MANPOWER ASSESSMENT BRIEF

U.S. Department of Energy

Number 32, July 1995

Underrepresentation of Women and Minorities in Natural Science* and Engineering Bachelor's Degrees

SUMMARY

Women

Relatively fewer women major in natural science and engineering.

Women account for:

- 52% of 18- and 19-year-old college freshmen,
- 29% of freshmen planning to major in natural science and engineering, and
- 31% of bachelor's degrees with majors in natural science and engineering.

Women indicate less interest in natural science and engineering by middle school.

- 7th-, 8th-, and 10th-grade girls indicate less involvement in informal natural science and technology activities than boys.
- In 10th grade, fewer girls than boys express an interest in natural science and engineering college majors.

Women have less preparation in high school mathematics and natural science.

- Girls, on average, take fewer advanced science classes in high school.
- Girls have, on average, lower scores on 12th-grade mathematics and science achievement tests.

Underrepresented Minorities

Relatively fewer African Americans and Hispanic Americans complete bachelor's degrees in natural science and engineering majors.

African Americans account for:

- 11% of 18- and 19-year-old college freshmen,
- 11% of freshmen planning to major in natural science and engineering, and
- less than 6% of bachelor's degrees with majors in natural science and engineering.

Hispanic Americans account for:

- 8% of 18- and 19-year-old college freshmen,
- 8% of freshmen planning to major in natural science and engineering, and
- less than 5% of the bachelor's degrees with majors in natural science and engineering.

African Americans and Hispanic Americans have less preparation in mathematics and natural science.

- African Americans and Hispanic Americans have, on average, lower mathematics achievement scores by the 4th grade; these differences continue through the 12th grade.
- African Americans and Hispanic Americans take fewer advanced science and mathematics classes in high school.
- Among college freshmen majoring in natural science and engineering, higher percentages of African Americans and Hispanic Americans report a need for refresher work in mathematics and science.

Figure 1. Percentage of Total Natural Science and Engineering Bachelor's Degrees Granted to Women, African Americans, and Hispanic Americans, 1977-1992

This report provides information based on secondary data collected by Federal Government agencies and other institutions. The report does not contain value judgements or any other non-statistical interpretations of the data.

* Natural science includes physical, life, mathematical, computer, and environmental sciences, but excludes psychology and social sciences.

DISCLAIMER

**Portions of this document may be illegible
in electronic image products. Images are
produced from the best available original
document.**

Department of Energy Responsibility for Mathematics and Science Education

The Department of Energy is mandated in Public Law 101-501, "Department of Energy Science Education Enhancement Act" to conduct education programs to enhance the quality of mathematics and science education. Education programs established by the DOE strive to promote world-class quality, to support systemic education reform, and to increase participation of underrepresented populations in science, mathematics, and technology.

This OSEP Internal Report provides information on achievement and aptitude measures but makes no attempt to provide any interpretation as to why some groups have below-average test scores. *Several of the references (see endnotes) document lower test scores achieved by women and underrepresented minorities.* The interested reader can find a discussion of achievement test scores and reasons to explain why some groups lag behind in Science and Engineering Indicators—1993, Chapter 1 (endnote 9).

WOMEN UNDERREPRESENTED IN NATURAL SCIENCE AND ENGINEERING

Women Earn 31 Percent of Natural Science and Engineering Bachelor's Degrees

While women earn only 31 percent of the bachelor's degrees in natural science and engineering, they account for over one-half (52 percent) of 18- and 19-year-old college freshmen.¹ (Figures 1 and 2.) This is a modest increase in the percentage of natural science and engineering degrees earned by women in earlier years.

Figure 2. Females as a Percentage of All Students, 1986 and 1992

Fewer Freshmen Women Plan to Major in Science and Engineering

Women accounted for only 29 percent of college freshmen with plans to major in a science or engineering field.² (Figure 2.) This difference is a major factor explaining why women earn fewer science and engineering degrees than do men.

Women are about as likely as men to choose a major in some fields such as biology and mathematics. Women choose other natural science and engineering majors much less frequently than men, especially engineering where only about one in five freshmen are women.³

Women Have Higher Completion Rates Than Men for Natural Science and Engineering Majors

While a smaller percentage of women than men plan science or engineering majors as freshmen, the rate of completing bachelor's degrees in natural science or engineering is 59 percent for women versus 54 percent for men.⁴ Given current rates of high school graduation, college attendance, and bachelor's degree completion, if women selected natural science and engineering majors at the same rate as men, there would be over 60,000 more women earning bachelor's degrees in natural science and engineering each year.⁵

Women Indicate Less Involvement and Interest in Natural Science and Engineering in Middle School and High School

As early as the sophomore year of high school, young girls report less interest in a science or engineering college major than boys. (Figure 3.) Another indicator of early interest is time spent watching TV science programs or time

Figure 3. Interest in Natural Science and Engineering Majors and Informal Science and Technology Activities in Grades 7-11 by Gender

spent using computers outside of class. Figure 3 shows that girls report less involvement of this type as early as the 7th and 8th grades.⁶

Women Have Less Precollege Preparation in Mathematics and Science

The National Assessment of Educational Progress test scores indicate that girls' average test scores in math and science are only slightly lower than those of boys for 9-, 13-, and 17-year-olds. The gaps are slightly greater at age 17.⁷ (Figures 4 and 5.)

Figure 4. Math Proficiency of 9-, 13-, and 17-Year-Olds, 1982 and 1992

Figure 5. Science Proficiency of 9-, 13-, and 17-Year-Olds, 1982 and 1992

Women take advanced math courses in high school as frequently as men. (Figure 6.) However, women are less likely to take a high school science course curriculum that includes biology, chemistry, and physics.⁸ (Figure 7.) Women's average SAT math test scores are lower than men's. Fewer women than men score at least 550 on the SAT math test.⁹ (Figure 8.)

Many college freshmen have academic deficiencies requiring remediation prior to standard college coursework. Female freshmen report that they need remedial work in mathematics and science more frequently than other freshmen.¹⁰ (Figure 9.)

Figure 6. Percentage of High School Graduates Taking Advanced Math* Courses, 1982 and 1992

* Analysis/pre-calculus

Figure 7. Percentage of High School Graduates Taking Advanced Science* Courses, 1982 and 1992

* Biology, chemistry, physics

Figure 8. Percent of Test Takers Who Scored Above 550 on the Mathematics SAT, 1987 and 1992

Figure 9. Freshmen Science and Engineering Majors Reporting Need for Remedial Work in Science or Mathematics, 1992

AFRICAN AMERICANS UNDERREPRESENTED IN NATURAL SCIENCE AND ENGINEERING

African Americans Earn Less Than 6 Percent of Natural Science and Engineering Degrees

African Americans account for 15 percent of the 18- and 19-year-old population and 11 percent of the 18- and 19-year-old college freshmen.¹¹ However, they earn less than 6 percent of the bachelor's degrees in natural science and engineering.¹² (Figure 10.)

African American Freshmen Have Equal Interest in Natural Science and Engineering Majors

African Americans make up 11 percent of the college freshmen who plan a major in natural science or engineering.¹³ (Figure 10.) The proportion of African American college freshmen choosing science or engineering majors has increased substantially in recent years. They now choose science and engineering majors as frequently as other college freshmen.¹⁴

African Americans Have a Lower Completion Rate for Bachelor's Degrees

For African Americans, the completion rate of bachelor's degrees in natural science and engineering is 30 to 35 percent of the freshmen planning majors in these fields four years earlier. For all students, the completion rate is 56 percent. Thus, African Americans have lower-than-average completion rates for freshmen who planned natural science and engineering majors.¹⁵

Figure 10. African Americans as a Percentage of All Students, 1986 and 1992

African Americans Have Less Precollege Preparation in Mathematics and Science

The National Assessment of Educational Progress test scores indicate that African American students, on average, score well below the national average in mathematics and science at age 9, 13, and 17. (Figures 4 and 5.) There has been some progress in reducing the gap in NAEP test scores over the past decade, but the gap is still large.¹⁶

African Americans take advanced math and science courses in high school less frequently than all students (Figures 6 and 7.) They have made large gains in this area in recent years.¹⁷

African Americans, on average, score much lower than all students on the SAT math exam. The proportion scoring at least 550 has declined in recent years and was fewer than 5 percent in 1992.¹⁸ (Figure 8.)

African American college freshmen report that they need remedial work in mathematics and science more frequently than all college freshmen.¹⁹ (Figure 9.)

HISPANIC AMERICANS UNDERREPRESENTED IN NATURAL SCIENCE AND ENGINEERING

Hispanic Americans Earn Less Than 5 Percent of Natural Science and Engineering Degrees

Hispanic Americans account for 12 percent of the 18- and 19-year-old population, and 8 percent of the 18- and 19-year-old college freshmen. However, they earn less than 5 percent of the bachelor's degrees in natural science and engineering.²⁰ (See Figure 11.)

Figure 11. Hispanic Americans as a Percentage of All Students, 1986 and 1992

Hispanic American Freshmen Have Equal Interest in Natural Science and Engineering Majors

Hispanic Americans account for nearly 8 percent of the college freshmen who plan a major in natural science and engineering.²¹ (Figure 11.) Thus, Hispanic American freshmen choose science and engineering majors as frequently as other freshmen.

Hispanic Americans Have a Lower Completion Rate Than Other Natural Science and Engineering Majors

For Hispanic Americans, the completion rate of bachelor's degrees in natural science and engineering is 35 to 40 percent of the freshmen planning majors in these fields four years earlier. For all students, the completion rate is 56 percent. Thus, Hispanic Americans have lower-than-average completion rates for freshmen who planned natural science and engineering majors.²²

Hispanic Americans Have Less Precollege Preparation in Mathematics and Science

The National Assessment of Educational Progress test scores indicate that Hispanic American students, on average, score below the national average in mathematics and science at age 9, 13, and 17. There has been some progress in reducing the gap in test scores in recent years, but a gap still exists.²³ (Figures 4 and 5.)

Hispanic Americans take advanced math and science courses in high school much less frequently than all students. (Figures 6 and 7.) Hispanics have made large gains in this area in recent years, but so have other students.²⁴

Hispanic Americans, on average, score lower than all students on the SAT math exam. The proportion scoring at least 550 is only 15 percent of Hispanic American test takers, well below the 28 percent of all test takers scoring that high.²⁵ (Figure 8.)

Hispanic American college freshmen report that they need remedial work in mathematics and science more frequently than all college freshmen.²⁶ (Figure 9.)

Endnotes

1. U.S. Department of Commerce, Bureau of the Census, School Enrollment—Social and Economic Characteristics of Students: October 1992, Current Population Reports, pp. 20-474. Also, National Science Foundation, CASPAR Database System, Version 4.4.
2. Cooperative Institutional Research Program, American Council on Education and the University of California, Los Angeles, The American Freshman: National Norms for Fall 1992, cited in Professional Women and Minorities (Washington, D.C.: Commission on Professionals in Science and Technology, January 1994), p. 20.
3. The American Freshman: National Norms for Fall 1992.
4. OSEP Internal Report: Education Assessment, "The Shortfall of Underrepresented Groups Among Natural Science and Engineering Bachelor's Degree Recipients," In draft, February 1995.
5. OSEP Internal Report: Education Assessment, "The Shortfall of Underrepresented Groups Among Natural Science and Engineering Bachelor's Degree Recipients," In draft, February 1995.
6. National Science Foundation, Indicators of Science and Mathematics Education 1992, ed. Larry E. Suter, (Washington, D.C.: National Science Foundation, 1993), (NSF 93-95), pp. 258-260. Also, ORISE tabulations of High School and Beyond survey data.
7. U.S. Department of Education, National Center for Education Statistics, The Condition of Education, 1994 (NCES 94-149), (Washington, D.C. 1994), pp. 54, 56.
8. The Condition of Education, 1994, pp. 242-243.
9. National Science Board, Science and Engineering Indicators—1993 (NSB 93-1) (Washington, D.C.: U.S. Government Printing Office, 1993), pp. 240-245.
10. Science and Engineering Indicators—1993, p. 267.
11. U. S. Department of Commerce, Bureau of the Census, School Enrollment—Social and Economic Characteristics of Students: October 1992, Current Population Reports, pp. 20-474.
12. National Science Foundation, CASPAR Database System, Version 4.4.
13. Science and Engineering Indicators—1993, p. 262, and School Enrollment—Social and Economic Characteristics of Students: October 1992.
14. Science and Engineering Indicators—1993, p. 262.
15. OSEP Internal Report: Education Assessment, "The Shortfall of Underrepresented Groups Among Natural Science and Engineering Bachelor's Degree Recipients," In draft, February 1995.
16. The Condition of Education, 1994, pp. 54-57.
17. The Condition of Education, 1994, pp. 242-243.
18. Science and Engineering Indicators—1993, pp. 240-245.
19. Science and Engineering Indicators—1993, p. 267.
20. U. S. Department of Commerce, Bureau of the Census, School Enrollment—Social and Economic Characteristics of Students: October 1992, Current Population Reports, pp. 20-474. Also, National Science Foundation, CASPAR Database System, Version 4.4.
21. Science and Engineering Indicators—1993, p. 262, and School Enrollment—Social and Economic Characteristics of Students: October 1992.
22. OSEP Internal Report: Education Assessment, "The Shortfall of Underrepresented Groups Among Natural Science and Engineering Bachelor's Degree Recipients," In draft, February 1995.
23. The Condition of Education, 1994, pp. 54-57.
24. The Condition of Education, 1994, pp. 242-243.
25. Science and Engineering Indicators—1993, pp. 240-245.
26. Science and Engineering Indicators—1993, p. 267.

This report provides information based on secondary data collected by Federal Government agencies and other institutions. The report does not contain value judgements or any other non-statistical interpretations of the data.

Prepared by:

Oak Ridge Institute for Science and Education
Science/Engineering Education Division
Analysis and Evaluation Programs
P. O. Box 117
Oak Ridge, TN 37831-0117

The Oak Ridge Institute for Science and Education (ORISE) was established by the U.S. Department of Energy to undertake national and international programs in science and engineering education, training and management systems, energy and environment systems, and medical sciences. ORISE and its programs are operated by Oak Ridge Associated Universities (ORAU) through a management and operating contract with the U.S. Department of Energy. Established in 1946, ORAU is a consortium of 88 colleges and universities.

These programs are administered by the Science/Engineering Education Division under contract number DE-AC05-76OR00033 between the U.S. Department of Energy and Oak Ridge Associated Universities.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.