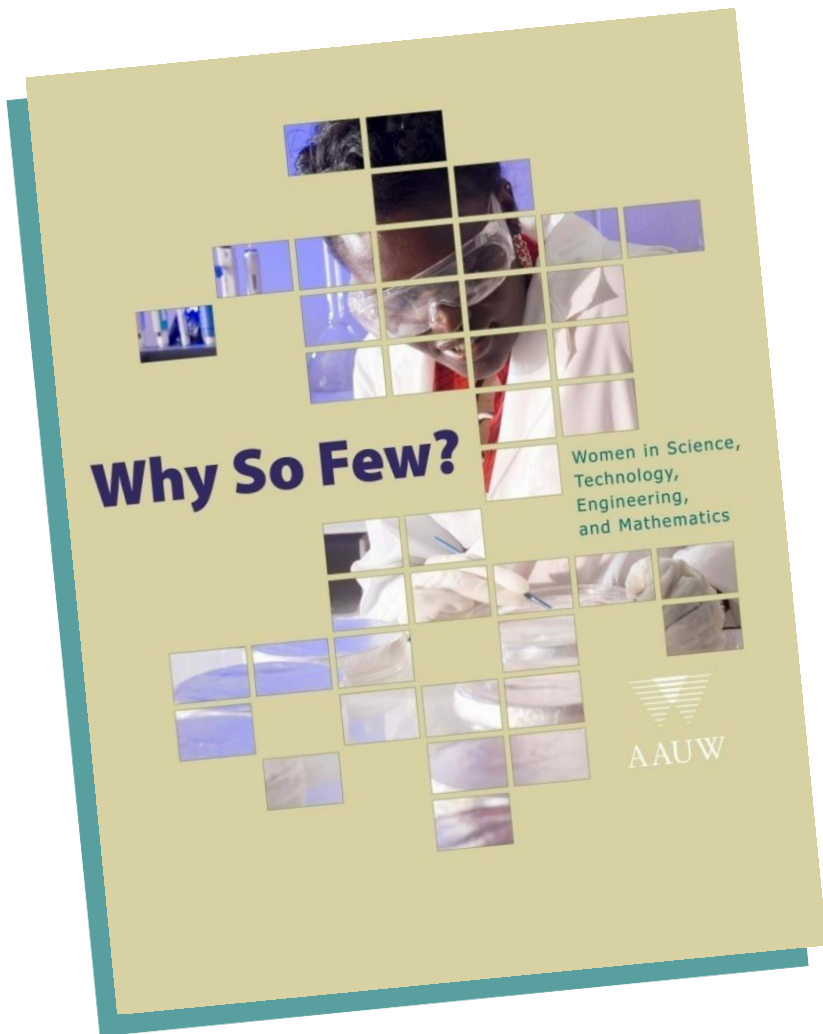




AAUW

Breaking through Barriers

for Women and Girls



Why So Few? Women in Science, Technology, Engineering, and Mathematics



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The Letitia Corum Memorial Fund

The Mooneen Lecce Giving Circle

The Eleanor Roosevelt Fund



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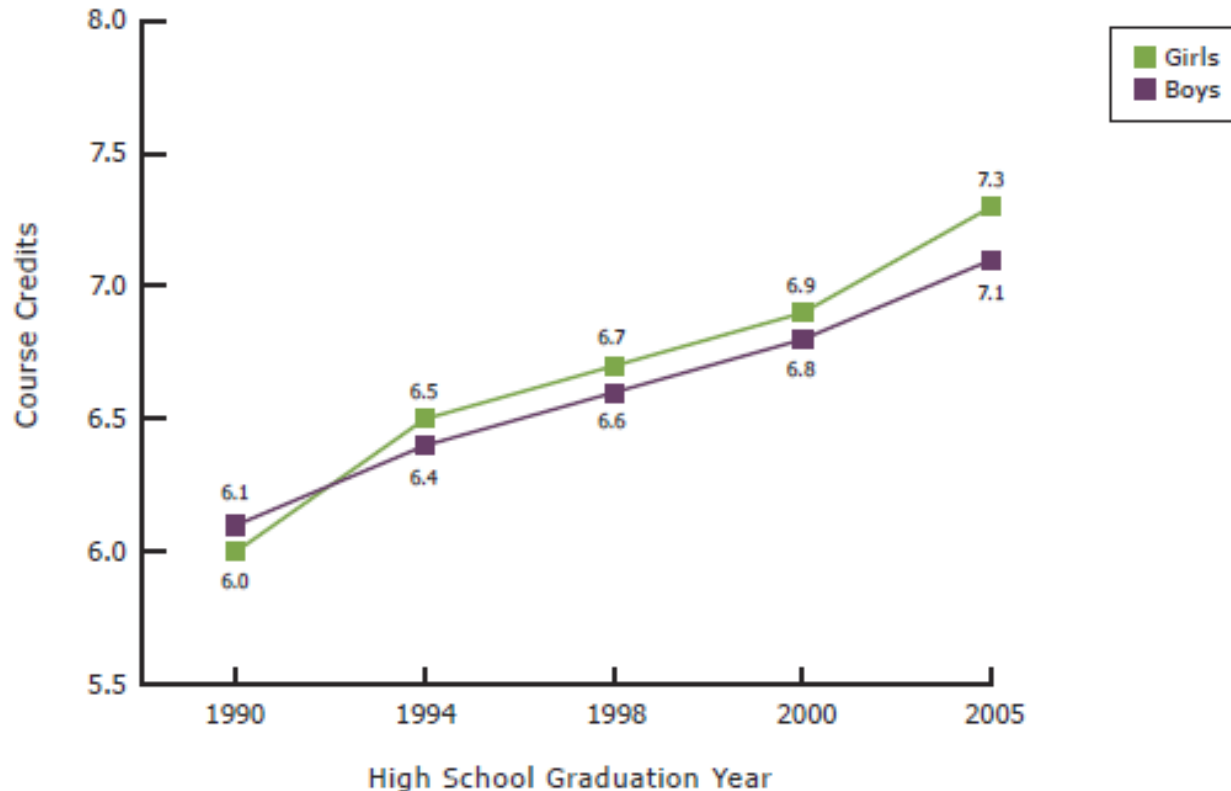
Girls' performance and participation in math and science subjects in high school has improved over time and, in some cases, has surpassed that of boys.



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In high school, both boys and girls are earning more credits in math and science over time, and girls earn more credits than boys do.

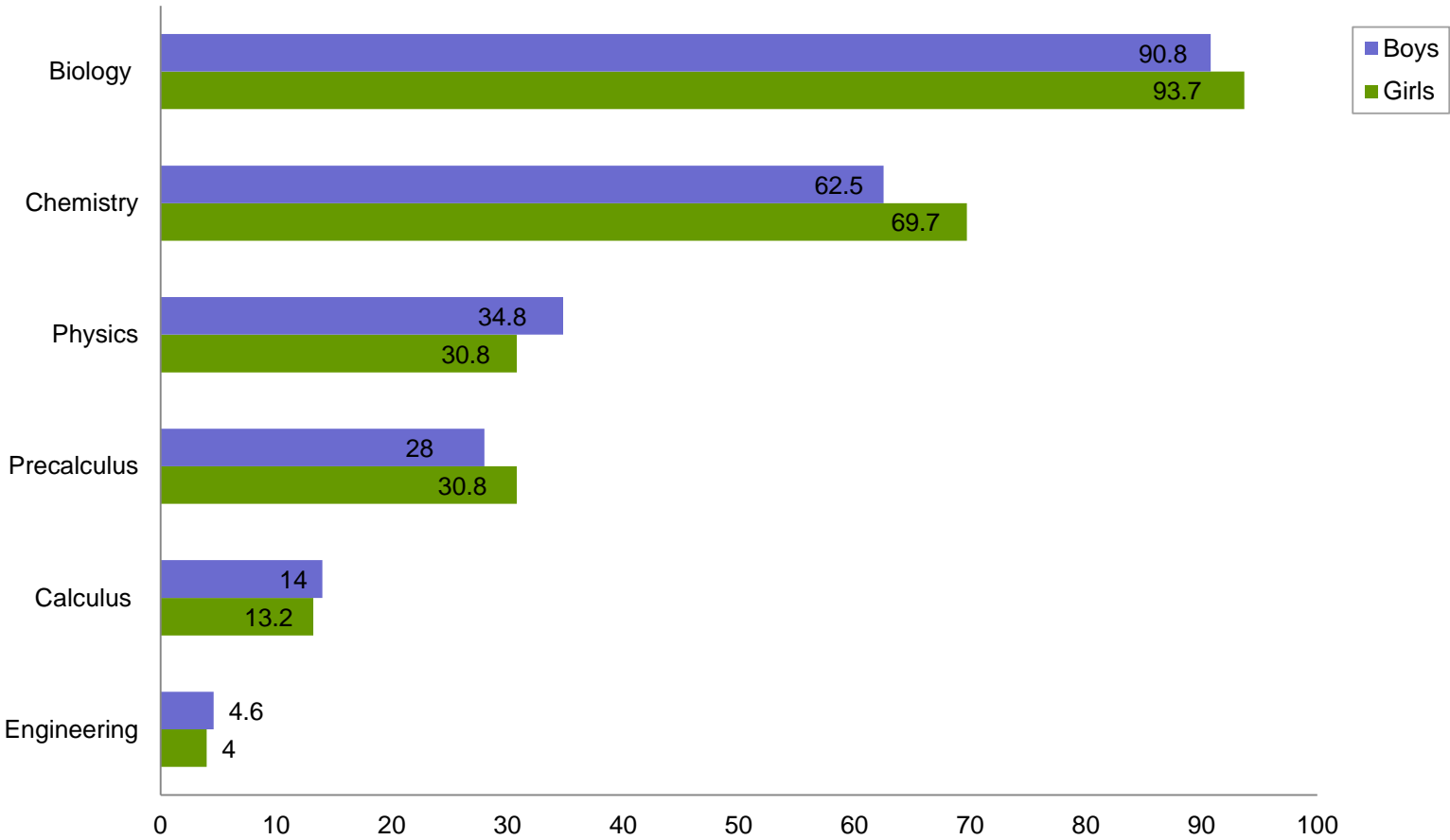
High School Credits Earned in Math and Science, by Gender, 1990–2005



Source: U.S. Department of Education, National Center for Education Statistics, 2007, *The Nation's Report Card: America's high school graduates. Results from the 2005 NAEP High School Transcript Study*, by C. Shettle et al. (NCES 2007-467) (Washington, DC: Government Printing Office).

High school girls are more likely to take biology, chemistry, and pre-calculus than boys are, but girls are less likely to take physics.

Percentage of High School Graduates Who Took Selected Math and Science Courses in High School, by Gender, 2005

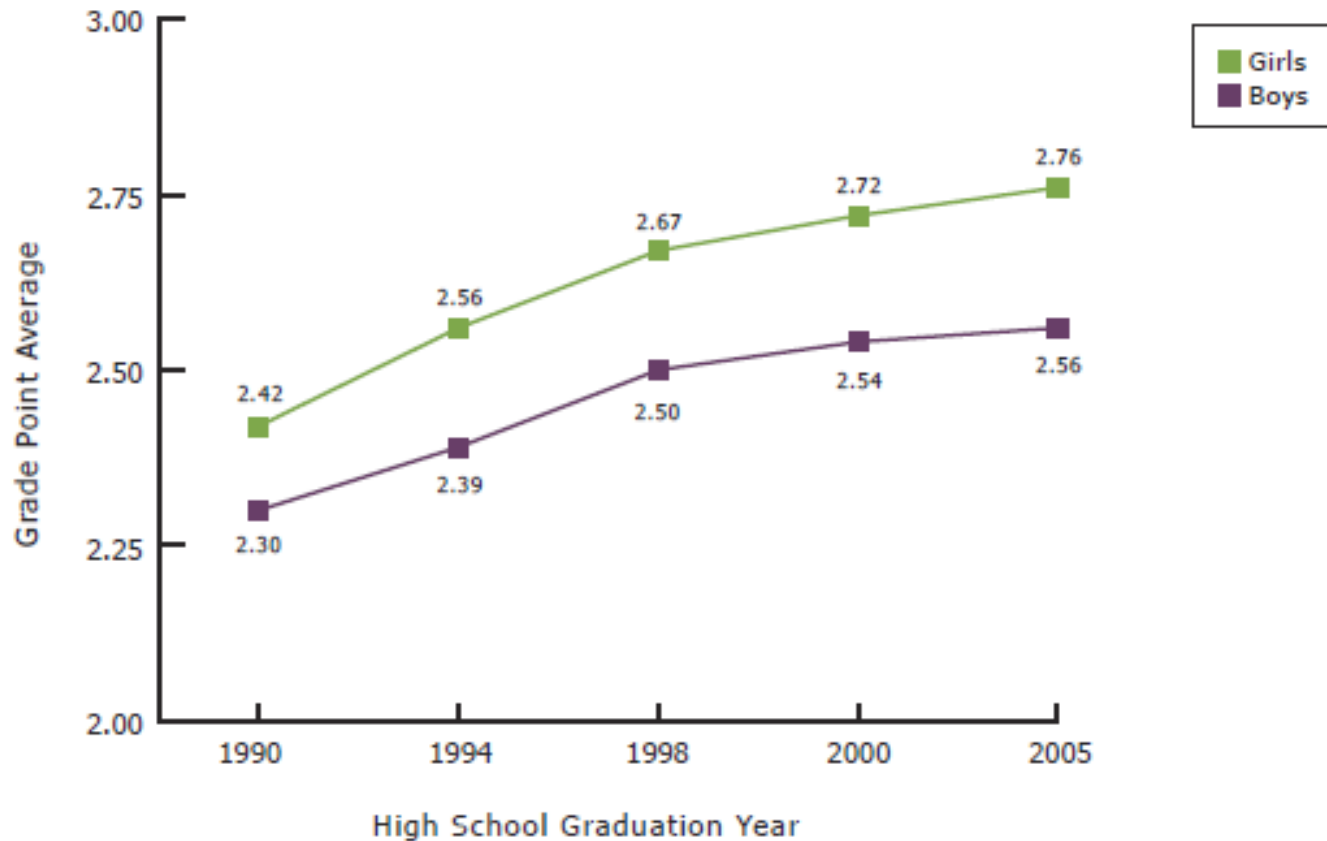


Source: National Center for Education Statistics. (2007). *Digest of Education Statistics*.



Female high school graduates now also earn higher GPAs, on average, in math and science, than their male peers do.

Grade Point Average in High School Mathematics and Science (Combined), by Gender, 1990–2005



Source: U.S. Department of Education, National Center for Education Statistics, 2007, *The Nation's Report Card: America's high school graduates: Results from the 2005 NAEP High School Transcript Study*, by C. Shettle et al. (NCES 2007-467) (Washington, DC: Government Printing Office).

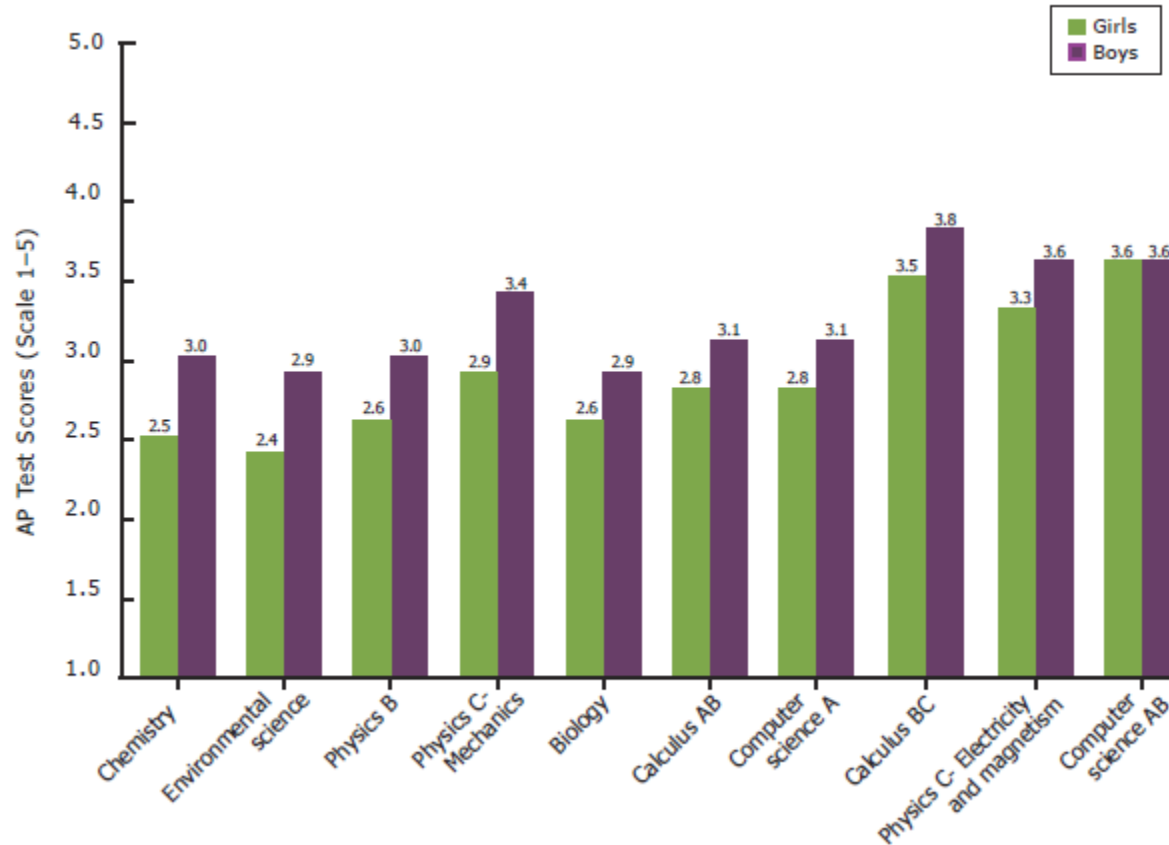
Girls' participation and performance on high-stakes tests in math and science in high school are also improving over time, although boys perform better on average.



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On average, boys perform better than girls do on Advanced Placement (AP) tests in math and science.

Average Scores on Advanced Placement Tests in Mathematics and Science Subjects, by Gender, 2009



Source: Retrieved November 11, 2009, from the College Board website at www.collegeboard.com.

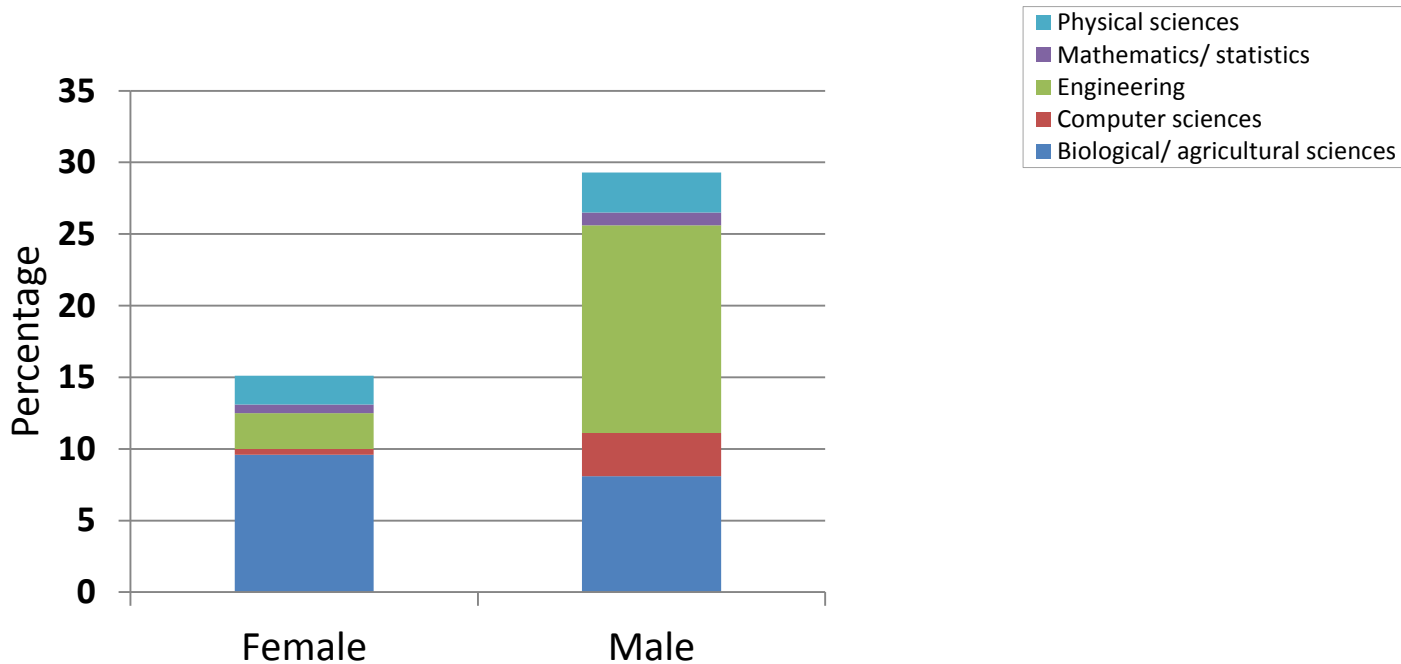
Despite the positive trends in high school, the transition from high school to college is a critical time for young women in STEM (science, technology, engineering, and mathematics).



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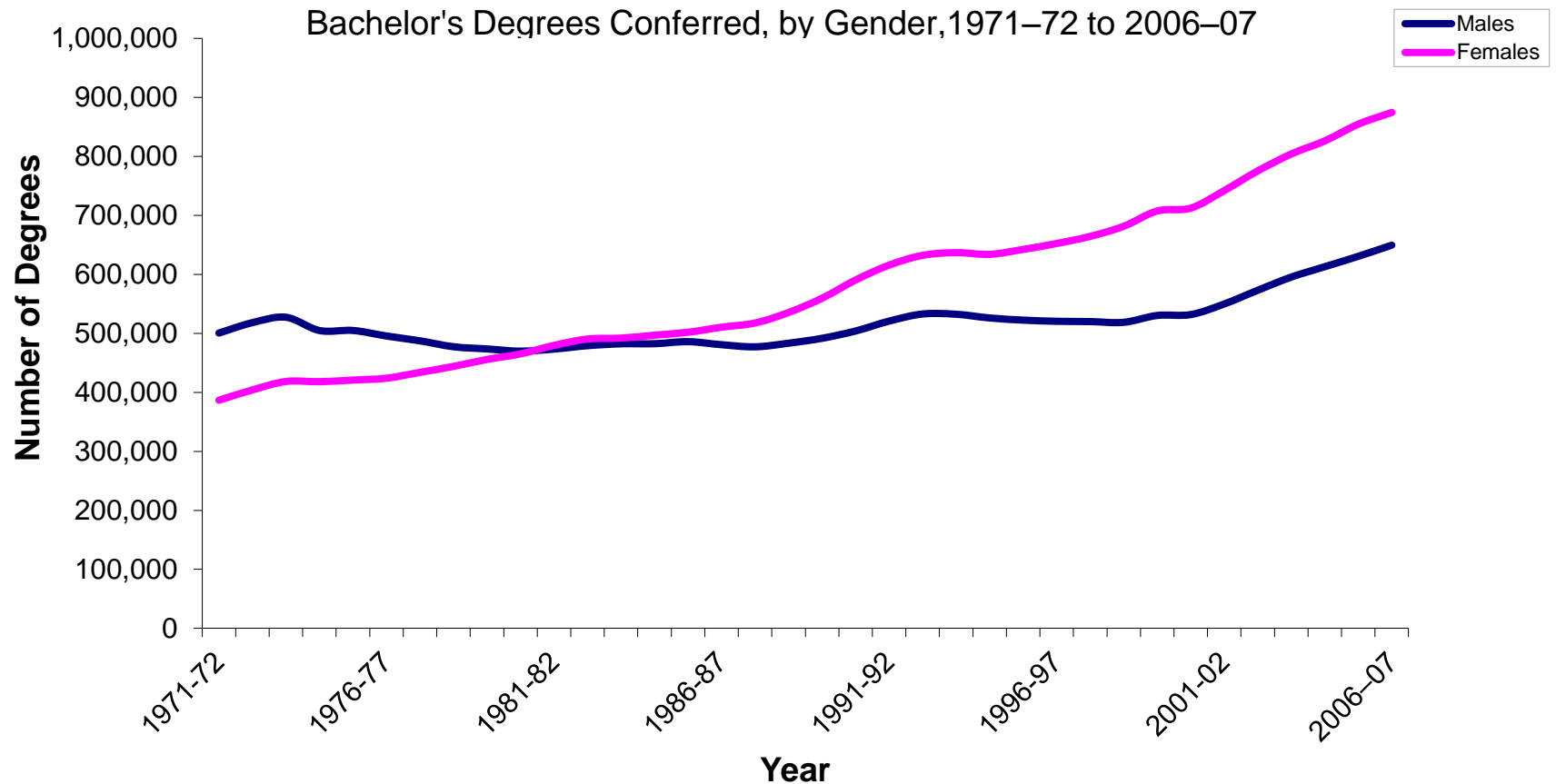
Women are less likely than men are to declare a STEM major in college.

Intent of First-Year College Students to Major in Science and Engineering Fields, by Gender, 2006



Source: Commission on Professionals in Science and Technology. Data derived from Cooperative Institutional Research Program, Higher Education Research Institute, Graduate School of Education and Information Studies, University of California, Los Angeles, *The American Freshman: National Norms for Fall 1990 through Fall 2006*, www.gseis.ucla.edu/heri/heri.htm.

Women have earned the majority of bachelor's degrees since 1982.



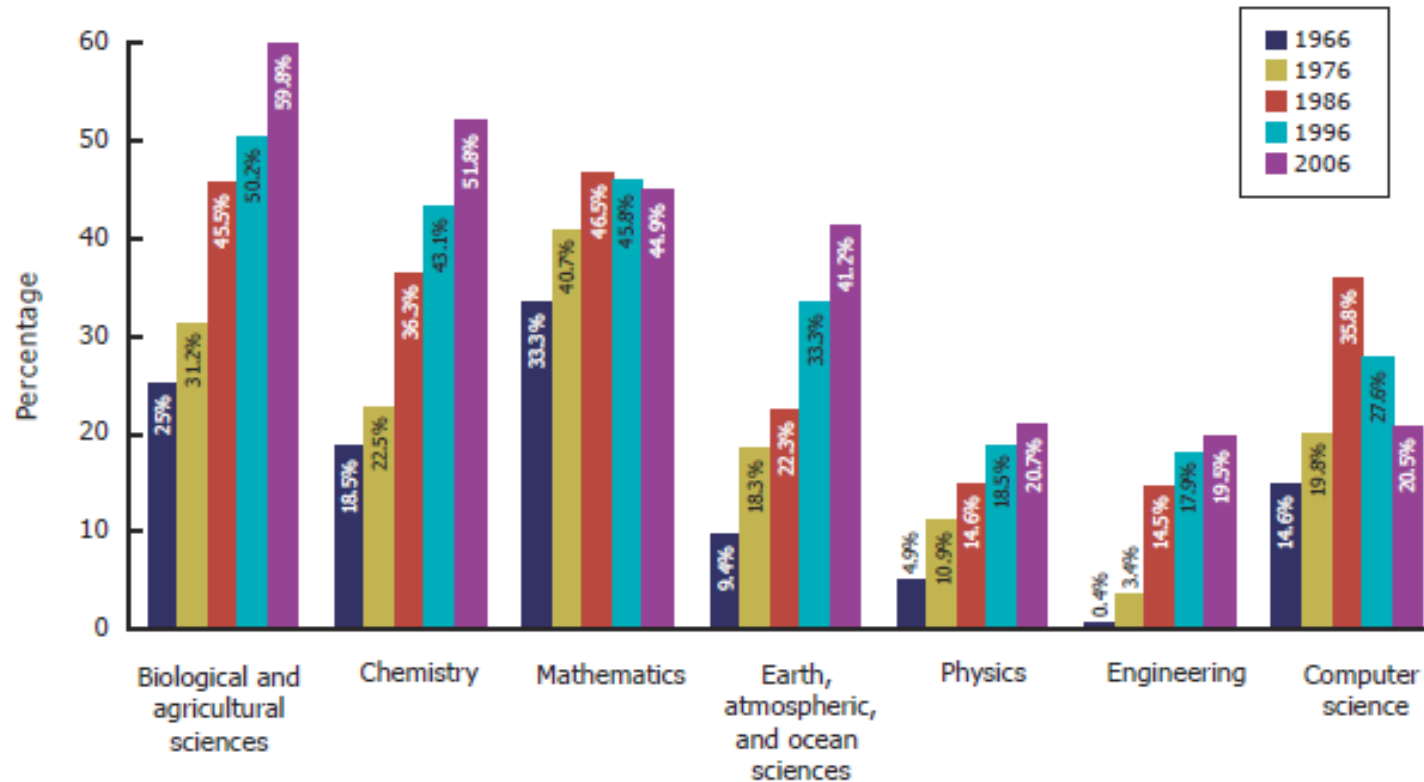
Source: Snyder, T.D., Dillow, S.A., and Hoffman, C.M. (2009). *Digest of Education Statistics 2008 (NCES 2009-020)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.



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Women's representation among STEM bachelor's degree holders has improved over time but varies by field.

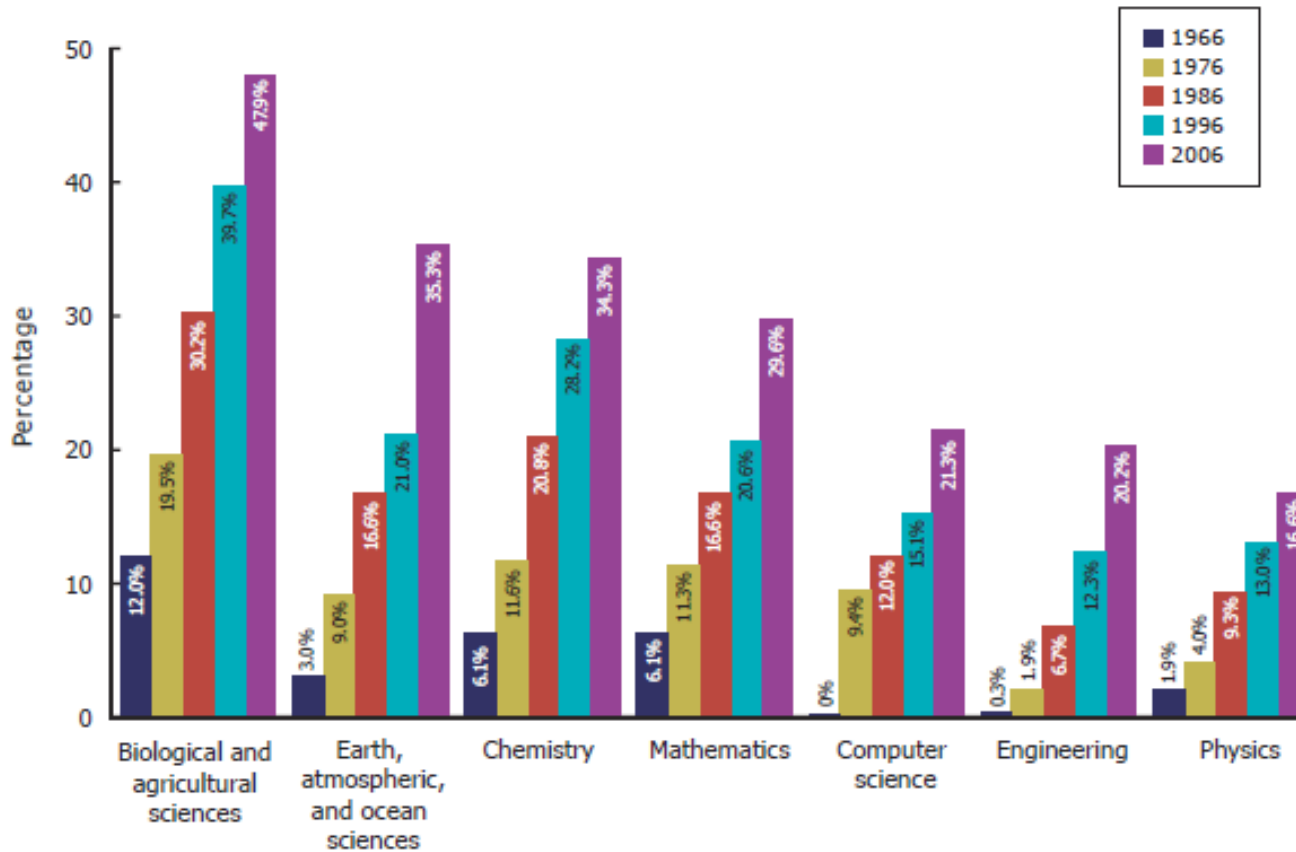
Bachelor's Degrees Earned by Women in Selected Fields, 1966–2006



Source: National Science Foundation, Division of Science Resources Statistics, 2008, *Science and engineering degrees: 1966–2006* (Detailed Statistical Tables) (NSF 08-321) (Arlington, VA), Table 11, Author's analysis of Tables 34, 35, 38, & 39.

Women's representation among STEM doctorates has also increased dramatically over time, although it varies by field.

Doctorates Earned by Women in Selected STEM Fields, 1966–2006



Source: National Science Foundation, Division of Science Resources Statistics, 2008, *Science and engineering degrees: 1966–2006* (Detailed Statistical Tables) (NSF 08-321) (Arlington, VA), Table 25, Author's analysis of Tables 34, 35, 38, & 39.

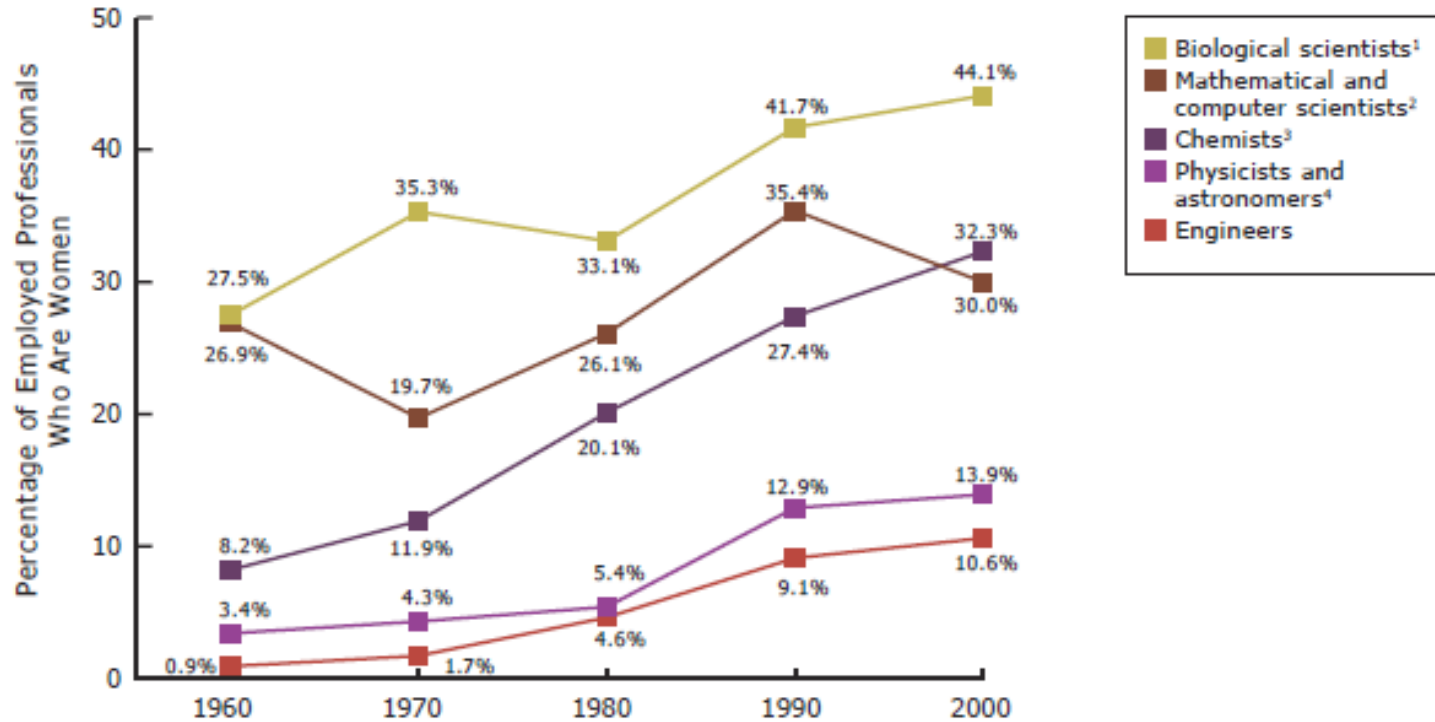
Women's representation in the
STEM workforce is also uneven.



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Women are well represented among biological scientists but makeup a small minority of engineers.

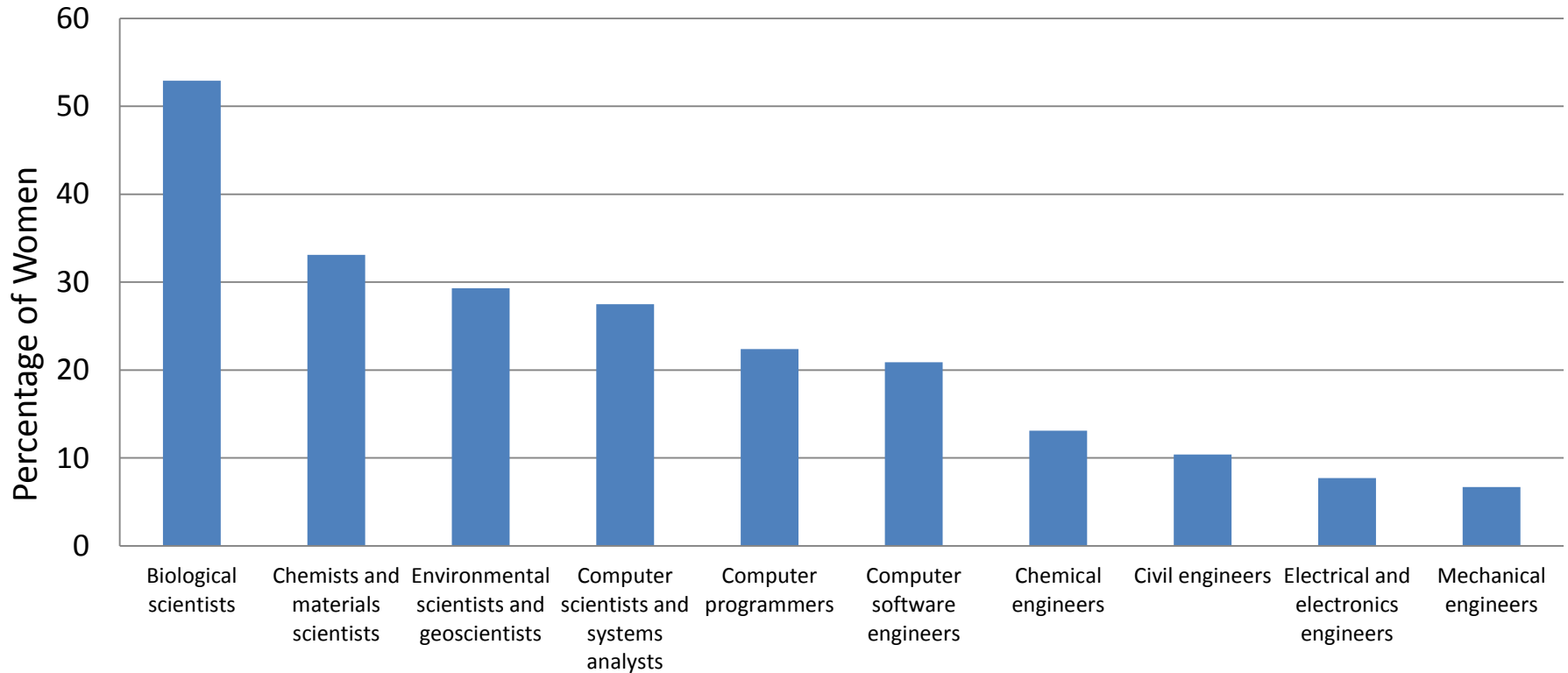
Women in Selected STEM Occupations, 1960–2000



Source: U.S. Census Bureau, 1960, 1970, 1980, 1990, & 2000, Census of the population (Washington, DC).

Women are underrepresented in many science and engineering occupations.

Percentage of Employed STEM Professionals Who Are Women, Selected Professions, 2008



Source: U.S. Department of Labor, Bureau of Labor Statistics, 2009, *Women in the labor force: A databook* (Report 1018) (Washington, DC), Table 11.

AAUW drew on the large body of academic research on gender in science in a number of fields and identified eight research findings that help to explain the underrepresentation of women and girls in STEM.

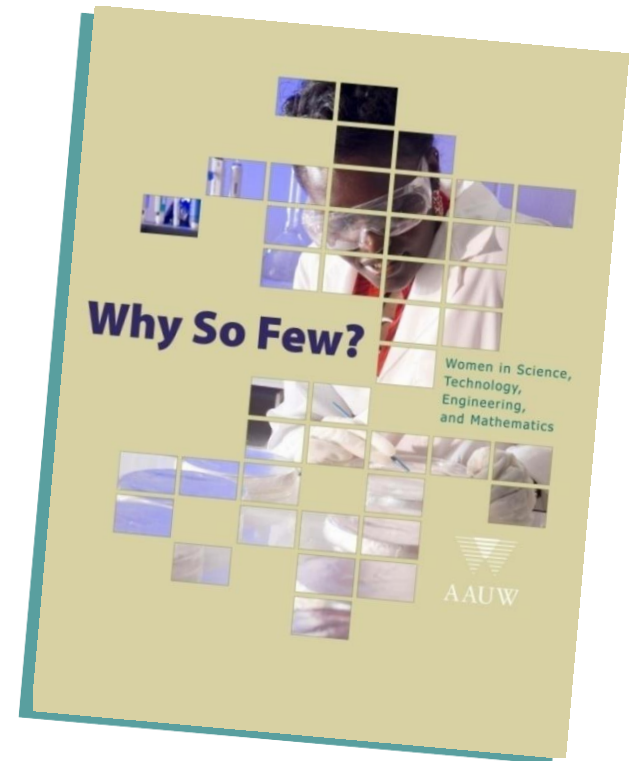


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Why So Few? presents evidence that social and environmental factors contribute to the underrepresentation of women and girls in STEM.

Eight research findings in three areas:

- How social and environmental factors shape girls' achievements and interests in math and science
- The climate of college and university science and engineering departments
- Continuing influence of bias



Girls' achievements and interests in math and science are shaped by the environment around them.



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Believing in the potential for intellectual growth, in and of itself, improves outcomes.



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In math and science, a growth mindset benefits girls.

Fixed Mindset	Growth Mindset
Intelligence is static.	Intelligence can be developed.
Leads to a desire to <i>look smart</i> and therefore a tendency to	Leads to a desire to <i>learn</i> and therefore a tendency to
• avoid challenges	• embrace challenges
• give up easily due to obstacles	• persist despite obstacles
• see effort as fruitless	• see effort as path to mastery
• ignore useful feedback	• learn from criticism
• be threatened by others' success	• be inspired by others' success

- Teach children that intellectual skills can be acquired.
- Praise children for effort.
- Highlight the struggle.
- Gifted and talented programs should send the message that they value growth and learning.

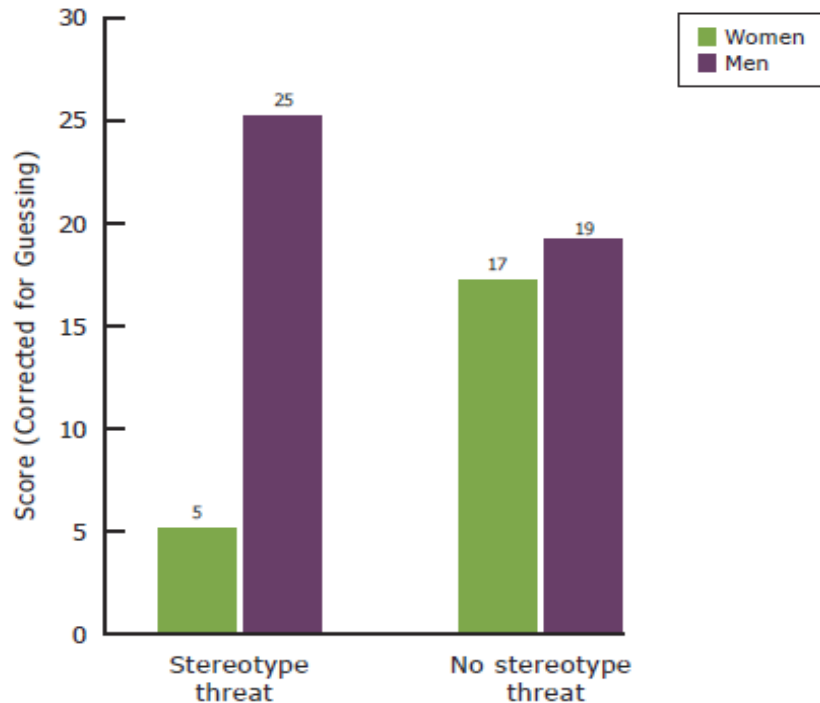
Negative stereotypes about girls' and women's abilities in math and science persist despite girls' and women's considerable gains in these areas in the last few decades.



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Negative stereotypes about girls' and women's abilities in math and science adversely affect their performance in these fields.

Performance on a Challenging Math Test,
by Stereotype Threat Condition and Gender



- Expose girls to successful female role models in math and science.
- Teach students about stereotype threat.

Source: Spencer, S. J., Steele, C. M., & Quinn, D. M., 1999, "Stereotype threat and women's math performance," *Journal of Experimental Social Psychology*, 35(1), p. 13.

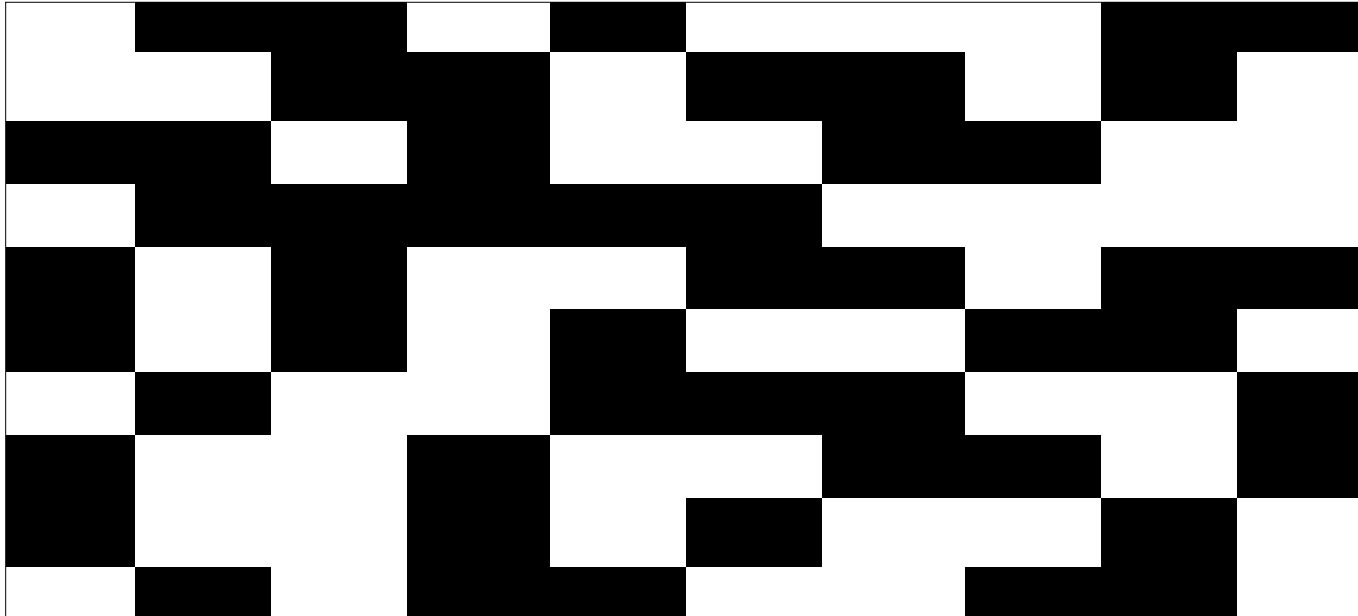
“Boys do not pursue mathematical activities at a higher rate than girls do because they are better at math. They do so, at least partially, because they think they are better.”

—Shelley Correll, professor



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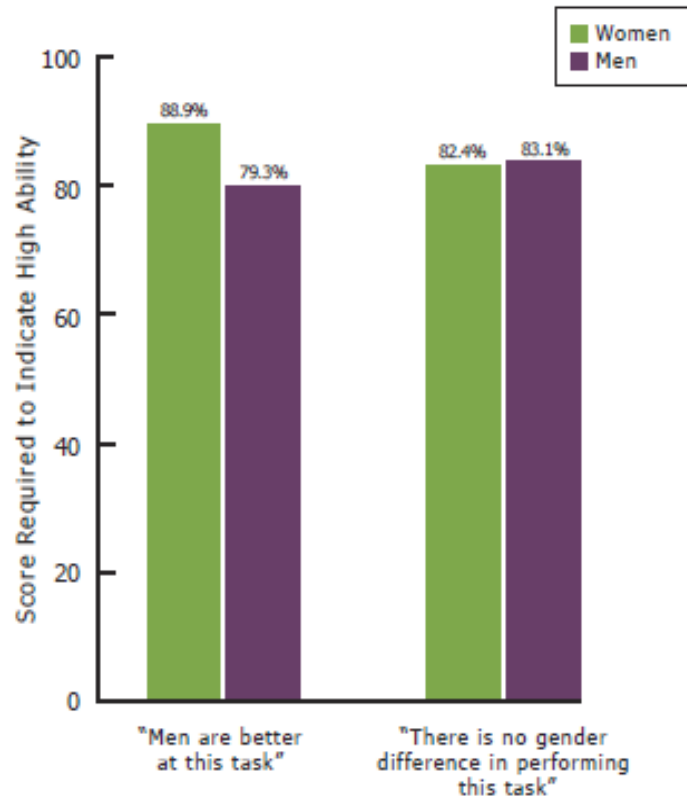
Women are “harder on themselves” when assessing their abilities in “male” fields like math and science.



Does this rectangle have more black or more white?

Women hold themselves to a higher standard compared with men in “masculine” fields.

Students' Standards for Their Own Performance, by Gender



When Subjects Are Told ...

- Set clear performance standards.
- Help girls recognize their career-relevant skills.

Note: Respondents were asked, "How high would you have to score to be convinced that you have high ability at this task?"

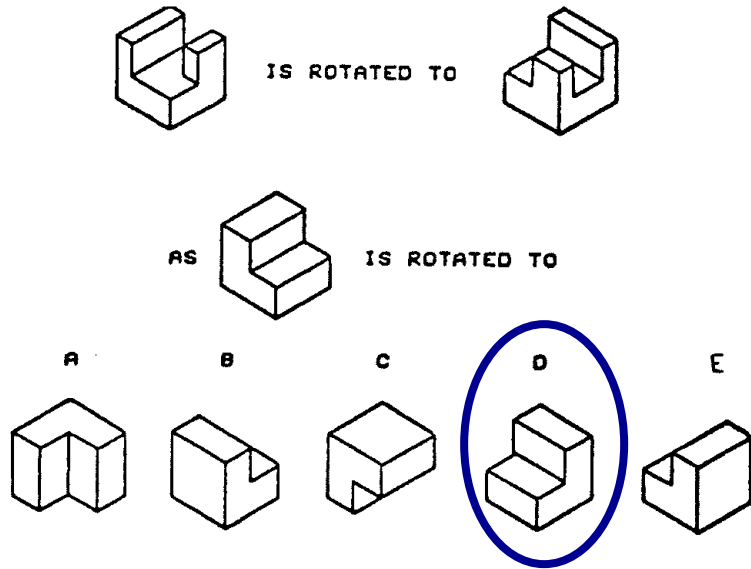
Source: Correll, S.J., 2004, "Constraints into preferences: Gender, status, and emerging career aspirations," American Sociological Review, 69, p. 106, Table 2.

One of the largest and most persistent gender gaps in cognitive skills is found in spatial skills, where boys consistently outperform girls.



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Spatial skills are not innate and can be improved with training.



This is a sample question on mental rotation.

Do you know the right answer?

Playing with building toys as well as drawing can help children develop spatial skills.



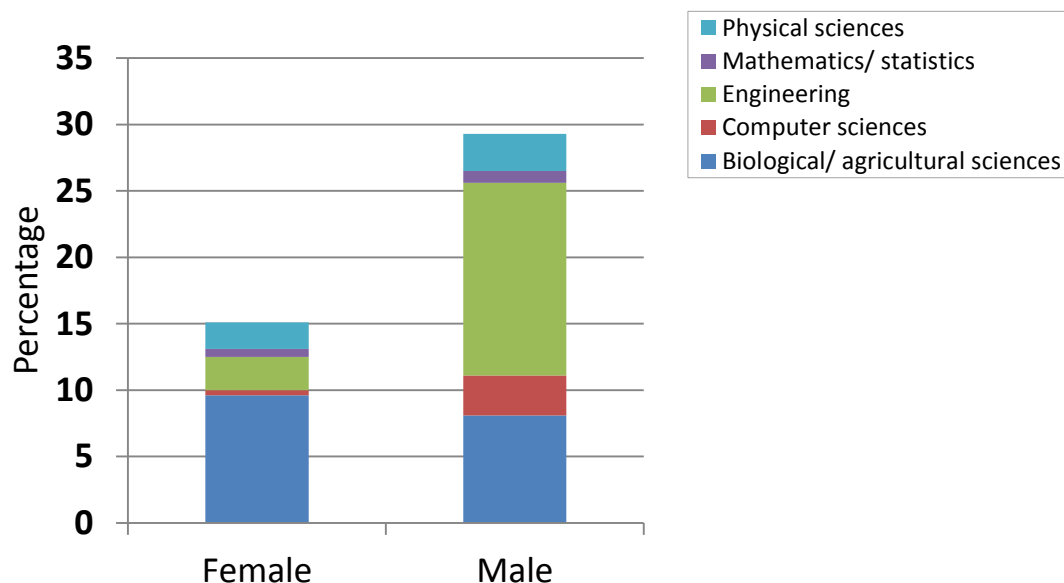
The climate of science and engineering departments at colleges and universities is especially important for women—both students and faculty.



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At colleges and universities, small changes can make a big difference in attracting and retaining women in STEM.

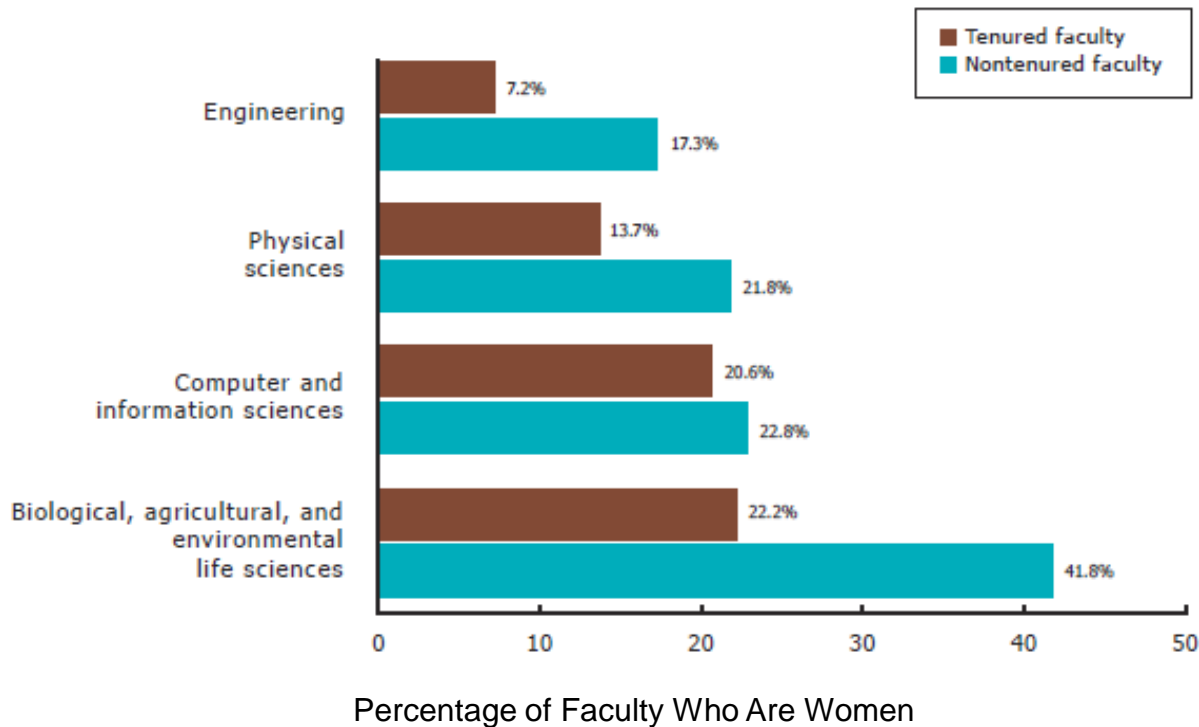
Intent of First-Year College Students to Major in Science and Engineering Fields, by Gender, 2006



- Actively recruit female students.
- Emphasize broad applications of science and engineering in introductory courses.
- Review admissions policies to ensure that departments are not unintentionally “weeding out” potentially successful students.

Source: Higher Education Research Institute, 2007, *Survey of the American freshman: Special tabulations* (Los Angeles, CA), cited in National Science Foundation, Division of Science Resources Statistics, 2009, *Women, minorities, and persons with disabilities in science and engineering: 2009 (NSF 09-305)* (Arlington, VA), Table B-8.

STEM departments in colleges and universities should focus on “fit” to improve female faculty satisfaction.



- Provide mentoring for junior faculty.
- Implement effective work-life balance policies to support faculty.

Source: National Science Foundation, Division of Science Resources Statistics, 2009, *Characteristics of doctoral scientists and engineers in the United States: 2006 (Detailed Statistical Tables) (NSF 09-317)* (Arlington, VA), Authors' analysis of Table 20.

Bias, often unconscious, limits women's progress in scientific and engineering fields.



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Even people who consciously reject negative stereotypes about women in science can still hold those beliefs at an unconscious level.

Most people associate science and math fields with “male” and humanities and arts fields with “female.”

-
- Take a test to learn about your unconscious bias at <https://implicit.harvard.edu>.
 - Take steps to address your biases.

Women in nontraditional fields can find themselves in a “double bind.”

- Women in “male” jobs are viewed as less competent than their male peers.
- When women are clearly competent, they are often considered less “likable.”

-
- Raise awareness about bias against women in STEM fields.
 - Create clear criteria for success.

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To download the report
www.aauw.org

To contact the researchers
aauw-research@aauw.org



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