown in Figure 3.29. At all three ages, students who said they typically watch six or more hours of television each day scored lower, on average, than their peers who spent less time watching television. Among 17- and 13-year-olds, students who watched television only two hours or less had the highest average mathematics scores.

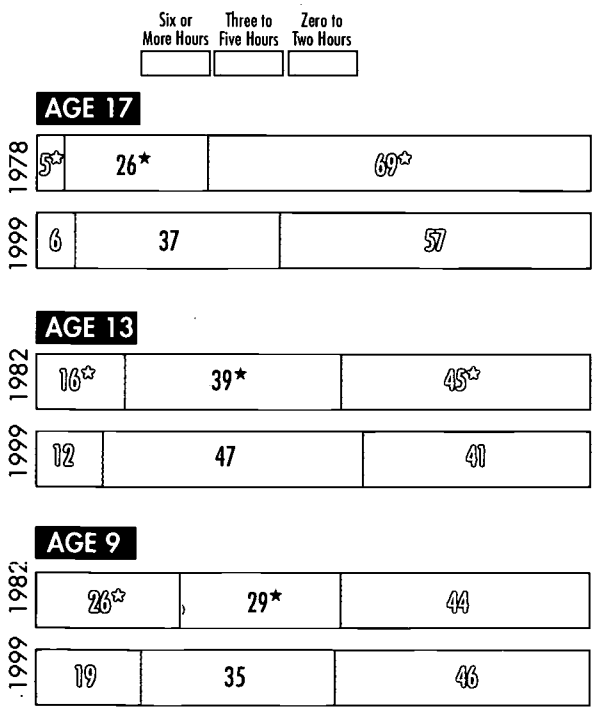
Figure 3.29
Average Mathematics Scores by Amount of Daily Television Watching at Ages 17, 13, and 9, 1999



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Indications of how the amount of time students spend watching television has changed are somewhat mixed. As shown in Figure 3.30, a smaller percentage of 9- and 13-year-olds claimed to spend six hours or more each day watching television in 1999 than in 1982; however, the percentage of these students watching television for three to five hours increased, and the percentage of 13-year-olds who watched only two hours or less decreased. Among 17-year-olds, the data indicate an overall increase in the reported amount of television viewing between 1978 and 1999—a greater percentage were watching television for three or more hours, and a smaller percentage were watching only two hours or less.

Figure 3.30
Percentage of 17-, 13-, and 9-Year-Olds by Amount of Daily Television Watching, 1978/1982 and 1999



★ Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Summary

The school and home experiences of 17-, 13-, and 9-year-olds described in this chapter demonstrate how the context of student learning has changed in the last three decades of this century. Many factors that are often associated with academic achievement and that had a positive relationship with students' scores on the NAEP long-term trend assessment have shown encouraging change. For example, the increases in percentages of students taking advanced mathematics and science course work are among the most positive changes highlighted in this chapter. In addition, the gender disparity that existed in the 1980s at the highest level of science course work, physics, was no longer present in 1999. It is also encouraging that black and Hispanic students, as well as white students, were taking these advanced courses in greater proportions in 1999 than in earlier years. Nevertheless, some disparity in course-taking at the highest levels between white 17-year-old students and their black and Hispanic peers was still evident in 1999.

Other changes documented in this chapter include increases in the uses of technology and scientific equipment in the classroom. Reflecting the technological trends in our society since the late 1970s, the availability and uses of computers for 17- and 13-year-olds increased substantially, and science learning for 9-year-olds was much more likely to involve a variety of scientific equipment in 1999.

Not all of the contextual factors addressed in the NAEP long-term trend questionnaires have changed so dramatically. Although homework was reportedly more likely to be assigned to students in 1999 than in earlier years, the amount of time students spend doing homework has changed little. Some increase in the number of pages read for school and homework was reported among 9- and 13-year-olds, but not among 17-year-olds. However, 17-year-olds reported doing mathematics homework more frequently in 1999 than in 1978.

Among the home factors discussed in this chapter, some of the trends were not entirely encouraging. A decrease in the number of different types of reading materials in the home was indicated by students in all three age groups. The frequency of reading for fun also reportedly decreased among 17- and 13-year-olds, and remained relatively stable for 9-year-olds. In addition, the frequency with which students reported observing adults reading at home decreased among 13- and 17-year-olds. Finally, trends in the amount of television viewing were mixed. Although 9- and 13-year-olds were less likely to watch six hours or more of television each day in 1999 than in earlier years, 17-year-olds were spending more time watching television on a daily basis.

Endnotes for Chapter 3

1 Chaney, B., Burgdorf, K., & Atash, N. (1997). Influencing achievement through high school graduation requirements. *Educational Evaluation and Policy Analysis, 19*(3), 229–244.

Jones, V. (1994). *Lessons from the Equity 2000 education reform model*. New York, NY: The College Board.

Legum, S., Caldwell, N., Davis, B., Haynes, J.; Telford, J.H., Litavecz, S., Rizzo, L., Rust, K., & Vo, N. (1998). *The 1994 high school transcript study tabulations: Comparative data on credits earned and demographics for 1994, 1990, 1987, and 1982 high school graduates. REVISED.* National Center for Education Statistics. Washington, DC: U.S. Government Printing Office. *http://nces.ed.gov.pubs98/98532.html/* (Download the complete report in a PDF file for viewing and printing. 2,185K)

2 Weinbaum, A., & Rogers, A. M. (1995). *Contextual learning: A critical aspect of school-to-work transition programs. Education reform and school-to-work transition series.* Washington, DC: National Institute for Work and Learning.

3 Merrifield, J., Bingman, M. B., Hemphill, D., & deMarrais, K. P. B. (1997). *Life at the margins. Literacy, language, and technology in everyday life. Language and literacy series.* New York, NY: Teachers College Press.

Sullivan, P., & Dautermann, J. (Eds.). (1996). *Electronic literacies in the workplace: Technologies of writing. Advances in computers and composition studies series.* Urbana, IL: National Council of Teachers of English.

4 Rock, D. A., & Pollack, J. M. (1995). *Mathematics course-taking and gains in mathematics achievement. Statistics in brief.* National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Lee, V. E., Burkam, D. T., Chow-Hoy, T., Smerdon, B. A., & Goverdt, F. (1998). *High school curriculum structure: Effects on coursetaking and achievement in mathematics for high school graduates. An examination of data from the National Education Longitudinal Study of 1988. Working paper series.* National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

5 Smith, J. B. (1996). Does an extra year make any difference? The impact of early access to algebra on long-term gains in mathematics attainment. *Educational Evaluation and Policy Analysis, 18*(2), 141–153.

6 Jones, V. (1994). op. cit.

7 Hawkins, E. F., Stancavage, F. B., & Dossey, J. A. (1998). *School policies and practices affecting instruction in mathematics: Findings from the National Assessment of Educational Progress.* National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

8 Chaney, Burgdorf, & Atash. (1997). op. cit.

9 National Commission for Excellence in Education. (1983). *A nation at risk: The imperative for educational reform.* Washington, DC: U.S. Government Printing Office.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

10 Sadker, D. (1999). Gender equity: Still knocking at the classroom door. *Educational Leadership, 56*(7), 22–26.

Weissglass, J. (1997). Deepening our dialogue about equity. *Educational Leadership, 54*(7), 78–81.

11 American Association for the Advancement of Science. (1997). *Project 2061: Science literacy for a changing future. Update 1997.* Washington, DC: Author.

Bruder, I. (1993). Redefining science: Technology and the new science literacy. *Electronic Learning, 12*(6), 20–24.

O'Neil, J. (Ed.). (1992). *Science education: Schools pushed to broaden access, overhaul practice.* Alexandria, VA; Association for Supervision and Curriculum Development.

12 Chaney, Burgdorf, & Atash. (1997). op. cit.

13 Feldman, A., & Arambula-Greenfield, T. (1997). Improving science teaching for all students. *School Science and Mathematics, 97*(7), 377–386.

National Women's Law Center. (1997). *Title IX at 25: Report card on gender equity.* Washington, DC: Author.

14 Lagemann, E. C., & Miller, L. P. (Eds.). (1996). *Brown v. Board of Education: The challenge for today's schools.* New York, NY: Teachers College Press.

Southern Regional Vision for Education. (1993). *The need for improved mathematics and science education. Policy brief.* Palatka, FL: Author.

15 Burnett, G. (1994). *Technology as a tool for urban classrooms. ERIC/CUE Digest, Number 95.* (Report No. EDO-UD-94-1).

16 Crow, T. (Ed.). (1996). *Active learning with hands-on resources.* Columbus, OH: Eisenhower National Clearinghouse.

Pedrotti, L. S., & Chamberlain, J. D. (1995). CORD applied mathematics: Hands-on learning in context. *Mathematics Teacher, 88*(8), 702–707.

Weinbaum, A., & Rogers, A. M. (1995). *Contextual learning: A critical aspect of school-to-work transition programs. Education reform and school-to-work transition series.* Washington, DC: Academy for Educational Development.

17 Wenglinsky, H. (1998). *Does it compute? The relationship between educational technology and student achievement in mathematics.* Princeton, NJ: Educational Testing Service.

18 Katz, P., & McGinnis, J. R. (1999). An informal elementary science education program's response to the national science education reform movement. *Journal of Elementary Science Education, 11*(1), 1–15.

Scott, W. (1995). *Reinventing science education: Reformers promote hands-on, inquiry-based learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Flick, L. B. (1993). The meaning of hands-on science. *Journal of Science Teacher Education, 4*(1), 1–8.

19 Cooper, H. (1994). *The battle over homework. An administrator's guide to setting sound and effective policies. The practicing administrator's leadership series.* Thousand Oaks, CA: Corwin Press.

20 Black, S. (1996). The truth about homework. *American School Board Journal, 183*(10), 48–51.

21 Fielding, L. G., & Pearson, P. D. (1994). Reading comprehension: What works. *Educational Leadership, 51*(5), 62–68.

Atwell, N. (1998). *In the middle: New understandings about writing, reading, and learning.* Portsmouth, NH: Boynton/Cook Publishers, Inc.

22 Bempechat, J. (1992). The role of parent involvement in children's academic achievement. *School Community Journal, 2*(2), 31–41.

Deslandes, R., Royer, E., Turcotte, D., & Bertrand, R. (1997). School achievement at the secondary level: Influence of parenting style and parent involvement in schooling. *McGill Journal of Education, 32*(3), 191–207.

Hara, S. R., & Burke, D. J. (1998). Parent involvement: The key to improved student achievement. *School Community Journal, 8*(2), 9–19.

23 Weinberger, J. (1996). A longitudinal study of children's early literacy experiences at home and later literacy development at home and school. *Journal of Research in Reading, 19*(1), 14–24.

Leseman, P. P. M., & de Jong, P. F. (1998). Home literacy: Opportunity, instruction, cooperation and social-emotional quality predicting early reading achievement. *Reading Research Quarterly, 33*(3), 294–318.

24 Watkins, M. W., & Edwards, V. A. (1992). Extracurricular reading and reading achievement: The rich stay rich and the poor don't read. *Reading Improvement, 29*(4), 236–242.

Carbo, M., & Cole, R. W. (1995). What every principal should know about teaching reading. *Instructional Leadership, 8*(1), 1–3.

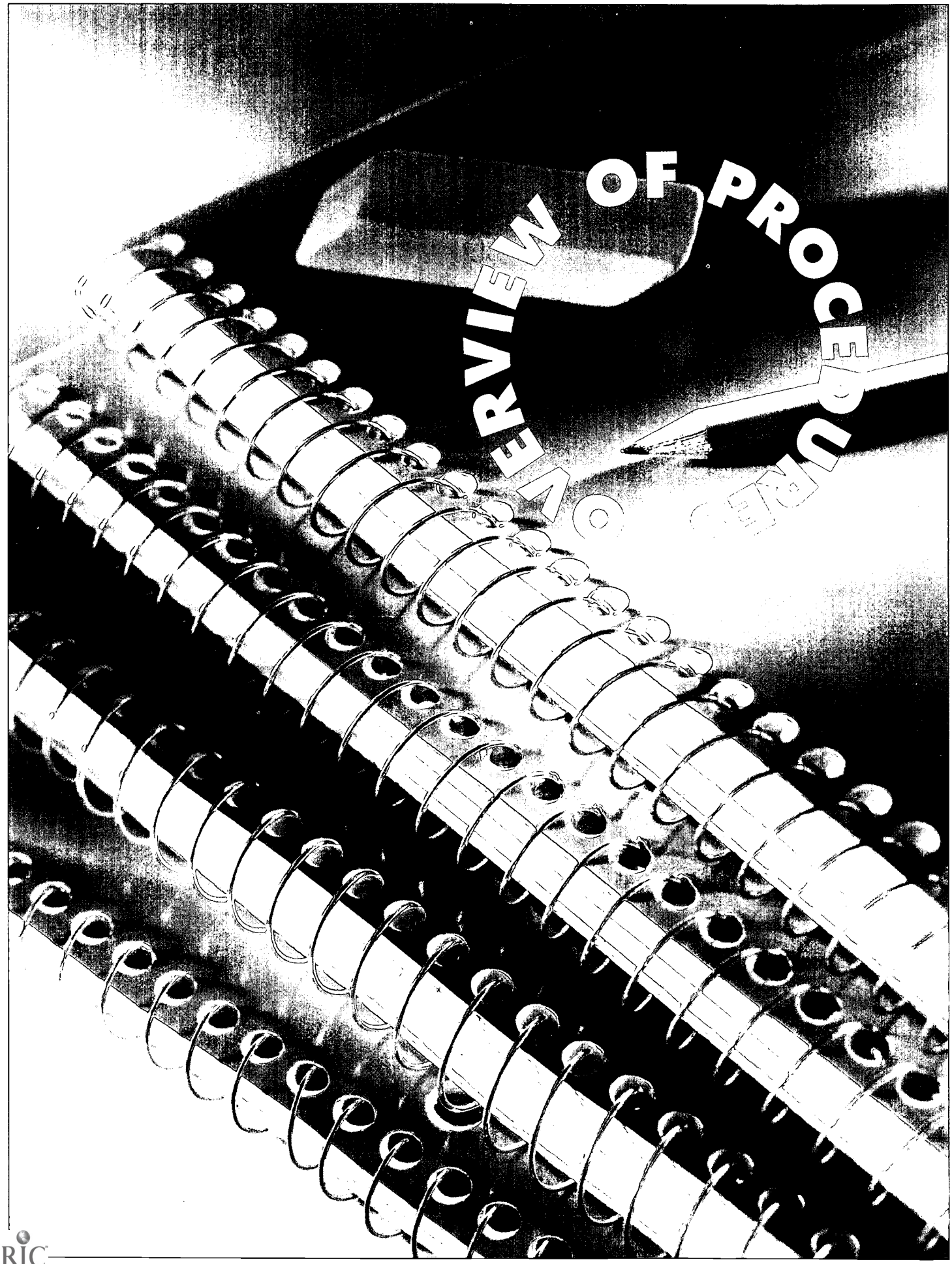
25 Hiebert, E. H., Pearson, P. D., Taylor, B. M., Richardson, V., & Paris, S. G. (1998). *Every child a reader. Applying reading research in the classroom.* Ann Arbor, MI: Center for the Improvement of Early Reading Achievement.

Martinez, M. G. (1991). What principals can do to promote voluntary reading. *Principal, 70*(3), 44–46.

26 Morrow, L. M. (Ed.). (1995). *Family literacy: Connections in schools and communities.* New Brunswick, NJ: Rutgers University.

27 Marcias, A. H. (1993). Hide your TV and seek other interests. *PTA Today, 18*(7), 10–11.

Beentjes, J. W. J., Van der Voort, T. H. A. (1988). Television's impact on children's reading skills: A review of the research. *Reading Research Quarterly, 23*, 389–413.


OVERVIEW OF PROCEDURES

APPENDIX A

OVERVIEW OF PROCEDURES USED IN THE 1999 NAEP TREND ASSESSMENTS

This appendix provides information about the methods and procedures used in NAEP's 1999 science, mathematics, and reading trend assessments. The *NAEP 1998 Technical Report* contains more extensive information about these procedures. Although a trend assessment in writing was also conducted in 1999, the methods and procedures used in that assessment are not provided here.

This NAEP trend report is based on results from 10 science assessments, 9 mathematics assessments, and 10 reading assessments, with the most recent assessment in each of the 3 curriculum areas having been conducted during the 1998-99 school year. In addition, "main" assessments separate from the trend assessment have occurred in each of the three curriculum areas during the late 1980s and throughout the 1990s. These "main" assessments measured somewhat different aspects of the content areas from the trend assessments that were administered during those years. In some cases, the main assessments have been administered in more than one year, and results from the different administrations have been compared to one another, providing short-term trend comparisons.[1] These short-term trend comparisons were based on different frameworks and content specifications from those used for the long-term trend assessments. For each of the three curriculum areas, the long-term trend comparisons described in this report are based on content specifications for the three curriculum areas have remained substantially constant over the assessments described in this report. In fact, the trend assessment booklets used in 1999 were also used in the past few long-term trend assessments. Questions that were common to several assessments before the mid-1980s were included in these current assessment booklets. More information about the composition of each of the trend assessments is presented below.

Science

NAEP conducted trend assessments of the science achievement of in-school 9-, 13-, and 17-year-olds during the school years ending in 1970, 1973, 1977, 1982, 1986, 1990, 1992, 1994, 1996, and 1999. In the first assessment, the 17-year-olds were assessed during the spring of the school year ending in 1969, rather than 1970. For each of the other assessments,

13-year-olds were assessed in the fall, 9-year-olds were assessed in the winter, and 17-year-olds were assessed in the spring of the assessment school year. Identical assessment booklets, containing blocks of science, math, and background questions, were used in 1986, 1990, 1992, 1994, 1996, and 1999. The assessments were administered using an audiotape that guided the students through the assessment questions. The use of audiotape minimized the dependence of the science results on reading ability.

The science trend assessments measured student achievement based on assessment objectives developed by nationally representative panels of scientists, science educators, and concerned citizens. The objectives which formed the basis for the 1986, 1990, 1992, 1994, 1996, and 1999 trend assessments[2] replicated the objectives used in previous assessments. The objectives for each assessment prior to 1986 were based on the framework used for the previous assessment with some revisions that reflected changes in content and trends in school science. That is, the objectives for assessments prior to 1986 were not identical from assessment to assessment. Since 1986, the objectives have been identical from assessment to assessment. Although changes were made in the content of the assessment before 1990, some questions were retained from one assessment to the next in order to measure trends in achievement across time. This allows comparisons across all of the available assessments to be made. All of the trend assessments from 1977 onward contained enough common questions to put the results from these assessments on the same scale using item response theory (IRT) scaling. The 1970 and 1973 assessments had too few questions in common with subsequent assessments to have results put directly on the IRT scale; results from these assessments were placed on the trend scale using mean proportion correct for the common questions. (This is the reason that the data points from 1970 and 1973 presented in figures in this report are connected to data points from the other years using dashed lines, rather than solid lines.)

The 1999 science trend assessment contained 63 multiple-choice questions at age 9, 83 multiple-choice questions at age 13, and 82 multiple-choice questions at age 17. The assessment covered a range of science content areas, including topics from the life sciences, physical sciences, and earth and space sciences. Questions assessed students' ability to understand basic scientific facts and principles, solve problems in scientific contexts, design experiments, interpret data and read tables and graphs, and understand the nature of science.

Mathematics

NAEP has assessed the mathematics achievement of in-school 9-, 13-, and 17-year-olds nine times: in the school years ending in 1973, 1978, 1982, 1986, 1990, 1992, 1994, 1996, and 1999. The trend assessment, which forms the basis of the results detailed in this report, uses procedures established in 1973. The assessments were presented in paced-tape administrations, and for each of the assessments, 13-year-olds were assessed in the fall, 9-year-olds were assessed in the winter, and 17-year-olds were assessed in the spring of the assessment school year. The same assessment booklets were used in 1986, 1990, 1992, 1994, 1996, and 1999; these booklets contained blocks of mathematics questions and blocks of science questions, as well as background questions.

The mathematics trend assessments contained a range of constructed-response and multiple-choice questions measuring performance on sets of objectives developed by nationally representative panels of mathematics specialists, educators, and other interested parties. The 1986, 1990, 1992, 1994, 1996, and 1999 assessments shared common objectives.[3] The objectives for each assessment prior to 1990 were based on the framework used for the previous assessment with some revisions that reflected changes in the content of mathematics education. Although changes were made from assessment to assessment before 1990, some questions were retained from one assessment to the next in order to measure trends in achievement across time. This allows comparisons across all of the

available assessments, other than the 1973 assessment, to be made using IRT. Results from the 1973 assessment were placed on the same scale using mean proportion correct extrapolation.

The 1986, 1990, 1992, 1994, 1996, and 1999 mathematics trend assessments contained 71 questions, including 28 constructed-response questions, at age 9; 127 questions, including 27 constructed-response questions, at age 13; and 132 questions, including 29 constructed-response questions, at age 17. The questions covered a range of content, including numbers and operations, measurement, geometry, and algebra. The process areas include knowledge, understanding, skills, applications, and problem solving.

Reading

Because students' ages vary within each grade level, the overall sample from which the reading results are derived contains students in grade 4 or at age 9, in grade 8 or at age 13, and in grade 11 or at age 17. For example, age 9 students may not all be in grade 4, but may be in grade 3 or grade 5. The NAEP assessments in reading and writing are administered to the same sample of students, but the results for the two subject areas are based on different subsamples of these students. For historical reasons, the writing assessment results are based on a subsample of students in grades 4, 8, and 11, and the reading assessment results reported herein are based on a subsample of students of ages 9, 13 and 17. NAEP reports student reading performance at age 9, at age 13, and at age 17 in 10 reading assessments conducted during the school years ending in 1971, 1975, 1980, 1984, 1988, 1990, 1992, 1994, 1996, and 1999. For each assessment, 13-year-olds and eighth graders were assessed in the fall, 9-year-olds and fourth graders were assessed in the winter, and 17-year-olds and eleventh graders were assessed in the spring of the assessment school year. Because data from both the age samples and the grade samples were used to establish the reading trend scale in 1986 when scaling of the trend assessments was first done, this practice has been replicated in all subsequent trend assessments. Results reported in this document, however, are results for the 9-, 13-, and 17-year-olds assessed each year. The same assessment booklets, containing blocks of reading, writing, and background questions, were used in 1984, 1988, 1990, 1992, 1994, 1996, and 1999. The assessments were administered in printed form. Previous to 1984 the assessments were paced using audiotapes for timing purposes. In 1984, the assessment was administered in both modes.

The reading tasks required students to read and answer questions based on a variety of materials, including informational passages, literary text, and documents. Although some tasks required students to provide written responses, most questions were multiple-choice questions. The assessment was designed to evaluate students' ability to locate specific information, make inferences based on information in two or more parts of a passage, or identify the main idea in a passage. For the most part, these questions measured students' ability to read either for specific information or for general understanding. Although the reading assessments conducted through the 1970s underwent some changes from test administration to test administration, the set of reading passages and questions included in the trend assessments has been kept essentially the same since 1984, and most closely reflects the objectives developed for that assessment.[4] The reading trend assessment administered at age 9/grade 4 included 45 passages and 105 questions, including 8 that required students to construct written responses. At age 13/grade 8, the assessment included 43 passages and 107 questions, 7 of them requiring constructed responses. At age 17/grade 11, the assessment contained 36 passages and 95 questions, 8 of them requiring constructed responses.

The Design of the Science and Mathematics Trend Assessments

At each of the three ages assessed, both the science and mathematics trend assessments consisted of three different 15-minute segments or "blocks" of content questions. Each also contained a small set of background questions that pertained to students' experiences and instruction related to the particular

subject area being assessed (i.e., either science or mathematics).

The blocks were assembled three to a booklet, together with a general background questionnaire that was common to all booklets. This questionnaire included questions about demographic information as well as home environment.

At ages 9 and 13, the blocks were placed in three booklets, each containing one block of mathematics questions, one block of science questions, and one block of reading questions. The reading block in these booklets is not used in the reading trend assessment, but is included in order to preserve the context of the science and mathematics questions. To replicate procedures established in 1986, at age 17, two booklets were administered. One contained two mathematics blocks and one science block, while the other contained two science blocks and one mathematics block.

At all three ages, the science and mathematics questions were administered using a paced audiotape. The tape recording that accompanied the booklets standardized timing, and was intended to help students with any difficulty they might have in reading the questions. Thus, in an administration session, all students were being paced through the same booklet.

The Design of the Reading Trend Assessment

The reading trend assessment consisted of 10 15-minute blocks of reading passages and questions at each of the three age/grade levels. In addition, each block contained a short set of background questions. The background questions in the reading blocks pertained to students' reading habits and experiences.

In keeping with procedures established with the 1984 reading trend assessment, the reading blocks were assembled into six booklets at each age/grade assessed. Each student participating in the reading assessment received a booklet containing three content blocks as well as a six-minute section of general background questions about demographic information and the students' home environment.

Sampling and Data Collection

Sampling and data collection activities for the 1999 trend assessments were conducted by Westat, Inc. Based on procedures used since the inception of NAEP, the data collection schedule was 13-year-olds/eighth graders in the fall (October to December, 1998), 9-year-olds/fourth graders in the winter (January to mid-March, 1999), and 17-year-olds/eleventh graders in the spring (mid-March to May, 1999). Although only 9-, 13-, and 17-year-olds were assessed in science and mathematics, both age- and grade-eligible students were assessed in reading. Age eligibility was defined by calendar year for 9- and 13-year olds, while the birth date range for 17-year-olds was from October 1, 1981 through September 30, 1982.

As with all NAEP national assessments, students attending both public and nonpublic schools were selected for participation based on a stratified, three-stage sampling plan. The first stage included defining geographic primary sampling units (PSUs), which are typically groups of contiguous counties, but sometimes a single county; classifying the PSUs into strata defined by region and community type; then selecting PSUs with probability proportional to size. In the second stage, within each PSU that was selected at the first stage, both public and nonpublic schools were selected from a list of public and nonpublic schools with probability proportional to the number of age-eligible students within the school. The third stage involved systematically selecting students within a school for participation with equal probability.

The student sample sizes for the trend assessments, as well as the school and student participation rates, are presented in the following tables. The numbers in the tables are based on the full age/grade samples of students, when the age/grade samples were collected. Students within schools were randomly assigned to either mathematics/science or reading assessment sessions subsequent to their selection for participation in the 1996 assessments. Student sample sizes appear in Tables A.1, A.3, and A.5. School and student participation rates are shown in Tables A.2, A.4, and A.6. These rates are included in

Table A.1
Student Sample Sizes for the Science Trend Scaling

	1977	1982	1986	1990	1992	1994	1996	1999
Age 9	17,345	1,960	6,932	6,235	7,335	5,663	5,414	6,032
Age 13	25,653	7,873	6,200	6,649	5,909	6,052	5,658	5,941
Age 17 (in school)	31,436	7,974	3,868	4,411	4,359	3,813	3,539	3,795
Total	74,434	17,817	17,000	17,295	17,603	15,528	14,611	15,768

Table A.2
School and Student Participation Rates for the Science Trend Assessments

	Age	Weighted Percentage of Schools Participating	Weighted Percentage of Students Participating	Overall Participation
1970	9	—	88.0	—
	13	—	85.6	—
	17	—	74.5	—
1973	9	93.9	91.0	85.4
	13	93.8	84.6	79.4
	17	92.4	73.6	68.0
1977	9	91.5	88.6	81.1
	13	91.3	86.2	78.7
	17	89.5	73.1	65.4
1982	9	88.3	90.5	79.9
	13	89.2	85.5	76.3
	17	86.5	74.2	64.2
1986	9	88.7	92.9	82.4
	13	88.1	89.2	78.6
	17	82.7	78.9	65.3
1990	9	87.0	92.5	80.5
	13	89.0	90.2	80.3
	17	79.0	82.1	64.9
1992	9	87.8	94.4	82.9
	13	85.6	90.9	77.8
	17	81.0	82.3	66.7
1994	9	87.1	94.4	82.2
	13	80.4	92.3	74.2
	17	79.5	84.8	67.4
1996	9	82.6	95.4	78.8
	13	80.8	92.6	74.8
	17	75.6	84.1	63.6
1999	9	83.5	93.7	78.3
	13	79.3	92.5	73.4
	17	72.1	81.3	58.6

—Data not available.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table A.3
Student Sample Sizes for the Mathematics Trend Scaling

	1978	1982	1986	1990	1992	1994	1996	1999
Age 9	14,752	12,038	6,932	6,235	7,335	5,663	5,414	6,032
Age 13	24,209	15,758	6,200	6,649	5,909	6,052	5,658	5,941
Age 17 (in school)	26,756	16,319	3,868	4,411	4,359	3,813	3,539	3,795
Total	65,717	44,115	17,000	17,295	17,603	15,528	14,611	15,768

Table A.4
School and Student Participation Rates for the Mathematics Trend Assessments

	Age	Weighted Percentage of Schools Participating	Weighted Percentage of Students Participating	Overall Participation
1973	9	93.9	90.9	85.4
	13	93.8	84.2	79.0
	17	92.4	73.5	67.9
1978	9	91.5	87.2	79.8
	13	91.5	85.2	78.0
	17	89.5	73.2	65.5
1982	9	88.3	90.5	79.9
	13	89.2	85.5	76.3
	17	86.5	74.2	64.2
1986	9	88.7	92.9	82.4
	13	88.1	89.2	78.6
	17	82.7	78.9	65.3
1990	9	87.0	92.5	80.5
	13	89.0	90.2	80.3
	17	79.0	82.1	64.9
1992	9	87.8	94.4	82.9
	13	85.6	90.9	77.8
	17	81.0	82.3	66.7
1994	9	87.1	94.4	82.2
	13	80.4	92.3	74.2
	17	79.5	84.8	67.4
1996	9	82.6	95.4	78.8
	13	80.8	92.6	74.8
	17	75.6	84.1	63.6
1999	9	83.5	93.7	78.3
	13	79.3	92.5	73.4
	17	72.1	81.3	58.6

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table A.5
Student Sample Sizes for the Reading Trend Scaling

	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
Age 9	23,201	21,697	21,159	22,291	3,782	4,268	4,944	5,335	5,019	5,793
Age 13	25,545	21,393	22,530	22,693	4,005	4,609	3,965	5,547	5,493	5,933
Age 17 (in school)	23,661	19,624	18,103	25,193	3,652	4,383	4,447	4,840	4,669	5,288
Total	72,407	62,714	61,592	70,177	11,439	13,260	13,356	15,722	15,181	17,014

Table A.6
School and Student Participation Rates for the Reading Trend Assessments

	Age	Weighted Percentage of Schools Participating	Weighted Percentage of Students Participating	Overall Participation
1971	9	92.5	90.9	84.1
	13	92.0	84.2	77.5
	17	90.5	73.5	66.5
1975	9	93.9	87.2	81.9
	13	92.8	85.2	79.1
	17	91.0	73.2	66.6
1980	9	94.5	90.5	85.5
	13	93.2	85.5	79.7
	17	90.5	74.2	67.2
1984	9	88.6	92.9	82.3
	13	90.3	89.2	80.5
	17	83.9	78.9	66.2
1988	9	87.2	92.5	80.7
	13	92.7	90.2	83.6
	17	78.1	82.1	64.1
1990	9	87.0	92.5	80.5
	13	89.0	90.2	80.3
	17	79.0	82.1	64.9
1992	9	87.0	93.8	81.6
	13	85.3	90.8	77.5
	17	80.9	83.3	67.4
1994	9	86.7	94.1	81.6
	13	79.7	91.8	73.2
	17	80.1	84.2	67.4
1996	9	83.5	95.6	79.9
	13	82.0	92.2	75.6
	17	81.7	83.8	68.5
1999	9	84.9	94.4	80.2
	13	80.8	92.1	74.4
	17	74.0	80.2	59.4

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

individual tables for each subject area for convenience in comparing across assessment years, although the rates are common for the math and science samples for many assessment years. For assessments conducted prior to 1984, the school and student participation rates were obtained from the Public Use Data Tape User Guides. Figures for more recent assessments were obtained from the reports on the NAEP field operation and data collection activities, prepared by Westat, Inc. Although sampled schools that refused to participate were replaced, school cooperation rates were computed based on the schools originally selected for participation in the assessments. The student participation rates represent the percentage of students assessed of those invited to be assessed, including in follow-up sessions when necessary.

The overall response rate (the product of the weighted school participation rate before substitution and the weighted student participation rate) for age 17 fell below the NCES reporting target of 70 percent. In a number of previous NAEP assessments for 17-year-old students, with response rates similar to those found in 1999, the background characteristics of both responding schools and students were compared to all schools and students to determine whether there was bias evident. The similarities in the distribution lend support to the conclusion that the data are not seriously biased by these low response rates.

Student Exclusion Rates

Some students selected for participation in the NAEP assessments are identified as special needs students. The term "special needs students" is generally used to describe both students with limited proficiency in English and students with disabilities. If, in accordance with guidelines provided by NAEP, it is decided that a special needs student cannot meaningfully participate in the NAEP assessment for which he or she was selected, then that student is excluded from the assessment. Recent years have seen changes in policy, legislative, and civil rights issues that may have had an impact on the rate at which students are excluded from NAEP assessments.

The exclusion rates for the 1990s are presented in Table A.7. In reading, mathematics, and science, the exclusion rates at ages 9 and 17 are higher in 1999 than in 1990, and similar at age 13. The exclusion rates in the other assessment years are similar to those in 1999 for all ages and subject areas.

Table A.7
Student Exclusion Rates for the Reading, Mathematics, and Science Trend Assessments

	1990	1992	1994	1996	1999
Reading					
Age 9	5.54 (0.45)*	6.56 (0.37)	7.38 (0.56)	8.12 (0.88)	7.94 (0.73)
13	5.27 (0.47)	5.73 (0.4)	6.05 (0.53)	6.88 (0.53)	6.45 (0.64)
17	4.49 (0.28)*	5.33 (0.33)	5.19 (0.45)	7.3 (0.53)	6.02 (0.58)
Mathematics					
Age 9	5.3 (0.44)*	6.71 (0.38)	7.76 (0.57)	7.78 (0.88)	7.35 (0.66)
13	5.28 (0.47)	6.04 (0.43)	6.19 (0.54)	6.52 (0.52)	6.09 (0.64)
17	4.47 (0.27)*	5.44 (0.34)	5.27 (0.45)	7.38 (0.53)	6.12 (0.59)
Science					
Age 9	5.3 (0.44)*	6.71 (0.38)	7.76 (0.57)	7.78 (0.88)	7.35 (0.66)
13	5.28 (0.47)	6.04 (0.43)	6.19 (0.54)	6.52 (0.52)	6.09 (0.64)
17	4.47 (0.27)*	5.44 (0.34)	5.27 (0.45)	7.38 (0.53)	6.12 (0.59)

Standard errors of the exclusion rates appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Scoring the Booklets

Materials from the NAEP 1999 trend assessments were shipped to National Computer Systems (NCS) in Iowa City, Iowa, for processing. Receipt and quality control were managed through a sophisticated bar-coding and tracking system. After all appropriate materials were received from a school, they were forwarded to the professional scoring area, where the responses to constructed-response questions were evaluated by trained staff using guidelines prepared by NAEP. Each constructed-response question had a unique scoring guide that defined the criteria to be used in evaluating students' responses. Subsequent to the professional scoring, the booklets were scanned, and all information was transcribed to the NAEP database at ETS. Each processing activity was conducted with rigorous quality control. An overview of the professional scoring for mathematics and reading follows. (No constructed-response questions were scored for science.)

Scoring the Mathematics Constructed-Response Questions

Most of the constructed-response mathematics trend questions were scored on a correct/incorrect basis. The scoring guides identified the correct or acceptable answers for each question in each block. The scores for these questions included a 0 for no response, a 1 for a correct answer, or a 2 for an incorrect or "I don't know" response. Because of the straightforward nature of the scoring, lengthy training was not required. In an orientation period, the readers were trained to follow the procedures for scoring the mathematics questions and given an opportunity to become familiar with the scoring guides, which listed the correct answer for the questions in each of the blocks.

During the scoring, every tenth booklet in a session was scored by a second reader to provide a quality check. These quality checks were recorded on a separate sheet with the few discrepancies noted, and the scores were corrected. For the most part, the discrepancies were due to a score not being coded for a response to a question.

Scoring the Reading Constructed-Response Questions

The 1999 reading trend assessment included eight questions at age 9 for which students were required to construct written responses, seven such questions at age 13, and eight such questions at age 17. Some of the questions were administered to more than one age group of students.

The scoring guides for the constructed-response reading questions focused on students' ability to perform various reading tasks—for example, identifying the author's message or mood and substantiating their interpretations, making predictions based on given details, supporting an interpretation, and comparing and contrasting information.

The scoring guides for the reading questions varied somewhat, but typically included a distribution of five rating categories.

Some of the scoring guides included secondary scores, which typically involved categorizing the kind of evidence or details the student used as support for an interpretation. The document literacy tasks, most of which required short answers, were scored on a correct/incorrect basis.

The training program for the reading trend assessment scoring was carried out on all assessment questions one at a time for each age group and covered the range of student responses. Because the purpose of the scoring was to measure trends from the 1984 assessment, preparation for training included rereading hundreds of 1984 responses and compiling training sets. In order to ensure continuity with the past scoring of the trend questions, at least half of the sample papers in the training sets were taken from the 1984 training sets, and previously scored 1984 booklets were masked to ensure that scoring for training and the subsequent trend reliability scoring would be done without knowledge of the previous scores given.

The actual training was conducted by ETS staff assisted by NCS's scoring director and team leaders. Training began with each reader receiving a photocopied packet of materials consisting of a scoring guide, a set of 15 to 20

Table A.8
Percent Exact Agreement Between Readers: Reading Trend Assessment Scoring

	1984 Responses Rescored in 1999		1996 Responses Rescored in 1999		1999 Responses Scored Twice	
	Mean Percent Agreement	Range of Agreement	Mean Percent Agreement	Range of Agreement	Mean Percent Agreement	Range of Agreement
Age 9	89.4	86.7-91.7	86.1	78.9-91.9	91.7	88.1-95.7
Age 13	85.9	83.7-88.8	86.8	66.7-95.7	88.6	84.1-92.7
Age 17	92.6	87.0-96.5	92.4	89.4-96.4	91.9	85.2-96.9

Note: The reading scoring was generally based on 5 scoring catagories.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

scored samples, and an additional 20 to 40 response samples to be scored. The trainers reviewed the scoring guide, explained all the applicable score points, and elaborated on the rationale used to arrive at a particular score. The readers then reviewed the 15 to 20 scored samples, as the trainers clarified and elaborated on the scoring guide. After this explanation, the additional samples were scored and discussed until the readers were in agreement. If necessary, additional packets of 1984 responses were used for practice scoring.

As a further step to achieve reliability with 1984, a 25 percent sample of the 1984 responses was scored on separate scoring sheets following the formal training session. These sheets were key entered, and a computerized report was generated comparing the new scores with those assigned in 1984. After some further discussion, scoring of the 1999 responses began. Three reliability studies were conducted as part of this scoring. For the 1999 material, 25 percent of the constructed responses were scored by a second reader to produce interreader reliability statistics. In addition, a trend reliability study was conducted by rereading 20 percent of the 1984 responses. Finally, a trend reliability study was conducted by rereading 20 percent of the 1996 responses. The reliability information from these studies is shown in Table A.8.

Data Analysis and IRT Scaling

After the assessment information had been compiled in the NAEP database, the data were weighted according to the sample design and the population structure. The weighting for the samples reflected the probability of selection for each student as a result of the sampling design, adjusted for nonresponse. Through poststratification, the weighting assured that the representation of certain subpopulations corresponded to figures from the U.S. Census and the Current Population Survey.

Analyses were then conducted to determine the percentage of students who gave various responses to each cognitive and background question. Item response theory (IRT) was used to estimate average proficiency for the nation and various subgroups of interest within the nation. IRT scaling was performed separately within each age/grade level for each of the three trend assessments (science, mathematics, and reading). Each of the three assessments employs slightly different steps in data analysis and IRT scaling. The steps for each subject area are described in detail in the *NAEP 1998 Technical Report*. Because these descriptions are rather lengthy they are not repeated in this appendix.

IRT models the probability of answering a question correctly as a mathematical function of proficiency or skill. The main purpose of IRT analysis is to provide a common scale on which performance can be compared across groups, such as those defined by age, assessment year, or subpopulations (e.g., race/ethnicity or gender).

Students do not receive enough questions about a specific topic to permit reliable esti-

mates of individual performance. Traditional test scores for individual students, even those based on IRT, would contribute to misleading estimates of population characteristics, such as subgroup averages and percentages of students at or above a certain proficiency level. Instead, NAEP constructs sets of plausible values designed to represent the distribution of proficiency in the population.[5] A plausible value for an individual is not a scale score for that individual, but may be regarded as a representative value from the distribution of potential scale scores for all students in the population with similar characteristics and identical patterns of item response. Statistics describing performance on the NAEP scales are based on these plausible values. These statistics estimate values that would have been obtained had individual proficiencies been observed—that is, had each student responded to a sufficient number of cognitive questions so that his or her proficiency could be precisely estimated.

For the 1999 mathematics, reading, and science trend assessments, separate IRT scales were constructed within each grade. These scales were linked to the previously established scales within each subject area via a common population linking procedure. The reading trend scale was constructed based on the 1984 assessment and included all previous reading assessments. The science and mathematics trend scales were developed based on the 1986 science and mathematics assessments, respectively, and also included previous assessments.

The initial trend scaling, however, did not include the 1969–70 or 1973 science assessments or the 1973 mathematics assessment because these assessments had too few questions in common with subsequent assessments. To provide a link to the early assessment results for the nation and for subgroups defined by race/ethnicity and gender at each of three age levels, estimates of average scale scores were extrapolated from previous analyses.

The extrapolated estimates were obtained by assuming that, within a given age level, the relationship between the logit transformation of a subgroup's average p-value (i.e., average proportion correct) for common questions and its respective scale score average was linear, and that the same line held for all assessment years and for all subgroups within the age level. More details about how these estimates were extrapolated appear in *The NAEP 1998 Technical Report*. Because of the necessity for the use of extrapolation of the average scale scores for these early assessments, caution should be used in interpreting the patterns of trends across those assessment years.

As described earlier, the NAEP scales for all the subjects make it possible to examine relationships between students' performance and a variety of background factors measured by NAEP. The fact that a relationship exists between achievement and another variable, however, does not reveal the underlying cause of the relationship, which may be influenced by a number of other variables. Similarly, the assessments do not capture the influence of unmeasured variables. The results are most useful when they are considered in combination with other information about the student population and the educational system, such as trends in instruction, changes in the school-age population, and societal demands and expectations.

Setting the Performance Levels

To facilitate interpretation of the NAEP results, the scales were divided into successive levels of performance and a "scale anchoring" process was used to define what it means to score in each of these levels. NAEP's scale anchoring follows an empirical procedure whereby the scaled assessment results are analyzed to delineate sets of questions that discriminate between adjacent performance levels on the scales. For the science, mathematics, and reading trend scales, these levels are 150, 200, 250, 300, and 350. For these five levels, questions were identified that were likely to be answered correctly by students performing at a particular 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 such questions were as follows: students at a given level must have at least a specified probability of success with the questions (65 percent for math and science, 80 percent for reading), while students at the next lower level have a

much lower probability of success (that is, the difference in probabilities between adjacent levels must exceed 30 percent). For each of the three curriculum areas, subject-matter specialists 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 and science trend reporting was based on the 1986 assessments.

NAEP Reporting Groups

This report contains results for the nation and for groups of students within the nation defined by shared characteristics. The subgroups described by race/ethnicity, parents' education level, gender, and public/nonpublic school attendance are discussed below.

Race/Ethnicity. Results are presented for students in different racial/ethnic groups according to the following mutually exclusive categories: white, black, and Hispanic. Results for Asian/Pacific Islander and American Indian (including Alaskan Native) students are not reported separately because there were too few students in the groups. The data for all students, regardless of whether their racial/ethnic group was reported separately, were included in computing the overall national results.

Parents' Education Level. Students were asked to indicate the extent of schooling for each of their parents: did not finish high school, graduated from high school, had some education after high school, or graduated from college. The response indicating the higher level of education for either parent was selected for reporting.

Gender. Results are reported separately for males and females. The student reported gender.

Public/Nonpublic Attendance. Students were defined as attending one of two types of schools educating students: Public and nonpublic. Public schools are generally those schools funded by public money, received from the local school district, state, and federal sources. Such schools must comply with all rules, regulations, and laws from the local, state, and federal regulatory bodies. Nonpublic schools primarily derive their funding from private sources, such as tuition, private donations, and religious organizations. Such schools are subject to some regulation at the local, state, and federal level, but do not have to comply with all such rules.

Estimating Variability

The statistics presented in this report are estimates of group and subgroup performance based on samples of students, rather than the values that could be calculated if every student in the nation answered every assessment question. It is therefore important to have measures of the degree of uncertainty of the estimates. Accordingly, in addition to providing estimates of percentages of students and their average scale score, this report provides information about the uncertainty of each statistic.

Two components of uncertainty are accounted for in the variability of statistics based on scale scores: the uncertainty due to sampling only a small number of students relative to the whole population, and the uncertainty due to sampling only a relatively small number of questions from the content domain. The variability of estimates of percentages of students having certain background characteristics or answering a certain cognitive question correctly is accounted for by the first component alone. Because NAEP uses complex sampling procedures, conventional formulas for estimating sampling variability that assume simple random sampling are inappropriate. For this reason, NAEP uses a jackknife replication procedure to estimate standard errors. The jackknife standard error provides a reasonable measure of uncertainty for any information about students that can be observed without error, but each student typically responds to so few questions within any content area that the scale score for any single student would be imprecise. In this case, using plausible values technology makes it possible to describe the performance of groups and subgroups of students, but the underlying imprecision that makes this step necessary adds an additional component of variability to statistics based on NAEP scale scores.[6]

The reader is reminded that, like those from all surveys, NAEP results are also subject to other kinds of errors including the effects of necessarily imperfect adjustments for student and school nonresponse and other largely unknowable effects associated with the particular instrumentation and data collection methods used. Nonsampling errors can be attributed to a number of sources: inability to obtain complete information about all selected students in all selected schools in the sample (some students or schools refused to participate, or students participated but answered only certain questions); ambiguous definitions; differences in interpreting questions; inability or unwillingness to give correct information; mistakes in recording, coding, or scoring data; and other errors of collecting, processing, sampling, and estimating missing data. The extent of nonsampling errors is difficult to estimate. By their nature, the impact of such error cannot be reflected in the data-based estimates of uncertainty provided in NAEP reports.

Drawing Inferences from the Results

The use of confidence intervals, based on the standard errors, provides a way to make inferences about the population averages and percentages in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample scale score average ± 2 standard errors represents about a 95 percent confidence interval for the corresponding population quantity. This means that, with 95 percent certainty, the average performance of the entire population of interest is within about $\pm$ 2 standard errors of the sample average.

As an example, suppose that the average mathematics scale score of students in a particular group was 256, with a standard error of 1.2. A 95 percent confidence interval for the population quantity would be as follows:

Average $\pm$ 2 standard errors =
256 $\pm$ 2 (1.2) = 256 $\pm$ 2.4 =
256 — 2.4 and 256 + 2.4 =
(253.6, 258.4)

Thus, one can conclude with close to 95 percent certainty that the average scale score for the entire population of students in that group is between 253.6 and 258.4.

Similar confidence intervals can be constructed for percentages, provided that the percentages are not extremely large or extremely small. For percentages, confidence intervals constructed in the above manner work best when sample sizes are large, and the percentages being tested have magnitudes relatively close to 50 percent. Statements about group differences should be interpreted with caution if at least one of the groups being compared is small in size and/or if "extreme" percentages are being compared. Percentages, P, were treated as "extreme" if:

$$P < P_{lim} = \frac{200}{N_{EFF} + 2},$$

where the effective sample size is

$$N_{EFF} = \frac{P(100 - P)}{(SE)^2},$$

and SE is the jackknife standard error of P. Similarly, at the other end of the 0–100 scale, a percentage is deemed extreme if $100 - P < P_{lim}$. This "rule of thumb" cutoff leads to flagging a large proportion of confidence intervals that would otherwise include values < 0 or > 1. In either extreme case, the confidence intervals described above are not appropriate, and procedures for obtaining accurate confidence intervals are quite complicated. In this case, the value of P was reported, but no standard error was estimated and hence no tests were conducted.

As for percentages, confidence intervals for average scale scores are most accurate when sample sizes are large. For some of the subgroups of students for which average scale scores or percentages were reported, student sample sizes could be quite small. For results to be reported for any subgroup, a minimum student sample size of 62 was required.

If students in a particular subgroup were clustered within a small number of geographic primary sampling units (PSUs), the estimates of the standard errors might also be inaccurate. So, subgroup data were required to come from a minimum of five PSUs.

To determine whether there is a real difference between the average scale score (or percentage of a certain attribute) for two groups in the population, one needs to obtain an estimate of the degree of uncertainty associated with the difference between the average scale scores or percentages of these groups for the sample. This estimate of the degree of uncertainty—called the standard error of the difference between the groups—is obtained by squaring each group's standard error, summing these squared standard errors, and then taking the square root of this sum. This procedure produces a conservative estimate of the standard error of the difference, since the estimates of the group averages or percentages will be positively correlated to an unknown extent due to the sampling plan. Direct estimation of the standard errors of all reported differences would involve a heavy computational burden. Similar to the manner in which the standard error for an individual group average or percentage is used, the standard error of the difference can be used to help determine whether differences between assessment years are real. If zero is within the confidence interval for the differences, there is no statistically significant difference between the groups.

To be more specific about the way in which differences between average scale scores for two groups were shown to be statistically significant with 95 percent certainty, whenever comparisons were made with the students assessed in the assessment years for which average scale scores were extrapolated (1970 and 1973 for science; 1973 for mathematics) $\pm$ about 2 standard errors (from a normal distribution) was used to construct the confidence interval. However, when the two groups that were being compared were from other assessments (those with scale scores estimated without extrapolation), the number multiplied by the standard error varied. This multiplier is the .975(1−.025) percentile from a T-distribution with the degrees of freedom that vary by the values of the average scale scores, their standard errors, and the number of PSUs that contribute to the average scale scores. (See the *NAEP 1998 Technical Report* for more details.) It is possible that scale scores that appear equal when rounded for two assessment years or two student subgroups, when compared to another year or subgroups, may not have the same significance test results. This may be due to the actual non-rounded value of the data and/or the standard error of the differences.

Sometimes a group of related comparisons are made, such as comparing the average scale scores for a previous assessment with those for the current assessment year for specific groups of students. If one wants to hold the certainty level for a specific set of comparisons at a particular level (e.g., 95), adjustments (called multiple-comparisons procedures) need to be made. One such procedure—the False Discovery Rate (FDR) method—was used to form confidence intervals for the differences for sets of comparisons. The set of comparisons is referred to as a "family," and the typical family involves all subgroups related by a certain background question. An example of a set of comparisons is the comparison of average science scale scores from 1999 and 1990 for male students and the comparison of average scale scores from 1999 and 1990 for female students.

Multiple-comparisons procedures, like the FDR method, are useful for controlling the overall Type I error rate for a defined set of hypothesis tests. However, especially when the number of potential comparisons that could be made is large, as in NAEP data, this protection comes at the substantial loss of power in detecting specific consistent patterns in the data. For example, more powerful and complex tests of significance designed to identify consistent patterns in the data might judge that two groups were significantly different when an FDR multiple-comparisons procedure would not.

One such set of tests of significance is the test of linear and test of quadratic trends applied to the trend data for the nation and selected subpopulations. The purpose of this first set of general tests was to determine whether the results of the series of assessments in a given subject could be generally characterized as increasing or decreasing, and whether the results could be generally characterized as a simple curve. Throughout this

report, descriptions of generally decreasing or increasing trends are based on these analyses. A linear relationship indicates that results have steadily increased (or decreased) over the time period of interest. Simple curvilinear (i.e., quadratic) relationships capture more complex patterns. For example, one possible pattern is to have initial score declines over part of the time period followed by score increases in more recent assessments. Another possible pattern is to have a sequence of several assessments in which scores increased followed by a period of relative stable performance. These examples are two, but not all, of the simple curvilinear relationships that were tested.

The linear and quadratic components of the trend in average scale scores for a given subject area and age group were estimated by applying two sets of contrasts to the set of average scale scores by year. The linear component of the trend was estimated by the sum $b_1 = \Sigma c_j x_j$, where the x_j are the average scale scores by year and the c_j are defined such that b_1 corresponds to the slope of an unweighted regression of the average scale scores on the assessment year. The quadratic component was estimated by the sum $b_2 = \Sigma d_j x_j$, in which the d_j are formally orthogonal to the c_j and are defined such that b_2 is the quadratic term in the unweighted regression of the average scale scores on the assessment year and the square of the assessment year. The statistical significance of b_1 and b_2 was evaluated by comparing each estimate to its estimated standard error. The standard error of b_1 was estimated as the square root of the sum $\Sigma c_j^2 SE_j^2$, in which SE_j is the estimated standard error of x_j. The estimated standard error of the b_2 was analogously defined. The linear and quadratic trend tests make it possible to make statements about results across assessment years in a more powerful way than if results for each year had been compared to those of every other year, using a multiple-comparison procedure such as the FDR method. These tests do not control the overall Type I error rate when they are applied to several related subgroups, such as the students in each region of the country. For this reason, the FDR method for controlling Type I error was used when the trends for related subgroups were tested. For example, when tests were conducted for linear trend for the separate race/ethnicity groups (i.e., white, black, and Hispanic) these tests were treated as a single family of comparisons of size 3. The significance level for each of the separate tests was adjusted by the FDR procedure to yield a family-wise error rate of .05.

The reader is cautioned that some averages and standard errors in this report may differ slightly from values reported in previous trend reports because of a slight modification of procedures. The method used to round off numbers to the number of reported decimal places was modified to conform to NCES standards, beginning with the analysis of the 1994 long-term trend assessments. Also, the use of the FDR procedure for controlling overall Type I error rate for families of comparisons is new to the 1999 long-term trend assessments.

Endnotes for Appendix A

1 Reese, C. M., Miller, K. E., Mazzeo, J., & Dossey, J. A. (1997). *NAEP 1996 mathematics report card for the nation and the states*. National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Campbell, J. R., Donahue, P. L., Reese, C. M., & Phillips, G. W. (1996). *NAEP 1994 reading report card for the nation and the states*. National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

2 National Assessment of Educational Progress (1986). *Science objectives: 1985-86 assessment*. Princeton, NJ: Educational Testing Service.

3 National Assessment of Educational Progress (1986). *Math objectives: 1985-86 assessment*. Princeton, NJ: Educational Testing Service.

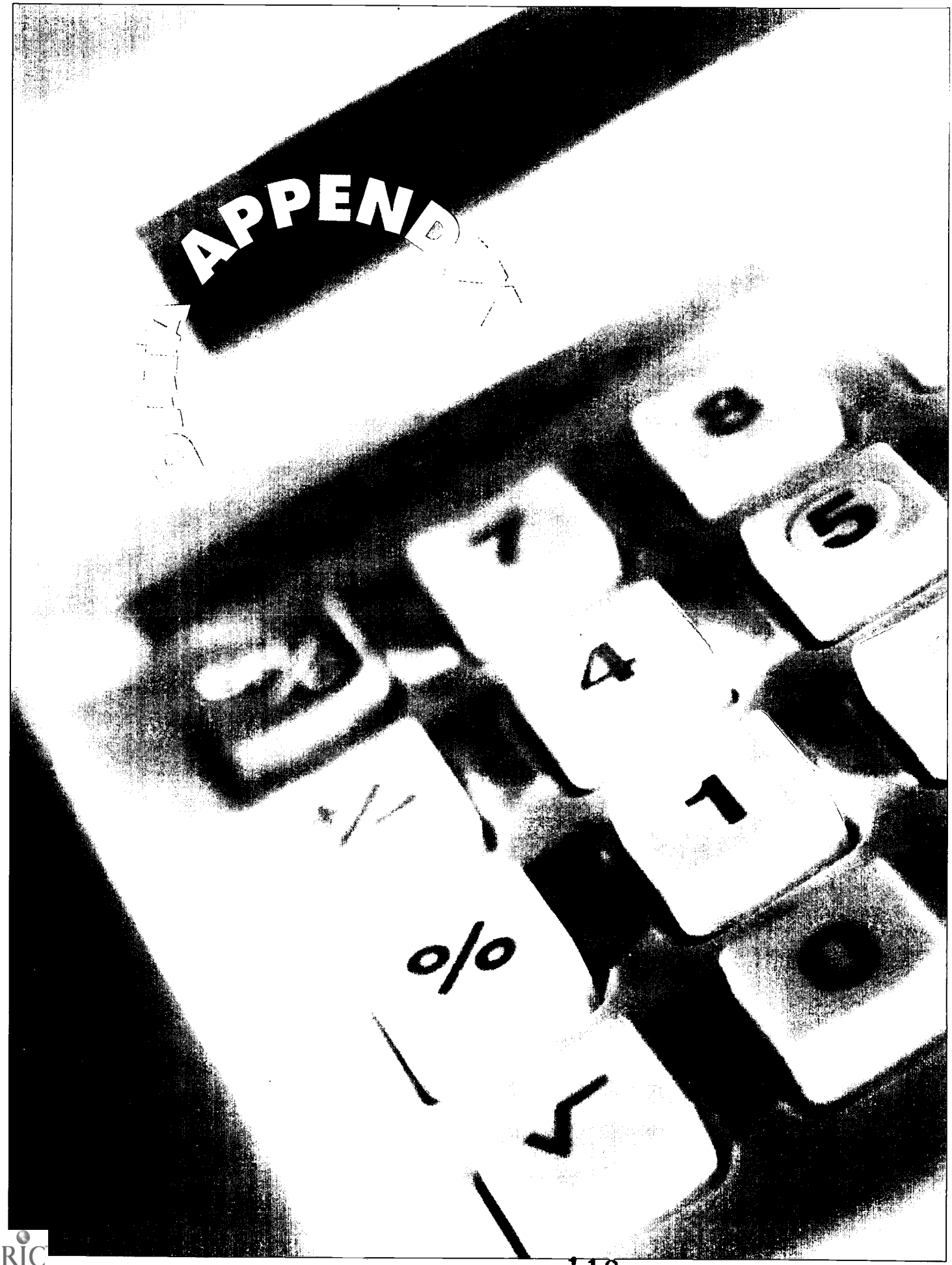
4 National Assessment of Educational Progress (1984). *Reading objectives*: 1983-84 assessment. Princeton, NJ: Educational Testing Service.

5 For theoretical justification of the procedures employed, see Mislevy, R. J. (1988). Randomization-based inferences about latent variables from complex samples. *Psychometrika*, 56 (2), 177-96.

For computational details, see the *NAEP 1996 Technical Report*.

6 For further details, see Johnson, E. G. (1989). Considerations and techniques for the analysis of NAEP data. *Journal of Educational Statistics*, 14(4) 303-334.

APPEND



APPENDIX B

DATA APPENDIX

This appendix contains complete data, including average scale scores and percentages of students, for each figure in Chapters 1, 2, and 3 of this report. In addition, the standard errors appear in parentheses next to each scale score and percentage. As with the figures presented in the chapters, data from earlier assessment years are highlighted when they were significantly different from 1999.

Table B.1
Data for Figure 1.1: Trends in Average Scale Scores for the Nation in Reading, Mathematics, and Science

Reading	**1971**	**1975**	**1980**	**1984**	**1988**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	285.2 (1.2)	285.6 (0.8)	285.5 (1.2)	288.8 (0.6)	290.1 (1.0)	290.2 (1.1)	289.7 (1.1)	288.1 (1.3)	287.6 (1.1)	287.8 (1.3)
Age 13	255.2 (0.9)*	255.9 (0.8)*	258.5 (0.9)	257.1 (0.5)	257.5 (1.0)	256.8 (0.8)*	259.8 (1.2)	257.9 (0.9)	257.9 (1.0)	259.4 (1.0)
Age 9	207.6 (1.0)*	210.0 (0.7)	215.0 (1.0)	210.9 (0.7)	211.8 (1.1)	209.2 (1.2)	210.5 (0.9)	211.0 (1.2)	212.5 (1.0)	211.7 (1.3)
Mathematics		**1973**	**1978**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17		304.0 (1.1)*	300.4 (1.0)*	298.5 (0.9)*	302.0 (0.9)*	304.6 (0.9)*	306.7 (0.9)	306.2 (1.0)	307.2 (1.2)	308.2 (1.0)
Age 13		266.0 (1.1)*	264.1 (1.1)*	268.6 (1.1)*	269.0 (1.2)*	270.4 (0.9)*	273.1 (0.9)*	274.3 (1.0)	274.3 (0.8)	275.8 (0.8)
Age 9		219.0 (0.8)*	218.6 (0.8)*	219.0 (1.1)*	221.7 (1.0)*	229.6 (0.8)*	229.6 (0.8)*	231.1 (0.8)	231.0 (0.8)	232.0 (0.8)
Science	**1970†**	**1973**	**1977**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	305.0 (1.0)*	296.0 (1.0)	289.5 (1.0)*	283.3 (1.2)*	288.5 (1.4)*	290.4 (1.1)*	294.1 (1.3)	294.0 (1.6)	295.7 (1.2)	295.3 (1.3)
Age 13	255.0 (1.1)	250.0 (1.1)*	247.4 (1.1)*	250.1 (1.3)*	251.4 (1.4)*	255.2 (0.9)	258.0 (0.8)*	256.8 (1.0)	256.0 (1.0)	255.8 (0.7)
Age 9	225.0 (1.2)*	220.0 (1.2)*	219.9 (1.2)*	220.8 (1.8)*	224.3 (1.2)*	228.7 (0.8)	230.6 (1.0)	231.0 (1.2)	229.7 (1.2)	229.4 (0.9)

Standard errors of the estimated scale scores appear in parentheses.
*Significantly different from 1999.
†At age 17, the first science assessment was administered in 1969.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.2
Data for Figure 1.2: Trends in Average Reading Scale Scores by Quartile

Reading	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
Age 17										
Upper quartile	332.5 (0.6)	334.0 (0.5)	326.8 (0.8)*	331.4 (0.5)	330.1 (1.3)*	335.5 (1.1)	335.3 (0.9)	336.7 (1.3)	334.3 (1.2)	333.7 (1.1)
Middle two quartiles	289.0 (0.5)	288.4 (0.4)	288.7 (0.4)	290.7 (0.3)	292.1 (0.7)*	292.1 (0.5)*	293.3 (0.7)*	290.7 (0.7)	289.3 (1.0)	289.8 (0.8)
Lower quartile	230.2 (0.8)*	231.5 (1.0)*	237.6 (1.0)	240.8 (0.3)	246.0 (1.1)*	241.1 (1.6)	236.9 (1.3)	234.4 (1.3)	237.5 (1.1)	237.7 (1.5)
Age 13										
Upper quartile	293.2 (0.4)*	296.4 (0.4)*	294.1 (0.5)*	296.2 (0.5)*	295.8 (1.0)*	296.8 (0.8)*	303.1 (1.1)	301.4 (0.8)	300.6 (1.2)	301.8 (1.2)
Middle two quartiles	257.6 (0.4)*	258.1 (0.4)*	260.5 (0.3)	258.4 (0.2)*	258.5 (0.7)*	257.9 (0.5)*	262.0 (0.6)	260.3 (0.8)	260.1 (0.7)	261.2 (0.9)
Lower quartile	212.4 (0.7)	211.3 (0.5)	218.7 (0.7)*	214.5 (0.5)	217.2 (1.0)*	214.5 (0.9)	212.2 (1.4)	209.5 (0.9)*	210.9 (1.4)	213.6 (1.3)
Age 9										
Upper quartile	252.6 (0.5)*	251.3 (0.7)*	255.0 (0.8)	257.9 (0.4)	259.1 (1.6)	261.3 (1.1)*	256.4 (0.9)	256.1 (1.0)	256.4 (0.8)	255.9 (1.1)
Middle two quartiles	210.6 (0.4)*	213.1 (0.3)	218.0 (0.3)*	211.8 (0.3)	212.8 (0.7)	209.4 (0.6)*	212.0 (0.7)	213.2 (0.7)	213.9 (0.7)	213.2 (1.0)
Lower quartile	156.6 (0.7)*	162.8 (0.5)	169.3 (1.0)*	161.6 (0.6)*	162.7 (1.6)	156.5 (1.5)*	161.7 (1.0)*	161.7 (1.4)	165.7 (1.7)	164.8 (1.0)

Standard errors of the estimated scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.3
Data for Figure 1.3: Trends in Average Mathematics Scale Scores by Quartile

Mathematics	1978	1982	1986	1990	1992	1994	1996	1999
Age 17								
Upper quartile	338.5 (0.4)*	336.1 (0.6)*	339.8 (0.7)*	341.1 (0.8)*	342.0 (0.7)	341.9 (1.1)	342.2 (0.9)	343.7 (0.8)
Middle two quartiles	301.7 (0.3)*	298.8 (0.3)*	301.4 (0.5)*	304.7 (0.5)*	307.5 (0.4)*	306.5 (0.4)*	308.3 (0.7)	308.9 (0.5)
Lower quartile	259.6 (0.5)*	260.2 (0.7)*	265.2 (0.9)*	267.5 (0.9)*	269.9 (0.9)	269.9 (0.8)	270.1 (0.9)	271.4 (1.0)
Age 13								
Upper quartile	305.0 (0.6)*	305.6 (0.7)*	305.7 (0.7)*	306.5 (0.6)*	308.6 (0.6)*	311.5 (0.9)*	310.5 (1.0)*	313.8 (0.7)
Middle two quartiles	265.5 (0.4)*	269.3 (0.3)*	268.6 (0.5)*	270.7 (0.4)*	273.8 (0.4)*	275.1 (0.5)	274.8 (0.5)*	276.2 (0.4)
Lower quartile	220.6 (0.7)*	230.3 (0.8)*	232.9 (0.7)*	233.7 (0.8)*	236.3 (1.2)	235.7 (1.0)	236.9 (0.5)	237.3 (1.3)
Age 9								
Upper quartile	256.0 (0.8)*	256.0 (0.6)*	259.3 (0.7)*	265.6 (0.8)*	265.6 (0.8)*	267.1 (0.8)	268.3 (1.2)	269.2 (0.9)
Middle two quartiles	220.5 (0.5)*	220.7 (0.5)*	223.3 (0.5)*	231.3 (0.4)*	231.5 (0.5)*	233.0 (0.6)	232.3 (0.4)*	233.8 (0.4)
Lower quartile	177.6 (0.6)*	178.5 (0.8)*	180.9 (0.7)*	190.3 (1.0)	189.9 (0.8)	191.2 (0.8)	190.9 (0.9)	191.3 (0.8)

Standard errors of the estimated scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.4
Data for Figure 1.4: Trends in Average Science Scale Scores by Quartile

Science	1977	1982	1986	1990	1992	1994	1996	1999
Age 17								
Upper quartile	333.6 (0.9)*	328.9 (1.0)*	339.9 (1.1)*	344.3 (0.7)	346.4 (0.7)	346.0 (0.9)	347.4 (1.7)	345.3 (1.2)
Middle two quartiles	291.2 (0.5)*	286.1 (0.7)*	289.6 (0.7)*	291.6 (0.7)*	295.3 (1.0)	296.2 (0.7)	297.7 (1.0)	296.9 (0.8)
Lower quartile	242.0 (0.8)	232.1 (1.3)*	234.7 (1.3)*	234.0 (1.2)*	239.6 (1.9)	237.5 (1.7)*	240.2 (1.5)	242.0 (1.2)
Age 13								
Upper quartile	290.5 (0.5)*	290.5 (0.9)*	292.1 (1.1)*	297.1 (0.7)	298.1 (1.0)	297.6 (1.2)	299.1 (1.0)	296.3 (1.1)
Middle two quartiles	249.0 (0.6)*	251.1 (0.6)*	252.3 (0.7)*	256.2 (0.6)	260.1 (0.5)*	258.6 (0.7)	256.9 (0.6)	257.2 (0.5)
Lower quartile	201.1 (0.8)*	208.1 (0.8)*	209.2 (0.9)*	211.2 (1.2)	213.9 (0.8)	212.4 (1.3)	211.0 (1.0)	212.5 (1.2)
Age 9								
Upper quartile	265.6 (0.9)*	268.3 (1.8)	268.8 (1.2)	271.0 (0.8)	272.7 (1.2)	273.9 (1.1)*	275.5 (1.0)*	271.0 (0.8)
Middle two quartiles	222.1 (0.5)*	221.7 (1.1)*	225.8 (0.6)*	231.0 (0.5)	232.5 (0.7)	233.5 (1.1)	231.1 (1.1)	231.5 (0.5)
Lower quartile	169.6 (1.1)*	171.4 (2.0)*	176.7 (1.0)*	181.9 (0.9)	184.4 (1.2)	183.1 (1.2)	181.2 (1.3)	183.3 (0.9)

Standard errors of the estimated scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.5
Data for Figure 1.5: Trends in Percentages of Students At or Above Reading Performance Levels

Reading	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
Age 17										
Level 150	99.6 (0.1)	99.7 (0.1)	99.9 (0.1)	100.0 (0.0)	100.0 (****)	99.9 (****)	99.8 (0.1)	99.8 (0.1)	100.0 (****)	100.0 (****)
Level 200	96.0 (0.3)*	96.4 (0.3)*	97.2 (0.3)	98.3 (0.1)	98.9 (0.3)*	98.1 (0.3)	97.1 (0.4)	96.8 (0.5)	97.5 (0.5)	97.6 (0.4)
Level 250	78.6 (0.9)*	80.1 (0.7)	80.7 (0.9)	83.1 (0.5)	85.7 (0.8)*	84.1 (1.0)	82.5 (0.8)	80.8 (1.0)	81.8 (0.8)	82.0 (1.0)
Level 300	39.0 (1.0)	38.7 (0.8)	37.8 (1.1)	40.3 (0.8)	40.9 (1.5)	41.4 (1.0)	43.2 (1.1)	41.0 (1.2)	39.4 (1.4)	39.6 (1.4)
Level 350	6.8 (0.4)	6.2 (0.3)	5.3 (0.4)	5.7 (0.3)	4.6 (0.6)*	7.0 (0.5)	6.8 (0.6)	7.3 (0.7)	6.7 (0.8)	6.5 (0.6)
Age 13										
Level 150	99.8 (0.0)	99.7 (0.1)	99.9 (0.1)	99.8 (0.0)	99.9 (0.1)	99.8 (0.1)	99.5 (0.3)	99.3 (0.2)	99.6 (0.2)	99.6 (0.2)
Level 200	93.0 (0.5)	93.2 (0.4)	94.8 (0.4)*	93.9 (0.3)	94.9 (0.6)	93.8 (0.6)	92.7 (0.7)	91.7 (0.6)	92.1 (0.7)	93.2 (0.7)
Level 250	57.8 (1.1)	58.6 (1.0)	60.7 (1.1)	59.0 (0.6)	58.7 (1.3)	58.7 (1.0)	61.6 (1.4)	60.4 (1.2)	59.9 (1.3)	60.9 (1.5)
Level 300	9.8 (0.5)*	10.2 (0.5)*	11.3 (0.5)*	11.0 (0.4)*	10.9 (0.8)*	11.0 (0.6)*	15.3 (0.9)	14.1 (0.8)	13.5 (1.0)	14.5 (1.1)
Level 350	0.1 (0.0)*	0.2 (0.0)*	0.2 (0.0)*	0.3 (0.1)	0.2 (0.1)*	0.4 (0.1)	0.6 (0.3)	0.5 (0.1)	0.5 (0.2)	0.5 (0.1)
Age 9										
Level 150	90.6 (0.5)*	93.1 (0.4)	94.6 (0.4)	92.3 (0.3)	92.7 (0.7)	90.1 (0.9)*	92.3 (0.4)	92.1 (0.7)	93.5 (0.6)	93.0 (0.7)
Level 200	58.7 (1.0)*	62.1 (0.8)	67.7 (1.0)*	61.5 (0.7)	62.6 (1.3)	58.9 (1.3)*	62.0 (1.1)	63.3 (1.4)	64.2 (1.3)	63.7 (1.4)
Level 250	15.6 (0.6)	14.6 (0.6)	17.7 (0.8)	17.2 (0.6)	17.5 (1.1)	18.4 (1.0)	16.2 (0.8)	16.5 (1.2)	16.7 (0.8)	15.9 (1.0)
Level 300	0.9 (0.1)	0.6 (0.1)	0.6 (0.1)	1.0 (0.1)	1.4 (0.3)*	1.7 (0.3)*	0.7 (0.2)	0.7 (0.3)	0.7 (0.2)	0.6 (0.2)
Level 350	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)

Standard errors of the estimated percentages appear in parentheses.
*Significantly different from 1999.
(****)Standard error estimates cannot be accurately determined.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.6
Data for Figure 1.6: Trends in Percentages of Students At or Above Mathematics Performance Levels

Mathematics	1978	1982	1986	1990	1992	1994	1996	1999
Age 17								
Level 150	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)
Level 200	99.8 (0.1)	99.9 (0.0)	99.9 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)
Level 250	92.0 (0.5)*	93.0 (0.5)*	95.6 (0.5)	96.0 (0.5)	96.6 (0.5)	96.5 (0.5)	96.8 (0.4)	96.8 (0.5)
Level 300	51.5 (1.1)*	48.5 (1.3)*	51.7 (1.4)*	56.1 (1.4)*	59.1 (1.3)	58.6 (1.4)	60.1 (1.7)	60.7 (1.6)
Level 350	7.3 (0.4)	5.5 (0.4)*	6.5 (0.5)	7.2 (0.6)	7.2 (0.6)	7.4 (0.8)	7.4 (0.8)	8.4 (0.8)
Age 13								
Level 150	99.8 (0.1)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)	100.0 (****)
Level 200	94.6 (0.5)*	97.7 (0.4)*	98.6 (0.2)	98.5 (0.2)	98.7 (0.3)	98.5 (0.3)	98.8 (0.2)	98.7 (0.2)
Level 250	64.9 (1.2)*	71.4 (1.2)*	73.3 (1.6)*	74.7 (1.0)*	77.9 (1.1)	78.1 (1.1)	78.6 (0.9)	78.8 (1.0)
Level 300	18.0 (0.7)*	17.4 (0.9)*	15.8 (1.0)*	17.3 (1.0)*	18.9 (1.0)*	21.3 (1.4)	20.6 (1.2)	23.2 (1.0)
Level 350	1.0 (0.2)	0.5 (0.1)	0.4 (0.1)*	0.4 (0.1)*	0.4 (0.2)*	0.6 (0.2)	0.6 (0.1)	0.9 (0.2)
Age 9								
Level 150	96.7 (0.3)*	97.1 (0.3)*	97.9 (0.3)*	99.1 (0.2)	99.0 (0.2)	99.0 (0.2)	99.1 (0.2)	98.9 (0.2)
Level 200	70.4 (0.9)*	71.4 (1.2)*	74.1 (1.2)*	81.5 (1.0)	81.4 (0.8)	82.0 (0.7)	81.5 (0.8)	82.5 (0.8)
Level 250	19.6 (0.7)*	18.8 (1.0)*	20.7 (0.9)*	27.7 (0.9)*	27.8 (0.9)*	29.9 (1.1)	29.7 (1.0)	30.9 (1.1)
Level 300	0.8 (0.1)*	0.6 (0.1)*	0.6 (0.2)*	1.2 (0.3)	1.2 (0.3)	1.3 (0.4)	1.6 (0.3)	1.7 (0.3)
Level 350	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)	0.0 (****)

Standard errors of the estimated percentages appear in parentheses.
*Significantly different from 1999.
(****) Standard error estimates cannot be accurately determined.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.7
Data for Figure 1.7: Trends in Percentages of Students At or Above Science Performance Levels

Science	1977	1982	1986	1990	1992	1994	1996	1999
Age 17								
Level 150	99.8 (0.0)	99.7 (0.1)	99.9 (****)	99.9 (****)	100.0 (****)	99.8 (0.1)	100.0 (****)	99.9 (0.1)
Level 200	97.1 (0.2)*	95.7 (0.5)*	97.1 (0.5)	96.7 (0.3)*	97.8 (0.5)	97.1 (0.7)	97.8 (0.3)	98.0 (0.3)
Level 250	81.6 (0.7)*	76.6 (1.0)*	80.7 (1.3)*	81.2 (0.9)*	83.3 (1.2)	83.1 (1.2)	83.8 (0.9)	85.0 (1.1)
Level 300	41.7 (0.9)*	37.3 (0.9)*	41.3 (1.4)*	43.3 (1.3)*	46.6 (1.5)	47.5 (1.3)	48.4 (1.3)	47.4 (1.4)
Level 350	8.5 (0.4)	7.1 (0.4)*	7.9 (0.7)	9.2 (0.5)	10.1 (0.7)	10.0 (0.8)	10.8 (1.0)	9.7 (0.7)
Age 13								
Level 150	98.5 (0.2)*	99.5 (0.1)	99.7 (0.1)	99.7 (0.1)	99.6 (0.1)	99.7 (0.1)	99.7 (0.1)	99.8 (0.1)
Level 200	86.0 (0.7)*	89.8 (0.8)*	91.6 (1.0)	92.3 (0.7)	93.1 (0.5)	92.4 (0.6)	92.0 (0.8)	92.7 (0.4)
Level 250	48.8 (1.1)*	50.9 (1.6)*	52.5 (1.6)*	56.5 (1.0)	61.3 (1.1)*	59.5 (1.1)	57.6 (1.1)	57.9 (1.0)
Level 300	11.1 (0.5)	9.6 (0.7)	9.1 (0.9)	11.2 (0.6)	12.0 (0.8)	11.8 (0.9)	12.3 (0.7)	10.9 (0.7)
Level 350	0.7 (0.1)*	0.4 (0.1)	0.2 (0.1)	0.4 (0.1)	0.2 (0.1)	0.2 (0.1)	0.4 (0.2)	0.2 (0.1)
Age 9								
Level 150	93.5 (0.6)*	95.2 (0.7)*	96.2 (0.3)	97.0 (0.3)	97.4 (0.3)	97.2 (0.4)	96.8 (0.4)	97.0 (0.3)
Level 200	68.0 (1.1)*	70.7 (1.9)*	72.0 (1.1)*	76.4 (0.9)	78.0 (1.2)	77.4 (1.0)	76.1 (1.2)	77.4 (0.8)
Level 250	25.7 (0.7)*	24.3 (1.8)*	27.5 (1.4)*	31.1 (0.8)	32.8 (1.0)	33.7 (1.2)	32.2 (1.3)	31.4 (1.0)
Level 300	3.2 (0.3)	2.3 (0.7)	3.0 (0.5)	3.1 (0.3)	3.4 (0.3)	3.8 (0.4)	4.4 (0.4)*	3.0 (0.4)
Level 350	0.1 (0.0)	0.0 (****)	0.1 (****)	0.1 (0.0)	0.1 (****)	0.1 (0.0)	0.1 (0.1)	0.1 (0.0)

Standard errors of the estimated percentages appear in parentheses.
*Significantly different from 1999.
(****) Standard errors estimates cannot be accurately determined.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.8
Data for Figure 2.1: Trends in Average Reading Scale Scores by Race/Ethnicity

Reading	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
White										
Age 17	87.1 (1.3)	84.3 (1.0)	83.1 (1.6)	77.4 (0.6)	76.7 (0.6)	73.5 (0.5)	74.7 (0.6)	71.9 (0.8)	71.8 (0.7)	71.7 (0.4)
	291.4 (1.0)	293.0 (0.6)	292.8 (0.9)	295.2 (0.7)	294.7 (1.2)	296.6 (1.2)	297.4 (1.4)	295.7 (1.5)	295.1 (1.2)	294.6 (1.4)
Age 13	84.2 (1.4)	80.9 (1.2)	79.7 (1.8)	76.8 (0.6)	76.4 (0.7)	73.5 (0.8)	73.0 (0.7)	73.8 (0.5)	70.6 (0.7)	69.8 (0.7)
	260.9 (0.7)*	262.1 (0.7)*	264.4 (0.7)	262.6 (0.6)*	261.3 (1.1)*	262.3 (0.9)*	266.4 (1.2)	265.1 (1.1)	265.9 (1.0)	266.7 (1.2)
Age 9	84.3 (1.4)	80.0 (1.2)	79.0 (1.3)	74.9 (1.2)	75.2 (1.0)	74.0 (1.0)	74.1 (0.9)	75.2 (0.7)	70.5 (0.9)	68.9 (0.9)
	214.0 (0.9)*	216.6 (0.7)*	221.3 (0.8)	218.2 (0.8)	217.7 (1.4)	217.0 (1.3)	217.9 (1.0)	218.0 (1.3)	219.6 (1.2)	221.0 (1.6)
Black										
Age 17	11.4 (1.2)	11.0 (0.8)	12.0 (1.4)	14.1 (0.2)	15.2 (0.3)	15.9 (0.3)	14.7 (0.3)	15.2 (0.3)	14.8 (0.3)	14.1 (0.2)
	238.7 (1.7)*	240.6 (2.0)*	243.1 (1.8)*	264.3 (1.0)	274.4 (2.4)*	267.3 (2.3)	260.6 (2.1)	266.2 (3.9)	266.1 (2.7)	263.9 (1.7)
Age 13	14.5 (1.4)	12.7 (0.9)	13.5 (1.3)	14.1 (0.2)	15.0 (0.3)	15.4 (0.2)	16.1 (0.4)	14.7 (0.5)	15.0 (0.6)	16.4 (0.6)
	222.4 (1.2)*	225.7 (1.2)*	232.8 (1.5)	236.3 (1.0)	242.9 (2.4)	241.5 (2.2)	237.6 (2.3)	234.3 (2.4)	234.0 (2.6)	238.2 (2.4)
Age 9	13.5 (1.3)	13.4 (0.8)	14.0 (1.0)	15.5 (0.5)	15.9 (0.7)	16.1 (0.6)	15.7 (0.4)	14.9 (0.6)	17.4 (0.5)	18.1 (0.4)
	170.1 (1.7)*	181.2 (1.2)	189.3 (1.8)	185.7 (1.1)	188.5 (2.4)	181.8 (2.9)	184.5 (2.2)	185.4 (2.3)	190.9 (2.6)	185.5 (2.3)
Hispanic										
Age 17		3.4 (0.6)	3.9 (0.6)	6.6 (0.7)	5.8 (0.5)	7.0 (0.4)	7.5 (0.6)	8.3 (0.5)	8.8 (0.6)	9.4 (0.3)
		252.4 (3.6)*	261.4 (2.7)	268.1 (2.2)	270.8 (4.3)	274.8 (3.6)	271.2 (3.7)	263.2 (4.9)	265.4 (4.1)	270.7 (3.9)
Age 13		4.9 (0.8)	5.5 (1.0)	6.9 (0.7)	6.1 (0.6)	8.2 (0.5)	7.3 (0.4)	8.0 (0.4)	8.5 (0.6)	10.3 (0.6)
		232.5 (3.0)*	237.2 (2.0)	239.6 (1.7)	240.1 (3.5)	237.8 (2.3)	239.2 (3.5)	235.1 (1.9)*	238.3 (2.9)	243.8 (2.9)
Age 9		4.8 (0.8)	5.7 (0.8)	7.3 (1.4)	6.2 (1.0)	6.2 (0.6)	6.8 (0.8)	5.8 (0.4)	7.7 (1.0)	9.0 (0.7)
		182.7 (2.2)*	190.2 (2.3)	187.2 (2.1)	193.7 (3.5)	189.4 (2.3)	191.7 (3.1)	185.9 (3.9)	194.8 (3.4)	193.0 (2.7)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.9
Data for Figure 2.2: Trends in Average Mathematics Scale Scores by Race/Ethnicity

Mathematics	1973	1978	1982	1986	1990	1992	1994	1996	1999
White									
Age 17		83.1 (1.3)	80.7 (2.0)	77.6 (0.5)	73.3 (0.5)	74.7 (0.5)	72.5 (0.5)	71.4 (0.6)	71.7 (0.5)
	310.0 (1.1)*	305.9 (0.9)*	303.7 (0.9)*	307.5 (1.0)*	309.5 (1.0)*	311.9 (0.8)*	312.3 (1.1)	313.4 (1.4)	314.8 (1.1)
Age 13		80.2 (1.7)	79.2 (2.1)	76.8 (1.0)	73.4 (0.7)	74.2 (0.5)	72.9 (0.5)	71.2 (0.6)	71.5 (0.6)
	274.0 (0.9)*	271.6 (0.8)*	274.4 (1.0)*	273.6 (1.3)*	276.3 (1.1)*	278.9 (0.9)*	280.8 (0.9)	281.2 (0.9)	283.1 (0.8)
Age 9		79.4 (1.4)	78.6 (2.5)	76.5 (1.1)	74.5 (1.1)	75.4 (0.9)	74.7 (0.7)	71.7 (1.1)	70.4 (0.7)
	225.0 (1.0)*	224.1 (0.9)*	224.0 (1.1)*	226.9 (1.1)*	235.2 (0.8)*	235.1 (0.8)*	236.8 (1.0)	236.9 (1.0)	238.8 (0.9)
Black									
Age 17		11.8 (1.1)	12.5 (1.7)	14.3 (0.3)	15.6 (0.3)	14.8 (0.3)	15.5 (0.3)	15.3 (0.3)	14.6 (0.4)
	270.0 (1.3)*	268.4 (1.3)*	271.8 (1.2)*	278.6 (2.1)	288.5 (2.8)	285.8 (2.2)	285.5 (1.8)	286.4 (1.7)	283.3 (1.5)
Age 13		13.1 (1.5)	13.8 (1.8)	14.4 (0.9)	15.6 (0.3)	15.9 (0.3)	15.3 (0.3)	15.3 (0.4)	15.3 (0.5)
	228.0 (1.9)*	229.6 (1.9)*	240.4 (1.6)*	249.2 (2.3)	249.1 (2.3)	250.2 (1.9)	251.5 (3.5)	252.1 (1.3)	251.0 (2.6)
Age 9		13.8 (1.4)	14.3 (2.0)	14.9 (0.5)	16.3 (0.7)	15.9 (0.4)	15.1 (0.5)	15.7 (0.5)	18.0 (0.6)
	190.0 (1.8)*	192.4 (1.1)*	194.9 (1.6)*	201.6 (1.6)*	208.4 (2.2)	208.0 (2.0)	212.1 (1.6)	211.6 (1.4)	210.9 (1.6)
Hispanic									
Age 17		4.0 (0.5)	4.9 (1.0)	5.5 (0.3)	6.9 (0.4)	7.4 (0.5)	8.8 (0.3)	9.3 (0.7)	9.8 (0.5)
	277.0 (2.2)*	276.3 (2.3)*	276.7 (1.8)*	283.1 (2.9)*	283.5 (2.9)*	292.2 (2.6)	290.8 (3.7)	292.0 (2.1)	292.7 (2.5)
Age 13		5.8 (0.9)	5.0 (1.2)	6.6 (1.1)	7.3 (0.5)	7.0 (0.5)	8.1 (0.4)	9.1 (0.7)	9.6 (0.6)
	239.0 (2.2)*	238.0 (2.0)*	252.4 (1.7)*	254.3 (2.9)	254.6 (1.8)	259.3 (1.8)	256.0 (1.9)	255.7 (1.6)	259.2 (1.7)
Age 9		5.4 (0.7)	5.4 (1.1)	6.2 (1.1)	5.5 (0.6)	5.6 (0.8)	6.1 (0.4)	8.0 (1.0)	7.6 (0.6)
	202.0 (2.4)*	202.9 (2.2)*	204.0 (1.3)*	205.4 (2.1)*	213.8 (2.1)	211.9 (2.3)	209.9 (2.3)	214.7 (1.7)	212.9 (1.9)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.10
Data for Figure 2.3: Trends in Average Science Scale Scores by Race/Ethnicity

Science	1970†	1973	1977	1982	1986	1990	1992	1994	1996	1999
White										
Age 17			83.4 (1.3)	80.7 (2.0)	77.6 (0.5)	73.3 (0.5)	74.6 (0.5)	71.7 (0.6)	71.1 (0.7)	71.2 (0.5)
	312.0 (0.8)*	304.0 (0.8)	297.7 (0.7)*	293.1 (1.0)*	297.5 (1.7)*	300.9 (1.1)*	304.2 (1.3)	306.0 (1.5)	306.8 (1.2)	306.2 (1.3)
Age 13			80.4 (1.6)	79.2 (2.1)	76.8 (1.0)	73.4 (0.7)	74.2 (0.5)	72.0 (0.8)	71.0 (0.6)	70.9 (0.5)
	263.0 (0.8)*	259.0 (0.8)*	256.1 (0.8)*	257.3 (1.1)*	259.2 (1.4)*	264.1 (0.9)	267.1 (1.0)	266.5 (1.0)	265.9 (1.1)	265.8 (0.8)
Age 9			79.6 (1.6)	78.6 (2.6)	76.5 (1.1)	74.5 (1.1)	75.4 (0.9)	74.1 (0.9)	71.5 (1.1)	70.1 (0.7)
	236.0 (0.9)*	231.0 (0.9)*	229.6 (0.9)*	229.0 (1.9)*	231.9 (1.2)*	237.5 (0.8)	239.1 (1.0)	240.3 (1.3)	239.0 (1.4)	239.6 (0.9)
Black										
Age 17			11.6 (1.1)	12.5 (1.4)	14.3 (0.3)	15.6 (0.3)	14.8 (0.3)	15.3 (0.3)	15.2 (0.3)	14.5 (0.4)
	258.0 (1.5)	250.0 (1.5)	240.2 (1.5)*	234.7 (1.7)*	252.8 (2.9)	253.0 (4.5)	256.2 (3.2)	256.8 (3.1)	260.3 (2.4)	254.4 (2.9)
Age 13			13.0 (1.2)	13.8 (1.9)	14.4 (0.9)	15.6 (0.3)	15.9 (0.3)	15.1 (0.3)	15.3 (0.4)	15.2 (0.5)
	215.0 (2.4)*	205.0 (2.4)*	208.1 (2.4)*	217.1 (1.3)*	221.6 (2.5)	225.7 (3.1)	224.4 (2.7)	223.9 (4.2)	225.7 (2.1)	226.9 (2.4)
Age 9			13.7 (1.4)	14.3 (2.1)	14.9 (0.5)	16.3 (0.7)	15.9 (0.4)	15.0 (0.5)	15.6 (0.5)	17.9 (0.6)
	179.0 (1.9)*	177.0 (1.9)*	174.8 (1.8)*	187.0 (3.0)*	196.2 (1.9)	196.4 (2.0)	200.3 (2.7)	201.4 (1.7)	201.9 (3.0)	198.9 (2.5)
Hispanic										
Age 17			3.7 (0.9)	4.5 (1.1)	5.5 (0.3)	6.9 (0.4)	7.4 (0.5)	8.7 (0.3)	9.2 (0.7)	9.7 (0.5)
			262.3 (2.2)*	248.7 (2.3)*	259.3 (3.8)*	261.5 (4.4)*	270.2 (5.6)	261.4 (6.7)	269.3 (3.3)	276.0 (4.2)
Age 13			5.0 (1.1)	5.3 (1.0)	6.6 (1.1)	7.3 (0.5)	7.0 (0.5)	8.0 (0.4)	9.1 (0.7)	9.6 (0.6)
			213.4 (1.9)*	225.5 (3.9)	226.1 (3.1)	231.6 (2.6)	237.5 (2.6)*	232.1 (2.4)	232.2 (2.5)	227.2 (1.9)
Age 9			5.3 (0.9)	5.2 (1.3)	6.2 (1.1)	5.5 (0.6)	5.6 (0.8)	6.1 (0.4)	7.9 (1.0)	7.6 (0.6)
			191.9 (2.7)*	189.0 (4.2)*	199.4 (3.1)	206.2 (2.2)	204.7 (2.8)	201.0 (2.7)	207.1 (2.8)	206.1 (2.2)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
†At age 17, the first science assessment was administered in 1969.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.11
Data for Figure 2.4: Trends in Differences Between White and Black Students' Average Scores Across Years (White Minus Black)

Reading	**1971**	**1975**	**1980**	**1984**	**1988**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	52.7 (2.0)*	52.3 (2.1)*	49.7 (2.0)*	30.6 (1.3)	20.3 (2.7)*	29.3 (2.6)	36.9 (2.5)	29.6 (4.2)	29.0 (3.0)	30.7 (2.3)
Age 13	38.5 (1.4)*	36.3 (1.4)*	31.6 (1.6)	26.2 (1.1)	18.4 (2.6)*	20.8 (2.4)*	28.8 (2.7)	30.8 (2.7)	31.9 (2.8)	28.5 (2.7)
Age 9	43.9 (1.9)*	35.4 (1.4)	32.0 (1.9)	32.2 (1.3)	29.2 (2.8)	35.2 (3.2)	33.4 (2.4)	32.6 (2.6)	28.8 (2.8)	35.4 (2.8)
Mathematics		**1973**	**1978**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17		40.0 (1.7)*	37.5 (1.6)*	31.9 (1.5)	28.9 (2.3)	20.9 (3.0)*	26.1 (2.4)	26.8 (2.1)	27.0 (2.2)	31.5 (1.9)
Age 13		46.0 (2.1)*	42.0 (2.1)*	34.0 (1.9)	24.4 (2.6)*	27.2 (2.6)	28.7 (2.1)	29.3 (3.7)	29.1 (1.6)	32.2 (2.7)
Age 9		35.0 (2.1)*	31.7 (1.5)	29.0 (2.0)	25.3 (2.0)	26.8 (2.4)	27.1 (2.2)	24.7 (1.8)	25.3 (1.8)	27.8 (1.8)
Science	**1970†**	**1973**	**1977**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	54.0 (1.7)	54.0 (1.7)	57.4 (1.7)	58.4 (2.0)	44.7 (3.3)	47.9 (4.6)	48.0 (3.5)	49.3 (3.5)	46.5 (2.7)	51.8 (3.2)
Age 13	49.0 (2.5)*	53.0 (2.5)*	48.0 (2.5)*	40.1 (1.7)	37.6 (2.8)	38.4 (3.2)	42.6 (2.9)	42.6 (4.3)	40.2 (2.4)	38.9 (2.5)
Age 9	57.0 (2.1)*	55.0 (2.1)*	54.7 (2.0)*	42.0 (3.6)	35.7 (2.2)	41.1 (2.1)	38.8 (2.9)	38.9 (2.2)	37.1 (3.3)	40.7 (2.6)

Standard errors of the differences in average scale scores appear in parentheses.
*Significantly different from 1999.
†At age 17, the first science assessment was administered in 1969.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.12
Data for Figure 2.5: Trends in Differences Between White and Hispanic Students' Average Scores Across Years (White Minus Hispanic)

Reading	**1975**	**1980**	**1984**	**1988**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	40.5 (3.6)*	31.4 (2.9)	27.3 (2.4)	23.9 (4.4)	21.8 (3.8)	26.2 (3.9)	32.6 (5.2)	29.7 (4.2)	23.9 (4.2)
Age 13	29.6 (3.1)	27.2 (2.1)	22.9 (1.8)	21.2 (3.6)	24.5 (2.5)	27.2 (3.7)	29.9 (2.2)	27.6 (3.1)	22.9 (3.1)
Age 9	33.8 (2.4)	31.1 (2.4)	30.4 (2.3)	24.0 (3.8)	27.5 (2.6)	26.2 (3.2)	32.1 (4.1)	24.8 (3.6)	27.9 (3.2)
Mathematics	**1973**	**1978**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	33.0 (2.5)*	29.6 (2.4)	27.0 (2.0)	24.4 (3.0)	26.0 (3.1)	19.7 (2.8)	21.5 (3.9)	21.4 (2.5)	22.1 (2.7)
Age 13	35.0 (2.4)*	33.6 (2.1)*	22.0 (1.9)	19.3 (3.2)	21.8 (2.1)	19.6 (2.0)	24.8 (2.1)	25.5 (1.9)	24.0 (1.9)
Age 9	23.0 (2.6)	21.2 (2.4)	20.0 (1.7)*	21.5 (2.3)	21.4 (2.3)	23.2 (2.5)	26.9 (2.5)	22.3 (2.0)	25.8 (2.1)
Science		**1977**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17		35.4 (2.3)	44.4 (2.5)*	38.2 (4.1)	39.5 (4.5)	34.1 (5.8)	44.6 (6.9)	37.5 (3.5)	30.2 (4.4)
Age 13		42.7 (2.1)	31.8 (4.0)	33.1 (3.4)	32.5 (2.7)	29.5 (2.8)*	34.4 (2.6)	33.7 (2.8)	38.6 (2.0)
Age 9		37.7 (2.8)	40.1 (4.6)	32.5 (3.3)	31.2 (2.4)	34.4 (3.0)	39.4 (3.0)	31.9 (3.1)	33.5 (2.4)

Standard errors of the differences in average scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.13
Data for Figure 2.6: Trends in Average Reading Scale Scores by Gender

Reading	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
Male										
Age 17	49.2 (0.5) 278.9 (1.2)	48.8 (0.5) 279.7 (1.0)	50.5 (0.6) 281.8 (1.3)	51.1 (0.7) 283.8 (0.6)	47.7 (1.3) 286.0 (1.5)*	50.3 (0.6) 284.0 (1.6)	52.1 (0.9) 284.2 (1.6)	50.2 (1.4) 281.7 (2.2)	51.4 (1.0) 280.6 (1.3)	52.2 (1.3) 281.5 (1.6)
Age 13	50.0 (0.4) 249.6 (1.0)*	49.9 (0.5) 249.6 (0.8)*	49.4 (0.3) 254.3 (1.1)	51.0 (0.5) 252.6 (0.6)	49.5 (0.8) 251.8 (1.3)	50.2 (0.9) 250.5 (1.1)	49.2 (0.9) 254.1 (1.7)	51.4 (0.8) 250.6 (1.2)	48.6 (0.9) 251.1 (1.2)	49.2 (1.0) 253.5 (1.3)
Age 9	49.8 (0.4) 201.2 (1.1)*	50.0 (0.4) 204.3 (0.8)*	50.0 (0.4) 210.0 (1.1)	49.9 (0.5) 207.5 (0.8)	50.3 (0.8) 207.5 (1.4)	50.8 (0.9) 204.0 (1.7)	50.8 (0.7) 205.9 (1.3)	49.8 (0.8) 207.3 (1.3)	49.4 (0.9) 207.0 (1.4)	48.9 (1.0) 208.5 (1.6)
Female										
Age 17	50.8 (0.5) 291.3 (1.3)	51.2 (0.5) 291.2 (1.0)	49.5 (0.6) 289.2 (1.2)*	48.9 (0.7) 293.9 (0.8)	52.1 (1.4) 293.8 (1.5)	49.7 (0.6) 296.5 (1.2)	47.9 (0.9) 295.7 (1.1)	49.6 (1.4) 294.7 (1.5)	48.6 (1.0) 295.1 (1.2)	47.8 (1.3) 294.6 (1.4)
Age 13	50.0 (0.4) 260.8 (0.9)*	50.1 (0.5) 262.3 (0.9)	50.6 (0.3) 262.6 (0.9)	49.0 (0.5) 261.7 (0.6)*	50.5 (0.8) 263.0 (1.0)	49.8 (0.9) 263.1 (1.1)	50.8 (0.9) 265.3 (1.2)	48.5 (0.8) 265.7 (1.2)	51.4 (0.9) 264.3 (1.2)	50.8 (1.0) 265.2 (1.2)
Age 9	50.2 (0.4) 213.9 (1.0)	50.0 (0.4) 215.8 (0.8)	50.0 (0.4) 220.1 (1.1)*	50.1 (0.5) 214.2 (0.8)	49.7 (0.8) 216.3 (1.3)	49.2 (0.9) 214.5 (1.2)	49.2 (0.7) 215.4 (0.9)	50.2 (0.8) 214.7 (1.4)	50.5 (0.9) 217.8 (1.1)	51.0 (1.0) 214.8 (1.5)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.14
Data for Figure 2.7: Trends in Average Mathematics Scale Scores by Gender

Mathematics	1973	1978	1982	1986	1990	1992	1994	1996	1999
Male									
Age 17		48.7 (0.5)	48.7 (0.6)	49.0 (1.2)	48.6 (0.9)	50.7 (1.2)	49.5 (1.3)	49.5 (1.2)	48.3 (1.0)
	309.0 (1.2)	303.8 (1.0)*	301.5 (1.0)*	304.7 (1.2)*	306.3 (1.1)*	308.9 (1.1)	308.5 (1.4)	309.5 (1.3)	309.8 (1.4)
Age 13		49.9 (0.5)	50.2 (0.4)	49.8 (0.9)	49.8 (0.6)	49.9 (0.8)	49.2 (0.8)	48.4 (0.8)	50.1 (0.7)
	265.0 (1.3)*	263.6 (1.3)*	269.2 (1.4)*	270.0 (1.1)*	271.2 (1.2)*	274.1 (1.1)*	276.0 (1.3)	276.3 (0.9)	277.2 (0.9)
Age 9		49.7 (0.5)	49.3 (0.6)	50.0 (0.6)	49.4 (0.6)	48.6 (0.6)	48.9 (0.8)	49.5 (0.6)	48.9 (0.7)
	218.0 (0.7)*	217.4 (0.7)*	217.1 (1.2)*	221.7 (1.1)*	229.1 (0.9)*	230.8 (1.0)	232.2 (1.0)	232.9 (1.2)	232.9 (1.0)
Female									
Age 17		51.3 (0.5)	51.3 (0.6)	51.0 (1.2)	51.4 (0.9)	49.3 (1.2)	50.5 (1.3)	50.5 (1.2)	51.7 (1.0)
	301.0 (1.1)*	297.1 (1.0)*	295.6 (1.0)*	299.4 (1.0)*	302.9 (1.1)*	304.5 (1.1)	304.1 (1.1)	304.9 (1.4)	306.8 (1.0)
Age 13		50.1 (0.5)	49.8 (0.4)	50.2 (0.9)	50.2 (0.6)	50.1 (0.8)	50.8 (0.8)	51.6 (0.8)	49.9 (0.7)
	267.0 (1.1)*	264.7 (1.1)*	268.0 (1.1)*	267.9 (1.5)*	269.6 (0.9)*	272.0 (1.0)	272.7 (1.0)	272.4 (1.0)	274.5 (1.1)
Age 9		50.3 (0.5)	50.7 (0.6)	50.0 (0.6)	50.6 (0.6)	51.4 (0.6)	51.1 (0.8)	50.5 (0.6)	51.1 (0.7)
	220.0 (1.1)*	219.9 (1.0)*	220.8 (1.2)*	221.7 (1.2)*	230.2 (1.1)	228.4 (1.0)*	230.0 (0.9)	229.0 (0.7)	231.2 (0.9)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.15
Data for Figure 2.8: Trends in Average Science Scale Scores by Gender

Science	1970†	1973	1977	1982	1986	1990	1992	1994	1996	1999
Male										
Age 17			49.5 (0.7)	48.4 (0.7)	49.0 (1.2)	48.6 (0.9)	50.7 (1.2)	49.3 (1.3)	49.5 (1.2)	48.3 (1.0)
	314.0 (1.2)*	304.0 (1.2)	297.0 (1.2)	291.9 (1.4)*	294.9 (1.9)*	295.6 (1.3)*	299.1 (1.7)	299.5 (2.0)	299.7 (1.6)	300.4 (1.6)
Age 13			49.8 (0.3)	48.5 (0.7)	49.8 (0.9)	49.8 (0.6)	49.9 (0.8)	49.2 (0.8)	48.4 (0.8)	50.1 (0.7)
	257.0 (1.3)	252.0 (1.3)*	251.1 (1.3)*	255.6 (1.5)	256.1 (1.6)	258.5 (1.1)	260.1 (1.2)	259.4 (1.2)	260.5 (1.0)	258.7 (0.9)
Age 9			50.6 (0.4)	50.5 (1.5)	50.0 (0.6)	49.4 (0.6)	48.6 (0.6)	48.7 (0.8)	49.5 (0.6)	48.9 (0.7)
	228.0 (1.3)	223.0 (1.3)*	222.1 (1.3)*	221.0 (2.3) *	227.3 (1.4)	230.3 (1.1)	234.7 (1.2)*	232.2 (1.3)	231.5 (1.7)	230.9 (1.3)
Female										
Age 17			50.5 (0.7)	51.6 (0.7)	51.0 (1.2)	51.4 (0.9)	49.3 (1.2)	50.3 (1.3)	50.4 (1.2)	51.6 (1.0)
	297.0 (1.1)*	288.0 (1.1)	282.2 (1.1)*	275.2 (1.3)*	282.3 (1.5)*	285.4 (1.6)*	289.0 (1.5)	288.9 (1.7)	291.8 (1.4)	290.6 (1.5)
Age 13			50.2 (0.3)	51.5 (0.7)	50.2 (0.9)	50.2 (0.6)	50.1 (0.8)	50.8 (0.8)	51.5 (0.8)	49.9 (0.7)
	253.0 (1.2)	247.0 (1.2)*	243.7 (1.2)*	245.0 (1.3)*	246.9 (1.5)*	251.8 (1.1)	256.0 (1.0)*	254.3 (1.2)	251.7 (1.3)	252.9 (1.0)
Age 9			49.4 (0.4)	49.5 (1.5)	50.0 (0.6)	50.6 (0.6)	51.4 (0.6)	50.8 (0.8)	50.4 (0.6)	51.0 (0.7)
	223.0 (1.2)*	218.0 (1.2)*	217.6 (1.2)*	220.7 (2.0)*	221.3 (1.4)*	227.1 (1.0)	226.7 (1.0)	230.0 (1.4)	228.0 (1.5)	227.9 (1.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
†At age 17, the first science assessment was administered in 1969.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.16

Data for Figure 2.9: Trends in Differences Between Male and Female Students' Average Scale Scores Across Years (Male Minus Female)

Reading	**1971**	**1975**	**1980**	**1984**	**1988**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	−12.4 (1.8)	−11.6 (1.4)	−7.4 (1.8)*	−11.0 (1.0)	−7.8 (2.1)	−12.5 (2.0)	−11.5 (1.9)	−13.0 (2.7)	−14.5 (1.8)	−13.1 (2.1)
Age 13	−11.3 (1.3)	−12.7 (1.2)	−8.3 (1.4)	−9.1 (0.8)	−11.1 (1.7)	−12.5 (1.6)	−11.2 (2.1)	−15.1 (1.7)	−13.2 (1.7)	−11.6 (1.8)
Age 9	−12.7 (1.5)*	−11.6 (1.1)*	−10.1 (1.6)	−6.7 (1.1)	−8.8 (1.9)	−10.5 (2.0)	−9.5 (1.6)	−7.4 (1.9)	−10.7 (1.8)	−6.3 (2.2)
Mathematics		**1973**	**1978**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17		8.0 (1.6)*	6.6 (1.4)	5.8 (1.4)	5.3 (1.5)	3.3 (1.5)	4.4 (1.5)	4.4 (1.8)	4.6 (1.9)	3.1 (1.7)
Age 13		−2.0 (1.7)*	−1.1 (1.7)	1.2 (1.7)	2.1 (1.9)	1.5 (1.5)	2.1 (1.5)	3.3 (1.6)	3.9 (1.4)	2.7 (1.4)
Age 9		−3.0 (1.3)*	−2.6 (1.3)*	−3.7 (1.7)*	0.0 (1.6)	−1.1 (1.4)	2.4 (1.4)	2.2 (1.4)	3.9 (1.4)	1.7 (1.3)
Science	**1970†**	**1973**	**1977**	**1982**	**1986**	**1990**	**1992**	**1994**	**1996**	**1999**
Age 17	17.0 (1.6)*	16.0 (1.6)*	14.8 (1.6)	16.7 (1.9)*	12.6 (2.4)	10.1 (2.1)	10.1 (2.2)	10.7 (2.6)	7.9 (2.1)	9.7 (2.2)
Age 13	4.0 (1.8)	5.0 (1.8)	7.4 (1.7)	10.7 (2.0)*	9.2 (2.2)	6.8 (1.6)	4.1 (1.6)	5.1 (1.7)	8.8 (1.7)	5.7 (1.4)
Age 9	5.0 (1.8)	4.0 (1.8)	4.5 (1.8)	0.3 (3.0)	5.9 (2.0)	3.2 (1.5)	8.0 (1.6)*	2.2 (1.9)	3.4 (2.3)	2.9 (1.7)

Standard errors of the differences in the average scale scores appear in parentheses.

*Significantly different from 1999.

†At age 17, the first science assessment was administered in 1969.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.17
Data for Figure 2.10: Trends in Average Reading Scale Scores by Parents' Highest Level of Education

Reading	1971	1975	1980	1984	1988	1990	1992	1994	1996	1999
Age 17										
Less than high school	19.8 (0.8) 261.3 (1.5)	16.0 (0.6) 262.5 (1.3)	12.8 (0.7) 262.1 (1.5)	11.6 (0.6) 269.4 (1.1)	8.9 (0.8) 267.4 (2.0)	8.8 (0.6) 269.7 (2.8)	8.1 (0.8) 270.8 (3.9)	7.3 (0.5) 267.9 (2.7)	6.9 (0.6) 267.3 (3.2)	7.3 (0.5) 264.8 (3.6)
Graduated high school	31.1 (0.8) 283.0 (1.2)*	33.6 (0.5) 281.4 (1.1)*	32.3 (0.9) 277.5 (1.0)	35.1 (1.0) 281.2 (0.7)*	30.3 (1.2) 282.0 (1.3)*	29.9 (1.0) 282.9 (1.4)*	28.4 (0.9) 280.5 (1.6)*	27.3 (1.1) 276.1 (1.9)	27.0 (1.5) 273.4 (1.7)	24.6 (1.1) 273.9 (2.1)
Some education after high school	41.9 (1.3) 302.2 (1.0)*	46.4 (0.8) 300.6 (0.7)*	51.3 (1.3) 298.9 (1.0)	49.9 (1.2) 301.2 (0.7)*	58.3 (1.6) 299.5 (1.3)	58.1 (1.3) 299.9 (1.1)	60.6 (1.4) 298.6 (1.4)	62.1 (1.4) 298.5 (1.4)	63.3 (1.7) 297.7 (1.2)	64.8 (1.4) 297.5 (1.2)
Unknown	7.2 (0.8) 261.1 (5.0)	4.0 (0.2) 239.8 (2.8)	3.6 (0.4) 249.8 (3.5)	3.3 (0.2) 256.5 (2.0)	2.4 (0.3) 254.7 (6.2)	3.2 (0.3) 245.9 (5.7)	2.9 (0.3) 254.7 (5.9)	3.3 (0.4) 242.9 (5.2)	2.8 (0.2) 251.8 (5.0)	3.3 (0.3) 252.9 (7.2)
Age 13										
Less than high school	16.4 (0.6) 238.4 (1.3)	14.0 (0.6) 238.7 (1.2)	10.2 (0.6) 238.5 (1.1)	8.7 (0.4) 240.0 (0.9)	7.9 (0.6) 246.5 (2.1)*	8.0 (0.6) 240.8 (1.8)	6.0 (0.5) 239.2 (2.6)	7.0 (0.6) 236.7 (2.4)	5.3 (0.5) 239.3 (2.8)	5.9 (0.4) 237.9 (3.4)
Graduated high school	31.6 (0.7) 255.5 (0.8)*	33.2 (0.6) 254.6 (0.7)	30.7 (0.7) 253.5 (0.9)	35.7 (1.0) 253.4 (0.7)	31.0 (1.1) 252.7 (1.2)	30.9 (1.2) 251.4 (0.9)	28.3 (1.2) 252.1 (1.7)	27.1 (1.2) 251.4 (1.4)	28.9 (1.4) 250.9 (1.5)	25.4 (1.2) 251.4 (1.8)
Some education after high school	38.1 (1.1) 270.2 (0.8)	40.0 (0.9) 269.8 (0.8)	49.1 (1.3) 270.9 (0.8)	45.6 (1.1) 267.6 (0.7)	51.8 (1.5) 265.3 (1.4)*	50.4 (1.5) 266.9 (1.0)	56.6 (1.6) 269.9 (1.4)	57.3 (1.5) 268.5 (1.2)	55.6 (1.6) 268.7 (1.2)	58.0 (1.4) 269.6 (1.1)
Unknown	14.0 (0.8) 233.1 (1.0)	12.7 (0.6) 234.8 (1.1)	10.0 (0.7) 233.3 (1.7)	9.8 (0.4) 236.5 (1.3)	9.2 (0.7) 240.4 (3.0)	10.7 (0.6) 237.7 (1.9)	9.1 (0.5) 236.2 (2.6)	8.6 (0.7) 230.3 (3.0)	10.1 (0.5) 230.3 (2.5)	10.7 (0.7) 236.7 (3.1)
Age 9										
Less than high school	10.0 (0.4) 188.6 (1.5)*	9.9 (0.4) 189.9 (1.3)*	6.5 (0.5) 194.3 (1.6)	5.6 (0.2) 195.1 (1.4)	4.6 (0.6) 192.5 (4.9)	5.0 (0.5) 192.6 (3.2)	5.1 (0.4) 194.9 (4.5)	4.1 (0.4) 189.1 (4.0)	4.1 (0.4) 197.3 (3.4)	4.0 (0.6) 199.1 (3.9)
Graduated high school	22.3 (0.5) 207.8 (1.2)	23.8 (0.4) 211.3 (0.9)*	25.3 (0.8) 213.0 (1.3)*	19.6 (0.6) 208.9 (1.0)	15.9 (0.6) 210.8 (2.2)	17.1 (0.8) 209.1 (1.8)	15.5 (0.8) 207.4 (1.5)	15.7 (0.8) 207.1 (2.6)	15.4 (0.7) 206.8 (2.0)	16.1 (0.9) 206.2 (2.0)
Some education after high school	33.0 (0.9) 223.9 (1.1)*	34.2 (0.7) 221.5 (0.9)	40.1 (1.5) 226.0 (1.1)*	36.7 (1.0) 222.9 (0.9)	45.2 (1.4) 220.0 (1.7)	42.4 (1.3) 217.7 (2.0)	44.7 (0.9) 219.5 (1.4)	46.3 (1.2) 221.0 (1.3)	44.8 (0.9) 219.4 (1.4)	45.8 (1.4) 219.7 (1.7)
Unknown	34.7 (0.7) 197.4 (1.0)*	32.1 (0.8) 203.1 (0.8)	28.1 (1.0) 206.1 (1.0)	37.6 (0.9) 204.4 (0.7)	34.2 (1.3) 204.4 (1.5)	35.5 (1.1) 201.4 (1.5)	34.4 (1.3) 204.1 (1.2)	33.8 (0.8) 202.4 (1.3)	35.5 (0.9) 207.8 (1.4)	33.6 (0.8) 205.1 (1.6)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.18
Data for Figure 2.11: Trends in Average Mathematics Scale Scores by Parents' Highest Level of Education

Mathematics	1978	1982	1986	1990	1992	1994	1996	1999
Age 17								
Less than high school	13.3 (0.6) 279.6 (1.2)*	13.8 (0.9) 279.3 (1.0)*	8.3 (0.4) 279.3 (2.3)*	7.9 (0.6) 285.4 (2.2)	8.1 (0.6) 285.5 (2.3)	7.0 (0.5) 283.7 (2.4)	6.4 (0.7) 280.5 (2.4)*	6.6 (0.4) 289.2 (1.8)
Graduated high school	33.3 (0.7) 293.9 (0.8)*	32.7 (0.8) 293.4 (0.8)*	27.9 (1.1) 293.1 (1.0)*	26.4 (1.1) 293.7 (0.9)*	21.4 (0.9) 297.6 (1.7)	22.1 (0.8) 295.3 (1.1)	21.1 (1.1) 297.3 (2.4)	20.2 (0.9) 299.1 (1.6)
Some education after high school	16.2 (0.4) 305.3 (0.9)	17.7 (0.5) 303.9 (0.9)*	24.1 (1.0) 305.2 (1.2)	23.8 (0.9) 307.7 (1.0)	25.4 (0.9) 307.5 (1.1)	23.5 (1.1) 305.0 (1.3)	24.1 (1.1) 306.7 (1.5)	23.0 (0.8) 307.6 (1.6)
Graduated college	32.4 (1.1) 316.8 (1.0)	31.8 (1.3) 312.4 (1.0)*	36.9 (1.2) 313.9 (1.4)	38.9 (1.4) 316.2 (1.3)	42.6 (1.4) 315.9 (1.0)	44.4 (1.5) 317.6 (1.4)	46.4 (1.5) 316.6 (1.3)	47.5 (1.7) 316.5 (1.2)
Unknown	4.8 (0.4) 275.7 (1.9)*	4.0 (0.3) 271.7 (1.8)*	2.8 (0.3) 280.6 (2.4)	3.0 (0.4) 276.8 (2.8)	2.5 (0.3) 290.2 (3.9)	3.1 (0.3) 282.7 (3.8)	2.0 (0.2) 287.3 (4.0)	2.6 (0.3) 285.2 (3.9)
Age 13								
Less than high school	12.2 (0.6) 244.7 (1.2)*	10.7 (0.6) 251.0 (1.4)	7.9 (1.1) 252.3 (2.3)	7.6 (0.5) 253.4 (1.8)	5.9 (0.5) 255.5 (1.0)	6.2 (0.4) 254.5 (2.1)	5.5 (0.4) 253.7 (2.4)	6.1 (0.4) 256.2 (2.8)
Graduated high school	33.0 (0.8) 263.1 (1.0)	34.4 (0.8) 262.9 (0.8)	31.0 (1.3) 262.7 (1.2)	26.8 (0.8) 262.6 (1.2)	23.1 (0.9) 263.2 (1.2)	23.1 (0.9) 265.7 (1.1)	22.7 (1.0) 266.8 (1.1)	20.8 (0.9) 264.0 (1.1)
Some education after high school	14.3 (0.4) 273.1 (1.2)*	14.1 (0.4) 275.1 (0.9)*	15.6 (0.6) 273.7 (0.8)*	16.8 (0.6) 277.1 (1.0)	18.4 (0.7) 277.6 (1.0)	16.8 (0.6) 277.3 (1.6)	16.8 (0.5) 277.5 (1.4)	16.8 (0.6) 279.4 (0.9)
Graduated college	25.7 (1.2) 283.8 (1.2)	32.1 (1.3) 282.3 (1.5)	37.5 (2.0) 279.9 (1.4)*	40.8 (1.2) 280.4 (1.0)*	44.1 (1.3) 282.8 (1.0)*	45.5 (1.3) 284.9 (1.2)	45.2 (1.6) 282.9 (1.2)	47.5 (1.4) 285.8 (1.0)
Unknown	14.8 (0.9) 239.5 (1.3)*	8.8 (0.8) 251.9 (3.2)	8.0 (0.4) 247.4 (2.3)*	7.9 (0.5) 247.8 (2.1)*	8.4 (0.4) 252.9 (1.8)	8.3 (0.5) 252.4 (2.4)	9.8 (0.6) 258.8 (1.4)	8.8 (0.5) 258.1 (2.2)
Age 9								
Less than high school	7.9 (0.4) 200.3 (1.5)*	8.0 (0.7) 199.0 (1.7)*	4.2 (0.4) 200.6 (2.5)*	4.9 (0.4) 210.4 (2.3)	4.2 (0.3) 216.7 (2.2)	3.8 (0.4) 210.0 (3.0)	3.9 (0.5) 219.8 (3.3)	3.9 (0.3) 213.5 (2.8)
Graduated high school	23.0 (0.8) 219.2 (1.1)*	25.1 (0.8) 218.3 (1.1)*	16.4 (0.7) 218.4 (1.6)*	16.0 (0.7) 226.2 (1.2)	13.5 (0.7) 222.0 (1.5)	14.0 (0.6) 225.3 (1.3)	12.6 (0.6) 221.2 (1.7)	12.2 (0.4) 224.4 (1.7)
Some education after high school	8.8 (0.4) 230.1 (1.7)*	9.4 (0.4) 225.2 (2.1)*	6.6 (0.6) 228.6 (2.1)*	7.4 (0.4) 235.8 (2.0)	7.8 (0.4) 237.4 (1.9)	7.0 (0.4) 239.3 (2.1)	7.2 (0.4) 238.2 (2.5)	6.9 (0.3) 236.7 (1.9)
Graduated college	23.6 (1.1) 231.3 (1.1)*	30.1 (1.5) 228.8 (1.5)*	37.8 (1.1) 231.3 (1.1)*	40.1 (1.1) 237.6 (1.3)	41.5 (1.2) 236.2 (1.0)*	45.0 (0.8) 237.8 (0.8)	43.0 (1.2) 239.7 (1.4)	45.2 (1.1) 239.7 (0.8)
Unknown	36.8 (1.5) 211.4 (1.1)*	27.3 (1.1) 212.6 (1.5)*	34.9 (1.0) 214.3 (1.4)*	31.7 (0.8) 223.0 (1.0)	33.0 (0.8) 224.5 (1.0)	30.2 (0.8) 224.8 (1.1)	33.3 (0.9) 223.3 (1.0)	31.7 (0.9) 225.3 (1.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.19
Data for Figure 2.12: Trends in Average Science Scale Scores by Parents' Highest Level of Education

Science	1977	1982	1986	1990	1992	1994	1996	1999
Age 17								
Less than high school	15.2 (0.9) 265.3 (1.3)	12.8 (0.7) 258.5 (2.4)	8.3 (0.4) 257.5 (3.1)	7.9 (0.6) 261.4 (2.8)	8.1 (0.6) 262.0 (3.8)	7.0 (0.5) 255.8 (4.2)	6.4 (0.7) 259.3 (4.0)	6.6 (0.4) 264.0 (3.7)
Graduated high school	33.1 (0.6) 284.4 (0.8)	28.7 (0.9) 275.2 (1.6)*	27.9 (1.1) 277.0 (2.0)	26.4 (1.1) 276.3 (1.4)	21.4 (0.9) 280.2 (2.4)	22.1 (0.8) 279.2 (1.7)	21.1 (1.1) 282.2 (2.5)	20.2 (0.9) 280.8 (2.0)
Some education after high school	17.0 (0.4) 295.6 (1.1)	21.5 (0.6) 290.1 (1.7)*	24.1 (1.0) 295.1 (2.5)	23.8 (0.9) 296.5 (1.6)	25.4 (0.9) 295.9 (1.7)	23.5 (1.1) 294.8 (1.9)	24.1 (1.1) 297.1 (1.9)	23.0 (0.8) 296.5 (2.1)
Graduated college	30.2 (1.2) 309.3 (1.0)	32.4 (1.4) 300.2 (1.7)*	36.9 (1.2) 303.8 (2.1)	38.9 (1.4) 305.5 (1.7)	42.6 (1.4) 308.3 (1.3)	44.4 (1.5) 310.6 (1.6)	46.4 (1.5) 307.8 (1.5)	47.5 (1.7) 307.2 (1.5)
Unknown	4.4 (0.4) 252.6 (3.2)	4.7 (0.8) 251.6 (3.9)	2.8 (0.3) 245.4 (5.5)*	3.0 (0.4) 248.2 (5.5)*	2.5 (0.3) 257.6 (7.4)	3.1 (0.3) 246.7 (6.7)*	2.0 (0.2) 257.6 (8.1)	2.6 (0.3) 264.9 (5.7)
Age 13								
Less than high school	12.7 (0.7) 223.5 (1.3)	9.7 (0.6) 225.3 (1.9)	7.9 (1.1) 229.4 (2.7)	7.6 (0.5) 232.9 (2.1)	5.9 (0.5) 233.8 (2.9)	6.2 (0.4) 234.3 (2.5)	5.5 (0.4) 229.8 (3.1)	6.1 (0.4) 229.3 (2.8)
Graduated high school	32.8 (0.6) 245.3 (1.1)	25.6 (1.1) 243.1 (1.3)	31.0 (1.3) 244.8 (1.4)	26.8 (0.8) 247.3 (1.3)*	23.1 (0.9) 246.4 (1.4)	23.1 (0.9) 247.1 (1.2)*	22.7 (1.0) 247.6 (1.7)	20.8 (0.9) 243.2 (1.4)
Some education after high school	15.0 (0.5) 260.3 (1.3)	16.8 (0.6) 258.8 (1.5)	15.6 (0.6) 257.8 (1.4)	16.8 (0.6) 262.8 (1.2)	18.4 (0.7) 265.9 (1.1)*	16.8 (0.6) 260.4 (2.0)	16.8 (0.5) 260.6 (1.4)	16.8 (0.6) 260.9 (1.3)
Graduated college	26.6 (1.0) 266.4 (1.0)	37.3 (1.5) 263.5 (1.5)*	37.5 (2.0) 264.4 (1.9)	40.8 (1.2) 267.5 (1.1)	44.1 (1.3) 269.2 (1.0)	45.5 (1.3) 268.8 (1.3)	45.2 (1.6) 266.4 (1.2)	47.5 (1.4) 267.7 (1.0)
Unknown	12.9 (1.1) 221.9 (1.8)*	10.5 (1.2) 229.1 (2.8)	8.0 (0.4) 226.5 (2.7)	7.9 (0.5) 224.3 (2.1)*	8.4 (0.4) 231.6 (2.0)	8.3 (0.5) 230.2 (2.5)	9.8 (0.6) 235.5 (2.3)	8.8 (0.5) 231.6 (2.8)
Age 9								
Less than high school	9.0 (0.4) 198.5 (2.2)*	6.5 (0.9) 198.2 (6.0)	4.2 (0.4) 203.6 (2.9)	4.9 (0.4) 209.8 (2.7)	4.2 (0.3) 217.2 (2.6)	3.8 (0.4) 211.4 (3.4)	3.9 (0.5) 210.4 (2.9)	3.9 (0.3) 212.7 (3.9)
Graduated high school	26.7 (0.5) 223.0 (1.4)*	14.7 (1.1) 218.0 (3.3)	16.4 (0.7) 219.6 (1.5)	16.0 (0.7) 225.8 (1.7)*	13.5 (0.7) 222.0 (1.9)	14.0 (0.6) 225.3 (1.4)*	12.6 (0.6) 222.1 (2.3)	12.2 (0.4) 218.0 (1.9)
Some education after high school	7.2 (0.3) 237.2 (1.5)	8.3 (0.6) 229.1 (3.2)	6.6 (0.6) 235.8 (2.6)	7.4 (0.4) 237.6 (2.1)	7.8 (0.4) 236.6 (2.4)	7.0 (0.4) 238.9 (2.8)	7.2 (0.4) 242.1 (2.9)	6.9 (0.3) 234.2 (3.1)
Graduated college	23.1 (0.7) 232.3 (1.4)*	42.0 (2.3) 230.5 (2.3)*	37.8 (1.1) 235.2 (1.4)	40.1 (1.1) 236.2 (1.3)	41.5 (1.2) 238.9 (1.2)	45.0 (0.8) 238.5 (1.4)	43.0 (1.2) 240.2 (1.6)	45.2 (1.1) 237.4 (1.1)
Unknown	34.0 (0.7) 211.0 (1.4)*	28.5 (1.8) 210.8 (2.8)*	34.9 (1.0) 215.3 (1.5)*	31.7 (0.8) 221.5 (1.2)	33.0 (0.8) 224.2 (1.4)	30.2 (0.8) 223.4 (1.9)	33.3 (0.9) 219.2 (1.3)*	31.7 (0.9) 223.5 (1.3)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.20
Data for Figure 2.13: Trends in Average Reading Scale Scores by Type of School

Reading	1980	1984	1988	1990	1992	1994	1996	1999
Age 17								
Public	92.6 (1.2) 284.4 (1.2)	88.9 (1.7) 287.2 (0.6)	87.6 (3.5) 288.7 (1.0)	92.9 (1.5) 288.6 (1.1)	91.8 (1.9) 287.8 (1.0)	89.4 (2.3) 286.0 (1.5)	91.7 (1.7) 287.0 (1.1)	90.1 (2.4) 285.6 (1.3)
Nonpublic	7.4 (1.2) 298.4 (2.7)	11.1 (1.7) 303.0 (2.0)	12.4 (3.5) 299.6 (3.8)	7.1 (1.5) 311.0 (4.2)	8.2 (1.9) 309.6 (4.2)	10.6 (2.3) 306.1 (5.8)	8.3 (1.7) 294.2 (5.7)	9.9 (2.4) 307.2 (3.5)
Age 13								
Public	88.4 (1.3) 256.9 (1.1)	87.9 (1.1) 255.2 (0.6)	89.1 (2.5) 256.1 (1.0)	87.7 (1.9) 255.0 (0.8)	86.4 (1.9) 257.2 (1.3)	88.9 (1.5) 255.6 (1.0)	88.5 (2.1) 256.0 (1.1)	87.3 (2.8) 256.9 (1.4)
Nonpublic	11.6 (1.3) 270.6 (1.5)	12.1 (1.1) 271.2 (1.7)	10.9 (2.5) 268.3 (2.8)	12.3 (1.9) 269.7 (2.9)	13.6 (1.9) 276.3 (2.6)	11.1 (1.5) 275.8 (3.4)	11.5 (2.1) 273.0 (3.4)	12.7 (2.8) 276.4 (3.4)
Age 9								
Public	88.8 (1.4) 213.5 (1.1)*	87.0 (1.7) 209.4 (0.8)	87.7 (2.7) 210.2 (1.2)	92.1 (1.9) 207.5 (1.4)	88.2 (1.7) 208.6 (1.0)	89.4 (2.1) 209.4 (1.4)	86.2 (1.6) 210.2 (1.0)	88.4 (1.9) 209.9 (1.3)
Nonpublic	11.2 (1.4) 227.0 (1.8)	13.0 (1.7) 222.8 (1.6)	12.3 (2.7) 223.4 (3.0)	7.9 (1.9) 228.3 (3.3)	11.8 (1.7) 224.7 (2.3)	10.6 (2.1) 225.0 (2.7)	13.8 (1.6) 226.6 (3.0)	11.6 (1.9) 225.7 (3.3)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.21
Data for Figure 2.14: Trends in Average Mathematics Scale Scores by Type of School

Mathematics	1978	1982	1986	1990	1992	1994	1996	1999
Age 17								
Public	94.4 (1.0)	91.6 (1.6)	96.0 (1.4)	92.8 (1.8)	91.3 (2.2)	87.8 (2.3)	91.4 (1.7)	89.5 (2.6)
	299.6 (1.0)*	297.3 (0.9)*	301.2 (1.0)*	303.5 (0.8)*	305.3 (0.9)	304.4 (0.9)	306.4 (1.1)	306.7 (1.0)
Nonpublic	5.6 (1.0)	8.4 (1.6)	4.0 (1.4)	7.2 (1.8)	8.7 (2.2)	12.2 (2.3)	8.6 (1.7)	10.5 (2.6)
	314.3 (3.2)	311.4 (1.7)	320.1 (9.8)	317.7 (6.6)	320.4 (3.0)	319.4 (4.0)	315.5 (4.5)	320.6 (4.1)
Age 13								
Public	90.8 (1.6)	89.4 (1.3)	95.9 (1.8)	89.6 (1.4)	88.1 (1.9)	88.4 (1.7)	88.8 (1.8)	88.2 (2.2)
	262.6 (1.2)*	267.1 (1.3)*	268.7 (1.2)*	269.3 (1.0)*	271.7 (1.0)	273.0 (1.1)	272.9 (0.9)	274.2 (1.2)
Nonpublic	9.2 (1.6)	10.6 (1.3)	4.1 (1.8)	10.4 (1.4)	11.9 (1.9)	11.6 (1.7)	11.2 (1.8)	11.8 (2.2)
	279.2 (1.4)*	281.1 (2.1)*	275.7 (4.9)*	279.9 (1.7)*	283.3 (2.5)	284.6 (2.4)	285.5 (3.6)	288.5 (2.6)
Age 9								
Public	88.9 (1.8)	86.5 (2.2)	83.9 (2.7)	88.9 (2.1)	86.6 (1.6)	88.1 (1.8)	86.8 (1.5)	87.6 (1.6)
	217.2 (0.8)*	217.0 (1.1)*	220.1 (1.2)*	228.6 (0.9)	227.7 (0.9)*	229.3 (0.9)	229.7 (0.8)	230.6 (0.9)
Nonpublic	11.1 (1.8)	13.5 (2.2)	16.1 (2.7)	11.1 (2.1)	13.4 (1.6)	11.9 (1.8)	13.2 (1.5)	12.0 (1.7)
	230.5 (1.7)*	231.8 (2.1)*	230.0 (2.5)*	238.1 (2.3)	241.5 (1.7)	244.5 (2.3)	239.1 (2.1)	242.0 (1.9)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.22
Data for Figure 2.15: Trends in Average Science Scale Scores by Type of School

Science	1977	1982	1986	1990	1992	1994	1996	1999
Age 17								
Public	93.6 (1.8) 288.2 (1.0)*	90.1 (2.0) 282.3 (1.1)*	96.0 (1.4) 287.1 (1.6)*	92.8 (1.8) 289.0 (1.1)*	90.2 (2.4) 292.2 (1.3)	87.8 (2.3) 291.7 (1.5)	91.4 (1.7) 294.9 (1.2)	89.5 (2.6) 293.4 (1.3)
Nonpublic	6.4 (1.8) 308.4 (2.4)	9.9 (2.0) 292.0 (2.9)*	4.0 (1.4) 321.3 (10.1)	7.2 (1.8) 307.8 (6.6)	8.6 (2.1) 311.7 (3.7)	12.2 (2.3) 310.4 (4.8)	8.6 (1.7) 303.6 (5.5)	10.5 (2.6) 311.4 (4.9)
Age 13								
Public	90.4 (1.4) 245.2 (1.2)*	89.4 (1.7) 248.5 (1.4)*	95.9 (1.8) 250.9 (1.4)	89.6 (1.4) 253.6 (1.1)	88.1 (1.9) 257.2 (1.0)*	88.4 (1.7) 255.4 (1.1)	88.8 (1.8) 254.5 (1.1)	88.2 (2.2) 254.0 (1.1)
Nonpublic	9.6 (1.4) 267.7 (2.1)	10.6 (1.7) 263.7 (3.2)	4.1 (1.8) 263.1 (6.4)	10.4 (1.4) 269.0 (1.8)	11.9 (1.9) 264.5 (2.4)	11.6 (1.7) 267.6 (2.6)	11.2 (1.8) 267.8 (5.0)	11.8 (2.2) 269.3 (2.7)
Age 9								
Public	88.8 (1.2) 218.0 (1.4)*	90.4 (2.3) 219.7 (2.0)*	83.9 (2.7) 222.6 (1.4)*	88.9 (2.1) 227.7 (0.9)	86.6 (1.6) 229.1 (1.0)	88.1 (1.8) 229.5 (1.4)	86.8 (1.5) 228.5 (1.3)	87.6 (1.6) 228.0 (0.9)
Nonpublic	11.2 (1.2) 234.6 (2.2)	9.6 (2.3) 231.5 (3.2)	16.1 (2.7) 233.0 (2.9)	11.1 (2.1) 236.8 (2.4)	13.4 (1.6) 240.2 (2.7)	11.9 (1.8) 242.2 (2.8)	13.2 (1.5) 237.9 (4.1)	12.0 (1.7) 238.9 (2.6)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, Natianal Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.23
Data for Figure 3.1 and Figure 3.2: Average Mathematics Scores and Percentage of 13-Year-Olds by Type of Mathematics Course, 1986 and 1999

Mathematics	1986	1999
Regular Math	60.5 (3.0)* 260.8 (0.9)	36.9 (1.6) 265.6 (1.1)
Prealgebra	18.9 (1.8)* 280.0 (1.2)	34.5 (1.6) 279.6 (1.1)
Algebra	15.6 (2.0)* 298.6 (1.6)	21.7 (1.1) 293.1 (1.6)
Other	4.7 (0.5)* 262.3 (3.8)	6.1 (0.5) 276.8 (2.8)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
NOTE: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.24
Data for Figure 3.3 and Figure 3.4: Average Mathematics Scores and Percentage of 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999

Mathematics	1978	1999
Prealgebra or General Mathematics	20.2 (1.0)* 266.7 (0.8)	6.7 (0.6) 278.2 (2.8)
Algebra I	16.9 (0.6)* 286.4 (0.7)	11.4 (0.8) 284.8 (1.7)
Geometry	16.4 (0.6) 306.9 (0.7)	15.9 (0.9) 297.6 (1.2)
Algebra II	37.3 (1.2)* 321.4 (0.7)	51.1 (1.2) 315.4 (0.8)
Precalculus or Calculus	5.5 (0.4)* 333.7 (1.4)	12.9 (1.0) 341.3 (1.4)
Other	3.6 (0.2)* 274.1 (1.6)	2.0 (0.4) 277.3 (3.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
NOTE: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.25
Data for Figure 3.5: Percentage of Male and Female 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999

Mathematics	1978	1999
Male		
Prealgebra or General Mathematics	20.9 (1.0)*	7.7 (0.9)
Algebra I	15.4 (0.6)*	12.0 (0.9)
Geometry	15.3 (0.5)	14.5 (0.9)
Algebra II	37.7 (1.2)*	50.4 (1.4)
Precalculus or Calculus	6.7 (0.5)*	13.1 (1.3)
Other	4.0 (0.3)*	2.3 (0.6)
Female		
Prealgebra or General Mathematics	19.6 (1.1)*	5.7 (0.6)
Algebra I	18.4 (0.7)*	10.8 (1.0)
Geometry	17.5 (0.8)	17.1 (1.1)
Algebra II	36.9 (1.3)*	51.9 (1.5)
Precalculus or Calculus	4.4 (0.4)*	12.7 (1.1)
Other	3.2 (0.2)*	1.8 (0.4)

Standard errors of the estimated percentages appear in parentheses.

NOTE: Percentages may not add to 100 due to rounding.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.26
Data for Figure 3.6: Percentage of White, Black, and Hispanic 17-Year-Olds by Highest Mathematics Course Taken, 1978 and 1999

Mathematics	1978	1999
White		
Prealgebra or General Mathematics	18.1 (1.1)*	5.7 (0.7)
Algebra I	16.6 (0.6)*	10.4 (0.8)
Geometry	17.4 (0.7)*	15.0 (0.8)
Algebra II	39.1 (1.3)*	52.8 (1.3)
Precalculus or Calculus	5.6 (0.4)*	14.6 (1.2)
Other	3.2 (0.2)*	1.6 (0.4)
Black		
Pre-algebra or General Mathematics	31.2 (1.3)*	6.9 (1.2)
Algebra I	19.4 (1.2)*	13.3 (1.1)
Geometry	11.2 (0.8)*	20.3 (2.1)
Algebra II	28.3 (2.1)*	51.6 (2.4)
Precalculus or Calculus	4.4 (0.6)	4.5 (0.8)
Other	5.4 (0.5)	3.4 (0.9)
Hispanic		
Pre-algebra or General Mathematics	36.2 (3.1)*	14.4 (2.5)
Algebra I	18.6 (2.1)	20.3 (2.3)
Geometry	12.3 (1.2)	16.8 (2.4)
Algebra II	22.6 (2.5)*	36.9 (2.6)
Precalculus or Calculus	3.4 (0.9)	7.7 (2.0)
Other	6.9 (0.5)*	3.9 (1.0)

Standard errors of the estimated percentages appear in parentheses.

NOTE: Percentages may not add to 100 due to rounding.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.27
Data for Figure 3.7 and Figure 3.8: Average Science Scores and Percentage of 13-Year-Olds by Content of Science Class, 1986 and 1999

Science	1986	1999
Not taking science	8.0 (1.8)* 241.7 (4.5)	2.4 (0.5) 242.6 (4.8)
Life Science	19.4 (2.4) 243.3 (2.3)	21.1 (1.5) 251.3 (1.6)
Physical Science	22.2 (2.9) 259.8 (2.8)	18.7 (2.0) 261.0 (1.9)
Earth Science	23.6 (3.5) 258.5 (2.3)	19.0 (2.0) 261.7 (1.7)
General Science	20.4 (2.0)* 255.4 (1.8)	31.1 (1.9) 260.2 (1.1)
Other	6.4 (1.7) 244.7 (6.2)	7.6 (0.7) 243.2 (2.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.28
Data for Figure 3.9 and Figure 3.10: Average Science Scores and Percentage of 17-Year-Olds by Science Courses Taken, 1986 and 1999

Science	1986	1999
General Science	83.2 (1.3)* 290.1 (1.3)	87.7 (1.2) 297.8 (1.4)
Biology	87.8 (1.0)* 293.5 (1.5)	93.4 (0.7) 299.3 (1.3)
Chemistry	40.1 (1.6)* 311.5 (2.1)	57.2 (1.7) 312.4 (1.4)
Physics	11.2 (0.9)* 296.1 (4.7)	16.8 (1.5) 314.1 (2.7)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.29
Data for Figure 3.11: Percentage of Male and Female 17-Year-Olds by Science Courses Taken, 1986 and 1999

Science	1986	1999
Male		
General Science	84.1 (1.5)*	87.9 (1.2)
Biology	87.1 (1.1)*	91.5 (0.9)
Chemistry	41.6 (1.8)*	54.5 (2.1)
Physics	14.2 (1.3)	17.8 (1.9)
Female		
General Science	82.4 (1.6)*	87.5 (1.5)
Biology	88.4 (1.1)*	95.1 (0.7)
Chemistry	38.7 (2.1)*	59.6 (1.8)
Physics	8.4 (0.7)*	15.9 (1.3)

Standard errors of the estimated percentages appear in parentheses.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.30
Data for Figure 3.12: Percentage of White, Black, and Hispanic 17-Year-Olds by Science Courses Taken, 1986 and 1999

Science	1986	1999
White		
General Science	83.5 (1.6)*	89.8 (1.2)
Biology	88.6 (1.1)*	94.4 (0.6)
Chemistry	42.5 (1.8)*	59.1 (2.0)
Physics	9.7 (0.8)*	16.5 (1.7)
Black		
General Science	83.0 (2.6)	81.5 (2.5)
Biology	83.6 (2.7)*	91.1 (1.6)
Chemistry	29.3 (2.6)*	51.7 (3.0)
Physics	18.2 (3.5)	17.3 (3.3)
Hispanic		
General Science	82.2 (3.5)	81.8 (3.9)
Biology	83.8 (3.4)	87.9 (3.9)
Chemistry	24.4 (2.2)*	42.2 (3.0)
Physics	12.9 (2.8)	13.8 (1.9)

Standard errors of the estimated percentages appear in parentheses.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.31
Data for Figure 3.13 and Figure 3.14: Average Mathematics Scores and Percentage of 17- and 13-Year-Olds by Availability and Use of Computers, 1978 and 1999

Mathematics	1978		1999	
	Yes	No	Yes	No
Age 17				
Had access to computer to learn mathematics	24.4 (2.7)* 313.6 (2.9)	54.6 (2.9) 296.7 (1.5)	53.6 (1.5) 310.5 (1.7)	18.4 (1.0) 303.6 (1.6)
Studied mathematics through computer instruction	12.3 (1.1)* 309.3 (4.7)	85.4 (1.2) 298.8 (1.5)	36.2 (1.4) 310.6 (1.6)	60.9 (1.5) 306.9 (1.2)
Used a computer to solve mathematics problems	46.2 (1.5)* 303.1 (2.1)	52.7 (1.6) 297.4 (1.8)	66.5 (1.4) 310.4 (1.3)	32.0 (1.4) 303.7 (1.5)
Age 13				
Had access to computer to learn mathematics	12.2 (1.8)* 261.9 (4.1)	63.0 (1.8) 269.4 (1.8)	52.6 (2.5) 277.1 (1.9)	25.5 (2.2) 276.9 (2.0)
Studied mathematics through computer instruction	14.4 (0.9)* 266.7 (3.2)	76.1 (1.2) 266.7 (1.6)	50.4 (1.7) 277.3 (1.9)	47.3 (1.7) 275.4 (2.0)
Used a computer to solve mathematics problems	56.3 (1.4)* 268.4 (1.8)	41.8 (1.3) 263.7 (2.0)	71.2 (1.4) 277.0 (1.7)	27.6 (1.3) 274.2 (2.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.32

Data for Figure 3.15 and Figure 3.16: Average Science Scores and Percentage of 9-Year-Olds by Use of Scientific Equipment, 1977 and 1999

Science	1977		1999	
	Yes	No	Yes	No
Meter stick	41.9 (2.4)* 222.4 (2.3)	49.6 (2.2) 215.1 (2.7)	63.0 (1.6) 235.2 (1.4)	27.2 (1.4) 226.0 (2.4)
Scale to weigh things	88.8 (0.8) 219.9 (2.3)	8.9 (0.7) 201.9 (4.5)	88.4 (1.0) 233.8 (1.2)	9.5 (1.0) 211.6 (3.0)
Telescope	44.0 (1.2)* 221.7 (2.6)	52.7 (1.0) 216.4 (2.1)	65.9 (1.1) 235.0 (1.4)	31.9 (1.2) 224.3 (2.0)
Thermometer	83.7 (1.0)* 221.8 (2.2)	13.8 (0.9) 199.2 (2.7)	88.9 (0.7) 233.9 (1.3)	9.3 (0.7) 208.3 (3.3)
Microscope	52.8 (1.4) 222.4 (2.5)	42.9 (1.5) 214.2 (2.1)	56.6 (1.8) 236.7 (1.7)	38.2 (1.6) 223.5 (1.8)
Compass	61.3 (1.3)* 222.3 (2.3)	32.9 (1.2) 214.0 (2.7)	71.3 (1.2) 235.8 (1.2)	25.3 (1.1) 220.9 (2.3)
Balance	37.6 (1.0)* 216.1 (2.9)	43.7 (1.2) 217.5 (2.5)	45.9 (1.5) 235.1 (1.7)	36.3 (1.6) 226.7 (2.0)
Stopwatch	44.0 (1.3)* 222.9 (2.6)	49.0 (1.2) 215.2 (2.5)	74.4 (1.3) 235.9 (1.2)	22.0 (1.2) 218.4 (2.1)

The percentage of students is listed first with the corresponding average scale score presented below.

Standard errors of the estimated percentages and scale scores appear in parentheses.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.33
Data for Figure 3.17 and Figure 3.18: Average Reading Scores and Percentage of 17-, 13-, and 9-Year-Olds by Amount of Time Spent on Homework, 1980/1984 and 1999

Reading	1980	1999
Age 17		
None was assigned	31.6 (1.3)* 275.9 (1.3)	26.4 (1.0) 275.4 (2.3)
Did not do it	12.5 (0.4) 285.4 (1.1)	13.1 (0.7) 282.4 (3.1)
Less than 1 hour	23.6 (0.5)* 288.1 (1.2)	26.4 (1.0) 291.1 (2.3)
1 to 2 hours	22.6 (0.5) 292.1 (1.5)	22.6 (0.8) 295.9 (2.0)
More than 2 hours	9.7 (0.5) 298.6 (2.2)	11.5 (0.9) 300.4 (2.8)
Age 13		
None was assigned	30.5 (1.2)* 253.5 (1.2)	24.1 (1.2) 251.0 (2.0)
Did not do it	6.0 (0.3)* 251.4 (1.7)	4.5 (0.4) 249.1 (4.2)
Less than 1 hour	32.4 (1.0)* 259.6 (1.1)	37.2 (1.4) 261.6 (1.2)
1 to 2 hours	23.9 (0.7) 264.5 (1.1)	26.3 (1.0) 268.6 (1.6)
More than 2 hours	7.2 (0.3) 261.8 (2.0)	7.9 (0.8) 269.1 (3.0)
Age 9	**1984**	**1999**
None was assigned	35.6 (1.3)* 212.5 (0.9)	25.8 (1.6) 209.9 (1.9)
Did not do it	4.1 (0.3) 198.5 (2.1)	3.8 (0.3) 204.4 (4.4)
Less than 1 hour	41.5 (1.0)* 217.5 (0.7)	53.1 (1.4) 214.0 (1.5)
1 to 2 hours	12.7 (0.5) 215.7 (1.3)	12.4 (0.7) 215.1 (3.2)
More than 2 hours	6.1 (0.2)* 201.2 (1.8)	4.9 (0.5) 197.0 (3.5)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
Note: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.34
Data for Figure 3.19 and Figure 3.20: Average Reading Scores and Percentage of 17-, 13-, and 9-Year-Olds by Pages Read Per Day in School and for Homework, 1984 and 1999

Reading	1984	1999
Age 17		
5 or fewer	21.1 (0.8) 272.9 (0.8)	23.5 (1.4) 272.8 (2.7)
6–10	26.2 (0.6) 287.4 (0.8)	24.4 (0.8) 285.0 (1.7)
11–15	18.0 (0.3) 293.6 (0.8)	16.7 (0.6) 291.8 (2.1)
16–20	14.4 (0.4) 295.9 (0.9)	13.9 (0.8) 292.2 (2.9)
More than 20	20.3 (1.0) 299.4 (1.0)	21.5 (1.2) 301.7 (1.9)
Age 13		
5 or fewer	26.5 (0.6)* 250.4 (0.7)	23.4 (1.0) 249.4 (2.0)
6–10	34.6 (0.5)* 260.7 (0.6)	30.6 (1.1) 261.7 (1.7)
11–15	17.5 (0.4) 264.0 (0.9)	17.6 (0.8) 263.0 (2.1)
16–20	10.9 (0.2)* 263.4 (1.0)	12.9 (0.7) 264.3 (2.6)
More than 20	10.5 (0.4)* 260.6 (1.2)	15.6 (1.0) 264.6 (2.0)
Age 9		
5 or fewer	35.1 (1.0)* 207.5 (0.8)	28.3 (1.4) 201.8 (1.8)
6–10	24.9 (0.5) 214.8 (1.0)	23.6 (0.9) 212.5 (1.7)
11–15	13.9 (0.5) 220.1 (1.2)	15.5 (0.7) 221.0 (2.4)
16–20	13.3 (0.5) 215.2 (1.2)	14.0 (0.7) 213.6 (2.0)
More than 20	12.9 (0.4)* 215.3 (1.4)	18.6 (1.0) 217.4 (2.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
Note: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.35
Data for Figure 3.21 and Figure 3.22: Average Mathematics Scores and Percentage of 17-Year-Olds by Frequency of Doing Mathematics Homework, 1978 and 1999

Mathematics	1978	1999
Age 17		
Never	5.8 (0.7)* 283.8 (3.5)	4.2 (0.5) 287.3 (4.6)
Sometimes	35.1 (1.9)* 290.9 (2.1)	19.9 (1.0) 297.4 (1.5)
Often	59.1 (2.0)* 309.2 (1.6)	75.9 (1.1) 312.0 (1.1)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
Note: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.36

Data for Figure 3.23 and Figure 3.24: Average Reading Scores and Percentage of 17-, 13-, and 9-Year-Olds by Number of Different Types of Reading Materials in the Home, 1971 and 1999

Reading	1971	1999
Age 17		
Zero to two	11.0 (0.6)* 245.7 (1.8)	18.6 (0.9) 266.9 (2.3)
Three	21.8 (0.5)* 273.6 (1.4)	29.7 (0.8) 284.9 (1.4)
Four	67.1 (0.9)* 295.5 (1.0)	51.5 (1.2) 297.3 (1.7)
Age 13		
Zero to two	16.8 (0.6)* 226.7 (1.3)	21.4 (0.9) 240.4 (1.9)
Three	25.2 (0.5)* 248.9 (0.9)	32.1 (0.8) 257.4 (1.2)
Four	57.7 (1.0)* 266.5 (0.7)	46.3 (1.0) 270.1 (1.4)
Age 9		
Zero to two	28.2 (0.8)* 186.2 (1.0)	43.2 (1.5) 199.9 (1.3)
Three	32.5 (0.4)* 208.0 (1.0)	30.3 (0.7) 218.2 (1.7)
Four	39.0 (0.9)* 223.2 (0.9)	26.2 (1.2) 224.1 (1.9)

The percentage of students is listed first with the corresponding average scale score presented below.

Standard errors of the estimated percentages and scale scores appear in parentheses.

Note: Percentages may not add to 100 due to rounding.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

Table B.37
Data for Figure 3.25 and Figure 3.26: Average Reading Scores and Percentage of 17-, 13, and 9-Year-Olds by Frequency of Reading for Fun, 1984 and 1999

Reading	1984	1999
Age 17		
Never	8.7 (0.6)* 268.8 (2.4)	16.2 (2.4) 261.6 (5.0)
Yearly	10.3 (0.5) 279.5 (2.7)	11.7 (1.4) 282.9 (4.4)
Monthly	16.7 (0.5) 290.1 (1.8)	19.1 (1.7) 286.4 (4.8)
Weekly	33.5 (1.1) 289.5 (1.7)	28.1 (2.7) 288.6 (2.9)
Daily	30.8 (0.8)* 296.6 (1.5)	24.8 (1.7) 301.4 (4.9)
Age 13		
Never	8.5 (0.6) 238.6 (2.5)	8.8 (1.4) 242.4 (5.3)
Yearly	7.2 (0.5)* 251.9 (3.6)	10.1 (1.2) 252.8 (4.4)
Monthly	14.2 (0.8) 254.8 (2.1)	17.2 (1.6) 260.3 (3.7)
Weekly	35.1 (1.2) 254.5 (1.4)	35.8 (1.7) 262.6 (3.2)
Daily	35.1 (1.0)* 263.6 (1.4)	28.2 (1.7) 271.8 (3.2)
Age 9		
Never	8.9 (0.5) 198.0 (2.7)	10.1 (0.8) 195.5 (3.3)
Yearly	3.0 (0.3) 197.1 (4.2)	4.2 (0.7) ***** (****)
Monthly	7.1 (0.6) 203.5 (3.3)	5.9 (0.6) 210.8 (4.2)
Weekly	27.7 (0.8) 211.6 (1.7)	25.7 (1.5) 215.0 (2.6)
Daily	53.3 (1.0) 214.2 (1.1)	54.1 (1.6) 215.4 (2.4)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
Note: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
*****(****) Sample size is insufficient to permit a reliable estimate.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Table B.38

Data for Figure 3.27 and Figure 3.28: Average Reading Scores and Percentage of 17- and 13-Year-Olds by Extent of Reading by Adults in the Home, 1984 and 1999

Reading	1984	1999
Age 17		
Never/Yearly/Monthly	14.3 (0.8) 267.6 (2.3)	17.9 (1.9) 264.6 (5.7)
Weekly	43.9 (1.1) 287.5 (1.5)	47.9 (1.8) 291.5 (3.0)
Daily	41.8 (1.4)* 292.1 (1.6)	34.2 (2.1) 294.6 (3.9)
Age 13		
Never/Yearly/Monthly	15.7 (1.0)* 245.2 (2.0)	21.4 (1.9) 241.0 (4.8)
Weekly	43.0 (1.1) 259.1 (2.0)	39.2 (2.5) 258.9 (3.3)
Daily	41.3 (0.9) 263.1 (1.8)	39.4 (2.8) 264.3 (2.6)

The percentage of students is listed first with the corresponding average scale score presented below.

Standard errors of the estimated percentages and scale scores appear in parentheses.

Note: Percentages may not add to 100 due to rounding.

*Significantly different from 1999.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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Table B.39
Data for Figure 3.29 and Figure 3.30: Average Mathematics Scores and Percentage of 17-, 13-, and 9-Year-Olds by Amount of Daily Television Watching, 1978/1982 and 1999

Mathematics	1978	1999
Age 17		
6 hours or more	4.8 (0.2)* 278.9 (2.1)	6.5 (0.5) 289.3 (2.2)
3–5 hours	26.4 (0.6)* 295.7 (1.1)	36.9 (0.9) 301.7 (1.1)
0–2 hours	68.8 (0.7)* 305.2 (1.0)	56.7 (0.9) 314.8 (1.3)
Age 13	**1982**	**1999**
6 hours or more	16.2 (0.8)* 255.7 (1.8)	11.9 (0.6) 259.6 (1.9)
3–5 hours	39.2 (0.4)* 269.0 (1.1)	46.7 (0.8) 273.8 (1.0)
0–2 hours	44.6 (0.8)* 273.1 (1.2)	41.4 (1.0) 283.2 (1.1)
Age 9		
6 hours or more	26.3 (1.0)* 214.5 (1.2)	18.8 (0.9) 219.3 (1.4)
3–5 hours	29.2 (0.6)* 227.4 (1.1)	35.0 (0.7) 235.2 (1.2)
0–2 hours	44.4 (1.1) 218.3 (1.4)	46.2 (1.2) 234.8 (1.0)

The percentage of students is listed first with the corresponding average scale score presented below.
Standard errors of the estimated percentages and scale scores appear in parentheses.
Note: Percentages may not add to 100 due to rounding.
*Significantly different from 1999.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1999 Long-Term Trend Assessment.

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