3 Subgroup Results for the Nation and the States

This chapter presents the NAEP 2000 science results for various subgroups of students at both the national and state levels. National average scale score and achievement-level results are presented by six demographic characteristics: gender, race/ethnicity, parents' education level, type of school, school location, and eligibility for the federal free/reduced-price school lunch program. State results at grades 4 and 8 are presented for gender, race/ethnicity, and eligibility for the free/reduced-price school lunch program. Additional information by subgroup for each jurisdiction that participated in the 2000 science assessment is available on the NAEP web site at http://nces.ed.gov/nationsreportcard.

The differences that are reported in this chapter for demographic subgroups are based on statistical tests that consider both the magnitude of the difference between group average scores or percentages and the standard error of those statistics. Differences between groups and between assessment years are discussed only if they have been determined to be statistically significant. Within the sections summarizing achievement level results, only significant differences detected at or above *Basic* and *Proficient* are discussed in the text. Significant differences detected within achievement levels are not discussed, although they are shown in the figures. The reader should bear in mind that differences in science performance most

Chapter Focus

Are selected subgroups of students making progress in science?

Chapter Contents

likely reflect a range of socioeconomic and educational factors that are not addressed in this report or by NAEP.

National Results: Performance of Selected Subgroups

Gender

Gender differences in science achievement on large-scale school assessments have been examined at the international, national, and state level. The Third International Mathematics and Science Study (TIMSS) that was conducted in 1995 reported that, at the fourth-grade level, males outperformed females in about one-half of the countries that participated including the U.S. At the eighth-grade level, while many of the countries that participated showed males outperforming females, this was not true for the U.S.; no difference in performance was seen.[1] At the twelfth-grade level, however, where mathematics and science literacy were tested, males outperformed females in most countries including the U.S.[2] A repeat of TIMSS at the eighth-grade in 1999 (TIMSS-R) showed that males outperformed females in nearly half of the 38 countries, including the United States.[3]

In addition to international data about the performance of male and female students on science assessments, national studies such as NAEP also show male and female differences. For example, the 1990 NAEP science assessment reported that males outperformed females at grade 8 and 12; but found no difference at grade 4.[4] In 1996, when a new NAEP science assessment was administered, these results showed that males outperformed females at the twelfth-grade level only.[5] The NAEP science assessment administered in 1996 was also administered in 2000; thus a measure of performance by males and females on the same assessment can be obtained.

Figure 3.1 presents the average science scores in 1996 and 2000 for male and female students at grades 4, 8, and 12. While average scores for males at grade 8 were higher in 2000 than in 1996, average scores for twelfth-grade males were lower in 2000. None of the apparent changes across years in females' average scores were statistically significant at any grade. In 2000, males had higher scores than females at grades 4 and 8, but the apparent difference between male and female students at grade 12 was not statistically significant.

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1 Mullis, I.V.S., Martin, M.O., Fierros, E.G., Goldberg, A.L., & Stemler, S.E. (2000). *Gender differences in achievement*. Chestnut Hill, MA: International Study Center, Lynch School of Education, Boston College.

2 Mullis, I.V.S., Martin, M.O., Beaton, A., Gonzalez, E.J., Kelly, D., & Smith, T.A. (1998). *Mathematics and science achievement in the final year of secondary school*. Chestnut Hill, MA: International Study Center, Lynch School of Education, Boston College.

3 Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., & O'Connor, K.M. (2000). *TIMSS 1999 international science report; Findings from IEA's repeat of the Third International Mathematics and Science Study at the eighth grade.* Chestnut Hill, MA: International Study Center, Lynch School of Education, Boston College.

Gonzales, P., Calsyn, C., Jocelyn, L., Mak, K., Kastberg, D., Arafeh, S., Williams, T., & Tsen, W. (2000). *Pursuing excellence: Comparisons of international eighth-grade mathematics and science achievement from a U.S. perspective, 1995 and 1999* (NCES Publication No. 2001-028). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

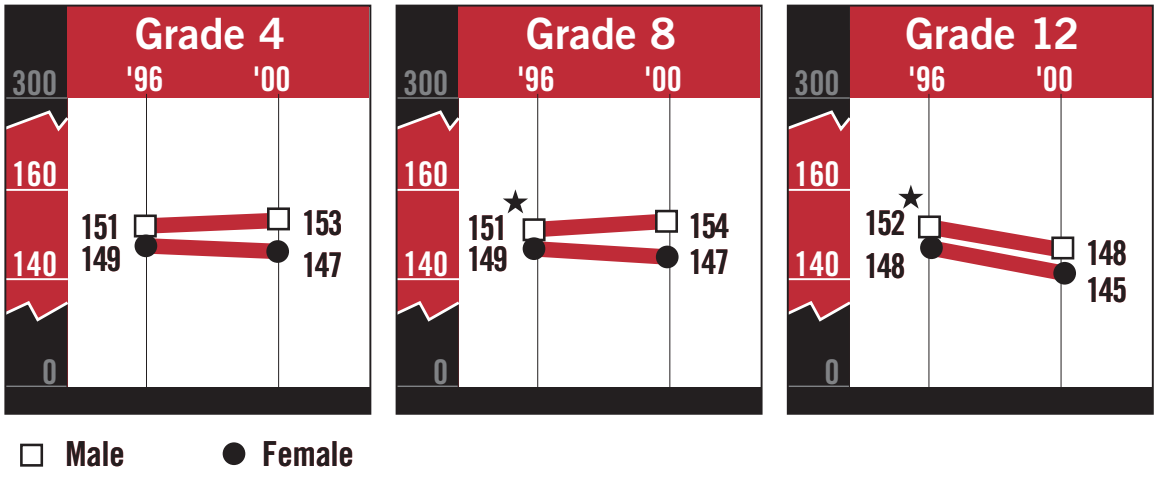
4 Jones, L.R., Mullis, I.V.S., Raizen, S.A., Weiss, I.R., & Weston, E.A. (1992). *The 1990 science report card*. Washington, DC: Office of Educational Research and Improvement.

5 O'Sullivan, C.Y., Reese, C.M., & Mazzeo, J. (1997). *NAEP 1996 science report card for the nation and the states*. Washington, DC: Office of Educational Research and Improvement.

Figure 3.1

National Scale Score Results by Gender

Average science scale scores by gender, grades 4, 8, and 12: 1996 and 2000



★ Significantly different from 2000.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

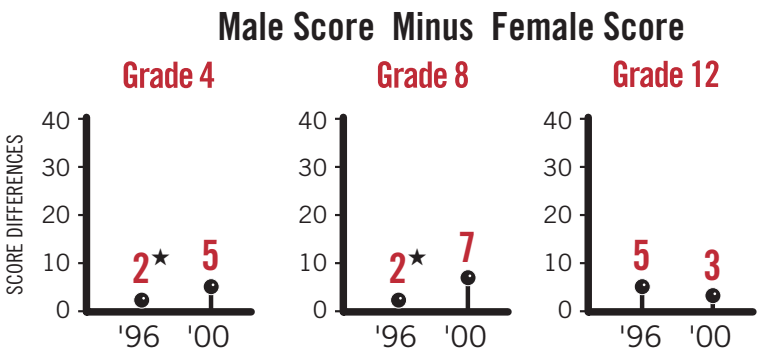
Figure 3.2 provides a display of the science score gap between male and female students in 1996 and 2000. Even though the individual changes in average scores for male and female students at grade 4 were not statistically significant, taken together they created a significant difference favoring males over females. The increase in average scores among male students at grade 8 contributed to the creation of a similar difference favoring males at this grade level. Although the apparent narrowing of the gap between male and female twelfth-graders' science scores was not statistically significant, their average scores in 2000 did not differ significantly as they did in 1996.

These score gaps, and the score gaps presented in the following section between selected racial/ethnic subgroups, should be interpreted with caution. The average score of a selected subgroup does not represent the entire range of performance within that group. Furthermore, differences between groups of students cannot be attributed solely to group identification, as a variety of educational and social factors can affect student performance.

Figure 3.2

National Scale Score Differences by Gender

Differences in average science scale scores by gender, grades 4, 8, and 12: 1996 and 2000



★ Significantly different from 2000.
NOTE: Score differences are calculated based on differences between unrounded average scale scores.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

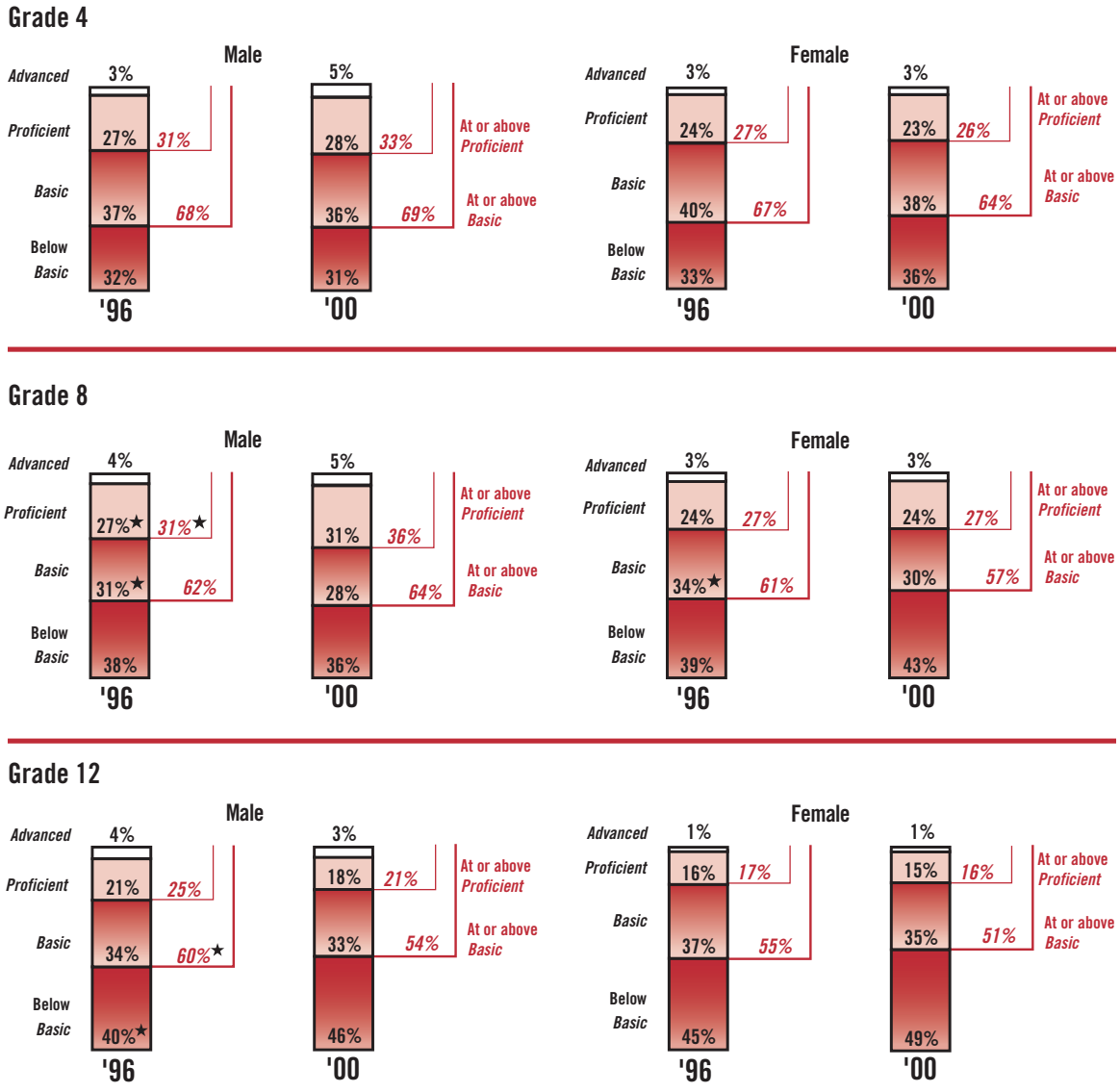
Another way of looking at student performance is to examine the percentages of male and female students at or above each science achievement level. These results are presented in figure 3.3. At grade 4, none of the apparent changes between 1996 and 2000 in the percentages of male or female students at or above any of the achievement levels was statistically significant. At grade 8, the percentage of male students at or above *Proficient* increased from 31 percent in 1996 to 36 percent in 2000. At grade 12, the percentage of male students at or above *Basic* decreased from 60 percent in 1996 to 54 percent in 2000.

Comparing the performance of males and females on the 2000 assessment shows a higher percentage of males than females at or above *Proficient* at all three grade levels, and a higher percentage of males at or above *Basic* at grades 4 and 8.

Figure 3.3

National Achievement-Level Results by Gender

Percentages of students within each science achievement-level range and at or above achievement levels by gender, grades 4, 8, and 12: 1996 and 2000



★ Significantly different from 2000.

NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Race/Ethnicity

NAEP assessments in all subject areas consistently report student achievement by race/ethnicity as well as by differences in performances among various racial/ethnic groups.

The differences provide important information about the progress being made to ensure that all students are making progress in a particular subject area. In order to collect data for this analysis, students who participated in the assessment were asked to indicate which of the following racial/ethnic subgroups best described them: White, Black, Hispanic, Asian/Pacific Islander, or American Indian (including Alaskan Native). Figure 3.4 presents average scale scores for students by these subgroups at grades 4, 8, and 12. Data for Asian/Pacific Islander students were not reported for the 2000 science assessment at grade 4 because special analyses raised concerns about the accuracy and precision of these results.[6]

At grade 4, none of the apparent changes between 1996 and 2000 in the average scores of each racial/ethnic subgroup were statistically significant. At grade 8, American Indian students' average scores declined. At grade 12, White students had lower average scores in 2000 than in 1996.

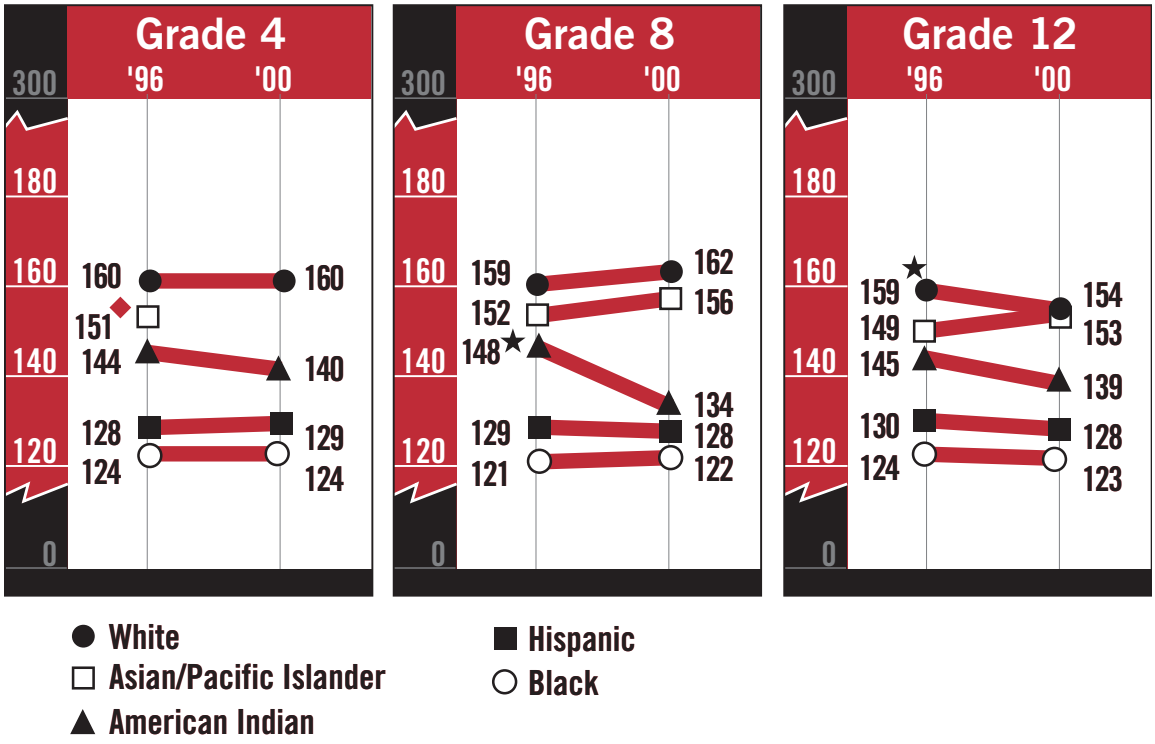
When students' performance in 2000 was compared across subgroups, differences in average scores were found at all three grade levels. At grade 4, White students scored higher, on average, than American Indian, Hispanic, or Black students. In addition, American Indian students scored higher on average than Hispanic or Black students. At grade 8, White students had higher average scores than any of the other subgroups. Eighth-grade Asian/Pacific Islanders scored higher, on average, than American Indian, Hispanic, or Black students. American Indian and Hispanic eighth-graders scored higher on average than Black eighth-graders. At grade 12, White and Asian/Pacific Islander students both had higher average scores than American Indian, Hispanic, or Black students. American Indian students had a higher average score than that of either Hispanic or Black students.

[6] See appendix A.

Figure 3.4

National Scale Score Results by Race/ Ethnicity

Average science scale scores by race/ethnicity, grades 4, 8, and 12: 1996 and 2000



★ Significantly different from 2000.

◆ Special analyses raised concerns about the accuracy and precision of national grade 4 Asian/Pacific Islander results in 2000. As a result, they are omitted from the body of this report. See appendix A for a more detailed discussion.

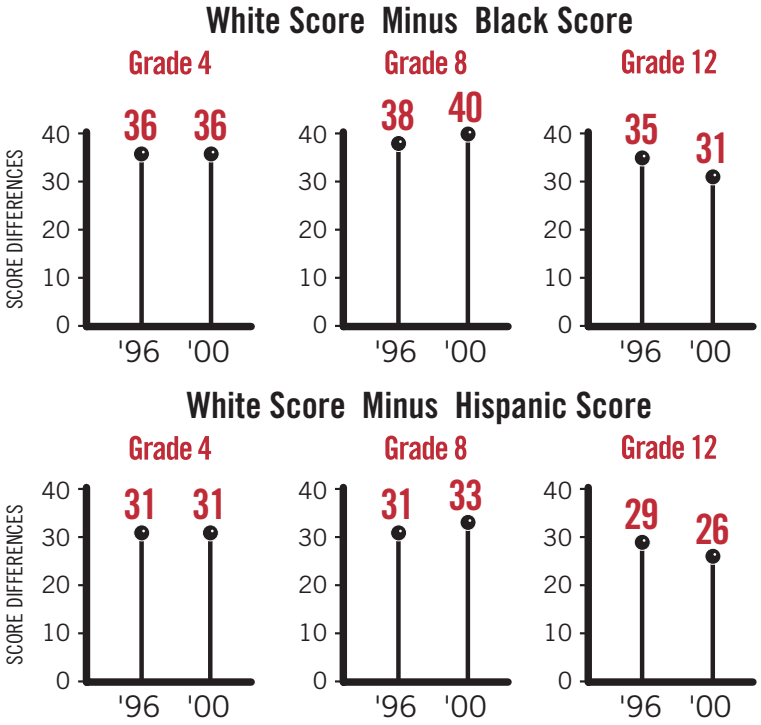
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

The average score gaps between White and Black students and between White and Hispanic students are shown in figure 3.5. Unlike the small gaps seen between male and female students, the size of the score gaps between these racial/ethnic subgroups are much larger. None of the apparent differences in these gaps between 1996 and 2000 were found to be statistically significant.

Figure 3.5

National Scale Score Differences by Race/ Ethnicity

Differences in average science scale scores by race/ethnicity, grades 4, 8, and 12: 1996 and 2000



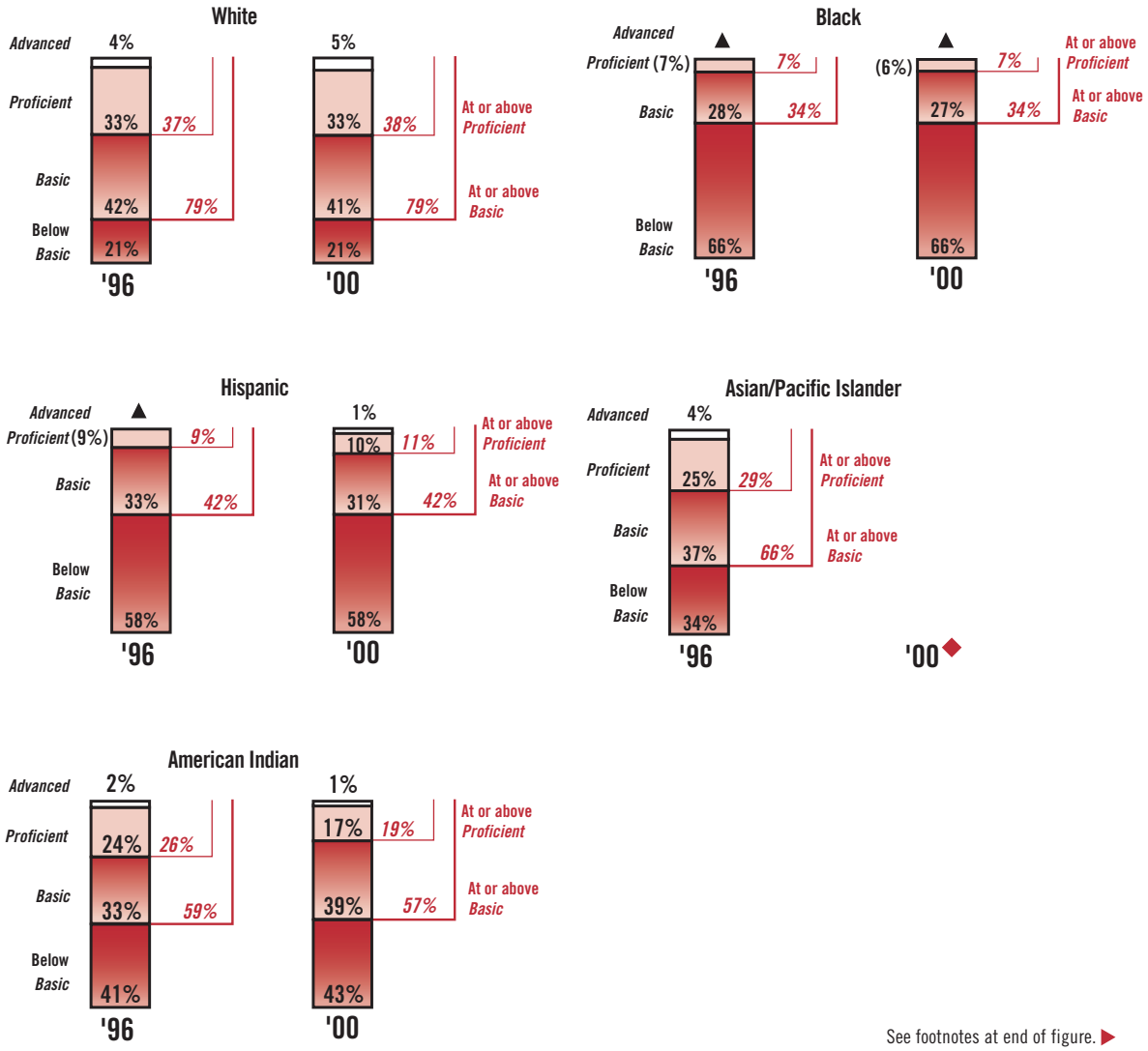
NOTE: Score differences are calculated based on differences between unrounded average scale scores.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Achievement-level results for the racial/ethnic groups are presented in figure 3.6. Although White twelfth-graders did show a decline in the percentage of students at or above *Basic* between 1996 and 2000, none of the apparent changes in the percentages of other racial/ethnic subgroups at or above the *Basic* or *Proficient* levels were found to be statistically significant. When the performance of students in different racial/ethnic subgroups was compared in 2000, a higher percentage of White and Asian/Pacific Islander students were found to be at or above *Basic* and *Proficient*, compared to the other subgroups. This finding was consistent across the three grades.

Figure 3.6a

National Achievement-Level Results by Race/Ethnicity

Percentages of students within each science achievement-level range and at or above achievement levels by race/ethnicity, grade 4: 1996 and 2000

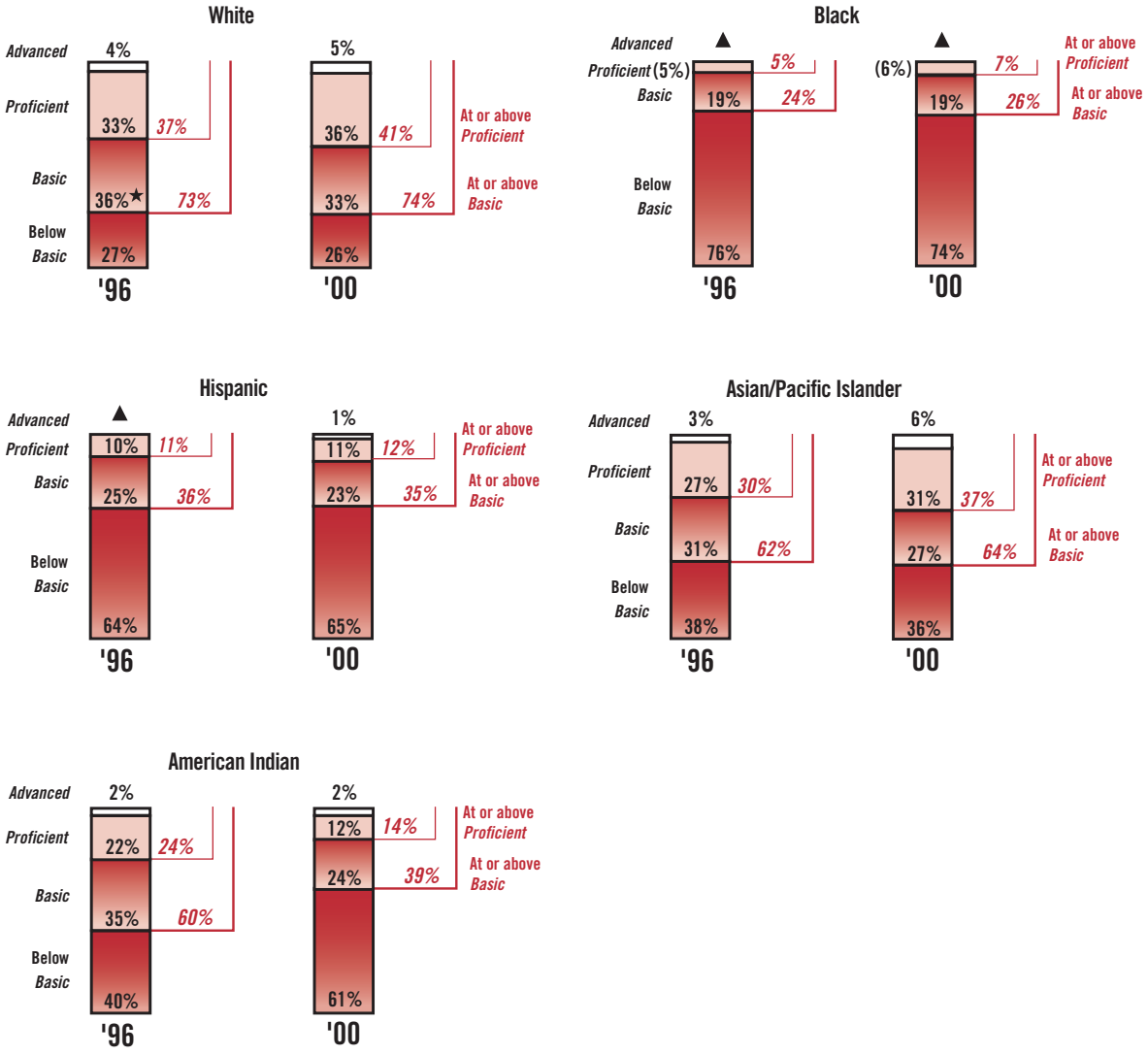


See footnotes at end of figure. ▶

Figure 3.6b

National Achievement-Level Results by Race/Ethnicity (continued)

Percentages of students within each science achievement-level range and at or above achievement levels by race/ethnicity, grade 8: 1996 and 2000

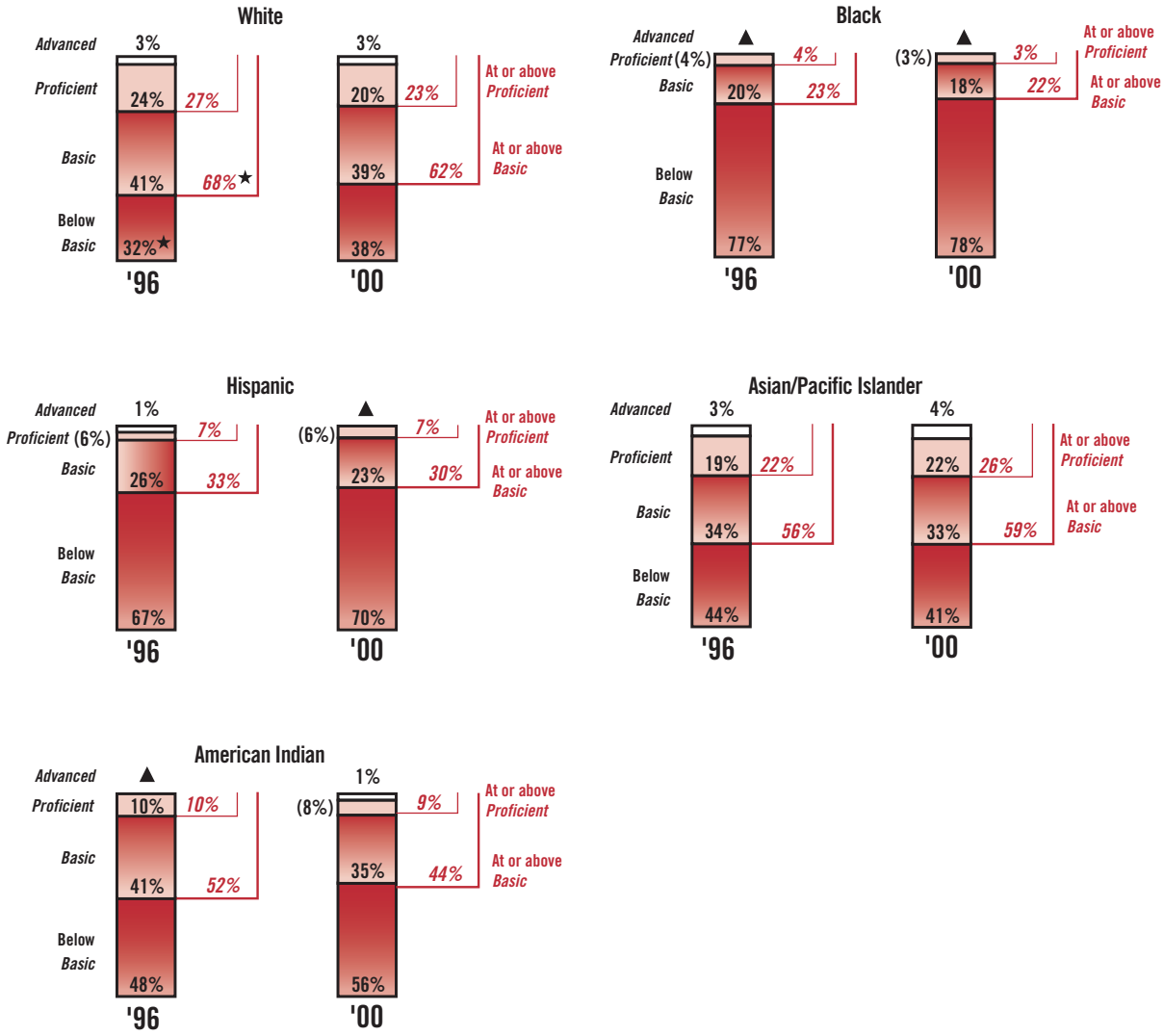


See footnotes at end of figure. ▶

Figure 3.6c

National Achievement-Level Results by Race/Ethnicity (continued)

Percentages of students within each science achievement-level range and at or above achievement levels by race/ethnicity, grade 12: 1996 and 2000



★ Significantly different from 2000.
▲ Percentage is between 0.0 and 0.5.
NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.
◆ Special analyses raised concerns about the accuracy and precision of national grade 4 Asian/Pacific Islander results in 2000. As a result, they are omitted from the body of this report. See appendix A for a more detailed discussion.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Parents' Highest Level of Education

It has been documented that, in general, higher levels of parental education are associated with higher levels of student performance.[7] This has been noted not only in the U.S., but also in a number of other countries around the world.[8]

Students who participated in the NAEP science assessment were asked to indicate the highest level of education completed by each parent. Four levels of education were identified: did not finish high school, graduated from high school, some education after high school, and graduated from college. Students could also choose the response, "I don't know." For this analysis, the highest education level reported for either parent was used. Data are presented for students in grades 8 and 12 only. Data were not collected at grade 4 because in previous NAEP assessments fourth-graders' responses about their parents' education were highly variable and contained a large percentage of "I don't know" responses.

The average science score results for all levels of student-reported parent education are presented in figure 3.7. Almost one-half of both eighth-graders and twelfth-graders (47 and 48 percent, respectively) reported that at least one parent had graduated from college, whereas only 6 percent of both eighth- and twelfth-graders reported that their parents had not graduated from high school. Additional information on the percentages of students reporting different levels of parents' education is available in appendix B.

Comparisons of average scores by parental education across years show a decline between 1996 and 2000 among twelfth-grade students whose parents' highest level of education was high school graduation or some education after high school. Comparing students' performance by level of parents' education in 2000 showed that eighth- and twelfth-graders whose parents graduated from college had higher scores, on average, than their peers whose parents had lower levels of education. In general, students who reported higher levels of parental education had higher average scores than their peers who reported lower levels of parental education. These results are consistent with the results from other studies.

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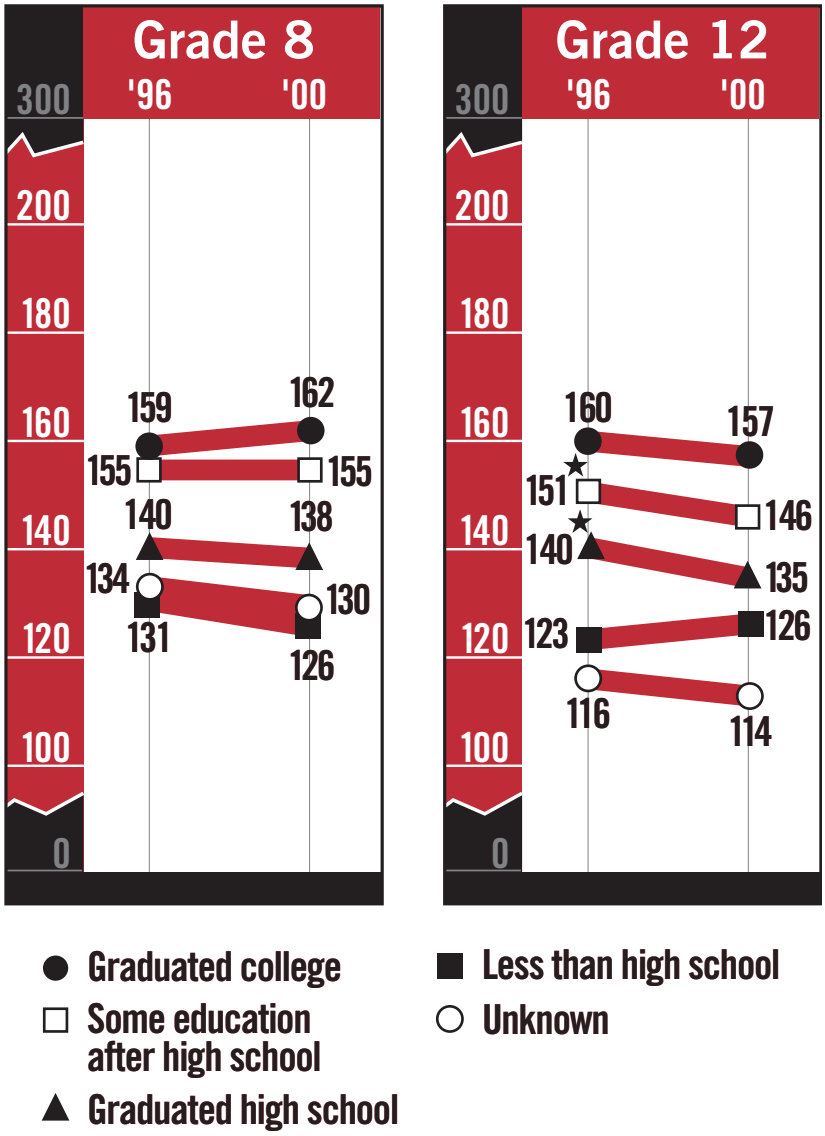
[7] Braswell, J.S., Lutkus, A.D., Grigg, W.S., Santapau, S.L., Tay-Lim, B. S.-H., & Johnson, M.S. (2001). *The nation's report card: Mathematics 2000* (NCES Publication No. 2001–517). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Donahue, P. L., Voelkl, K.E., Campbell, J.R., & Mazzeo, J. (1999). *NAEP 1998 reading report card for the nation and the states* (NCES Publication No. 1999–500). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

[8] Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., & O'Connor, K.M. (2000). *TIMSS 1999 international science report: Findings from IEA's repeat of the Third International Mathematics and Science Study at the eighth grade.* Chestnut Hill, MA: International Study Center, Lynch School of Education, Boston College.

Figure 3.7
National Scale Score Results by Parents' Education

Average science scale scores by student-reported parents' highest level of education, grades 8 and 12: 1996 and 2000



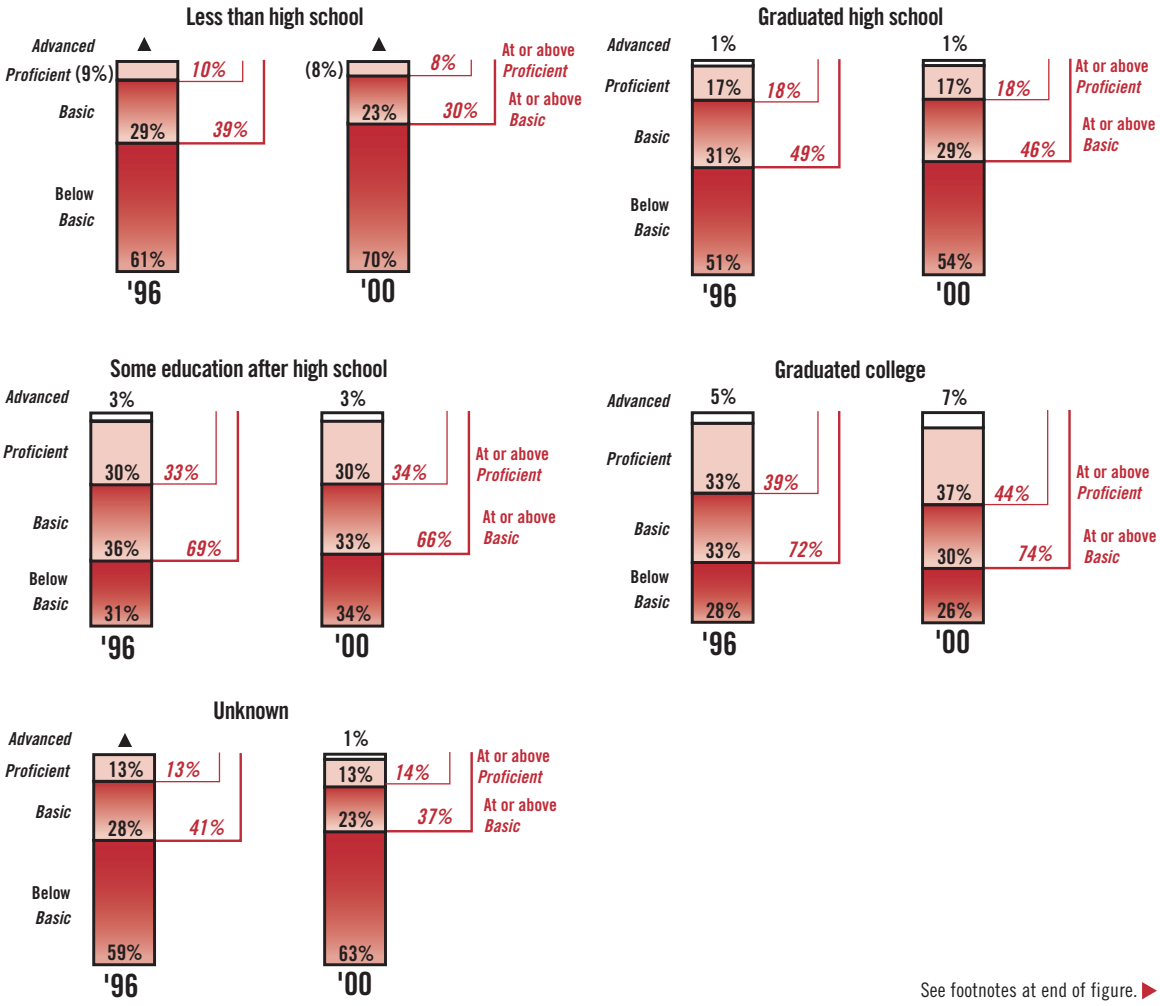
★ Significantly different from 2000.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Achievement-level results across years by level of parental education are presented in figure 3.8 and show patterns similar to those found for average scale scores. None of the apparent changes between 1996 and 2000 in percentages of eighth-grade students attaining achievement levels were statistically significant at any level of parental education. Among twelfth-graders, however, a drop in performance is evident at the two highest levels of parental education. The percentage of twelfth-graders at or above *Basic* decreased between 1996 and 2000 among those students whose parents' highest level of education was some education after high school and among those students with at least one parent who graduated from college.

Comparing students' performance by parents' level of education in 2000 shows a consistent pattern at grades 8 and 12. At both grades, the level of parents' education had a positive relationship to the percentage of students at or above *Basic* and *Proficient*.

Figure 3.8a
National Achievement-Level Results by Parents' Education

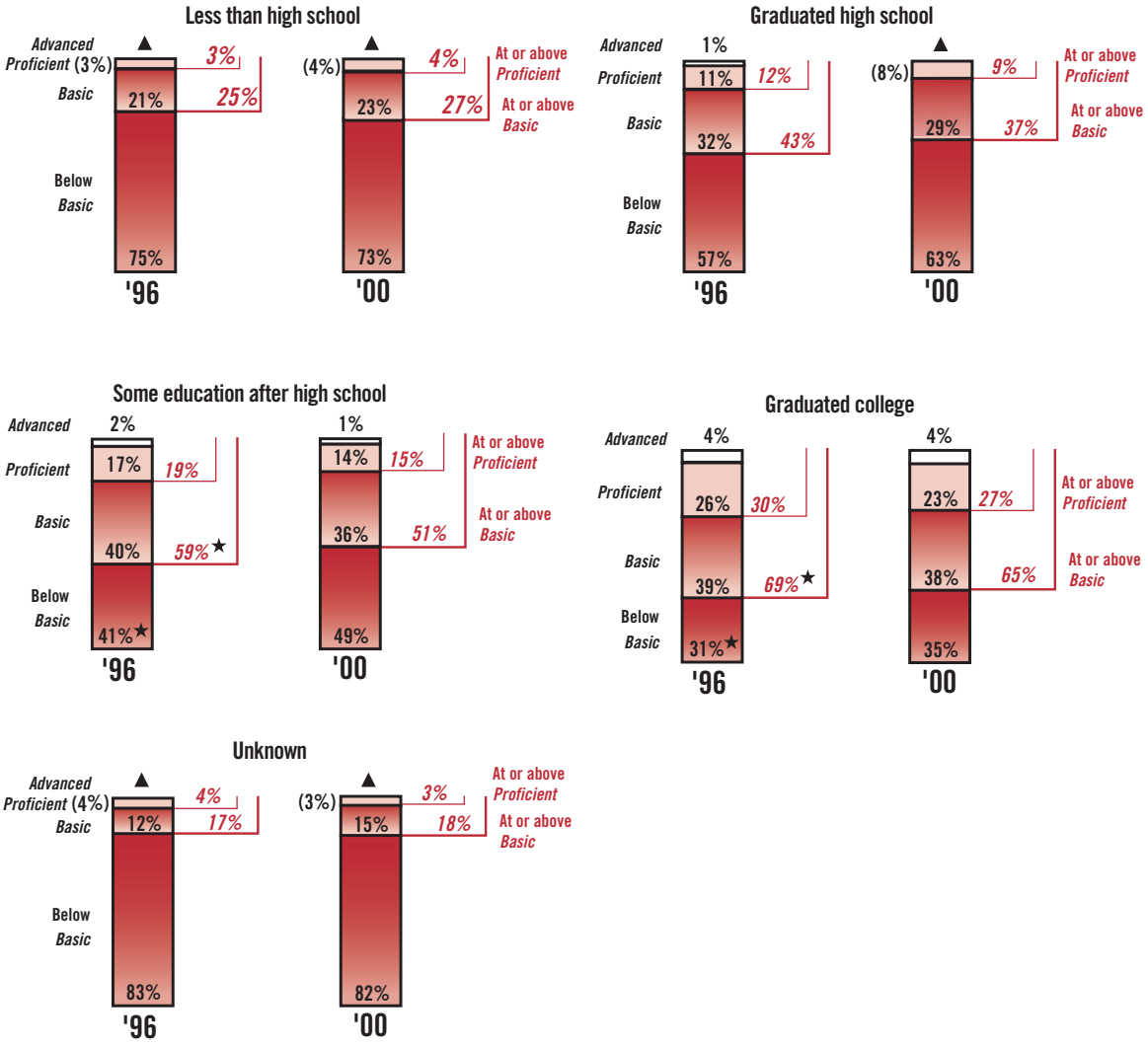
Percentage of students within each science achievement-level range and at or above achievement levels by parents' highest level of education, grade 8: 1996 and 2000



See footnotes at end of figure. ▶

Figure 3.8b
National Achievement-Level Results by Parents' Education
(continued)

Percentage of students within each science achievement-level range and at or above achievement levels by parents' highest level of education, grade 12: 1996 and 2000



★ Significantly different from 2000.
▲ Percentage is between 0.0 and 0.5.
NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Type of School

The schools that participate in the NAEP assessment are classified as either public or nonpublic.[9] Differences in performance on NAEP science assessments between students attending public and nonpublic schools typically show students attending nonpublic schools outperforming their public school peers, on average.[10] It is worth noting, however, that results from a special study of twelfth-grade students taking advanced science courses showed that the performance of twelfth-graders in public schools who were enrolled in an advanced science course was not found to be significantly different from that of twelfth-graders taking advanced science courses in nonpublic schools.[11] Despite the general pattern of nonpublic school students outperforming public school students, readers are cautioned to consider the possibility that socioeconomic and sociological factors related to type of school enrollment may affect student performance. These factors are not accounted for in the NAEP assessment results.

Nine out of ten students who participated in the 2000 NAEP science assessment attended public schools (89 percent at grade 4, 90 percent at grade 8, and 91 percent at grade 12). Additional information on the percentages of students attending public and nonpublic schools can be found in appendix B. Figure 3.9 presents the average science scores by type of school. None of the apparent changes between 1996 and 2000 in average scores of fourth- and eighth-graders attending either public or nonpublic schools were statistically significant. At grade 12, however, average scores for students attending nonpublic schools increased from 155 in 1996 to 161 in 2000, while scores for students attending public schools decreased from 149 to 145.

A comparison of students' average score by type of school attended in 2000 continues the trend found in other NAEP assessments; fourth- eighth-, and twelfth-graders who attended nonpublic schools had higher scores, on average, than their peers who attended public schools.

[9] More details on results by school type including additional breakouts by types of nonpublic schools are available at the NAEP web site (http://nces.ed.gov/nationsreportcard).

[10] Campbell, J.R., Voelkl, K.E., & Donahue, P.L. (1997). *NAEP 1996 trends in academic progress* (NCES Publication No. 97–985). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

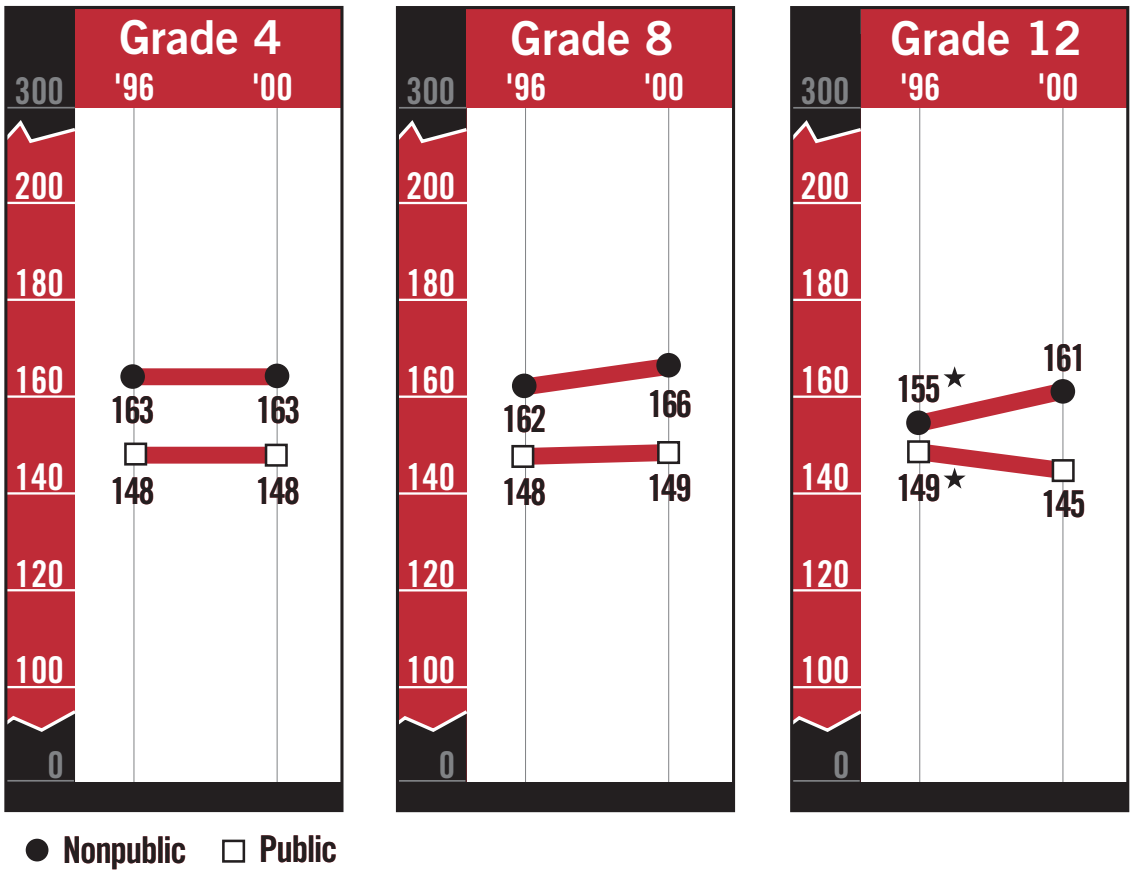
Campbell, J.R., Hombo, C.M., & Mazzeo, J. (2000). *NAEP 1999 trends in academic progress: Three decades of student performance* (NCES Publication No. 2000–469). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

[11] O'Sullivan, C.Y., & Grigg, W.S. (2001). *Assessing the best: NAEP's 1996 assessment of twelfth-graders taking advanced science courses* (NCES Publication No. 2001–451). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Figure 3.9

National Scale Score Results by Type of School

Average science scale scores by type of school, grades 4, 8, and 12: 1996 and 2000



★ Significantly different from 2000.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Achievement-level results by school type are presented in figure 3.10. At grades 4 and 8, none of the apparent changes between 1996 and 2000 in percentages of either public or nonpublic school students at or above *Basic*, at or above *Proficient*, or at *Advanced* were statistically significant. At grade 12, however, the results for public school and nonpublic school students show opposite trends in attainment of the *Basic* and *Proficient* achievement levels. Between 1996 and 2000, the percentage of public school twelfth-graders at or above *Basic* and at or above *Proficient* decreased, while the percentages of their nonpublic school peers attaining these achievement levels increased.

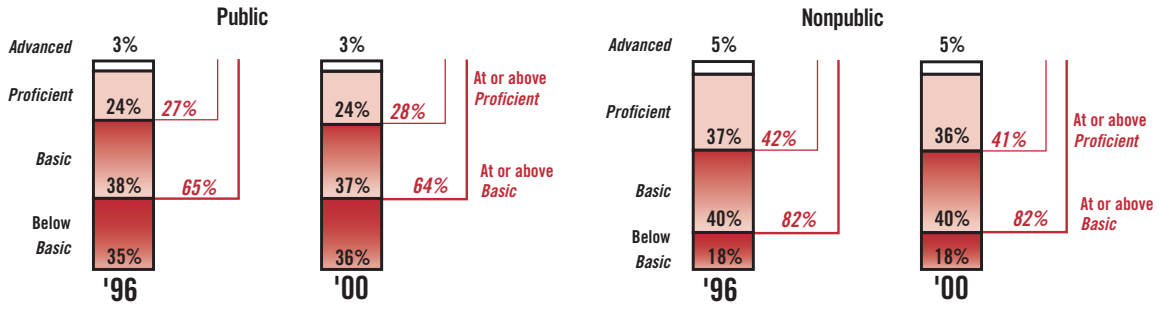
Comparing students' performance by type of school in 2000 shows a consistent pattern at grades 4, 8, and 12. At all three grades, a greater percentage of nonpublic school students than public school students were at or above *Basic*, at or above *Proficient*, or at *Advanced*.

Figure 3.10

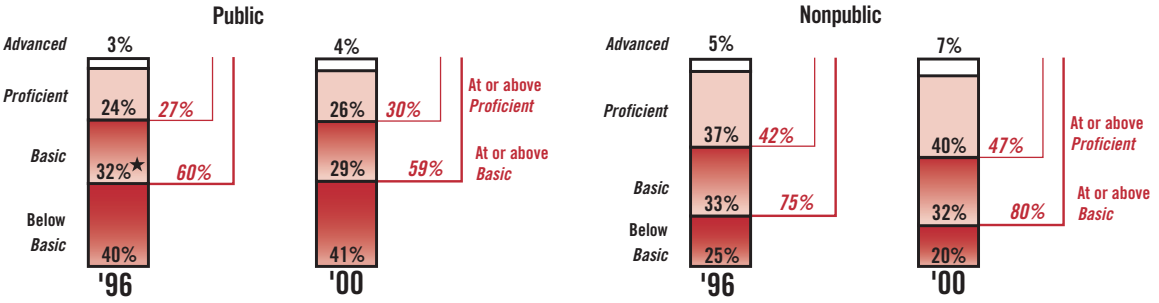
National Achievement-Level Results by Type of School

Percentage of students within each science achievement-level range and at or above achievement levels by type of school, grades 4, 8, and 12: 1996 and 2000

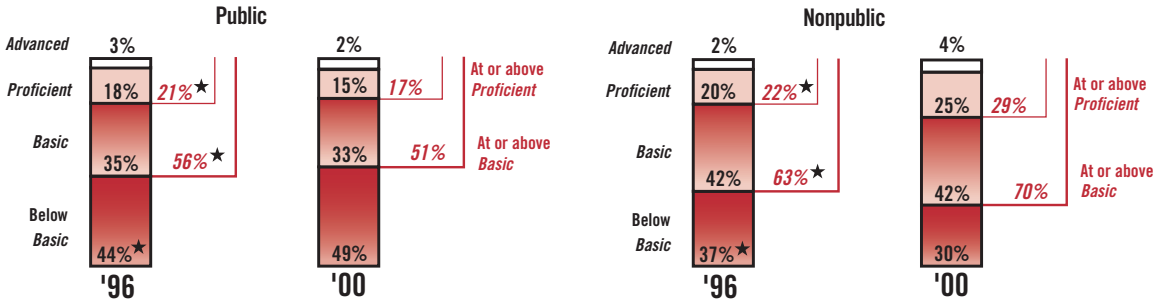
Grade 4



Grade 8



Grade 12



★ Significantly different from 2000.
NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Type of Location

The schools from which NAEP draws its samples of students are classified according to their type of location. Based on Census Bureau definitions of metropolitan statistical areas, including population size and density, the three mutually exclusive categories are: central city, rural/small town, and urban fringe/large town. Because of slight changes by the Census Bureau in the definitions of these categories, schools were not classified in exactly the same way in 2000 as in previous years in terms of location type. Therefore, comparisons to previous years are not possible, and only the data for the 2000 assessment are reported. More information on the definitions of the 2000 assessment classifications of location type is given in appendix A.

Average science scale scores for fourth-, eighth-, and twelfth-grade students attending schools in the three different types of location are presented in table 3.1. At grades 4 and 8, students in central city locations had lower average scores than students in urban fringe/large town or rural/small town locations. At grade 12, there was no statistically significant relationship between school location and student performance.

Table 3.1 National Scale Score Results by Type of Location

Average science scale scores by type of location, grades 4, 8, and 12: 2000

	Central city	Urban fringe/large town	Rural/small town
Grade 4	140	155	152
Grade 8	142	156	152
Grade 12	144	149	145

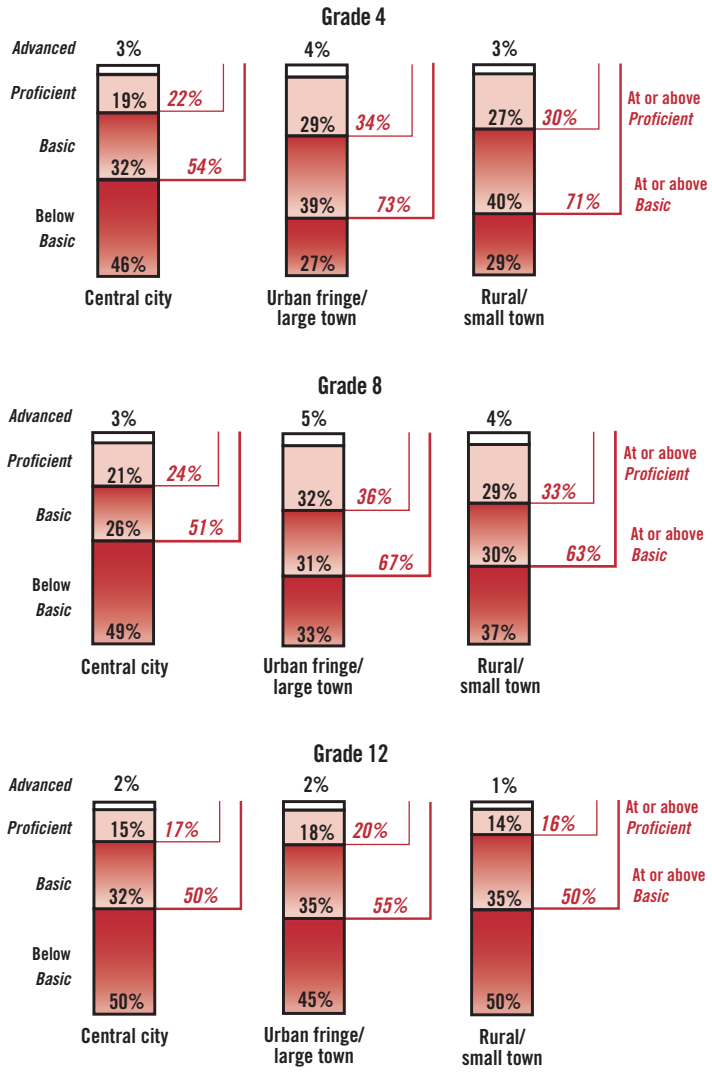
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Percentages of students within and at or above each achievement level by type of school location are presented in figure 3.11. At grades 4 and 8, the percentages of students at or above *Basic* and *Proficient* were higher in urban fringe/large town and rural/small town locations than central city locations. The percentage of fourth-graders at *Advanced* was also higher among students in urban fringe locations than in central cities. At grade 12, there were no statistically significant differences in the percentages of students at or above *Basic* or *Proficient* or at *Advanced* based on the school's location.

Figure 3.11

National Achievement-Level Results by Type of Location

Percentage of students within each science achievement-level range and at or above achievement levels by type of location, grades 4, 8, and 12: 2000



NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Free/Reduced-Price School Lunch Eligibility

Funded by the U.S. Department of Agriculture (USDA) as part of the National School Lunch program, the free/reduced-price school lunch program is designed to assure that children at, near, or below the poverty line receive nourishing meals. Eligibility guidelines for the lunch program are based on the Federal income poverty guidelines and are stated by household size.[12] NAEP began collecting data on student eligibility for this program in 1996.

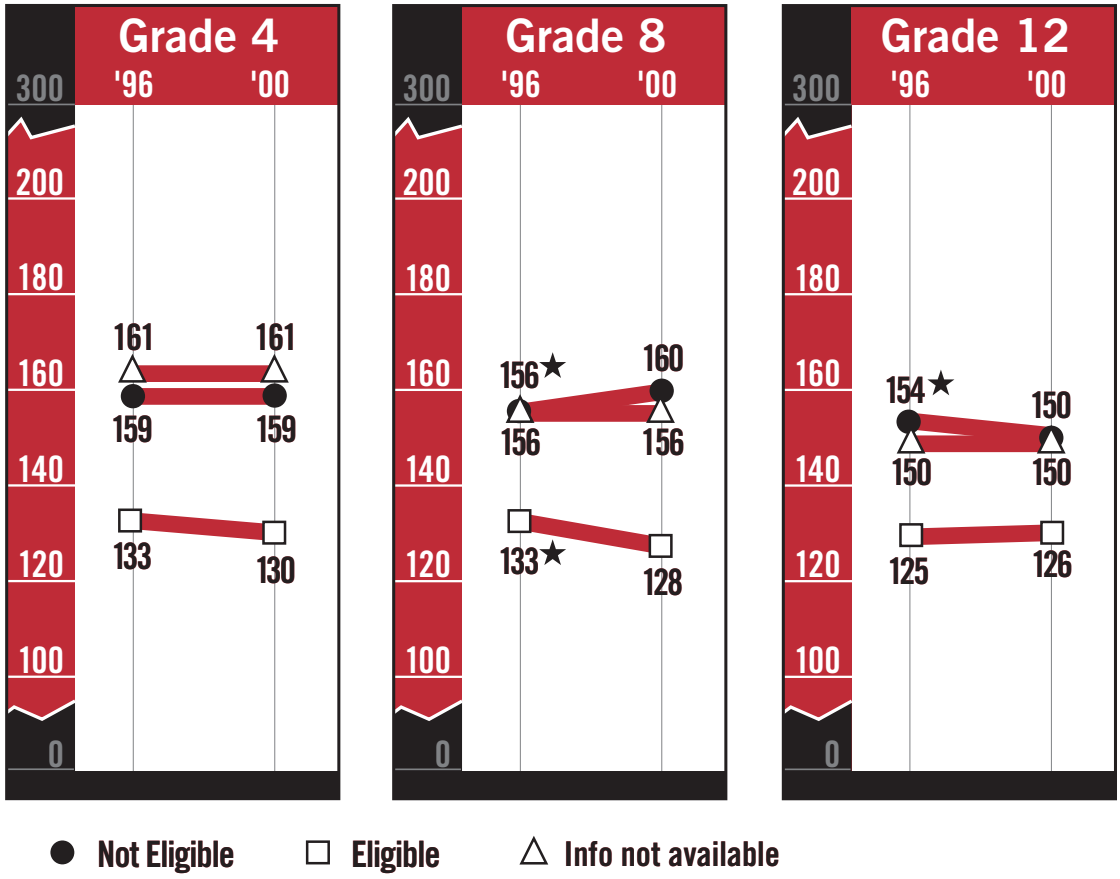
As shown in figure 3.12, average science scores for students who were not eligible for the free/reduced-price school lunch program (i.e., those above the poverty guidelines) were higher than the scores for students who were eligible for the program. Since information on eligibility is not available for a substantial percentage of the students at each grade, scale score averages for this group of students are also provided. It should be noted that students for whom the information was not available (which included students from schools that did not offer free/reduced-price school lunches) also had higher average scores at each of the three grades than the students who were eligible for the free/reduced-price school lunch program.

Comparisons across years show lower average scores in 2000 than in 1996 among eighth-graders who were eligible for the program and higher scores among students who were not eligible. At grade 12, students who were not eligible for the program had lower average scores in 2000 than in 1996.

[12] U.S. General Services Administration. (1999). *Catalogue of federal domestic assistance.* Washington, DC: Executive Office of the President, Office of Management and Budget.

Figure 3.12
National Scale Score Results by Free/Reduced-Price School Lunch Eligibility

Average science scale scores by student eligibility for free/reduced-price school lunch program, grades 4, 8, and 12: 1996 and 2000



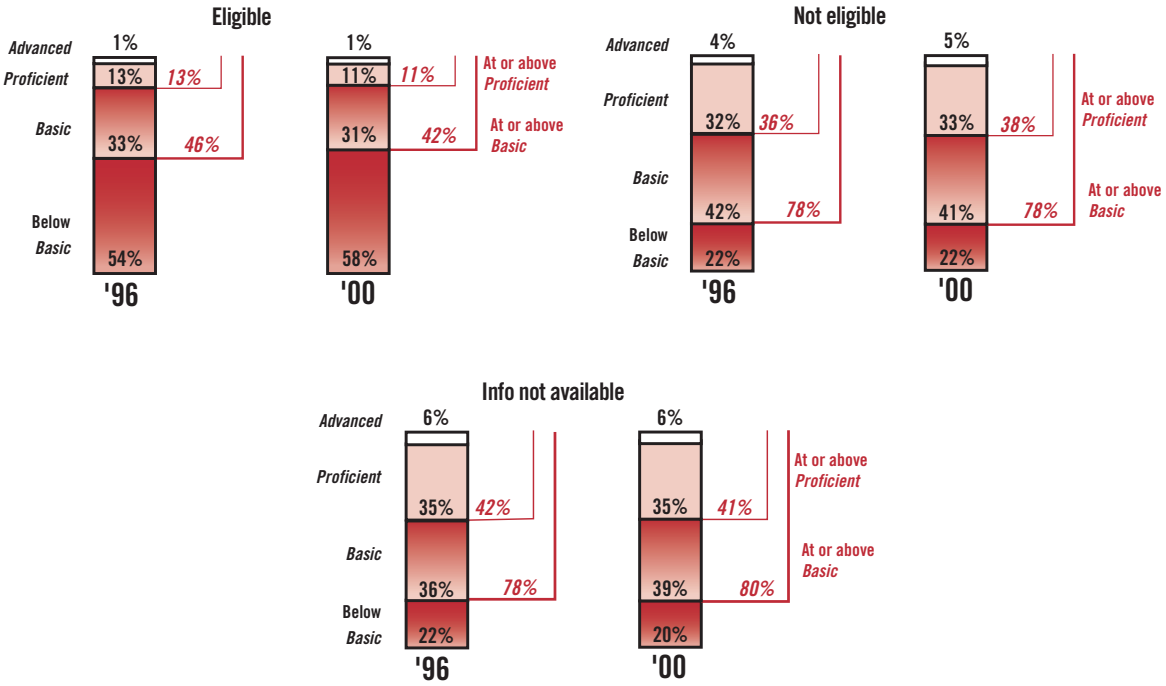
★ Significantly different from 2000.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Achievement-level results by students' eligibility for the free/reduced-price school lunch program are displayed in figure 3.13. At grade 4, there were no statistically significant changes between 1996 and 2000 in the percentages of students at or above achievement levels among students who were either eligible or not eligible for the free/reduced-price school lunch program. At grade 8, the percentage of students at or above *Proficient* increased between 1996 and 2000 for those students who were not eligible for the free/reduced-price school lunch program. At grade 12, the percentages of students at or above *Basic* decreased between 1996 and 2000 for those students who were not eligible for the free/reduced-price school lunch program. Similar to the pattern observed for scale score results in 2000, there were higher percentages of fourth-, eighth-, and twelfth-graders at or above *Basic* and *Proficient* among those students who were not eligible for the program than among those who were.

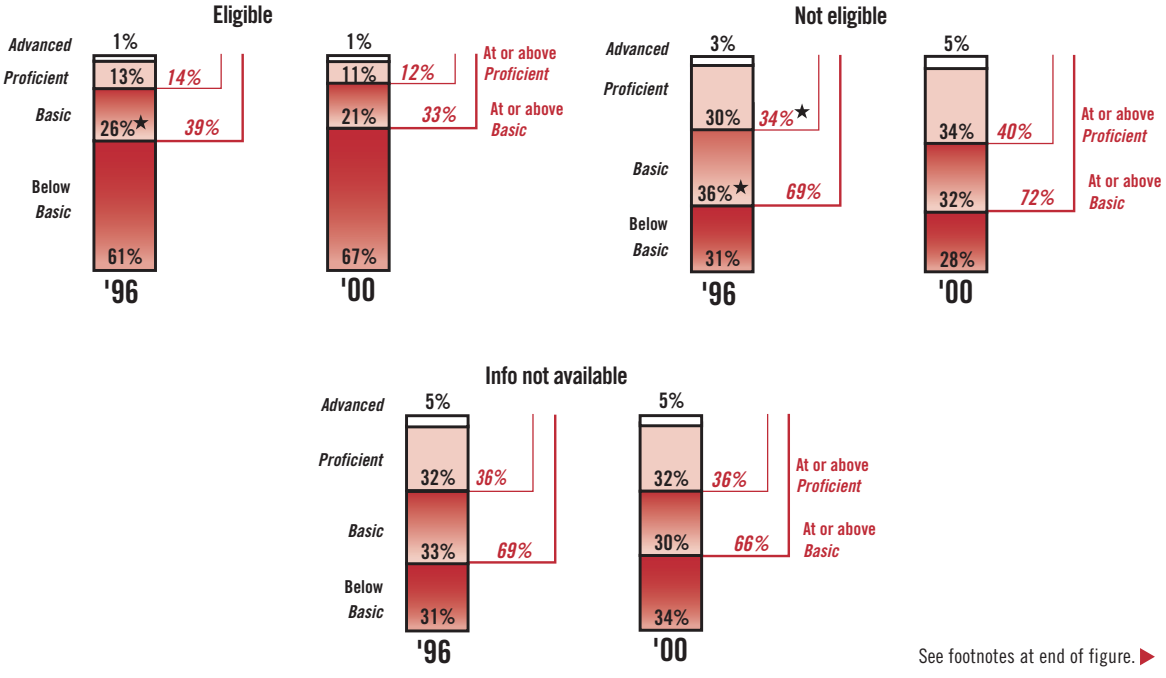
Figure 3.13
National Achievement-Level Results by Free/Reduced-Price School Lunch Program Eligibilty

Percentage of students within each science achievement-level range and at or above achievement levels by student eligibility for the free/reduced-price school lunch program, grades 4, 8, and 12: 1996 and 2000

Grade 4



Grade 8

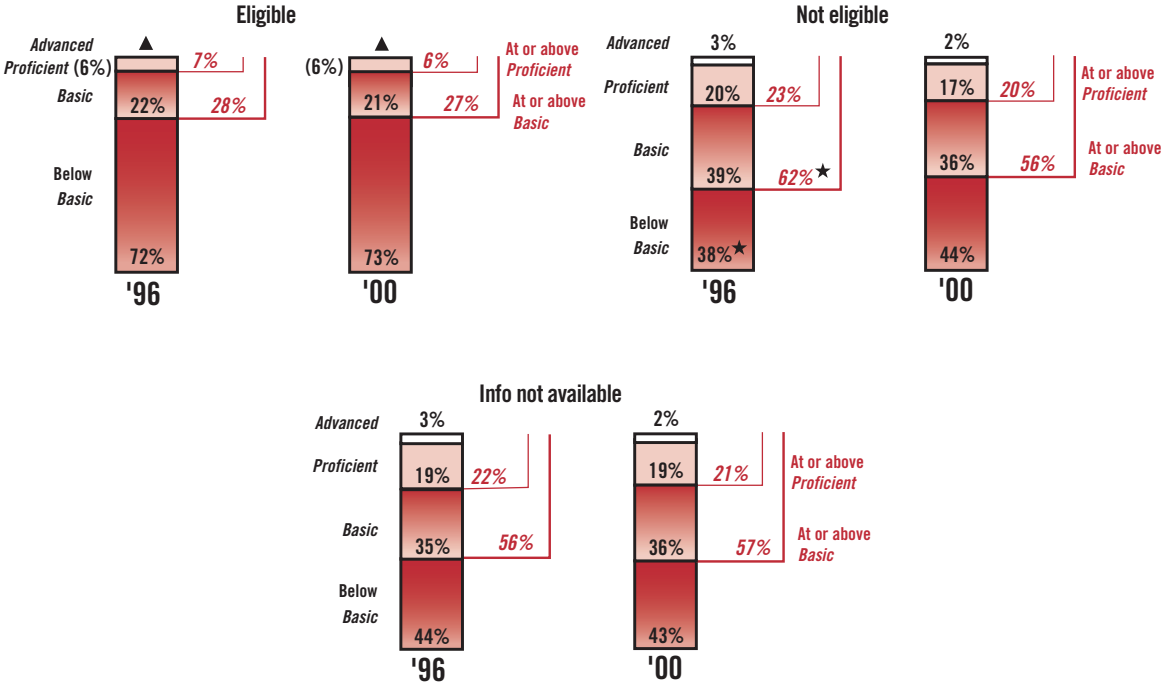


See footnotes at end of figure. ▶

Figure 3.13
National Achievement-Level Results by Free/Reduced-Price School Lunch Program Eligibilty (continued)

Percentage of students within each science achievement-level range and at or above achievement levels by student eligibility for the free/reduced-price school lunch program, grades 4, 8, and 12: 1996 and 2000

Grade 12



★ Significantly different from 2000.
▲ Percentage is between 0.0 and 0.5.
NOTE: Percentages within each science achievement-level range may not add to 100, or to the exact percentages at or above achievement levels, due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

State Results: Performance of Selected Subgroups

Results for public schools in participating states and jurisdictions are presented in this section by gender, race/ethnicity, and eligibility for free/reduced-price school lunch. Complete data for participating jurisdictions are available on the NAEP web site at http://nces.ed.gov/nationsreportcard.

Nonpublic schools were not included in the state NAEP assessments for 2000, but were included in the national samples. While the national results shown in the previous sections of this chapter represented both public and nonpublic school students combined, the national data shown for comparison at the top of the following state tables are based on the national sample—not on aggregated state samples—of students from public schools only.

In addition to results from the 2000 state assessment, results are also available from 1996 for many of the jurisdictions at grade 8. Not all jurisdictions, however, met minimum school participation guidelines in every NAEP assessment. (See appendix A for details on the participation and reporting guidelines.) In 2000, results for grades 4 and 8 in Wisconsin and grade 8 in

the Virgin Islands are not included in the relevant tables because they did not meet the criteria.

The state results presented here were obtained by assessing a representative sample of students in each state under conditions that did not permit accommodations for special-needs students. These were the same conditions under which results were obtained in previous state assessments. Consequently, it is possible to report changes in student performance across the assessment years at grade 8. In 2000, a separate representative sample was assessed in each participating jurisdiction for which accommodations were offered to special-needs students. Those results are presented in chapter 4, along with a comparison of "accommodations-permitted" and "accommodations-not-permitted" results in each state. Subgroup "accommodations-permitted" results by state are available on the NAEP web site.

In examining the state results presented in this section, it should be noted that schools participating in the NAEP assessments under these conditions are permitted to exclude those students who cannot be assessed meaningfully without accommodations. Exclusion rates vary considerably across years in many jurisdictions. In 2000, in the sample that did not permit accommodations, the pattern in most jurisdictions was for more special-needs students to be excluded from the assessment than in 1996.

In addition to changes across years in exclusion rates for a particular jurisdiction, there is considerable variation in exclusion rates across jurisdictions. Comparisons of assessment results across jurisdictions and within jurisdictions across years should be made with caution. No adjustments have been made for differing exclusion rates across jurisdictions or across years. Thus, a comparison within a jurisdiction across years or between two jurisdictions may be based on samples with exclusion rates that differ considerably. The exclusion rates for each jurisdiction are presented in appendix A. Tables presenting state-level results at grade 8 indicate statistically significant changes across years when examining only one jurisdiction at a time (*), and when using a multiple comparison procedure based on all the jurisdictions that participated (‡). Only those differences based on the multiple comparison procedure are discussed.

Gender Results by State

Table 3.2 presents the results for the grade 4 male and female average science scores for each jurisdiction that participated in the 2000 assessment. Since this was the first time the assessment was given at the state level, there are no comparisons to other years. At grade 4, the average score of male students was higher than that of female students in 7 states and other jurisdictions—Connecticut, Georgia, Maine, North Dakota, Utah, Wyoming, and the Department of Defense Dependents Schools (Overseas) (DoDDS).

Table 3.3 presents the results for the grade 8 male and female average science scores for each jurisdiction that participated in the 2000 assessment. For both males and females the 2000 average score is compared to scores from 1996, where available. The following discussion of changes in subgroup performance within jurisdictions is based only on results of the statistical testing using a multiple-comparison procedure. At grade 8, in 2000, the average score

Table 3.2 State Scale Score Results by Gender, Grade 4

State average science scale scores by gender for grade 4 public schools: 2000

	Male	Female
Nation	151	146
Alabama	143	143
Arizona	142	140
Arkansas	145	143
California †	132	130
Connecticut	160	153
Georgia	147	140
Hawaii	138	135
Idaho †	155	150
Illinois †	154	148
Indiana †	157	153
Iowa †	163	158
Kentucky	155	150
Louisiana	141	136
Maine †	165	158
Maryland	148	144
Massachusetts	164	159
Michigan †	156	151
Minnesota †	159	155
Mississippi	135	132
Missouri	159	153
Montana †	163	157
Nebraska	153	148
Nevada	142	142
New Mexico	140	136
New York †	151	147
North Carolina	150	146
North Dakota	164	156
Ohio †	156	152
Oklahoma	153	150
Oregon †	151	148
Rhode Island	151	145
South Carolina	143	139
Tennessee	150	145
Texas	150	145
Utah	157	152
Vermont †	161	157
Virginia	157	155
West Virginia	152	149
Wyoming	162	153
Other Jurisdictions		
American Samoa	52	49
DDESS	158	155
DoDDS	159	153
Guam	108	113
Virgin Islands	118	113

† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.3 State Scale Score Results by Gender, Grade 8

State average science scale scores by gender for grade 8 public schools: 1996 and 2000

	1996		2000	
	Male	Female	Male	Female
Nation	149 *	148	153	146
Alabama	138	139	144	139
Arizona †	147	143	150	142
Arkansas	147	142	144	142
California †	140	136 *	136	129
Connecticut	156	155	158	150
Georgia	144	139	147	140
Hawaii	135	135	133	131
Idaho †	—	—	162	155
Illinois †	—	—	153	148
Indiana †	154	152	158	154
Kentucky	148 ‡	147	155	148
Louisiana	136	129	138	134
Maine †	165	161 *	163	157
Maryland	146 *	145	152	147
Massachusetts	159	154 *	162	160
Michigan †	156	150	158	154
Minnesota †	161	157	162	158
Mississippi	134	132	136	132
Missouri	152 ‡	150 *	159	154
Montana †	164	160	169	161
Nebraska	160	155	160	154
Nevada	—	—	145	142
New Mexico	143	139	144	137
New York †	148	143	151	147
North Carolina	149	145	151	144
North Dakota	163	161	163	159
Ohio	—	—	164	157
Oklahoma	—	—	152	146
Oregon †	157	153	155	153
Rhode Island	150	148	152	147
South Carolina	141	136	145	139
Tennessee	144	142	149	143
Texas	147	143	147	141
Utah	159	154	158	153
Vermont †	158 *	156	163	159
Virginia	150 *	148	156	148
West Virginia	148 *	147	153	147
Wyoming	159	156	159	156
Other Jurisdictions				
American Samoa	—	—	70	75
DDESS	157	149 ‡	160	157
DoDDS	157 ‡	154	162	156
Guam	120	120	116	112

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
‡ Significantly different from 2000 when examining only one jurisdiction and when using a multiple comparison procedure based on all jurisdictions that participated both years.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

of male students was higher than that of female students in 23 jurisdictions. Between 1996 and 2000 gains were evident for males in three jurisdictions—Kentucky, Missouri, and the Department of Defense Dependents School (Overseas) (DoDDS). Gains were made by females in only one jurisdiction between 1996 and 2000—the Department of Defense Domestic Dependent Elementary and Secondary Schools (DDESS).

Tables 3.4 and 3.5 present the percentage of males and females at or above *Proficient* for the participating jurisdictions at grades 4 and 8 respectively. At grade 4, the percentage of students at or above *Proficient* in 2000 was higher for male students than for female students in 7 jurisdictions—Connecticut, Maine, North Dakota, Rhode Island, Utah, Wyoming, and the Department of Defense Dependents School (Overseas). At grade 8, the percentage of students at or above *Proficient* in 2000 was higher for male students than for female students in 29 jurisdictions. When results from 1996 were compared to those of 2000, the percentage of male students at or above *Proficient* was higher in 2000 in 4 jurisdictions—Kentucky, Missouri, West Virginia, and the Department of Defense Dependents School (Overseas) (DoDDS). There were no statistically significant changes between 1996 and 2000 among female eighth-graders in any of the jurisdictions.

Table 3.4 State *Proficient* Level Achievement Results by Gender, Grade 4

State percentages of students at or above the *Proficient* level in science by gender for grade 4 public schools: 2000

	Male	Female
Nation	31	24
Alabama	23	21
Arizona	24	20
Arkansas	26	21
California †	16	12
Connecticut	40	30
Georgia	27	20
Hawaii	18	14
Idaho †	35	25
Illinois †	34	28
Indiana †	37	28
Iowa †	42	33
Kentucky	32	25
Louisiana	22	16
Maine †	43	34
Maryland	29	23
Massachusetts	46	38
Michigan †	37	29
Minnesota †	38	32
Mississippi	16	12
Missouri	39	31
Montana †	43	32
Nebraska	29	23
Nevada	21	17
New Mexico	20	16
New York †	28	24
North Carolina	26	22
North Dakota	44	32
Ohio †	34	29
Oklahoma	29	24
Oregon †	29	26
Rhode Island	31	23
South Carolina	24	17
Tennessee	29	23
Texas	28	21
Utah	36	27
Vermont †	41	36
Virginia	35	30
West Virginia	26	23
Wyoming	39	27
Other Jurisdictions		
American Samoa	▲	▲
DDESS	33	26
DoDDS	35	26
Guam	4	4
Virgin Islands	4	3

▲ Percentage is between 0.0 and 0.5.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.5 State *Proficient* Level Achievement Results by Gender, Grade 8

State percentages of students at or above the *Proficient* level in science by gender for grade 8 public schools: 1996 and 2000

	1996		2000	
	Male	Female	Male	Female
Nation	29 *	26	35	26
Alabama	19	17	24	20
Arizona †	25	20	29	19
Arkansas	26	18	25	21
California †	21	18	18	13
Connecticut	37	35	39	30
Georgia	24	17	27	20
Hawaii	16	14	17	14
Idaho †	—	—	44	32
Illinois †	—	—	34	26
Indiana †	32	28	38	32
Kentucky	25 ‡	21	34	24
Louisiana	17	10 *	21	15
Maine †	45	38	42	32
Maryland	26	24	32	25
Massachusetts	40	33	44	40
Michigan †	36	29	38	35
Minnesota †	40	33	45	38
Mississippi	14	11	17	12
Missouri	31 ‡	25 *	40	32
Montana †	44	37	52	39
Nebraska	39	30	41	31
Nevada	—	—	25	20
New Mexico	23	16	25	16
New York †	31	23	32	27
North Carolina	26	22	31	23
North Dakota	44	37	44	36
Ohio	—	—	46	36
Oklahoma	—	—	31	22
Oregon †	35	29	37	30
Rhode Island	28	24	31	26
South Carolina	20	15	23	18
Tennessee	24	20	29	21
Texas	27	20	27	20
Utah	37	27	39	30
Vermont †	36 *	32	43	36
Virginia	28	26	35	27
West Virginia	22 ‡	19	30	22
Wyoming	35	32	39	32
Other Jurisdictions				
American Samoa	—	—	3	1
DDESS	32	21 *	38	33
DoDDS	33 ‡	29	42	33
Guam	8	7	7	5

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
‡ Significantly different from 2000 when examining only one jurisdiction and when using a multiple comparison procedure based on all jurisdictions that participated both years.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools. DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Race/Ethnicity Results by State

Tables 3.6 and 3.7 display the average science scores for each of the racial/ethnic groups by jurisdiction in 2000 for grade 4, and in 1996 and 2000 for grade 8. In every state and other jurisdiction where sample sizes were large enough for reliable statistical comparisons, White students outperformed Black and Hispanic students at both grades. There were no statistically significant differences detected between 1996 and 2000 in any state or jurisdiction in the average scores of eighth-graders in the different racial/ethnic subgroups.

Table 3.6 State Scale Score Results by Race/Ethnicity, Grade 4

State average science scale scores by race/ethnicity for grade 4 public schools: 2000

	White	Black	Hispanic	Asian/ Pacific Islander	American Indian
Nation	159	124	127	~	139
Alabama	158	125	117	****	****
Arizona	157	128	123	****	115
Arkansas	156	117	121	****	144
California †	151	119	115	142	****
Connecticut	166	127	133	****	****
Georgia	160	124	128	162	****
Hawaii	148	125	119	138	****
Idaho †	158	****	126	****	****
Illinois †	166	127	129	****	****
Indiana †	160	132	130	****	****
Iowa †	162	****	141	****	****
Kentucky	156	129	138	****	****
Louisiana	156	121	126	****	****
Maine †	163	****	144	****	****
Maryland	162	125	133	164	134
Massachusetts	169	137	130	161	****
Michigan †	164	121	132	****	****
Minnesota †	163	126	136	134	148
Mississippi	153	117	114	****	****
Missouri	164	131	129	****	152
Montana †	164	****	147	****	145
Nebraska	155	125	136	****	****
Nevada	152	121	127	147	145
New Mexico	155	129	129	****	123
New York †	163	131	132	156	****
North Carolina	159	128	133	****	132
North Dakota	163	****	145	****	136
Ohio †	161	129	141	****	****
Oklahoma	159	133	136	****	148
Oregon †	156	****	123	****	148
Rhode Island	159	121	116	143	****
South Carolina	157	123	128	****	****
Tennessee	157	122	128	****	****
Texas	162	134	135	158	****
Utah	160	****	135	147	138
Vermont †	160	****	****	****	****
Virginia	166	139	140	176	****
West Virginia	152	132	135	****	****
Wyoming	161	****	142	****	149
Other Jurisdictions					
American Samoa	****	****	36	58	****
DDESS	166	145	154	157	****
DoDDS	163	141	151	156	153
Guam	112	****	88	116	****
Virgin Islands	****	119	106	****	****

**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
~ Special analyses raised concerns about the accuracy and precision of the National grade 4 Asian/Pacific Islander results in 2000. As a result, they are omitted from the body of this report. See appendix A for a more detailed discussion.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools. DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.7 State Scale Score Results by Race/Ethnicity, Grade 8

State average science scale scores by race/ethnicity for grade 8 public schools: 1996 and 2000

	White		Black		Hispanic		Asian/Pacific Islander		American Indian	
	1996	2000	1996	2000	1996	2000	1996	2000	1996	2000
Nation	159	160	120	121	127	127	150	154	148 *	132
Alabama	151	154	117	116	107	106	****	****	****	****
Arizona †	157	159	124	127	129	126	****	****	121	137
Arkansas	154	154	116	113	122	118	****	****	****	****
California †	156	150	121	120	121	117	148	147	****	****
Connecticut	165	166	121	122	122	129	163	160	****	****
Georgia	155	159	122	123	128	124	****	****	****	****
Hawaii	146	149	128	128	119	119	136 *	132	****	****
Idaho †	—	162	—	****	—	135	—	****	—	****
Illinois †	—	165	—	123	—	131	—	162	—	****
Indiana †	158	161	125	127	139	132	****	****	****	****
Kentucky	151 *	155	127	126	113	****	****	****	****	****
Louisiana	148 *	154	113	113	104	119	****	****	****	****
Maine †	164 *	161	****	****	141	****	****	****	****	****
Maryland	160	163	124	127	121 *	135	161	170	****	****
Massachusetts	163 *	168	126	134	126	128	152	165	****	****
Michigan †	161	164	122	120	134	137	****	****	****	****
Minnesota †	162	165	130	122	134	136	152	****	****	****
Mississippi	149	150	119 *	114	105	113	****	****	****	****
Missouri	158 *	162	120	125	130	141	****	****	****	****
Montana †	166	168	****	****	147	151	****	****	139	143
Nebraska	161	162	130	129	134	132	****	****	****	****
Nevada	—	154	—	125	—	126	—	148	—	134
New Mexico	159	160	****	****	130	130	****	****	126	124
New York †	161	165	120	128	116	125	155	151	****	****
North Carolina	157	158	126	123	123 *	139	****	158	136	****
North Dakota	164	164	****	****	137	139	****	****	137	133
Ohio	—	165	—	131	—	147	—	****	—	****
Oklahoma	—	156	—	127	—	123	—	****	—	145
Oregon †	158	160	****	131	133	128	157	157	142	144
Rhode Island	155	156	130	128	118	127	142	143	****	****
South Carolina	153	155	122	122	122	123	****	****	****	****
Tennessee	151	155	117	118	104	123	****	****	****	****
Texas	161	159	127	122	129	132	157	162	****	****
Utah	159	159	****	****	133	135	143	152	****	****
Vermont †	159	162	****	****	136	****	****	****	****	****
Virginia	158	161	126	130	132	138	165	169	****	****
West Virginia	149	151	127	125	122	****	****	****	****	****
Wyoming	161	161	****	****	140	139	****	****	138	141
Other Jurisdictions										
American Samoa	—	****	—	****	—	55	—	90	—	****
DDESS	162 *	169	137	140	149	156	****	****	****	****
DoDDS	164	168	140	142	146	153	156	160	****	****
Guam	138	****	****	****	106	97	122	119	****	****

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

The percentages of students in the different racial/ethnic subgroups across jurisdictions who were at or above *Proficient* are presented in table 3.8 (grade 4) and table 3.9 (grade 8). The patterns seen in the grade 4 results are very similar to those found in the average score results. White students outperformed Black and Hispanic students in jurisdictions where sample sizes were large enough for reliable statistical comparisons.

At grade 8, the percentage of White students in most states and jurisdictions at or above *Proficient* was on average higher than the percentage of Black or Hispanic students in jurisdictions where a comparison was possible. There were no statistically significant changes between 1996 and 2000 in any state or jurisdiction in the percentages of eighth-graders in the different racial/ethnic subgroups who were at or above *Proficient*.

Table 3.8 State *Proficient* Level Achievement Results by Race/Ethnicity, Grade 4

State percentages of students at or above the *Proficient* level in science by race/ethnicity for grade 4 public schools: 2000

	White	Black	Hispanic	Asian/ Pacific Islander	American Indian
Nation	37	6	10	~	17
Alabama	34	5	8	****	****
Arizona	34	9	7	****	7
Arkansas	32	3	9	****	22
California †	27	4	5	19	****
Connecticut	45	4	12	****	****
Georgia	39	6	12	39	****
Hawaii	25	8	7	16	****
Idaho †	35	****	8	****	****
Illinois †	46	7	10	****	****
Indiana †	37	9	12	****	****
Iowa †	40	****	16	****	****
Kentucky	32	5	15	****	****
Louisiana	31	5	17	****	****
Maine †	40	****	16	****	****
Maryland	40	6	13	44	18
Massachusetts	50	13	11	41	****
Michigan †	43	6	12	****	****
Minnesota †	41	7	14	11	18
Mississippi	26	2	7	****	****
Missouri	42	9	20	****	35
Montana †	41	****	23	****	19
Nebraska	31	5	12	****	****
Nevada	27	4	8	21	20
New Mexico	33	9	10	****	6
New York †	40	6	9	36	****
North Carolina	35	6	11	****	10
North Dakota	41	****	23	****	13
Ohio †	38	7	17	****	****
Oklahoma	34	9	11	****	22
Oregon †	32	****	10	****	26
Rhode Island	35	5	4	18	****
South Carolina	34	4	11	****	****
Tennessee	34	6	9	****	****
Texas	39	10	12	38	****
Utah	36	****	13	21	16
Vermont †	40	****	****	****	****
Virginia	44	12	17	58	****
West Virginia	26	8	12	****	****
Wyoming	37	****	15	****	22
Other Jurisdictions					
American Samoa	****	****	0	▲	****
DDESS	42	15	26	25	****
DoDDS	41	12	23	30	24
Guam	7	****	▲	4	****
Virgin Islands	****	4	1	****	****

**** Sample size is insufficient to permit a reliable estimate. † Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
▲ Percentage is between 0.0 and 0.5.
~ Special analyses raised concerns about the accuracy and precision of the National grade 4 Asian/Pacific Islander results in 2000. As a result, they are omitted from the body of this report. See appendix A for a more detailed discussion.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools. DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.9 State *Proficient* Level Achievement Results by Race/Ethnicity, Grade 8

State percentages of students at or above the *Proficient* level in science by race/ethnicity for grade 8 public schools: 1996 and 2000

	White		Black		Hispanic		Asian/Pacific Islander		American Indian	
	1996	2000	1996	2000	1996	2000	1996	2000	1996	2000
Nation	36	40	4	6	10	11	27	36	24	14
Alabama	25	31	4	4	7	7	****	****	****	****
Arizona †	33	35	7	8	8	8	****	****	6	9
Arkansas	29	30	3	2	9	8	****	****	****	****
California †	33	26	5	6	6	5	27	29	****	****
Connecticut	44	45	5	6	7	11	45	44	****	****
Georgia	31	36	5	6	14	13	****	****	****	****
Hawaii	23	29	9	10	7	7	15	14	****	****
Idaho †	—	42	—	****	—	12	—	****	—	****
Illinois †	—	44	—	5	—	12	—	42	—	****
Indiana †	34	40	8	6	15	12	****	****	****	****
Kentucky	25 *	32	6	7	9	****	****	****	****	****
Louisiana	21 *	29	3	3	7	11	****	****	****	****
Maine †	43 *	38	****	****	16	****	****	****	****	****
Maryland	38	41	5	8	8	16	38	47	****	****
Massachusetts	41 *	49	9	12	11	12	38	46	****	****
Michigan †	39	43	6	6	14	20	****	****	****	****
Minnesota †	40	46	9	11	13	21	30	****	****	****
Mississippi	22	24	3	2	3	7	****	****	****	****
Missouri	34 *	42	3	7	12	19	****	****	****	****
Montana †	45	49	****	****	19	29	****	****	12	25
Nebraska	38	40	7	10	16	16	****	****	****	****
Nevada	—	31	—	7	—	9	—	25	—	14
New Mexico	36	39	****	****	9	10	****	****	8	7
New York †	39	44	4	8	7	11	37	29	****	****
North Carolina	33	37	6	6	8	19	****	36	14	****
North Dakota	43	44	****	****	16	21	****	****	12	12
Ohio	—	45	—	11	—	30	—	****	—	****
Oklahoma	—	32	—	7	—	10	—	****	—	19
Oregon †	34	38	****	8	13	10	35	38	21	22
Rhode Island	31	34	7	6	4	9	16	26	****	****
South Carolina	29	31	4	5	7	11	****	****	****	****
Tennessee	26	31	5	6	3	13	****	****	****	****
Texas	38	36	6	7	8	12	34	40	****	****
Utah	34	38	****	****	13	15	17	32	****	****
Vermont †	36 *	41	****	****	16	****	****	****	****	****
Virginia	36	39	6	9	12	18	41	49	****	****
West Virginia	22 *	28	4	7	3	****	****	****	****	****
Wyoming	37	39	****	****	14	17	****	****	8	21
Other Jurisdictions										
American Samoa	—	****	—	****	—	0	—	3	—	****
DDESS	39	48	8	13	20	31	****	****	****	****
DoDDS	42 *	50	13	16	20	28	33	37	****	****
Guam	23	****	****	****	4	2	6	7	****	****

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Scale Score Differences Between Selected Subgroups by State

Similar to results for the nation, changes in the score differences or "gaps" between male and female students were relatively small across states, and were not found to be significantly different across assessment years at grade 8. Also similar to the national data, the score gaps between male and female students are generally much smaller than those seen between racial/ethnic subgroups. None of the apparent changes in racial/ethnic score gaps across years at grade 8 were statistically significant. The gender and racial/ethnic score gap results for jurisdictions are provided in appendix B.

Free/Reduced-Price School Lunch Eligibility Results by State

NAEP collects data on students' eligibility for the federal free/reduced-price school lunch program as an indicator of economic status in both the national and state (or jurisdiction) samples. Tables 3.10 and 3.11 present the results by state and jurisdiction for grades 4 and 8, respectively. As previously noted, comparison data for grade 4 do not exist because the science assessment was only offered state-by-state at the eighth-grade level in 1996.

At grade 4, in all jurisdictions where sample sizes were large enough for reliable statistical comparisons, students who were not eligible for the free/reduced-price school lunch program outperformed students who were. A similar result was seen at grade 8. When data were compared across years, eighth-graders in five jurisdictions who were not eligible for the program had higher average scores in 2000 than in 1996. They are: Louisiana, Missouri, Vermont, West Virginia, and DoDDS.

The percentage of students at or above *Proficient* by free/reduced-price school lunch eligibility in 2000 are presented for participating jurisdiction in tables 3.12 and 3.13 for grades 4 and 8, respectively. There were higher percentages of eighth-graders who were not eligible for the program at or above *Proficient* in 2000 than in 1996 in Lousiana, Missouri, and West Virginia. Additional data for these subgroups are included in appendix B.

Table 3.10 State Scale Score Results by Free/Reduced-Price School Lunch Eligibility, Grade 4

State scale score results by student eligibility for free/reduced-price school lunch for grade 4 public schools: 2000

	Eligible	Not eligible	Information not available
Nation	129	159	160
Alabama	128	159	146
Arizona	125	155	136
Arkansas	131	157	****
California †	115	150	137
Connecticut	135	165	144
Georgia	124	159	151
Hawaii	125	147	132
Idaho †	142	159	163
Illinois †	132	163	157
Indiana †	138	162	153
Iowa †	153	163	159
Kentucky	142	161	156
Louisiana	128	159	133
Maine †	150	166	161
Maryland	126	158	137
Massachusetts	139	171	155
Michigan †	134	163	131
Minnesota †	141	163	166
Mississippi	122	153	132
Missouri	141	165	145
Montana †	147	167	162
Nebraska	135	159	151
Nevada	128	150	137
New Mexico	126	154	146
New York †	133	163	158
North Carolina	131	158	155
North Dakota	150	164	159
Ohio †	136	164	158
Oklahoma	144	162	149
Oregon †	136	158	147
Rhode Island	125	162	138
South Carolina	128	157	138
Tennessee	132	159	153
Texas	132	160	151
Utah	142	160	161
Vermont †	145	165	155
Virginia	138	164	163
West Virginia	143	158	152
Wyoming	148	162	155
Other Jurisdictions			
American Samoa	51	****	****
DDESS	152	160	160
DoDDS	150	158	156
Guam	101	121	****
Virgin Islands	115	****	****

**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.11 State Scale Score Results by Free/Reduced-Price School Lunch Eligibility, Grade 8

State scale score results by student eligibility for free/reduced-price school lunch for grade 8 public schools: 1996 and 2000

	Eligible		Not eligible		Information not available	
	1996	2000	1996	2000	1996	2000
Nation	133 *	127	155 *	160	154	151
Alabama	121	124	150	153	151	152
Arizona †	127	127	155	156	144	148
Arkansas	128	127	152	153	155	139
California †	120 *	113	152 *	145	137	135
Connecticut	127	125	163	163	154	147
Georgia	124	125	151	155	146	145
Hawaii	125	119	141	142	115 ‡	139
Idaho †	—	149	—	164	—	155
Illinois †	—	126	—	162	—	152
Indiana †	136	139	158	161	****	149
Kentucky	135	139	155 *	160	142	****
Louisiana	121	122	145 ‡	155	128	133
Maine †	152	150	167	163	164	155
Maryland	122	127	154	158	143	138
Massachusetts	133	134	164	168	149	164
Michigan †	139	134	159	164	144	152
Minnesota †	145	141	162	165	162	164
Mississippi	121	120	148	149	134	138
Missouri	138	140	157 ‡	164	144	153
Montana †	150	155	166	170	165	168
Nebraska	144	142	162	162	161	161
Nevada	—	126	—	150	—	144
New Mexico	130	130	151	152	143	142
New York †	124	132	159	161	153	147
North Carolina	128	128	156	155	144	150
North Dakota	157 *	149	165	166	155	158
Ohio	—	144	—	166	—	151
Oklahoma	—	137	—	158	—	148
Oregon †	145	138	159	160	151	159
Rhode Island	131	130	157	158	125	136
South Carolina	126	126	149 *	155	****	****
Tennessee	125	129	151	155	144	147
Texas	130	128	157	156	127	137
Utah	149 *	142	158	159	157	158
Vermont †	146	144	160 ‡	165	157	163
Virginia	125	130	157	159	150	150
West Virginia	138	138	152 ‡	158	151	151
Wyoming	148	147	160	161	155	159
Other Jurisdictions						
American Samoa	—	72	—	****	—	****
DDESS	148	153	158	163	150	158
DoDDS	146 *	155	156 ‡	161	156	158
Guam	101	96	125	119	****	104

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
‡ Significantly different from 2000 when examining only one jurisdiction and when using a multiple comparison procedure based on all jurisdictions that participated both years.
**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools. DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Table 3.12 State *Proficient* Level Achievement Results by Free/Reduced-Price School Lunch Eligibility, Grade 4

State percentages of students at or above the *Proficient* level in science by student eligibility for free/reduced-price school lunch program for grade 4 public schools: 2000

	Eligible	Not eligible	Information not available
Nation	11	37	39
Alabama	9	36	23
Arizona	8	34	19
Arkansas	13	35	****
California †	4	26	16
Connecticut	12	44	26
Georgia	7	37	27
Hawaii	8	23	11
Idaho †	19	36	41
Illinois †	12	42	42
Indiana †	14	40	31
Iowa †	26	41	36
Kentucky	17	38	35
Louisiana	10	36	13
Maine †	23	46	36
Maryland	7	36	19
Massachusetts	16	53	37
Michigan †	15	43	12
Minnesota †	17	41	49
Mississippi	6	28	12
Missouri	19	44	29
Montana †	23	46	41
Nebraska	11	35	29
Nevada	8	26	13
New Mexico	9	30	26
New York †	11	39	36
North Carolina	9	34	29
North Dakota	26	43	38
Ohio †	12	43	32
Oklahoma	17	39	23
Oregon †	15	35	30
Rhode Island	8	38	19
South Carolina	9	34	16
Tennessee	12	36	36
Texas	9	37	30
Utah	19	37	40
Vermont †	22	45	34
Virginia	12	42	43
West Virginia	17	33	26
Wyoming	21	38	30
Other Jurisdictions			
American Samoa	▲	****	****
DDESS	23	35	32
DoDDS	22	33	31
Guam	2	6	****
Virgin Islands	3	****	****

**** Sample size is insufficient to permit a reliable estimate.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
▲ Percentage is between 0.0 and 0.5.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 3.13 State *Proficient* Level Achievement Results by Free/Reduced-Price School Lunch Eligibility, Grade 8

State percentages of students at or above the *Proficient* level in science by student eligibility for free/reduced-price school lunch program for grade 8 public schools: 1996 and 2000

	Eligible		Not eligible		Information not available	
	1996	2000	1996	2000	1996	2000
Nation	14	12	32 *	39	34	31
Alabama	7	9	24	31	33	31
Arizona †	9	10	31	31	18	25
Arkansas	10	12	28	30	30	22
California †	6	4	31	23	15	17
Connecticut	10	7	43	43	38	29
Georgia	6	9	29	33	25	23
Hawaii	9	7	18	20	5 *	20
Idaho †	—	27	—	44	—	36
Illinois †	—	10	—	40	—	28
Indiana †	12	16	35	41	****	28
Kentucky	11	16	31 *	38	16	****
Louisiana	7	8	20 ‡	32	16	13
Maine †	27	25	46	41	41	28
Maryland	8	9	32	37	16	17
Massachusetts	13	14	44	49	29	46
Michigan †	17	16	38	44	26	32
Minnesota †	22	21	40	47	42	45
Mississippi	5	6	22	24	9	17
Missouri	15	18	34 ‡	44	25	32
Montana †	25	34	46	51	43	48
Nebraska	20	21	40	41	38	44
Nevada	—	10	—	28	—	17
New Mexico	10	11	28	29	19	24
New York †	10	14	37	41	36	28
North Carolina	7	9	33	34	17	35
North Dakota	33	26	44	47	33	36
Ohio	—	22	—	46	—	33
Oklahoma	—	16	—	33	—	27
Oregon †	20	17	37	39	30	38
Rhode Island	10	10	32	36	10	14
South Carolina	7	8	26	31	****	****
Tennessee	9	11	28	33	23	26
Texas	9	9	34	33	14	21
Utah	25	23	34	38	32	37
Vermont †	22	22	38 *	44	30 *	43
Virginia	6	11	34	37	27	29
West Virginia	12	14	26 ‡	35	23	25
Wyoming	22	24	37	40	32	33
Other Jurisdictions						
American Samoa	—	2	—	****	—	****
DDESS	20	29	32	40	25	35
DoDDS	20 *	33	33 *	39	31	37
Guam	▲	3	9	7	****	5

* Significantly different from 2000 if only one jurisdiction or the Nation is being examined.
‡ Significantly different from 2000 when examining only one jurisdiction and when using a multiple comparison procedure based on all jurisdictions that participated both years.
† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation in 2000.
— Indicates that the jurisdiction did not participate. ▲ Percentage is between 0.0 and 0.5.
NOTE: Comparative performance results may be affected by changes in exclusion rates for students with disabilities and limited English proficient students in the NAEP samples.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

4 Becoming a More Inclusive National Assessment

Legislation at the federal level now mandates the inclusion of all students in large-scale academic assessments.[1] As a consequence, most states have assessment programs that must make provisions for special-needs students—those with disabilities or limited English proficient students—that include the allowance of testing accommodations when appropriate. Assessing as representative a sample of the nation's students as possible is particularly important for NAEP's mission to serve as a key indicator of the academic achievement of the nation's students. This mission can be satisfactorily accomplished only if the assessment results include data gathered from all groups of students, including those classified as having special needs.

Chapter Focus

How would the NAEP results differ if accommodations were permitted for special-needs students?

Although the intent of NAEP has consistently been to include special-needs students in its assessments to the fullest degree possible, the implementation of the assessment has always resulted in some exclusion of students who could not be assessed meaningfully without accommodations. Participating schools have been permitted to exclude certain students who have been classified as having a disability under the Individuals with Disabilities Education Act, based upon their Individualized Education Programs (IEP) and Section 504 of the Rehabilitation Act of 1973.

Chapter Contents

[1] Public Law 105–17. (1997). Individuals with Disabilities Education Act (IDEA). See also: Title VI of the Civil Rights Act, Equal Educational Opportunities Act, Section 504 of the Rehabilitation Act.

Similarly, schools have been permitted to exclude some students they identify as being limited-English proficient. Exclusion decisions are made in accordance with explicit criteria provided by the NAEP program.

In order to move the NAEP assessments toward more inclusive samples, the NAEP program began to explore the use of accommodations with special-needs students during the 1996 science assessment. An additional impetus for this change was the attempt to keep NAEP consistent with state and district testing policies that increasingly offered accommodations so that more special-needs students could be assessed. In 1996, the national NAEP sample was split so that some of the schools sampled were permitted to provide accommodations to special-needs students and the other schools were not. This sample design made it possible to study the effects on NAEP results of including special-needs students in the assessments under alternate testing conditions. Technical research papers have been published with the results of these comparisons.[2] Based on the outcomes of these analyses, the 1998 results of those NAEP assessments that used new test frameworks (writing and civics), and hence also began new trend lines, were reported with the inclusion of data from accommodated special-needs students.

The results presented in the NAEP 1996 science report card included the performance of those students with disabilities (SD) or limited English proficient students (LEP) who were assessed without the possibility of accommodations. They did not include results on the performance of students for whom accommodations were permitted. However, in both the 1996 and 2000 science assessments, NAEP used the split-sample design so that changes in students' science achievement could be reported across the two assessment years and, at the same time, the program could continue to examine the effects of including students assessed with accommodations.

Two Sets of 2000 NAEP Science Results

This report card is the first to display two different sets of NAEP science results based on the split-sample design: 1) those that reflect the performance of regular and special-needs students when accommodations were not permitted, and 2) those that reflect the performance of regular and special-needs students—both those who were accommodated and those who were tested without accommodations—when accommodations were permitted. It should be noted that accommodated students make up a small proportion of the total weighted number of students assessed (see table A.9, in appendix A for details). Mak-

[2] Olson, J. F., & Goldstein, A. A. (1997). *The inclusion of students with disabilities and limited English proficient students in large-scale assessments: A summary of recent progress*. (NCES Publication No. 97–482). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Mazzeo, J., Carlson, J. E., Voelkl, K. E., & Lutkus, A. D. (1999). *Increasing the participation of special needs students in NAEP: A report on 1996 research activities*. (NCES Publication No. 2000–473). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Lutkus, A. D., & Mazzeo, J. *Including special-needs students in the NAEP 1998 reading assessment: Part I, comparison of overall results with and without accommodations.* Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (forthcoming).

Lutkus, A. D. *Including special-needs students in the NAEP 1998 reading assessment: Part II, results for students with disabilities and limited English proficient students.* Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (forthcoming).

ing accommodations available may change the overall assessment results in subtle and different ways. For example, when accommodations are permitted, there may be some occurrences of students being accommodated who might have taken the test under standard conditions if accommodations were not permitted. This could lead to an overall increase in the average assessment results, if accommodations were to increase special-needs students' performance. Conversely, when accommodations are permitted, many special-needs students who could not have been tested without accommodations could be included in the sample. Assuming that these are generally lower-performing students, their inclusion in the sample—even with accommodations—could result in an overall lower average score.

Chapters 1, 2, 3, and 5 of this report are based on the first set of results (i.e., no accommodations offered). This chapter presents an overview of the second set of results—those that include students who were provided with accommodations during the assessment administration. By including these results, the NAEP program begins a phased transition toward a more inclusive reporting sample. Future assessment results will be based solely on student and school samples in which accommodations are permitted.

The two sets of results presented in this chapter were obtained by administering the assessment to a nationally representative sample of students and schools. In one part of the schools sampled, no accommodations were permitted: all students were assessed under the same conditions that were the basis for reporting results from the 1996 NAEP science assessments. In another part of the schools sampled, accommodations were permitted for SD and LEP students who normally receive accommodations in their district or state assessment programs. Most accommodations that schools routinely provide for their own testing programs were permitted. Such permitted accommodations included, but were not limited to the following:

- one-on-one testing,
- bilingual dictionary,
- large print book,
- small-group testing,
- extended time,
- oral reading of directions, and
- use of an aide for transcribing responses.

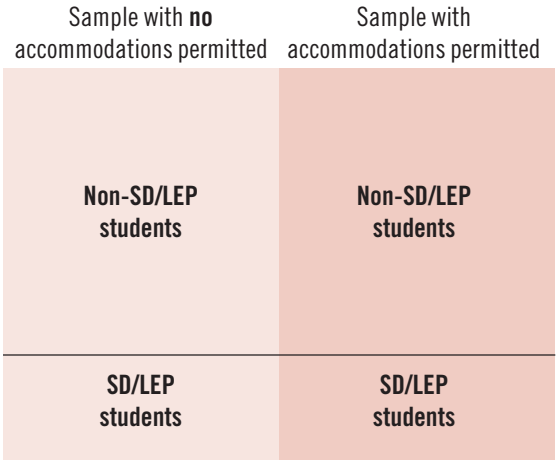
(See appendix A, table A.11, for greater detail on the numbers and percentages of students accommodated by accommodation type in the 1996 and 2000 science assessments.)

Figure 4.1 provides a visual representation of how the two sets of results were based on the two samples in 1996 and 2000. Included in both sets of results (accommodations not permitted and accommodations permitted) are those students from both samples of schools who were not identified as either SD or LEP. In addition, the first set of results (accommodations not permitted) includes SD and LEP students from the sample of schools where accommodations were not permitted (see middle portion of figure 4.1). This is the set of results that allowed for comparisons to 1996 and that are presented in the other chapters of this report.

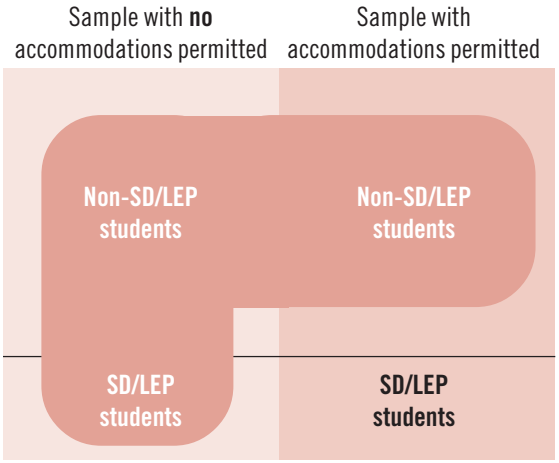
The second set of results, accommodations permitted (see bottom portion of figure 4.1), includes SD and LEP students from the sample of schools where accommodations were permitted. This is the set

Figure 4.1 Split-Sample Design

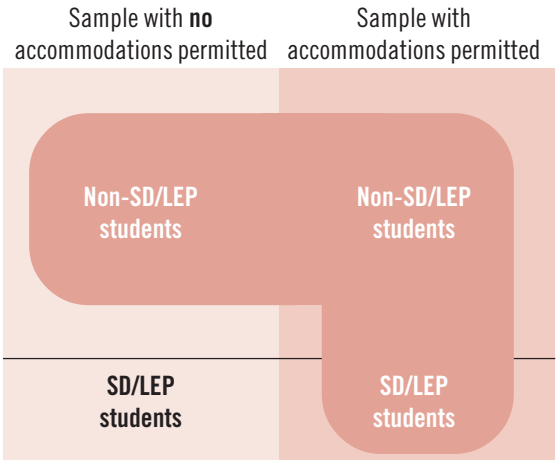
The two sets of NAEP results based on a split-sample design



Split-sample design
The national sample was split. In part of the schools, accommodations were not permitted for students with disabilities (SD) and limited English proficient students (LEP). In the other schools, accommodations were permitted for SD and LEP students who routinely received them in their school assessments.



Accommodations-not-permitted results
The accommodations-not-permitted results include the performance of students from both samples who were not classified as SD or LEP and the performance of SD and LEP students from the sample in which no accommodations were permitted.



Accommodations-permitted results
The accommodations-permitted results also include the performance of students from both samples who were not classified as SD or LEP; however, the SD and LEP students whose performance is included in this set of results were from the sample in which accommodations were permitted. Since students who required testing accommodations could be assessed and represented in the overall results, it was anticipated that these results would include more special-needs students and reflect a more inclusive sample.

of results that form the new, more inclusive baseline for future reporting of trend comparisons for the NAEP science assessment.

In the NAEP 2000 national sample where accommodations were not permitted, 14 percent of fourth-graders, 14 percent of eighth-graders, and 9 percent of twelfth-graders, were identified by their schools as having special needs (i.e., either as SD or LEP students). In the other national sample where accommodations were offered, 16 percent of fourth-graders, 13 percent of eighth-graders, and 9 percent of twelfth-graders were identified as having special needs. In the sample where accommodations were not permitted, 48 percent of the special-needs students at fourth and twelfth grade, and 49 percent at eighth grade (between 4 and 7 percent of all students—see appendix A, table A.7) were excluded from NAEP testing by their schools. In the sample where accommodations were offered, 28 percent of the special-needs students at each of the three grade levels were excluded from the assessment (between 2 and 4 percent of the total sample).

The focus of this chapter is a comparison of data from the two sets of results: 1) accommodations not permitted, and 2) accommodations permitted. Because the split-sample design was used in both 1996 and 2000 for the NAEP national science assessment, both sets of results are presented for both years. The split-sample design was first used in the NAEP state science assessment in 2000. Overall results are provided for the nation and for participating states and other jurisdictions. In addition, national results are presented by gender and by race/ethnicity. These results are discussed in terms of statistically significant differences between the two sets of results in each year, changes between assessment years, and differences between subgroups of students within each set of results. Throughout this chapter, the assessment results that include SD and LEP students for whom accommodations were not permitted will be referred to as the "accommodations-not-permitted" results. The set of results that includes SD and LEP students for whom accommodations were permitted will be referred to as the "accommodations-permitted" results.

Results for the Nation

Accommodations Not Permitted and Accommodations Permitted

Table 4.1 displays the average science scale scores for the nation in 1996 and 2000 for two sets of results: 1) accommodations not permitted, and 2) accommodations permitted. At grade 4, the accommodations-permitted average score in 2000 was two points lower than the accommodations-not-permitted average score. The small difference between the two sets of results in 1996 was not statistically significant. At grades 8 and 12 the apparent differences between the two average scores in either 1996 or 2000 were not found to be statistically significant. The decline in the average twelfth-grade score between 1996 and 2000 is evident in both sets of results.

Table 4.1 Comparison of Two Sets of National Scale Score Results

National average science scale scores by type of results, grades 4, 8, and 12: 1996 and 2000

	Accommodations not permitted	Accommodations permitted
Grade 4		
1996	150	149
2000	150	148 †
Grade 8		
1996	150	150
2000	151	151
Grade 12		
1996	150 *	150 *
2000	147	146

* Significantly different from 2000.
† Significantly different from the result where accommodations were not permitted.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

As noted in the introduction to this chapter, NAEP has always sought to include special-needs students proportionate to their representation in the U.S. population. Offering accommodations tends to reduce exclusion rates for special-needs students and therefore allows NAEP to offer a fairer and more accurate picture of the status of American education. Because special-needs students are typically classified as eligible for special educational services after having shown some difficulty in the regular learning environment, the academic achievement of special-needs students might be expected to be lower than that of students without such needs. This only appeared to be the case in the observed difference between the two sets of grade 4 science results in 2000, where the accommodations-permitted results, which included slightly more special-needs students because of the availability of accommodations, were lower than the accommodations-not-permitted results. It is important to examine the percentages of students attaining the NAEP achievement levels, however, to see if there were higher percentages at the lower achievement levels (i.e., below *Basic* and *Basic*), when students were assessed with accommodations.

Table 4.2 shows the percentages of students attaining each of the achievement levels. The percentages are similar across the two sets of 1996 results for grades 8 and 12: apparent differences between the accommodations-not-permitted and the accommodations-permitted results were not found to be significantly different. At grade 4, however, the percentage of students below *Basic* in both years was higher when accommodations were permitted than when they were not.

Table 4.2 Comparison of Two Sets of National Achievement-Level Results

Percentage of students within each science achievement-level range and at or above achievement levels by type of results, grades 4, 8, and 12: 1996 and 2000

	Below *Basic*	At *Basic*	At *Proficient*	At *Advanced*	At or above *Basic*	At or above *Proficient*
Grade 4						
1996: Accommodations were						
not permitted	33	38	26	3	67	29
permitted	35 †	36 †	25	4	65 †	29
2000: Accommodations were						
not permitted	34	37	26	4	66	29
permitted	36 †	36	25	3	64 †	29
Grade 8						
1996: Accommodations were						
not permitted	39	32 *	26	3	61	29 *
permitted	39	31 *	26	3 *	61	29
2000: Accommodations were						
not permitted	39	29	28	4	61	32
permitted	39	29	27	4	61	32
Grade 12						
1996: Accommodations were						
not permitted	43 *	36	19	3	57 *	21
permitted	43 *	35	19 *	3	57 *	21 *
2000: Accommodations were						
not permitted	47	34	16	2	53	18
permitted	48	34	16	2	52	18

* Significantly different from 2000.
† Significantly different from the result where accommodations were not permitted.
NOTE: Percentages within each science achievement-level range may not add to 100 or to the exact percentages at or above achievement levels due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

National Results by Gender

Accommodations Not Permitted and Accommodations Permitted

The average science scale scores by gender for both sets of results in 1996 and 2000 are provided in table B.67 in appendix B. In 2000, male students at grade 4 had higher science scores when accommodations were not permitted than when accommodations were permitted.

At grades 4 and 8, male students outperformed female students in 2000 regardless of whether or not accommodations were permitted. At grade 12, the apparent difference in scores between male and female students was not statistically significant in either set of results.

There was no variation in the two sets of results with respect to differences in the performance of male and female students between 1996 and 2000. In both sets of results, male students had higher average scores in 2000 than in 1996 at grade 8, and lower average scores in 2000 at grade 12. The performance among female students also remained stable between 1996 and 2000 at all three grades, with no statistically significant differences observed over time in either set of results.

The percentages of male and female students attaining the *Basic, Proficient,* and *Advanced* levels are provided in table B.68 in appendix B. Comparing the two sets of results both in 1996 and 2000, a higher percentage of fourth-grade males were below *Basic* when accommodations were permitted in 2000 than when they were not. No statistically significant differences were found in the percentages of students attaining each of the achievement levels at grades 8 or 12.

National Results by Race/Ethnicity

Accommodations Not Permitted and Accommodations Permitted

NAEP assessments across academic subjects have typically reported large score differences between different racial and ethnic subgroups. If students with disabilities (SD) or limited English proficient (LEP) students are overrepresented in a particular racial or ethnic group, that group's assessment scores may decrease. Table B.69 in appendix B provides the average science scale scores for each of the race/ethnicity categories for the two sets of results in 1996 and in 2000. There were no statistically significant differences observed between the average scores when accommodations were not permitted and when accommodations were permitted for any of the race/ethnicity categories in either 1996 or 2000.

As noted in chapter 3, a pattern of performance differences by race/ethnicity can be seen in the accommodations-not-permitted results in 2000. Similar patterns were observed in the accommodations-permitted results with three exceptions. American Indian eighth-graders scored higher than Hispanic eighth-graders when accommodations were permitted, while the apparent difference was not statistically significant when accommodations were not permitted. Hispanic twelfth-graders scored higher than Black twelfth-graders when accommodations were permitted but not significantly different from each other when accommodations were not permitted. Finally, the difference in average science scores between Asian/Pacific Islander and American Indian twelfth-graders was not significantly different when accommodations were permitted, while Asian/Pacific Islander students outperformed American Indian students when accommodations were not permitted.

At grade 8, American Indian students scored lower in 2000 than in 1996 when accommodations were not permitted, while the apparent decrease was not statistically significant when accommodations were permitted.

The percentages of students in each race/ethnicity category who attained the *Basic, Proficient,* and *Advanced* levels are provided in table B.70 in appendix B. No statistically significant differences were found between the accommodations-not-permitted results and the accommodations-permitted results for the percentages of students attaining any of the achievement levels at any of the grade levels in 1996 and 2000.

State Results

Accommodations Not Permitted and Accommodations Permitted

While the split-sample design was used for both the 1996 and 2000 national assessments, it was used for the first time in the state assessment of science in 2000. The two sets of average scale scores for the jurisdictions that participated in 2000 are presented in tables 4.3 and 4.4 for grades 4 and 8, respectively. As with the presentation of results for jurisdictions in previous

chapters, two types of statistical tests are indicated in these tables—one that involves a multiple-comparison procedure based on all jurisdictions that participated, and one that examines each jurisdiction separately. The following discussion of differences between the accommodations-not-permitted results and the accommodations-permitted results is based solely on the multiple-comparison procedure.

None of the apparent differences between the accommodations-not-permitted results and the accommodations-permitted results for either grade 4 or grade 8 were found to be statistically significant.

Figures 4.3 and 4.4 show comparisons of scale scores across states when accommodations were permitted for fourth- and eighth-grade students, respectively. Six states were included among the highest-performing jurisdictions at grade 4: Iowa, Maine, Massachusetts, Montana, North Dakota and Vermont. These states were also included among the highest-performing jurisdictions when accommodations were not permitted. At grade 8, a cluster of high-performing jurisdictions when accommodations were permitted included Department of Defense Dependents Schools (Overseas), Idaho, Maine, Massachusetts, Michigan, Minnesota, Nebraska, North Dakota, Ohio, and Vermont. This cluster of 10 states was outperformed only by Montana. Most of these states were also among the higher-performing jurisdictions when accommodations were not permitted. Michigan had lower average scores than Massachusetts, Vermont, and North Dakota, and scores in Nebraska were lower than in Vermont and North Dakota when accommodations were not permitted. A listing of these jurisdictions by type of results is presented in figure 4.2.

Figure 4.2 Highest Performing Jurisdictions by Type of Results

States with highest average science scale scores that did not differ from each other by type of results for grades 4 and 8: 2000

Grade 4		Grade 8	
Accommodations not permitted	Accommodations permitted	Accommodations not permitted	Accommodations permitted
Iowa	Iowa	Idaho	Idaho
Maine	Maine	Maine	Maine
Massachusetts	Massachusetts	Massachusetts	Massachusetts
Montana	Montana	Minnesota	Michigan
North Dakota	North Dakota	*Montana	Minnesota
Vermont	Vermont	North Dakota	* Montana
		Ohio	Nebraska
		Vermont	North Dakota
		DDESS	Ohio
		DoDDS	Vermont
			DoDDS

* Average science scores in Montana were higher than the other states listed for grade 8.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 4.3 Comparison of Two Sets of State Scale Score Results, Grade 4

State average science scale scores by type of results for grade 4 public schools: 2000

	Accommodations not permitted	Accommodations permitted
Nation	148	147
Alabama	143	143
Arizona	141	140
Arkansas	144	145
California †	131	129
Connecticut	156	156
Georgia	143	142
Hawaii	136	136
Idaho †	153	152
Illinois †	151	150
Indiana †	155	154
Iowa †	160	159
Kentucky	152	152
Louisiana	139	139
Maine †	161	161
Maryland	146	145
Massachusetts	162	161
Michigan †	154	152
Minnesota †	157	157
Mississippi	133	133
Missouri	156	157
Montana †	160	160
Nebraska	150	150
Nevada	142	142
New Mexico	138	140
New York †	149	148
North Carolina	148	147
North Dakota	160	160
Ohio †	154	155
Oklahoma	152	151
Oregon †	150	148
Rhode Island	148	148
South Carolina	141	140
Tennessee	147	145
Texas	147	145
Utah	155	154
Vermont †	159	160
Virginia	156	155
West Virginia	150	149
Wyoming	158	156
Other Jurisdictions		
American Samoa	51	54
DDESS	157	157
DoDDS	156	155
Guam	110	114
Virgin Islands	116	116

† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 4.4 Comparison of Two Sets of State Scale Score Results, Grade 8

State average science scale scores by type of results for grade 8 public schools: 2000

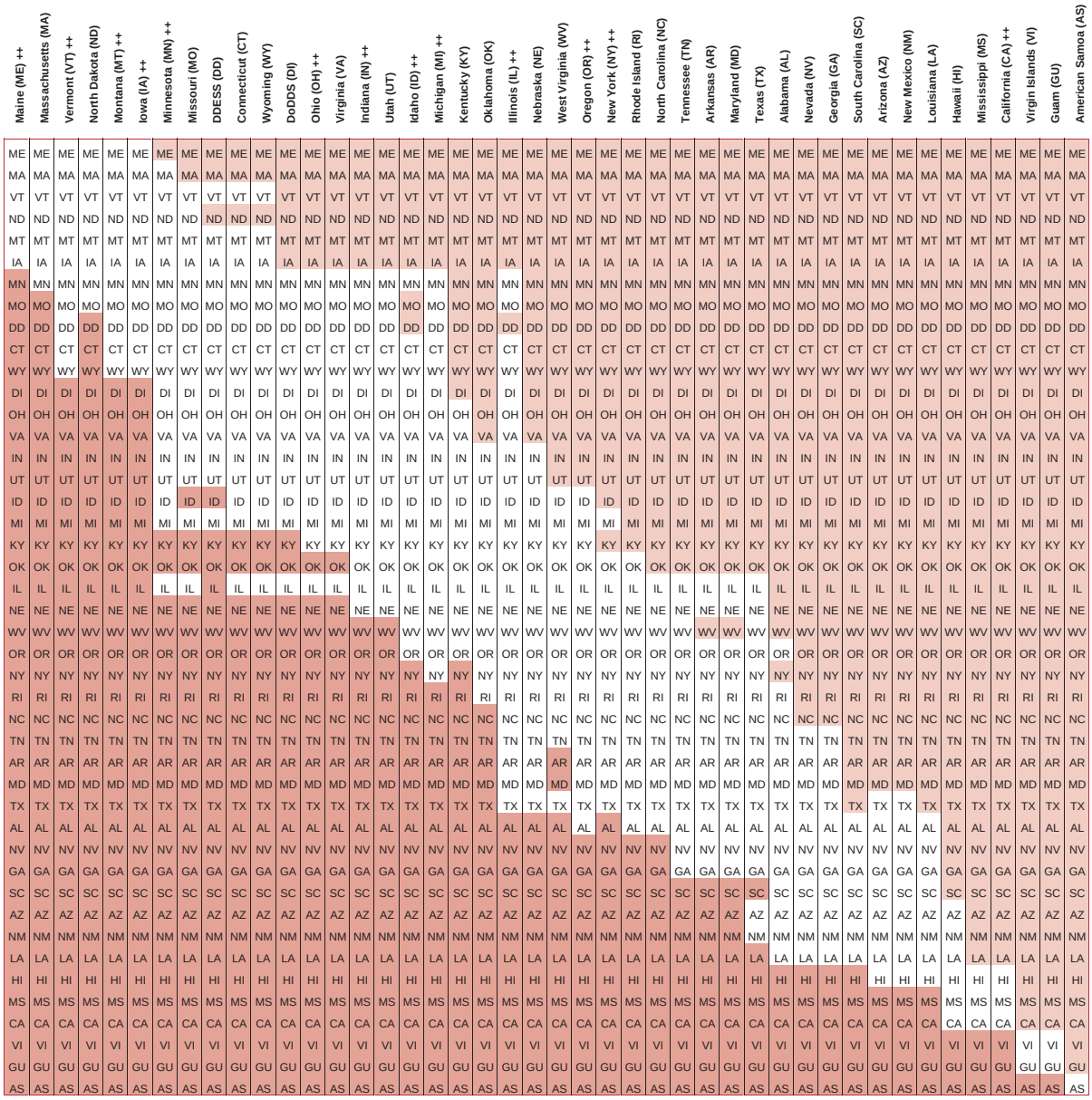
	Accommodations not permitted	Accommodations permitted
Nation	149	149
Alabama	141	143
Arizona †	146	145
Arkansas	143	142
California †	132	129
Connecticut	154	153
Georgia	144	142
Hawaii	132	130
Idaho †	159	158
Illinois †	150	148
Indiana †	156	154
Kentucky	152	150
Louisiana	136	134
Maine †	160	158
Maryland	149	146
Massachusetts	161	158
Michigan †	156	155
Minnesota †	160	159
Mississippi	134	134
Missouri	156	154
Montana †	165	164
Nebraska	157	158
Nevada	143	141
New Mexico	140	139
New York †	149	145
North Carolina	147	145
North Dakota	161	159
Ohio	161	159
Oklahoma	149	149
Oregon †	154	154
Rhode Island	150	148
South Carolina	142	140
Tennessee	146	145
Texas	144	143
Utah	155	154
Vermont †	161	159
Virginia	152	151
West Virginia	150	146 *
Wyoming	158	156
Other Jurisdictions		
American Samoa	72	74
DDESS	159	155
DoDDS	159	159
Guam	114	114

† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
* Significantly different from the result where accommodations were not permitted when examining only one jurisdiction.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Figure 4.3 Cross-State Scale Score Comparisons for Accommodations-Permitted Results, Grade 4

Comparisons of average science scale scores for grade 4 public schools: 2000 sample where accommodations were permitted

Instructions: Read down the column directly under a jurisdiction name listed in the heading at the top of the figure. Match the shading intensity surrounding a jurisdiction's abbreviation to the key below to determine whether the average science scale score of this jurisdiction is higher than, the same as, or lower than the jurisdiction in the column heading. For example, in the column under Indiana, Indiana's score was lower than Maine, Massachusetts, Vermont, North Dakota, Montana, and Iowa, about the same as all the states from Minnesota through Nebraska, and higher than the remaining states down the column.



Jurisdiction has statistically significantly higher average scale score than the jurisdiction listed at the top of the figure.

No statistically significant difference detected from the jurisdiction listed at the top of the figure.

Jurisdiction has statistically significantly lower average scale score than the jurisdiction listed at the top of the figure.

The between jurisdiction comparisons take into account sampling and measurement error and that each jurisdiction is being compared with every other jurisdiction. Significance is determined by an application of a multiple comparison procedure (see appendix A).

++Indicates that the jurisdiction did not satisfy one or more of the guidelines for school participation rates (see appendix A).

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).

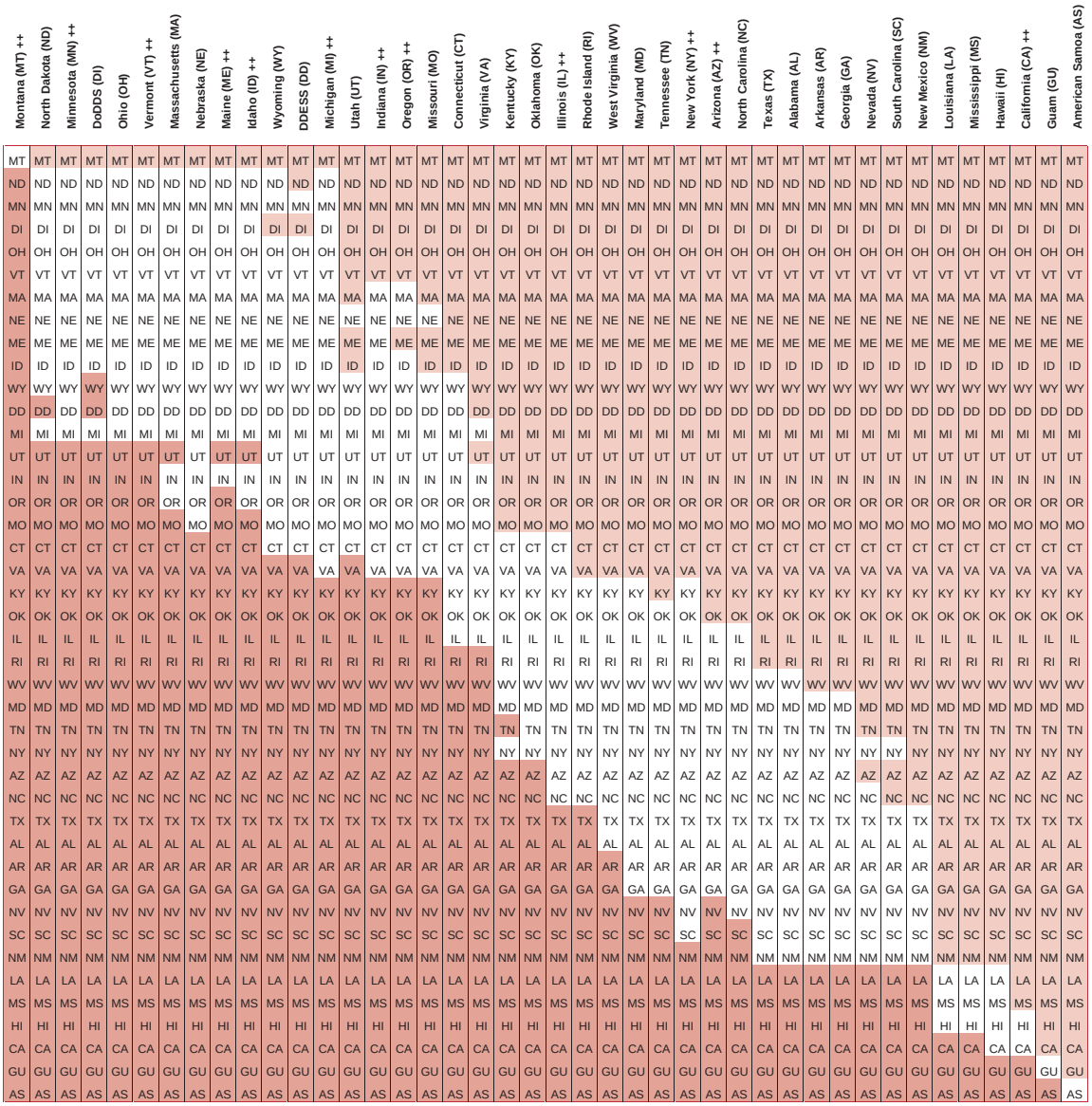
NOTE: Differences between states and jurisdictions may be partially explained by other factors not included in this figure.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Figure 4.4 Cross-State Scale Score Comparisons for Accommodations-Permitted Results, Grade 8

Comparisons of average science scale scores for grade 8 public schools: 2000 sample where accommodations were permitted

Instructions: Read down the column directly under a jurisdiction name listed in the heading at the top of the figure. Match the shading intensity surrounding a jurisdiction's abbreviation to the key below to determine whether the average science scale score of this jurisdiction is higher than, the same as, or lower than the jurisdiction in the column heading. For example, in the column under Ohio, Ohio's score was lower than Montana, about the same as all the states from North Dakota through Michigan, and higher than the remaining states down the column.



Jurisdiction has statistically significantly higher average scale score than the jurisdiction listed at the top of the figure.

No statistically significant difference detected from the jurisdiction listed at the top of the figure.

Jurisdiction has statistically significantly lower average scale score than the jurisdiction listed at the top of the figure.

The between jurisdiction comparisons take into account sampling and measurement error and that each jurisdiction is being compared with every other jurisdiction. Significance is determined by an application of a multiple comparison procedure (see appendix A).

++Indicates that the jurisdiction did not satisfy one or more of the guidelines for school participation rates (see appendix A).

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).

NOTE: Differences between states and jurisdictions may be partially explained by other factors not included in this figure.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Tables 4.5 and 4.6 show the percentages of students in each jurisdiction who were at or above the *Proficient* level when accommodations were not permitted and when accommodations were permitted. Again, no statistically significant differences were observed between the two sets of results at both grades 4 and 8.

Figures 4.5 and 4.6 indicate whether differences in the percentages of students at or above *Proficient* between pairs of participating jurisdictions were statistically significant when accommodations were permitted. At grade 4, the cluster of four states with the highest percentage at or above the *Proficient* level included Maine, Massachusetts, Montana, and Vermont. The same four states were also included among the jurisdictions clustered at the top when accommodations were not permitted (see chapter 2). At grade 8, Massachusetts, Minnesota, Montana, North Dakota, Ohio, and Vermont, had the highest percentages of students at or above *Proficient* when accommodations were permitted. Only four of these six states were among those with the highest percentage at or above the *Proficient* level (Massachusetts, Minnesota, Montana, and Ohio), in the accommodations-not-permitted results for grade 8.

Table 4.5 Comparisons of Two Sets of State *Proficient* Level Results, Grade 4

Percentage of students at or above the *Proficient* level in science by state and type of results for grade 4 public schools: 2000

	Accommodations not permitted	Accommodations permitted
Nation	28	27
Alabama	22	22
Arizona	22	22
Arkansas	24	23
California †	14	13
Connecticut	35	35
Georgia	23	23
Hawaii	16	16
Idaho †	30	29
Illinois †	31	31
Indiana †	32	32
Iowa †	37	36
Kentucky	29	28
Louisiana	19	18
Maine †	38	37
Maryland	26	24
Massachusetts	43	42
Michigan †	33	32
Minnesota †	35	34
Mississippi	14	13
Missouri	35	34
Montana †	37	36
Nebraska	26	26
Nevada	19	19
New Mexico	18	17
New York †	26	24
North Carolina	24	23
North Dakota	38	36
Ohio †	31	31
Oklahoma	26	26
Oregon †	28	27
Rhode Island	27	25
South Carolina	21	20
Tennessee	26	24
Texas	24	23
Utah	32	31
Vermont †	39	38
Virginia	33	32
West Virginia	25	24
Wyoming	33	31
Other Jurisdictions		
American Samoa	▲	▲
DDESS	29	30
DoDDS	30	30
Guam	4	4
Virgin Islands	4	4

† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
▲ Percentage is between 0.0 and 0.5.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
NOTE: National results are based on the national sample, not on aggregated state assessment samples.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Table 4.6 Comparisons of Two Sets of State *Proficient* Level Results, Grade 8

Percentage of students at or above the *Proficient* level in science by state and type of results for grade 8 public schools: 2000

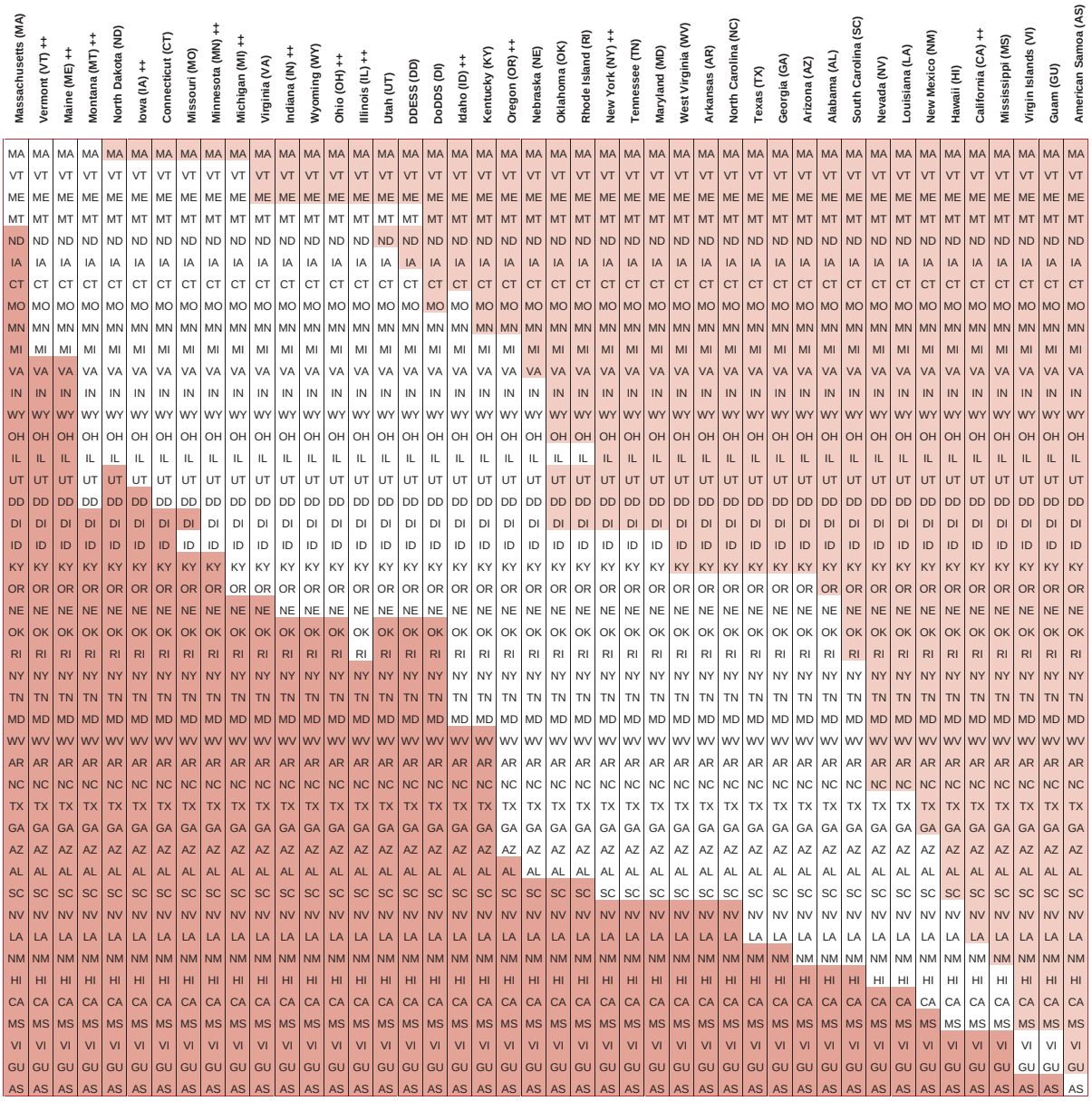
	Accommodations not permitted	Accommodations permitted
Nation	30	30
Alabama	22	23
Arizona †	24	23
Arkansas	23	22
California †	15	14
Connecticut	35	35
Georgia	23	23
Hawaii	15	14
Idaho †	38	37
Illinois †	30	29
Indiana †	35	33
Kentucky	29	28
Louisiana	18	18
Maine †	37	35
Maryland	28	27
Massachusetts	42	39
Michigan †	37	35
Minnesota †	42	41
Mississippi	15	15
Missouri	36	33
Montana †	46	44
Nebraska	36	38
Nevada	23	22
New Mexico	20	20
New York †	30	28
North Carolina	27	25
North Dakota	40	38
Ohio	41	39
Oklahoma	26	25
Oregon †	33	34
Rhode Island	29	27
South Carolina	20	20
Tennessee	25	24
Texas	23	23
Utah	34	34
Vermont †	40	39
Virginia	31	29
West Virginia	26	24
Wyoming	36	34
Other Jurisdictions		
American Samoa	2	2
DDESS	35	33
DoDDS	37	38
Guam	6	6

† Indicates that the jurisdiction did not meet one or more of the guidelines for school participation.
DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).
NOTE: National results are based on the national sample, not on aggregated state assessment samples.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Figure 4.5 Cross-State *Proficient* Level Comparisons for Accommodations-Permitted Results, Grade 4

Comparisons of percentage of students at or above *Proficient* in science for grade 4 public schools: 2000 sample where accommodations were permitted

Instructions: Read down the column directly under a jurisdiction name listed in the heading at the top of the figure. Match the shading intensity surrounding a jurisdiction's abbreviation to the key below to determine whether the percentage of students at or above *Proficient* in this jurisdiction is higher than, the same as, or lower than the jurisdiction in the column heading. For example, in the column under Virginia, the percentage of students at or above *Proficient* in Virginia was lower than Massachusetts, Vermont, and Maine, about the same as all the states from Montana through Oregon, and higher than the remaining states down the column.



Jurisdiction has statistically significantly higher percentage than the jurisdiction listed at the top of the figure.

No statistically significant difference detected from the jurisdiction listed at the top of the figure.

Jurisdiction has statistically significantly lower percentage than the jurisdiction listed at the top of the figure.

The between jurisdiction comparisons take into account sampling and measurement error and that each jurisdiction is being compared with every other jurisdiction. Significance is determined by an application of a multiple comparison procedure (see appendix A).

++Indicates that the jurisdiction did not satisfy one or more of the guidelines for school participation rates (see appendix A).

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.

DoDDS: Department of Defense Dependents Schools (Overseas).

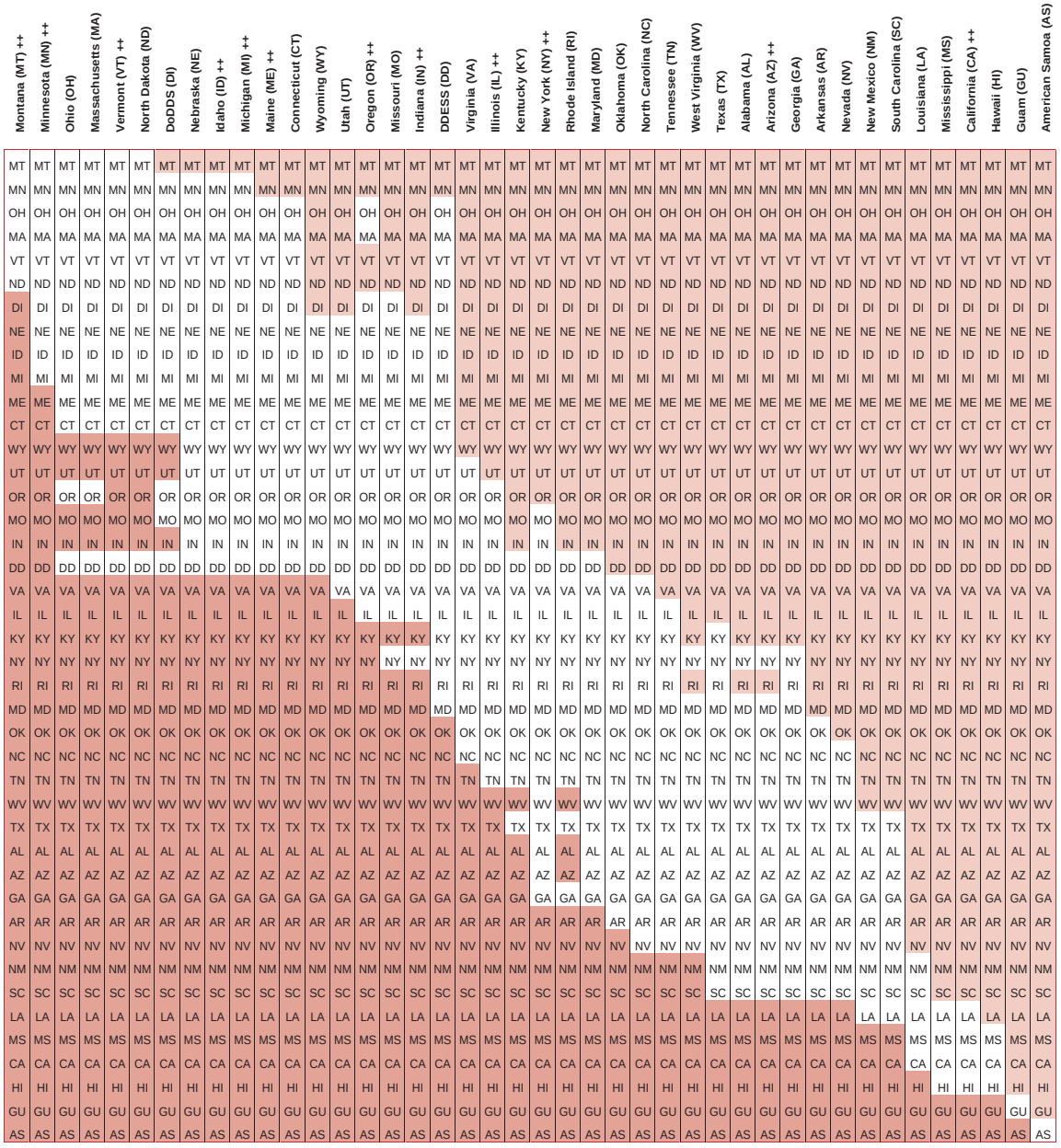
NOTE: Differences between states and jurisdictions may be partially explained by other factors not included in this figure.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Figure 4.6 Cross-State *Proficient* Level Comparisons for Accommodations-Permitted Results, Grade 8

Comparisons of percentage of students at or above *Proficient* in science for grade 8 public schools: 2000 sample where accommodations were permitted

Instructions: Read down the column directly under a jurisdiction name listed in the heading at the top of the figure. Match the shading intensity surrounding a jurisdiction's abbreviation to the key below to determine whether the percentage of students at or above *Proficient* in this jurisdiction is higher than, the same as, or lower than the jurisdiction in the column heading. For example, in the column under Maine, the percentage of students at or above *Proficient* in Maine was lower than Montana and Minnesota, about the same as all the states from Ohio through Department of Defense Domestic Dependent Elementary and Secondary Schools (DD), and higher than the remaining states down the column.



Jurisdiction has statistically significantly higher percentage than the jurisdiction listed at the top of the figure.

No statistically significant difference detected from the jurisdiction listed at the top of the figure.

Jurisdiction has statistically significantly lower percentage than the jurisdiction listed at the top of the figure.

The between jurisdiction comparisons take into account sampling and measurement error and that each jurisdiction is being compared with every other jurisdiction. Significance is determined by an application of a multiple comparison procedure (see appendix A).

++Indicates that the jurisdiction did not satisfy one or more of the guidelines for school participation rates (see appendix A).

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.
DoDDS: Department of Defense Dependents Schools (Overseas).

NOTE: Differences between states and jurisdictions may be partially explained by other factors not included in this figure.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

5

Teaching and Learning Science

During the past 15 to 20 years science education has undergone a number of reforms that were spurred on initially by the 1983 report entitled *A Nation at Risk*. This report raised the concern that national student achievement across core subjects was eroding.[1] Publications by organizations such as the American Association for the Advancement of Science (AAAS), the National Research Council of the Academy of Sciences (NRC), and the National Science Teachers Association helped focus attention on a number of critical issues in science education that ranged from what science content to teach to how learning should be assessed.[2] These publications, especially *Benchmarks for Science Literacy* and *The National Science Education Standards*, have been extensively used by some states as they have revised or created new science standards.[3] Some recent publications written by the AAAS and NRC build on the information contained in *Benchmarks* and the *National Standards*, addressing in more detail such topics as curriculum design, how learning should be assessed, and how inquiry-based learning

Chapter Focus

What teacher factors are related to science achievement?

How does technology use and student course work relate to achievement?

Chapter Contents

[1] National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington DC: Author.

[2] American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. Washington, DC: Author.

National Research Council of the Academy of Sciences. (1995). *National science education standards*. Washington, DC: Author.

National Science Teachers Association. (1992). *The content core: Scope, sequence, and coordination guide*. Washington, DC: Author

[3] For examples
http://www.dpi.state.wi.us/standards
http://www.isbe.state.il.us/ils/science
http://www.state.nj.us/njded/cccs

helps students learn science content.[4] However, the fact that a wealth of information on science teaching and learning is available to teachers does not necessarily mean that teachers incorporate such information into their daily classroom activities. Furthermore, there is a lack of information concerning the efficacy of certain teaching and learning strategies as they relate to what students know and can do in science. Thus, the results of the NAEP science assessment are very important since they give valuable information about teacher practices in the classroom, and may help to elucidate the relationship between those practices and student achievement.

This chapter considers school factors related to teaching and learning, as reported by teachers and students and examines their relationship to students' average scale scores on the NAEP 2000 science assessment. The information is based on responses to questionnaires answered both by teachers of students who participated in the assessment and by the students who took the assessment. Data based on teachers' responses are presented for grades 4 and 8 only. Grade 12 teachers were not administered a questionnaire because it is difficult to link students to teachers across the many different science courses taught at this grade level.

The information presented in this chapter may help readers interpret some of the findings found in earlier chapters of this report. The contexts for teaching and learning explore two areas: computer availability and use, and students' course-taking practices. As with all NAEP data, the unit of analysis in this chapter is the student. Although some of the data reported here are based on teachers' responses to the questionnaires, the results are reported in terms of percentages of students whose teachers responded to each question in a particular manner. The results for each of the factors described in this chapter include the percentages of students and their corresponding average scale scores. Results from the 2000 assessment are compared to 1996 for those questions that were asked of students or teachers in both assessment years. In some cases, data are available only from the 2000 assessment.

Readers of this report are reminded that the relationship between a contextual variable and science performance is not necessarily causal, and that different interpretations may apply to a given finding of association between a variable and average science scores. For example, one finding reported in this chapter is that twelfth-graders who used computers to collect data at least once a month outperformed their peers who did so less frequently. One possible interpretation of this finding is that the experience of using a computer in this manner for science learning may help students achieve in science. Conversely, it may also be possible that teachers of students who are already high achievers

[4] National Research Council of the Academy of Sciences. (2001). *Classroom assessment and the national science education standards*. Washington, DC: Author.

National Research Council of the Academy of Sciences. (2000). *Inquiry and the national science education standards: A guide to teaching and learning*. Washington, DC: Author.

American Association for the Advancement of Science. (2001). *Designs for science literacy*. Washington, DC: Author.

American Association for the Advancement of Science. (2001). *Atlas of science literacy*. Washington, DC: Author.

may be more likely to allow their students to spend time collecting data with computers than are teachers of lower-achieving students. Without further study, the exact cause for the relationship between this instructional practice and students' average science scores cannot be determined.

Technology Use: Availability of Computers for Science Classes

How to best use computers for teaching and learning is an ongoing discussion among educators. There are many issues associated with effective use of technology in the classroom that range from computer access to teachers' expertise in building the tools computers offer into their teaching and learning plans.[5] This multitude of factors makes it difficult to assess the effectiveness of computers vis-à-vis student learning. While the data on computers that were collected as part of the NAEP 2000 science assessment do not pretend to answer the questions these issues raise, the data do give an indication of how teachers are using computers. The following section reports some of these findings. Other data about computer availability and use can be found on the NAEP web site at http://nces.ed.gov/nationsreportcard.

Teachers of students in grades 4 and 8 were asked which best described the availability of computers for use by their science students. The response options are shown in table 5.1, together with the percentage of students whose teachers chose each response option and students' average science scores. In 2000, only 11 percent of fourth-graders and 10 percent of eighth-graders were taught by teachers who reported that no computers were available for use by the science students. Approximately 24 percent of fourth-graders and 41 percent of eighth-graders were taught by teachers who indicated that, although computers were available in a laboratory, they may not have had computers in their classrooms. Between 1996 and 2000, none of the apparent changes in the availability of computers at grades 4 and 8 were found to be statistically significant.

At both grades 4 and 8 in 2000, students who could access computers in laboratories scored higher, on average, than their peers who had no access at all to computers. Regardless of the number of computers teachers reported having in their classrooms, there was no statistically significant difference detected in the average scores of students who had no access to computers and those who had one or more computers available in their classrooms.

[5] National Science Teachers Association. (1992). *NSTA position statement: The use of computers in science education* [Online]. Available: http://www.nsta.org/159&id=4

Mayer, D.P., Mullens, J.E., Moore, M.T., & Mathematics Policy Research, Inc. (2000). *Monitoring school quality: An indicators report*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Table 5.1

Percentage of fourth- and eighth-graders and average scale score by teachers' reports on availability of computers for use by their science students: 1996 and 2000

Grades 4&8

Availability of Computers

	1996	2000
Grade 4		
None available	15 143	11 143
One within the classroom	26 149	27 147
Two to three within the classroom	17 150	23 148
Four or more within the classroom	10 155	15 151
Available in computer laboratory but difficult to access or schedule	15 161	8 158
Available in a computer laboratory and easy to access or schedule	17 148	16 156
Grade 8		
None available	16 149	10 142
One within the classroom	22 151	29 149
Two to three within the classroom	9 157	11 150
Four or more within the classroom	7 159	9 146
Available in computer laboratory but difficult to access or schedule	32 150	23 155
Available in a computer laboratory and easy to access or schedule	14 151	18 159

At both grades 4 and 8, students whose teachers said that computers were available in a laboratory had higher average scores than students whose teachers said that no computers were available for science instruction.

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Technology Use: Computers for Instruction in Science, Grades 4 and 8

Teachers whose students participated in the science assessment were asked how they used the computer for instruction in science. Since they could identify more than one type of computer use, the results are reported in terms of a "yes" or "no response" for each type of computer use. Table 5.2 shows the percentages and average scores of students whose teachers reported using the computer for drill and practice, playing science/learning games, simulations and modeling, data analysis and other applications, and word processing. It also provides the data for students whose teachers stated that they did not use computers for science instruction. It is important to note that any apparent relationship between computer use and student performance may reflect the influence of factors other than the type of computer use in and of itself.

In 2000, 43 percent of fourth-graders and 26 percent of eighth-graders had teachers who did not use computers for science instruction. At grade 4, students whose teachers indicated that they did not use computers for science instruction scored lower, on average, than did students whose teachers did use computers. (Note that a "no response" to this option in the table indicates that computers were used by teachers for science instruction.)

In 2000, fourth-graders whose teachers indicated that they used computers for playing science/learning games scored higher, on average, than fourth-graders whose teachers indicated that they did not use computers in this manner during science instruction. Eighth-graders whose teachers indicated using computers for simulations and modeling, and data analysis and other applications scored higher, on average, than eighth-graders whose teachers did not indicate doing so.

The results presented in table 5.2 also indicate an overall increase between 1996 and 2000 in the percentage of both fourth- and eighth-graders whose teachers reported using computers for science instruction. The percentage of students whose teachers indicated using computers increased from 47 to 57 percent at grade 4, and from 54 to 74 percent at grade 8. Also at grade 8, there was an increase in the percentage of students whose teachers said they used computers for data analysis and other applications, and for word processing, as a part of science instruction.

Table 5.2

Percentage of fourth- and eighth-graders and average scale score by teachers' reports on how they use computers for science instruction: 1996 and 2000

Grades 4&8

Computer Use

	1996		2000	
	Yes	No Response	Yes	No Response
Grade 4				
Drill and practice	5 149	95 151	3 149	97 150
Playing science/learning games	30 154	70 149	28 153	72 149
Simulations and modeling	18 * 155	82 150	11 152	89 150
Data analysis and other applications	6 149	94 151	9 153	91 150
Word processing	10 159	90 150	13 153	87 150
Do not use computers for science instruction	53 * 148	47 154	43 148	57 153
Grade 8				
Drill and practice	8 156	92 151	8 147	92 152
Playing science/learning games	21 152	79 152	15 151	85 152
Simulations and modeling	25 155	75 151	23 155	77 151
Data analysis and other applications	19 * 152	81 152	33 156	67 150
Word processing	22 * 154	78 151	35 154	65 151
Do not use computers for science instruction	46 * 150	54 153	26 150	74 152

Fourth-graders whose teachers used computers for playing science/learning games had higher average scores than fourth-graders whose teachers did not use computers in this manner.

Eighth-graders whose teachers used computers for simulations and modeling, and for data analysis and other applications, as a part of science instruction had higher average scores than eighth-graders whose teachers did not use computers in this manner.

The percentage of students is listed first with the corresponding average scale score presented below.
* Significantly different from 2000. Although not marked in the table, the difference in the percentage of students not responding in 1996 is significantly different from 2000 in all instances where the corresponding percentage of students responding yes is significantly different.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Technology Use: Computers for Instruction in Science, Grade 12

In 2000, twelfth-grade students were asked how frequently they used computers in their science classes for collecting data using lab equipment that interfaces with computers; downloading data and related information from the Internet; analyzing data using the computer; and using the Internet to exchange information with other students or scientists about science experiments or investigations. The results are shown in table 5.3.

Thirty-four percent of twelfth-graders reported that they were not taking a science course, and between 42 and 54 percent of students stated that they never used computers to do the listed activities. The remaining percentage of students were fairly evenly split between those who indicated that they used the computer for each of the listed activities at least once a month and those who did so less than once a month.

With one exception, students who reported that they were not taking a science course were outperformed by their peers who were, even when their peers were not using computers for the listed activities. Average scores for students who reported using the Internet to exchange information with other students once a month or more were not found to be significantly different from those of students who were not taking science. Twelfth-graders who reported collecting data and who reported analyzing data with computers at least once a month outperformed their peers who reported doing so less frequently. Students who said they never downloaded data and related information from the Internet scored lower, on average, than their peers who indicated doing so at least sometimes.

Table 5.3

Percentage of twelfth-graders and average scale score by students reports on how they use computers in science classes: 2000

Grade 12

Computer Use

	2000
Collect data using lab equipment that interfaces with computers	
I am not taking science	34 141
Once a month or more	13 158
Sometimes but less than once a month	11 154
Never	42 148
Download data and related information from the Internet	
I am not taking science	34 142
Once a month or more	9 155
Sometimes but less than once a month	13 158
Never	45 148
Analyze data using the computer	
I am not taking science	34 142
Once a month or more	11 163
Sometimes but less than once a month	11 157
Never	44 147
Use the Internet to exchange information with other students or scientists about science experiments or investigations	
I am not taking science	34 142
Once a month or more	4 146
Sometimes but less than once a month	7 151
Never	54 151

Twelfth-graders who said they used computers to collect data or to analyze data at least once a month had higher average scores than twelfth-graders who did so less frequently.

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

Student Coursework: Grade 4 Science Courses

Students in grade 4 tend to take a science course that incorporates a mixture of topics in science. While increasing emphasis on state standards and state assessments may have led to the topics covered in the early grades becoming more formalized, the topics taught in fourth-grade science classes are not necessarily unified across the nation.[6] Since the instructional information that can be collected from teachers on a questionnaire is somewhat limited, information collected by NAEP on science course work for fourth-graders was confined to asking teachers how much time was spent on the broad domains of life science, Earth science, and physical science. Teachers responding to this question could choose from the options "a lot," "some," "little," and "none." It is important to note that the responses did not refer to minutes or hours spent on the domain, but rather to time spent in relation to the other areas. Thus, teachers may have spent only 10 minutes a week on life science and still have indicated that they devoted "a lot" of time to this domain. The results for this question are presented in table 5.4.

In 2000, teachers of 31 percent of fourth-graders reported spending a lot of time on life science and Earth science, and teachers of 22 percent of fourth-graders reported spending a lot of time on physical science. A very small percentage of fourth-graders were taught by teachers who said they actually devoted no time to any of these three science domains—only 1 to 2 percent. The amount of time teachers devoted to life science and to Earth science displayed a fairly positive relationship with average NAEP science scores. In both cases, students whose teachers indicated that they devoted a lot or some time on these science domains outperformed their peers whose teachers indicated spending little time.

The percentage of students whose teachers reported spending a lot of time on Earth science increased from 19 percent in 1996 to 31 percent in 2000. At the same time, the percentage of students whose teachers reported spending only some time on the Earth science domain decreased from 76 to 62 percent.

[6] Council of Chief State School Officers, Wisconsin Center for Education Research, Eleven State Collaborative. (2000). *Using data on enacted curriculum in mathematics & science: Sample results from a study of classroom practices and subject content. Summary report from Survey of Enacted Curriculum Project.* Washington, DC: Council of Chief State School Officers.

National Committee on Science Education Standards and Assessment, National Research Council. (1996). *National science education standards.* Washington, DC: National Academy Press.

O'Sullivan, C.Y., Weiss, A.R., Askew, J.M. (1998). *Students learning science.* Washington, DC: U.S. Department of Education. Office of Educational Research and Improvement. National Center for Education Statistics.

Table 5.4

Percentage of fourth-graders and average scale score by teachers' reports on how much time is spent on certain science domains: 1996 and 2000

Grade 4

Time Spent Teaching Certain Science Domains

	1996	2000
Life science		
A lot	28 150	31 151
Some	65 151	60 152
Little	6 150	7 138
None	1 —	2 147
Earth science		
A lot	19 * 151	31 152
Some	76 * 151	62 151
Little	5 151	6 136
None	▲ —	1 143
Physical science		
A lot	16 154	22 151
Some	73 * 151	65 151
Little	9 145	11 145
None	2 137	2 142

Fourth-graders whose teachers spent at least some time on life science and earth science had higher average scores than fourth-graders whose teachers spent only a little time on these science domains.

The percentage of students is listed first with the corresponding average scale score presented below.
* Significantly different from 2000.
— Sample size is insufficient to permit a reliable estimate.
▲ Percentage is between 0.0 and 0.5.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Student Coursework: Grade 8 Science Courses

By the time students reach middle school, science is being taught as a core content area. There is, however, no consensus as to the order in which the key domains should be taught.[7] As part of the NAEP science assessment, eighth-grade teachers were asked the same question that was asked of teachers of fourth-graders, namely to indicate how much time they spent on certain science domains. Readers are reminded that the NAEP assessment surveys the content domains of Earth, physical, and life science; thus, if students are to do well on NAEP, breadth of coverage may be important in middle school.

Table 5.5 presents the percentages of eighth-graders and their average scores by teachers' reports on how much time they spent on various science domains. In 2000, 45 and 47 percent of eighth-graders were taught by teachers who spent a lot of time on Earth science and physical science, respectively. Twenty-one percent of eighth-graders were taught by teachers who indicated spending a lot of time on life science. None of the apparent changes between 1996 and 2000 in eighth-grade teachers' reports of amount of time devoted to any of the science domains were statistically significant.

In 2000, the relationship between teachers' reports on the amount of time devoted to the various science domains and eighth-graders' average science scores was somewhat different than that observed at the fourth grade. For both life science and Earth science, the students whose teachers reported spending no time on these domains outperformed their peers whose teachers reported spending a lot or some time.

[7] Council of Chief State School Officers, Wisconsin Center for Education Research, Eleven State Collaborative. (2000). *Using data on enacted curriculum in mathematics & science: Sample results from a study of classroom practices and subject content. Summary report from Survey of Enacted Curriculum Project.* Washington, DC: Council of Chief State School Officers.

National Committee on Science Education Standards and Assessment, National Research Council. (1996). *National science education standards.* Washington, DC: National Academy Press.

O'Sullivan, C.Y., Weiss, A.R., & Askew, J.M. (1998). *Students learning science.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Table 5.5

Percentage of eighth-graders and average scale score by teachers' reports on how much time is spent on certain science domains: 1996 and 2000

Grade 8

Time Spent Teaching Certain Science Domains

	1996	2000
Life science		
A lot	19 149	21 147
Some	40 150	36 150
Little	23 156	22 153
None	18 157	20 156
Earth science		
A lot	41 151	45 152
Some	39 151	33 148
Little	11 155	13 154
None	9 157	9 161
Physical science		
A lot	49 153	47 153
Some	35 153	36 150
Little	12 154	11 153
None	4 144	6 151

Eighth-graders whose teachers said they spent no time on life science or Earth science had higher average scores than eighth-graders whose teachers spent at least some time on these science domains.

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Student Coursework: Grade 12 Science Courses

Most states have science coursework requirements for graduation; however, in some states the requirements are determined at the local level. In 2000, according to a Council of Chief State School Officers report, 4 states required four credits for graduation, 15 states and the Department of Defense schools required three credits, 21 required two credits, and 2 required only one credit.[8] The number of science credits required in the remaining states were either determined by a local board or were included as part of combined credits in mathematics and science. Some states required that students take specific courses such as life science and physical science, while other states made no such demands. Some states required that students take courses in specific areas such as life science and physical science. However, course requirements in life science and physical science can often be fulfilled without taking a core course in biology, chemistry, or physics. While seven states did require at least one of the core science courses, no state required all three for graduation.[9]

Twelfth-grade students in the NAEP science assessment responded to several questions about their science studies. They were asked whether they were currently taking a science class and then asked to indicate which courses they had taken from the eighth grade to the present. The list of courses included Earth and space science, life science (other than biology), physical science (other than physics and chemistry), general science, integrated science, biology, chemistry, physics, and science and technology. Students were also asked if they were currently enrolled in or had taken Advanced Placement courses in biology, chemistry, and physics. The data collected from these questions are presented on the following pages.

[8] Council of Chief State School Officers. (2000). *Key state education policies on K-12 education: 2000: Time and attendance, graduation, content standards, teacher & school licensure, student assessment.* Washington, DC: Author.

[9] Ibid.

Table 5.6

Percentage of twelfth-graders and average scale score by students' reports on whether or not taking a science course this year: 1996 and 2000

Grade 12

Science Course Taking

	1996	2000
Are you taking a science course this year?		
Yes	54 160	53 157
No	46 140	47 137

Twelfth-graders who were enrolled in a science course had higher average scores than twelfth-graders who were not.

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.

Current Science Course Enrollment

Table 5.6 shows the percentages of students who were enrolled in a science course in 2000 and in 1996. As can be seen from the data, in 2000, 53 percent of students reported currently taking a science course, whereas 47 percent reported not taking one. This was similar to the results in 1996. Students who reported that they were currently taking a science course in 2000 outperformed their counterparts who reported that they were not taking a science course at the time of the assessment.

Science Courses Taken Since Eighth Grade

Table 5.7 presents the results for a question that asked students in which grade they had taken certain science courses. The grades covered were 8 through 12. Students were also asked to indicate if they had not taken a specific course. The actual list presented to students included more courses than are listed in the table; for example second year biology was included on the list that was presented to students, but is not presented in table 5.7. A complete listing can be found on the NAEP web site.

Table 5.7

Percentage of twelfth-graders and average scale score by students' reports on science courses taken since eighth grade: 2000

Grade 12

Science Course Taken

	Not taken	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Earth (and space) science	26	49	19	5	4	3
	148	150	146	135	140	144
First-year biology	8	2	31	54	5	1
	126	138	156	149	134	125
First-year chemistry	30	1	2	21	40	7
	128	128	144	166	155	145
First-year physics	64	1	2	2	12	19
	139	128	153	159	167	167
Life science (other than biology)	46	22	18	10	6	5
	151	152	139	131	141	157
Physical science (other than chemistry and physics)	36	12	36	11	6	3
	151	159	147	135	132	141
General science	47	37	14	4	2	1
	148	152	145	129	134	144
Integrated science	85	5	7	3	1	1
	149	147	149	132	135	142
Science and technology	86	4	4	3	4	4
	148	154	154	147	148	149

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Row percentages may not add to 100 because some students indicated taking a course in more than one grade.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.

The table shows that 26 percent of students reported not taking Earth and space science in grades 8 through 12. This does not mean that they never had a course in earth and space science. They may have taken it in grade 7, or even in grade 6. Almost one-half of the twelfth-grade student population did report taking the course during eighth grade. While almost all students had taken biology at some point since the eighth grade, the most popular grade for taking the course was tenth. Two-thirds of twelfth-graders reported taking chemistry. Forty percent of students took the course in the eleventh grade. Thirty-six percent of twelfth-graders reported taking physics—most typically in the eleventh or twelfth grade.

Enrollment in Advanced Placement Science Courses

Many schools offer higher-level courses that allow students to accumulate college credits. Table 5.8 displays the percentage of students in 2000 who reported that they were currently enrolled in or had taken an Advanced Placement course in the three core sciences—biology, chemistry, and physics. Students' average scores are also presented.

The results show that 10 percent of twelfth-graders had taken or were enrolled in biology, and that 6 and 5 percent had taken or were enrolled in chemistry and physics, respectively. Students who had taken or were enrolled in AP biology, chemistry, or physics scored higher, on average, than those students who said they had not taken and were not enrolled in these courses.

Table 5.8

Percentage of twelfth-graders and average scale score by students' reports on whether they are currently enrolled in or have taken an Advanced Placement course: 2000

Grade 12

Students' Reports on Advanced Placement Courses

	Yes	No response
AP Biology	10 166	90 145
AP Chemistry	6 169	94 145
AP Physics	5 173	95 145

Twelfth-graders who had taken an AP course in biology, chemistry, or physics had higher average scores than twelfth-graders who had not taken one of these courses.

The percentage of students is listed first with the corresponding average scale score presented below.
NOTE: Percentages may not add to 100 due to rounding.
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Science Assessment.