Expanding Options for Women and Girls in STEM

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National Alliance for
Partnerships in Equity

Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056

Why Do We Need to Encourage Students to Study Science & Engineering?

- In the last 50 years, more than half of America's sustained economic growth was fueled by engineers, scientists and advanced-degree technologists, a mere 5% of America's 132 million-person workforce. (1)

- Aging STEM workforce- DOD, NASA and NIH STEM workers eligible to retire will more than double by 2012. (1)

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Source: See Notes Page

Why Do We Need to Encourage Students to Study Science & Engineering?

- The National Bureau of Labor Statistics projects that our greatest needs will be in computer-related fields that propel innovation across the economy. (1)

- By the year 2050, 85% of the entrants into the workforce will be people of color and women. (2)

Source: See Notes Page

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Why Do We Care if Women and Minorities Become Engineers and Scientists?

- As a consequence of a lack of diversity we pay an opportunity cost, a cost in designs not thought of, in solutions not produced.

  Source: Dr. Bill Wulf, Past President, National Academy of Engineering

- If we do not engage women and minorities in the engineering enterprise, we are ignoring more than 50% of America's intellectual talent.

  Source: Bostonworks.com

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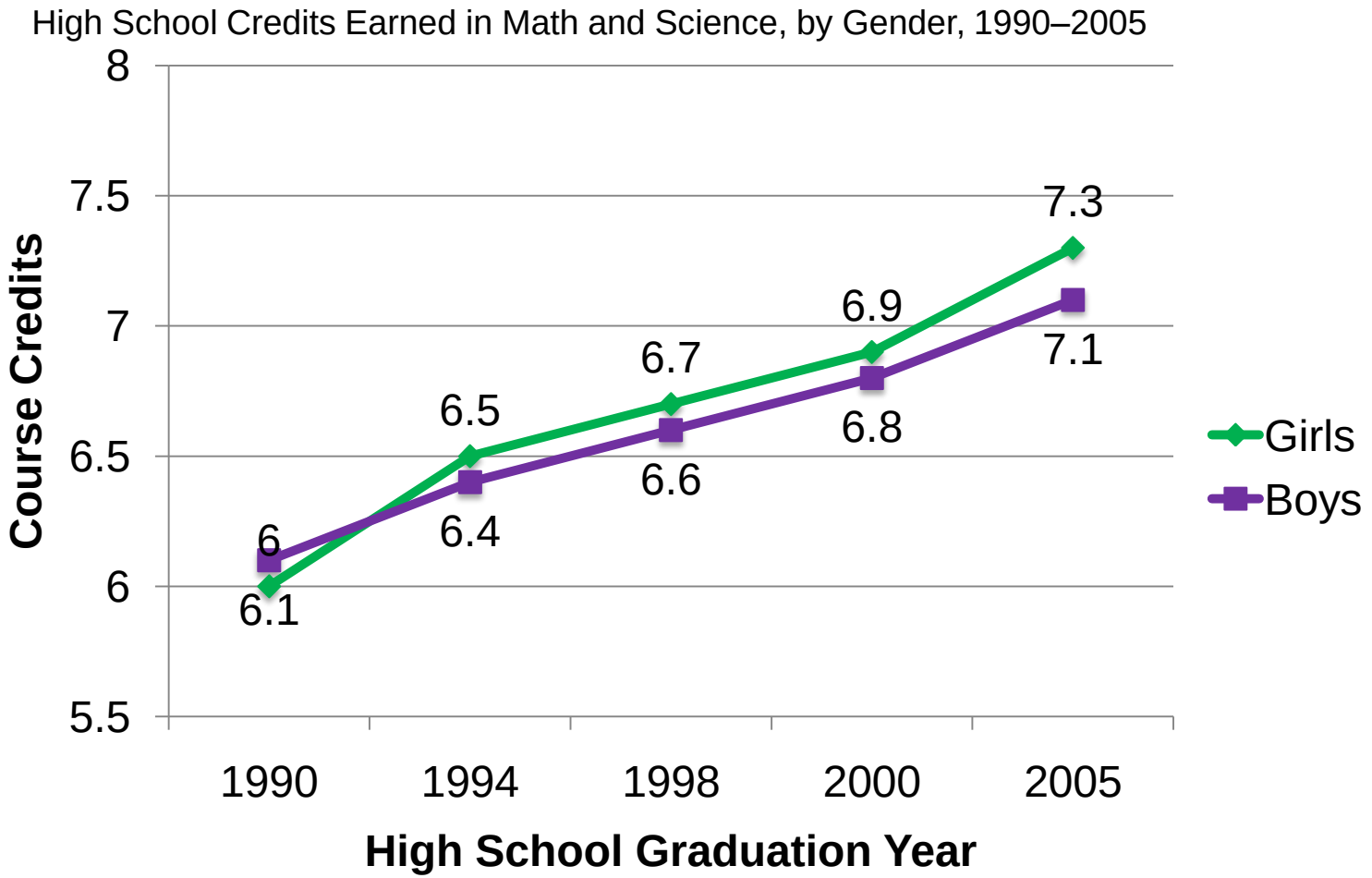
In high school, both boys and girls are earning more credits in math and science over time, and girls earn more credits than boys do.



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).

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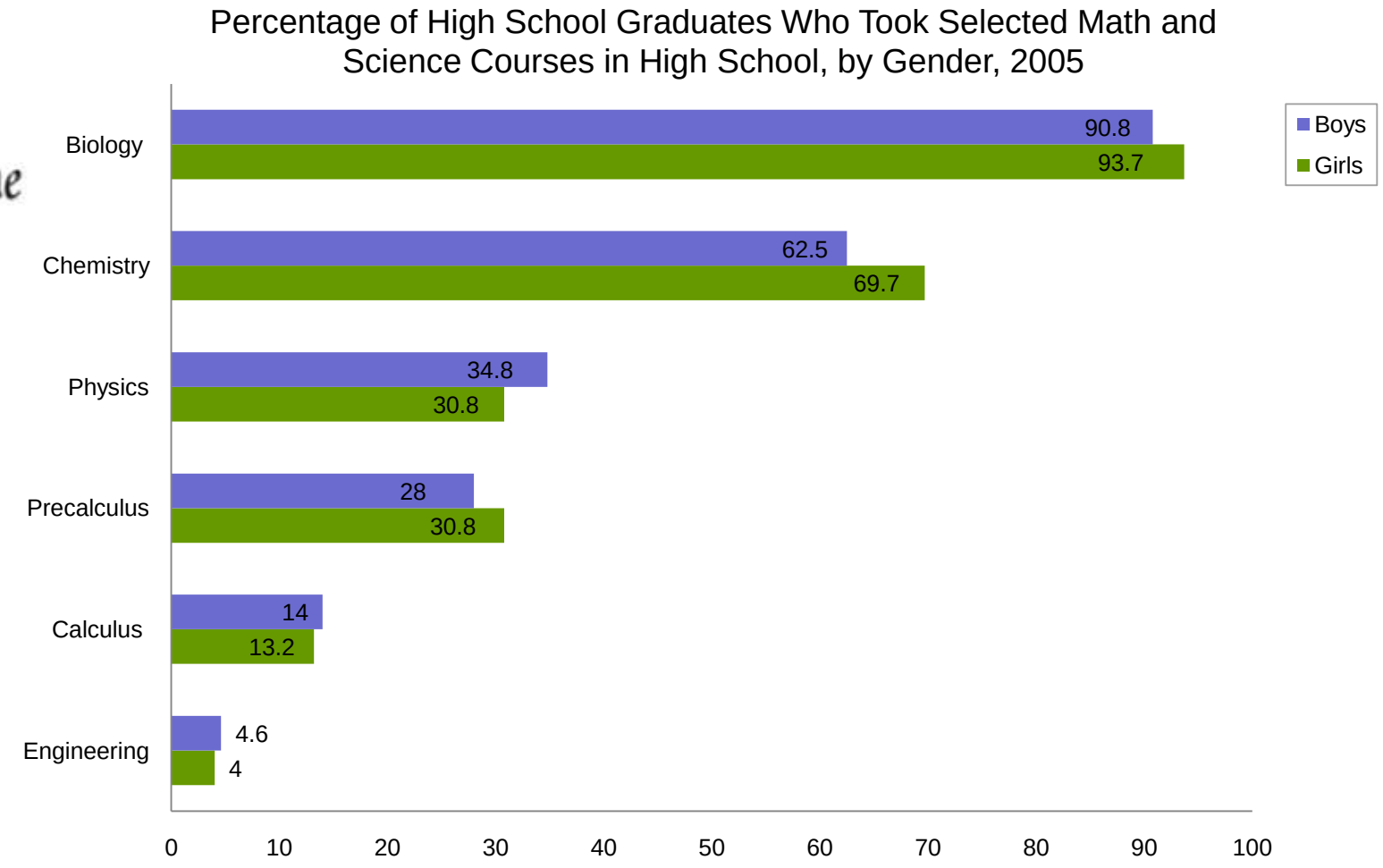
High school girls are more likely to take biology, chemistry, and pre-calculus than boys are, but girls are less likely to take physics.



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

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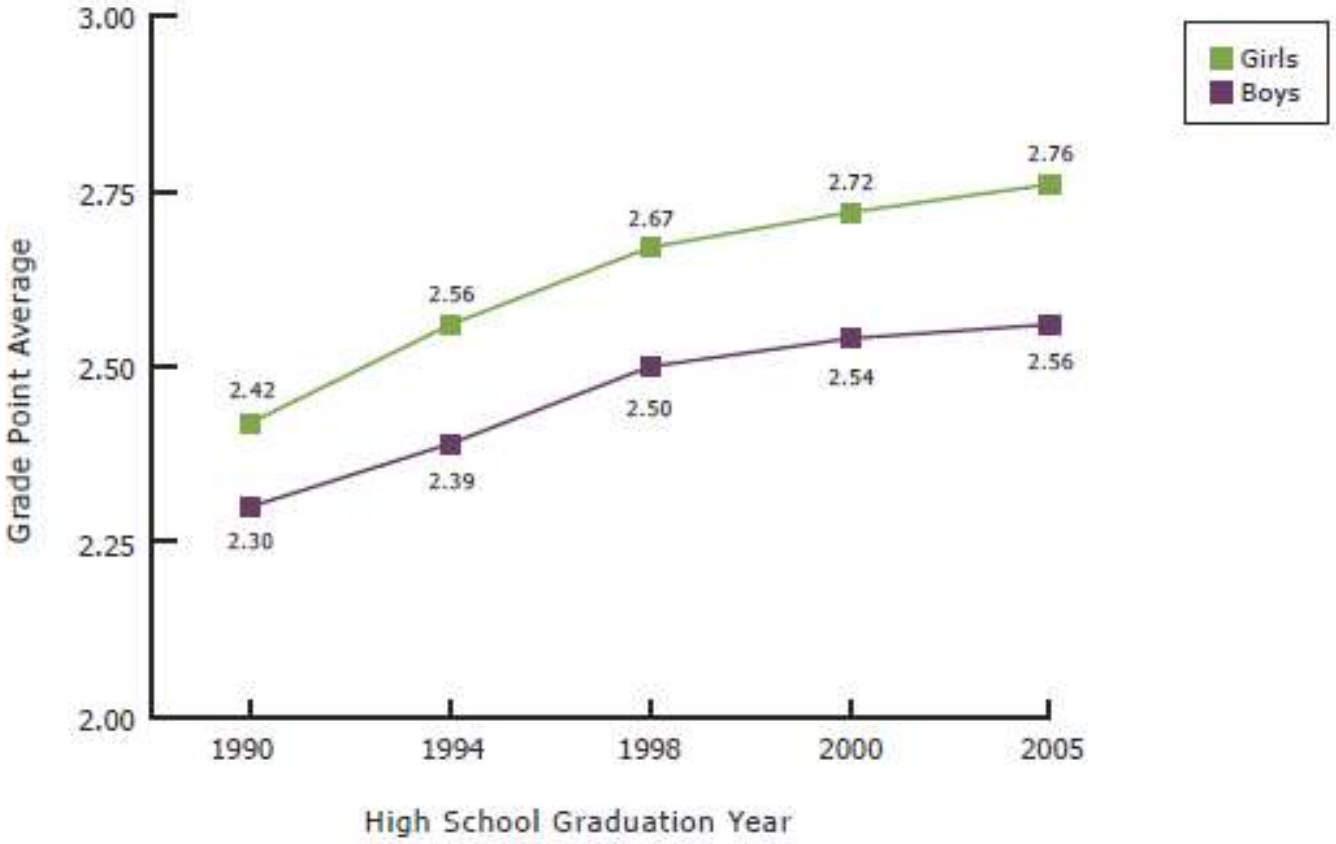
Female high school graduates now also earn higher GPAs, on average, in math and science, than their male peers do.

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



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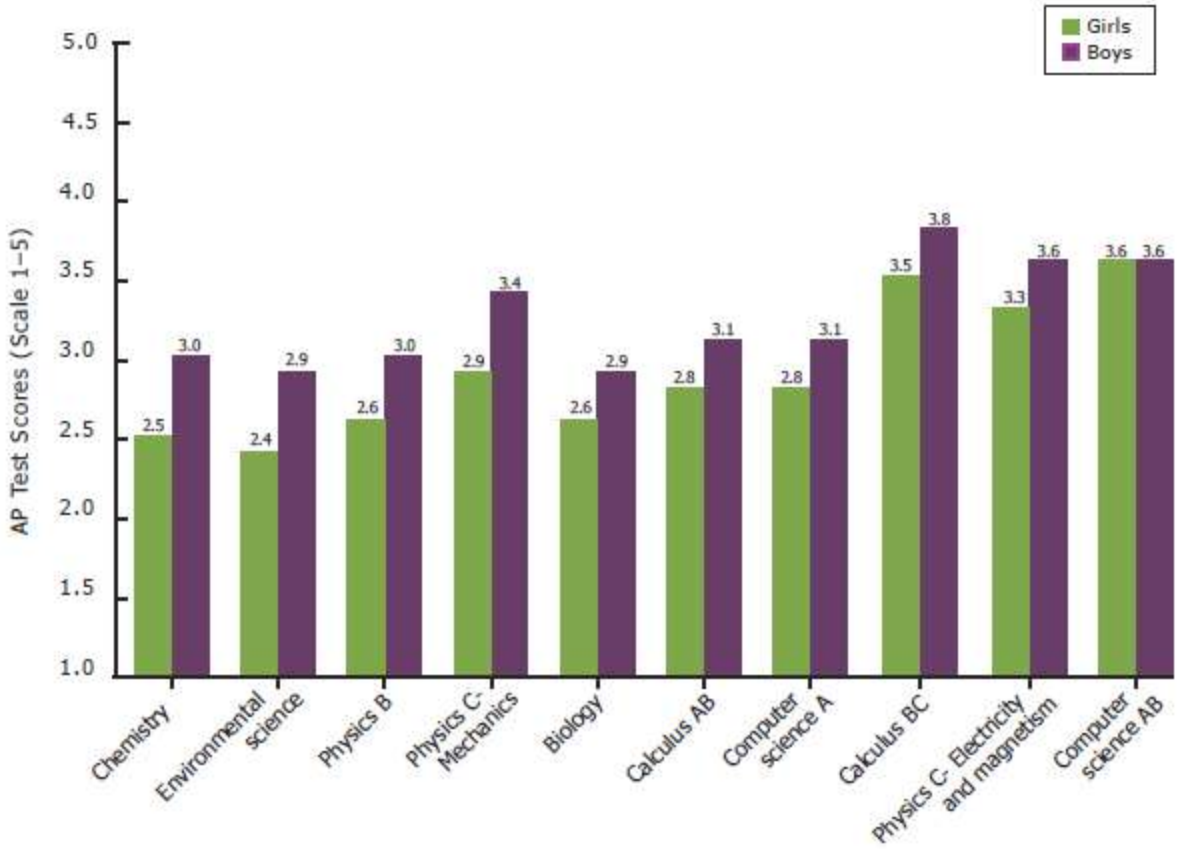
On average, boys perform better than girls do on Advanced Placement (AP) tests in math and science.

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.

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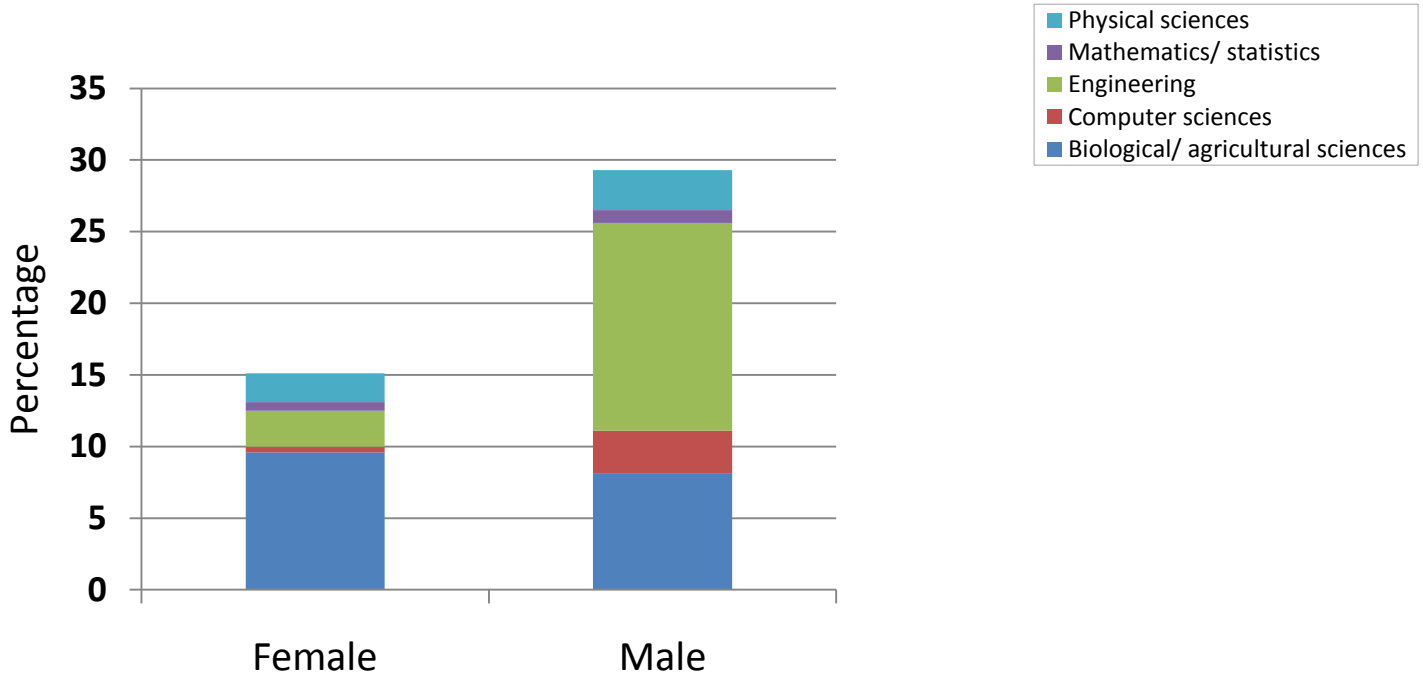
Women are less likely than men are to declare a STEM major in college.

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.

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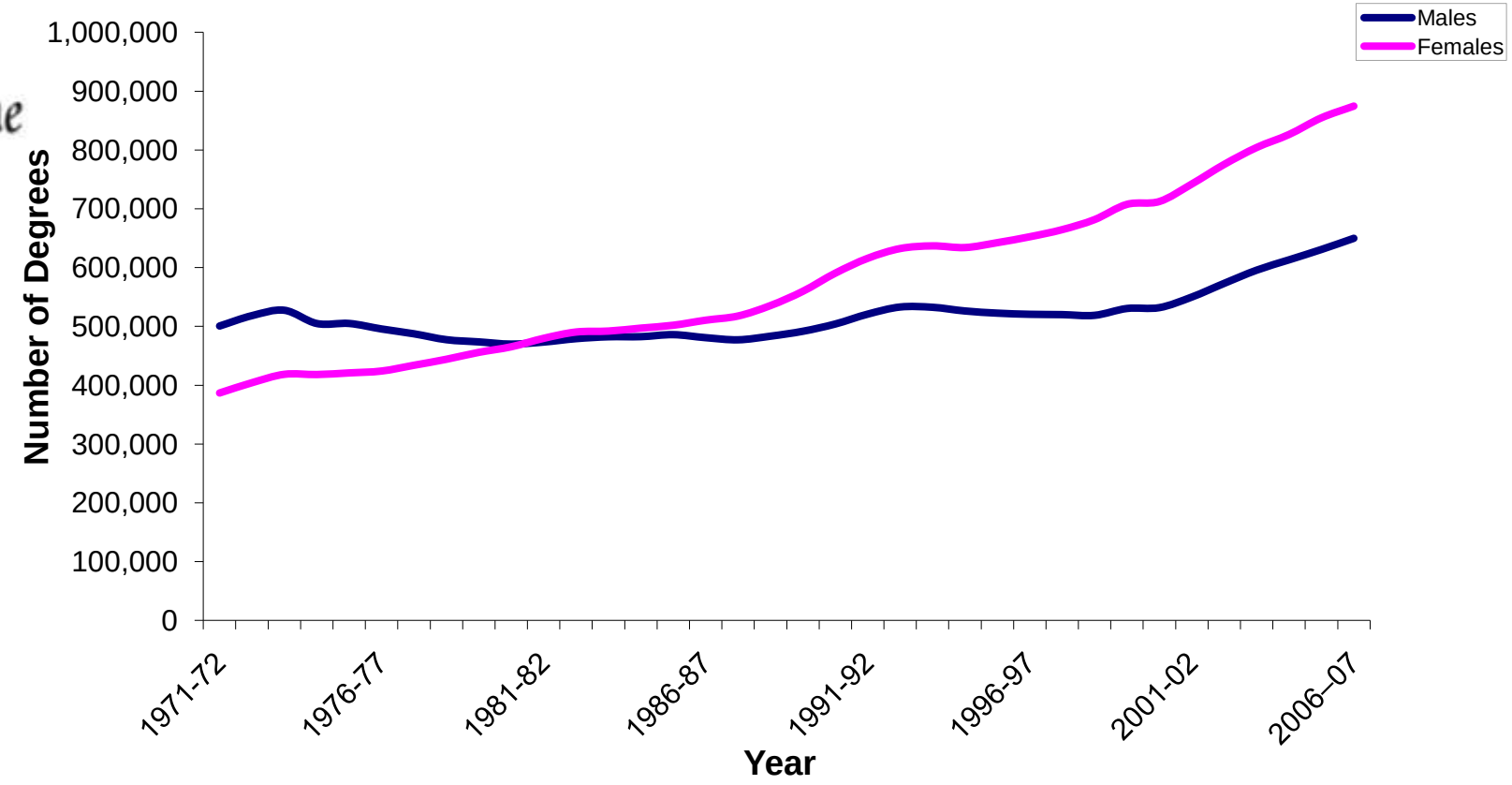
Women have earned the majority of bachelor's degrees since 1982.

Bachelor's Degrees Conferred, by Gender,1971–72 to 2006–07



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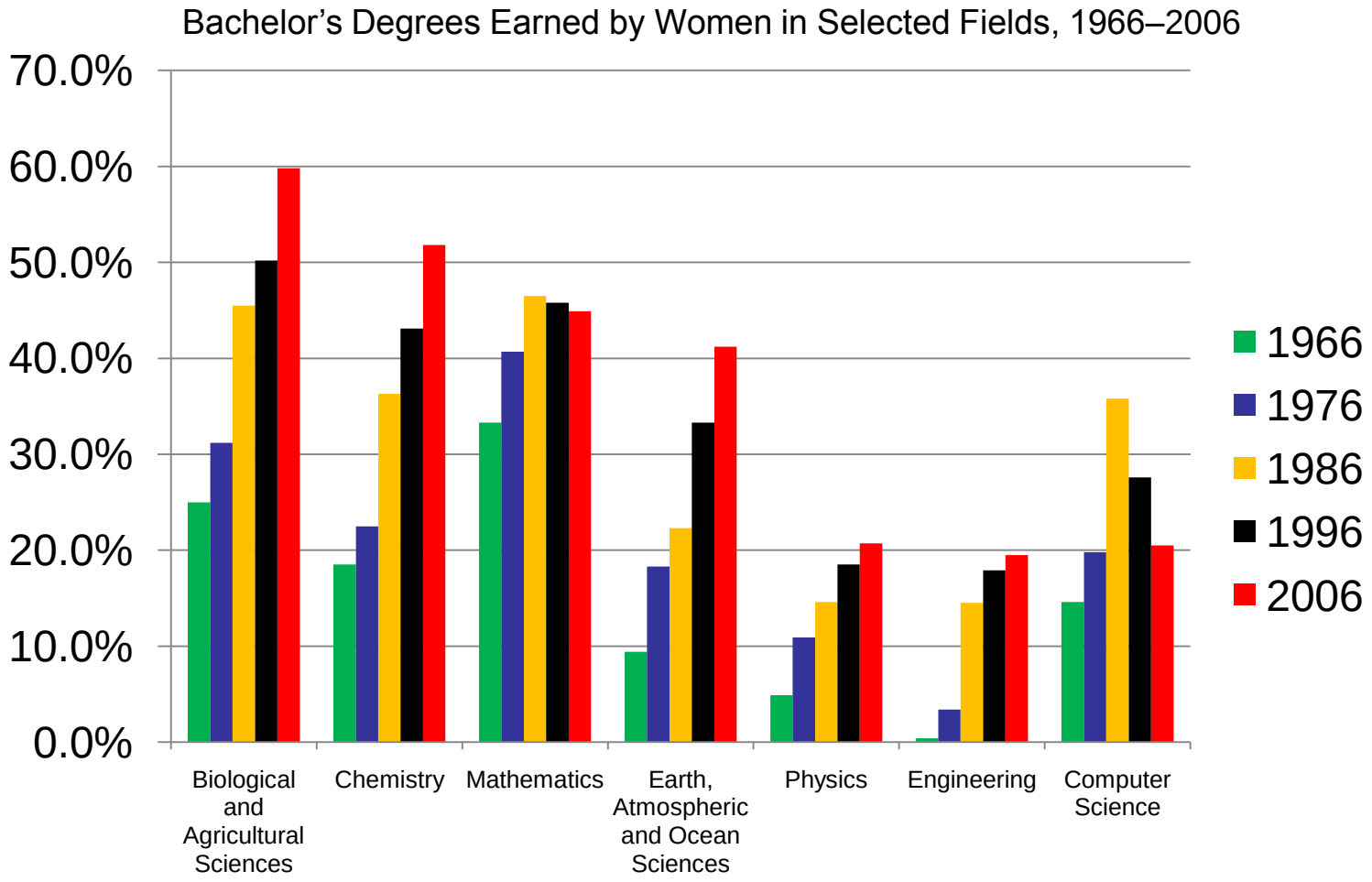
Women's representation among STEM bachelor's degree holders has improved over time but varies by field.



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.

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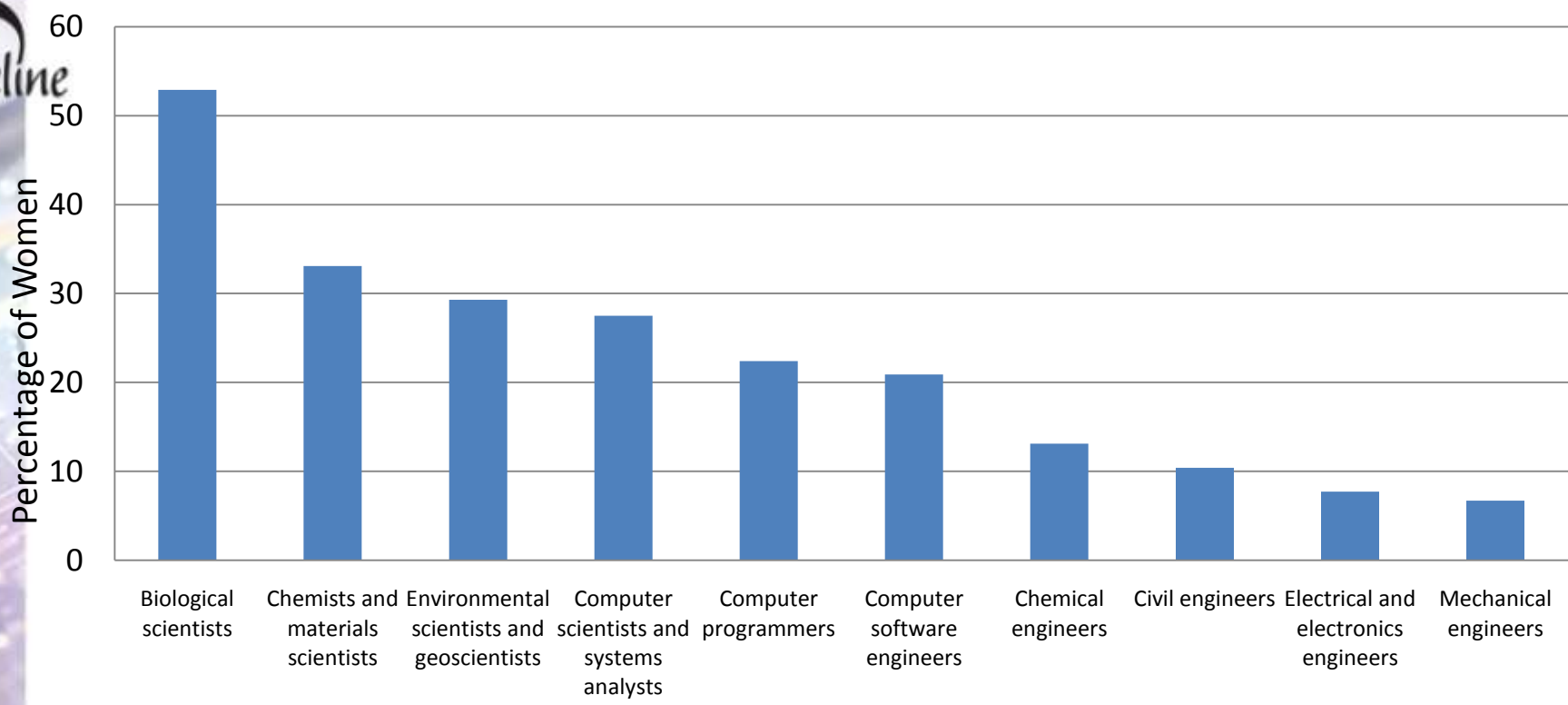
Women are underrepresented in many science and engineering occupations.

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.

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Research on gender in
science and engineering
helps explain the underrepresentation
of women and girls in STEM.

How can you make a difference?

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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 *look smart* and therefore a tendency to	Leads to a desire to *learn* 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 students that intellectual skills can be acquired.
- Praise students for effort.
- Highlight the struggle.
- Send the message that schools value growth and learning.

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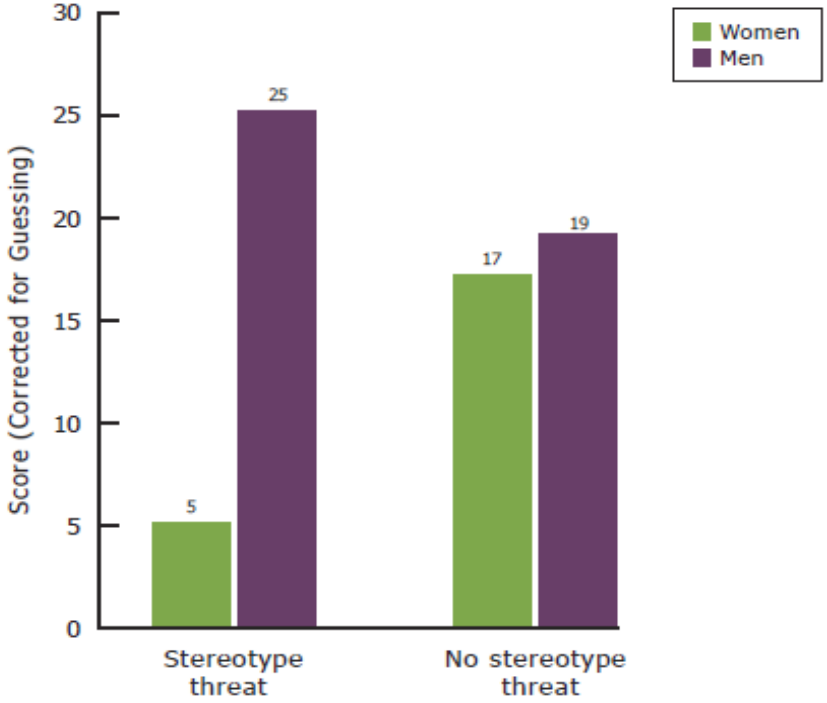
Negative stereotypes about girls' and women's abilities in math and science adversely affect their performance in these fields.

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.

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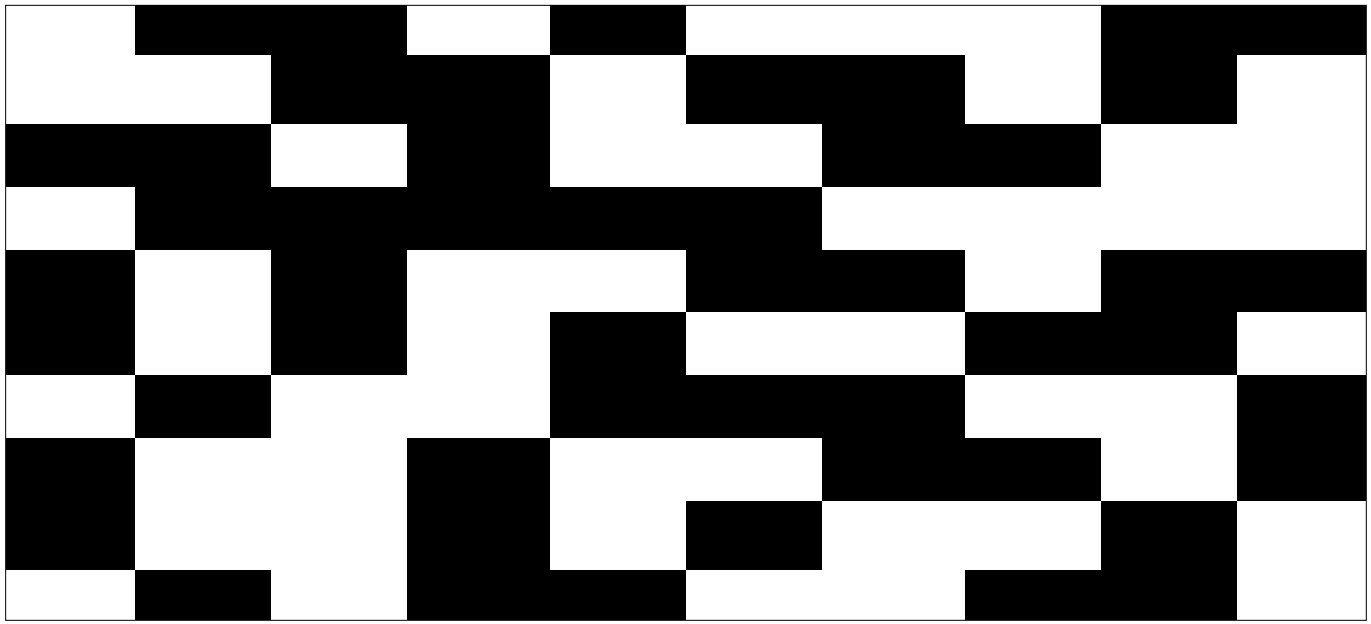
Women are “harder on themselves” when assessing their abilities in “male” fields like math and science.



Does this rectangle have more black or more white?

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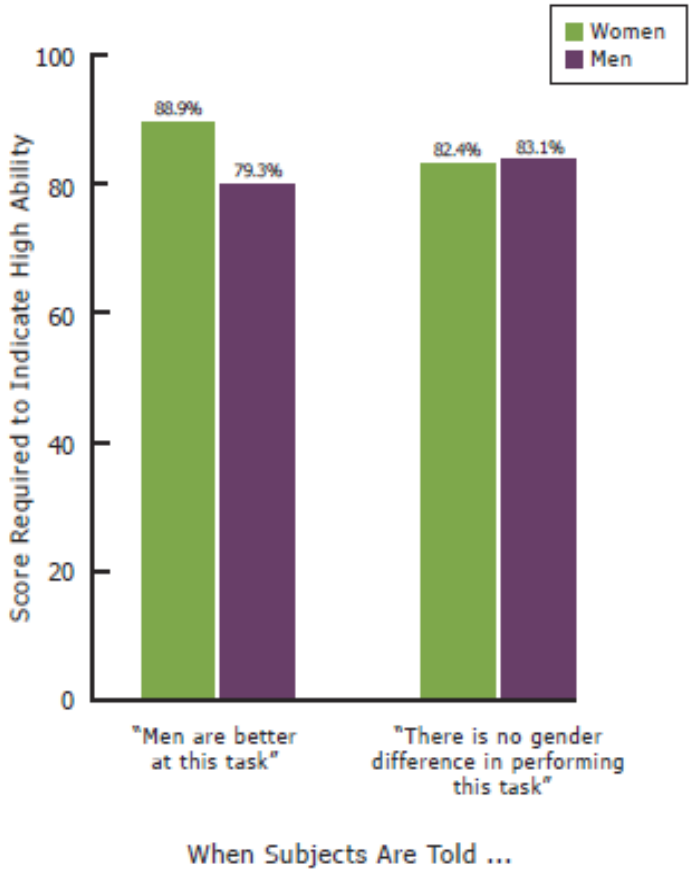
Women hold themselves to a higher standard compared with men in “masculine” fields.

Students’ Standards for Their Own Performance, by Gender



- Set clear performance standards and high expectations
- Encourage girls to attribute their success to their own skills
- 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.

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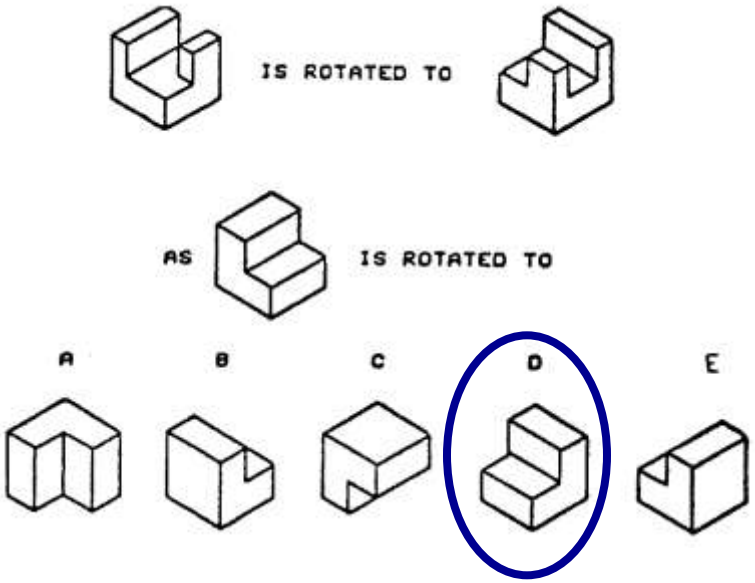
Spatial skills are not innate and can be improved with training.



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.
- Create hands-on learning opportunities

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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.

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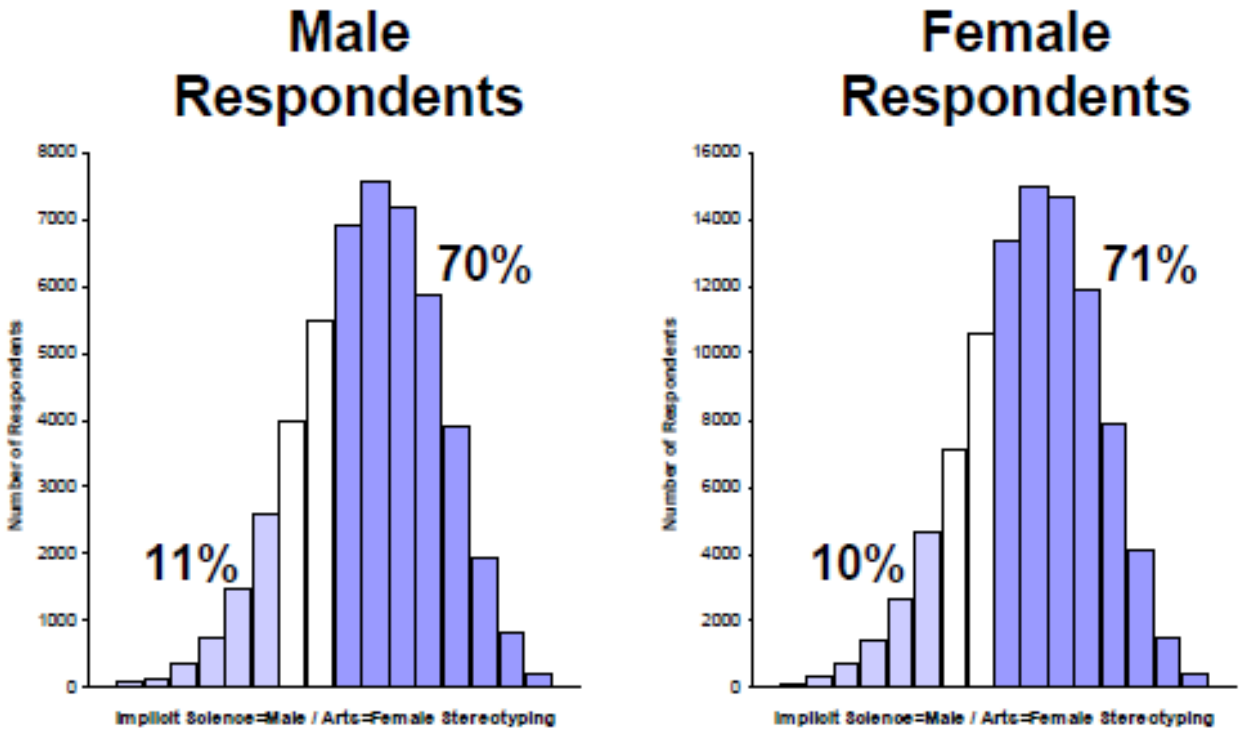
Science=Male Arts=Female

Same for Men and Women?



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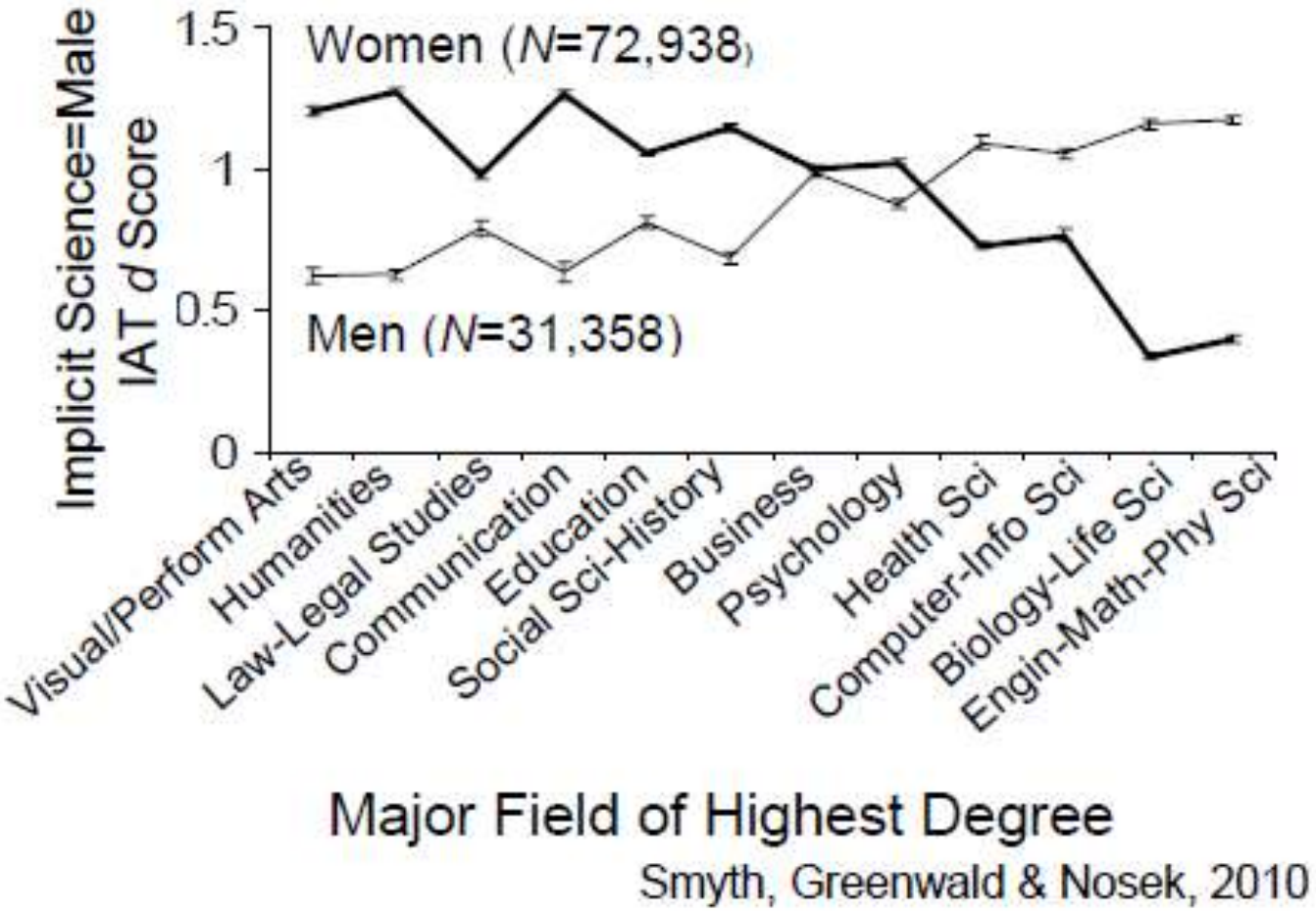
Implicit Bias Science=Male



Smyth, Greenwald & Nosek, 2010

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Summary

- Encourage a growth mindset
- Highlight and praise the effort
- Teach students about stereotype threat
- Expose girls to female role models in STEM
- Set clear performance standards and high expectations
- Help girls accurately assess their performance and internalize their success
- Help girls connect their skills to careers in STEM
- Create hands-on learning opportunities
- Raise your own and others awareness of bias

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Acknowledgements

Why So Few? Women in Science, Technology Engineering and Math by the American Association of University Women available at www.aauw.org

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Questions?

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