Diversity in Engineering

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Diversity in Engineering

MANAGING THE WORKFORCE OF THE FUTURE

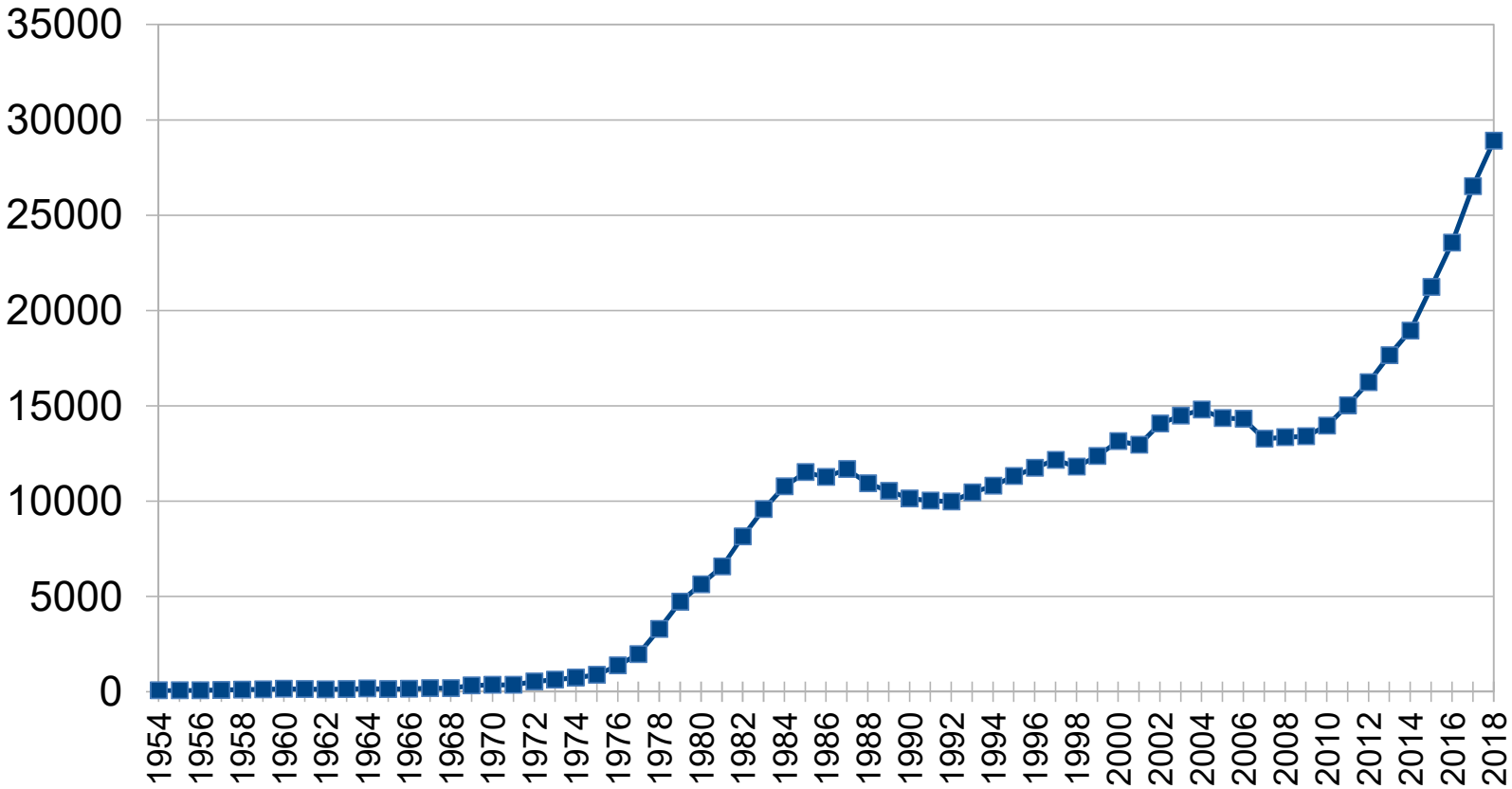
NATIONAL ACADEMY OF ENGINEERING

Executive Summary Recommendations

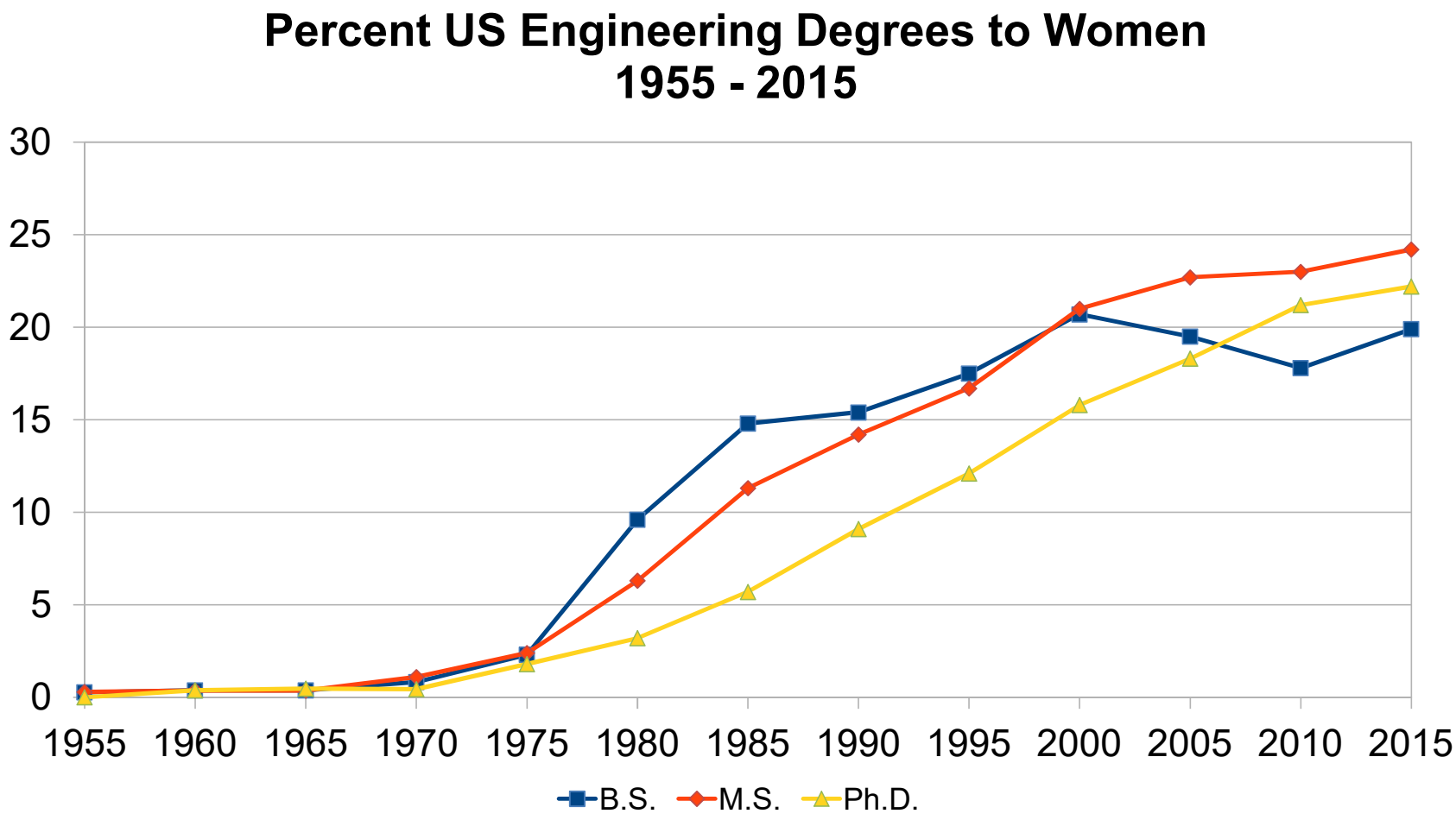
- High level commitment
- Clear link to business strategies
- Sustained effort
- Training
- Employee affinity groups
- Outreach to education

Statistics

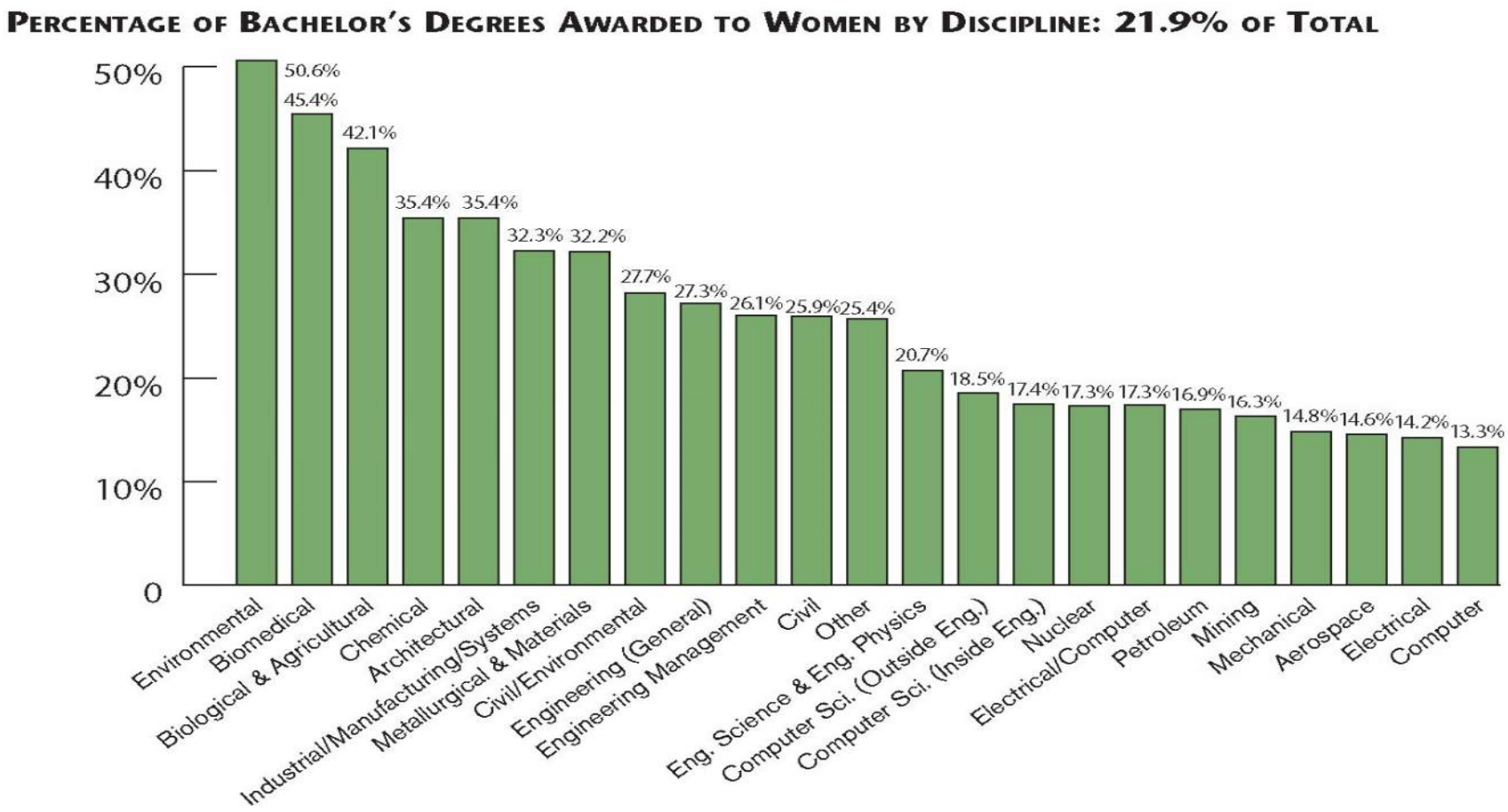
Number of Engineering Bachelors Degrees Earned by Women 1954 - 2018



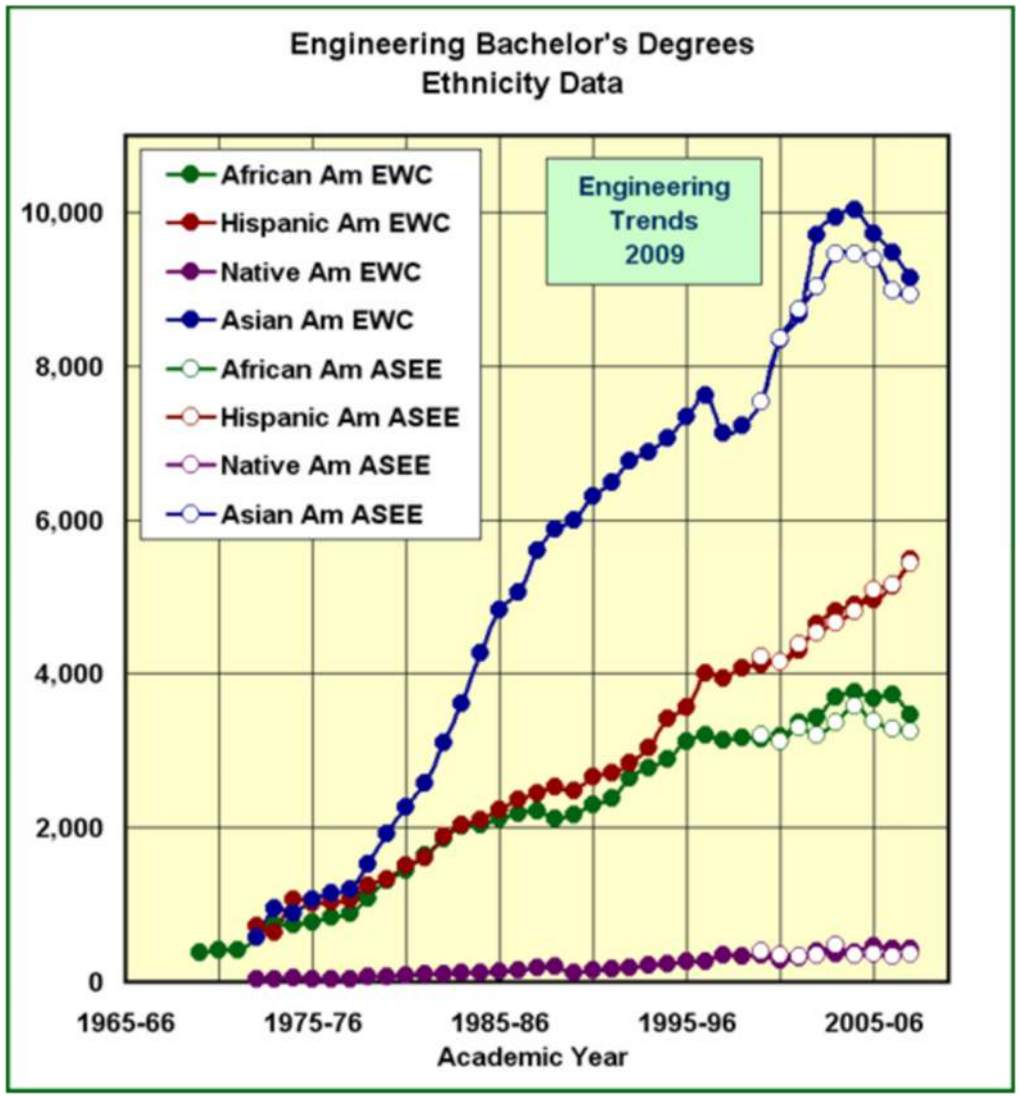
Source: Engineering Workforce Commission and American Society for Engineering Education



Source: Engineering Workforce Commission and American Society for Engineering Education



Source: American Society for Engineering Education, 2019


Engineering Bachelor's Degrees
Ethnicity Data
African Am EWC
Hispanic Am EWC
Native Am EWC
Asian Am EWC
African Am ASEE
Hispanic Am ASEE
Native Am ASEE
Asian Am ASEE
Engineering
Trends
2009
10,000
8,000
6,000
4,000
2,000
0
1965-66
1975-76
1985-86
1995-96
2005-06
Academic Year

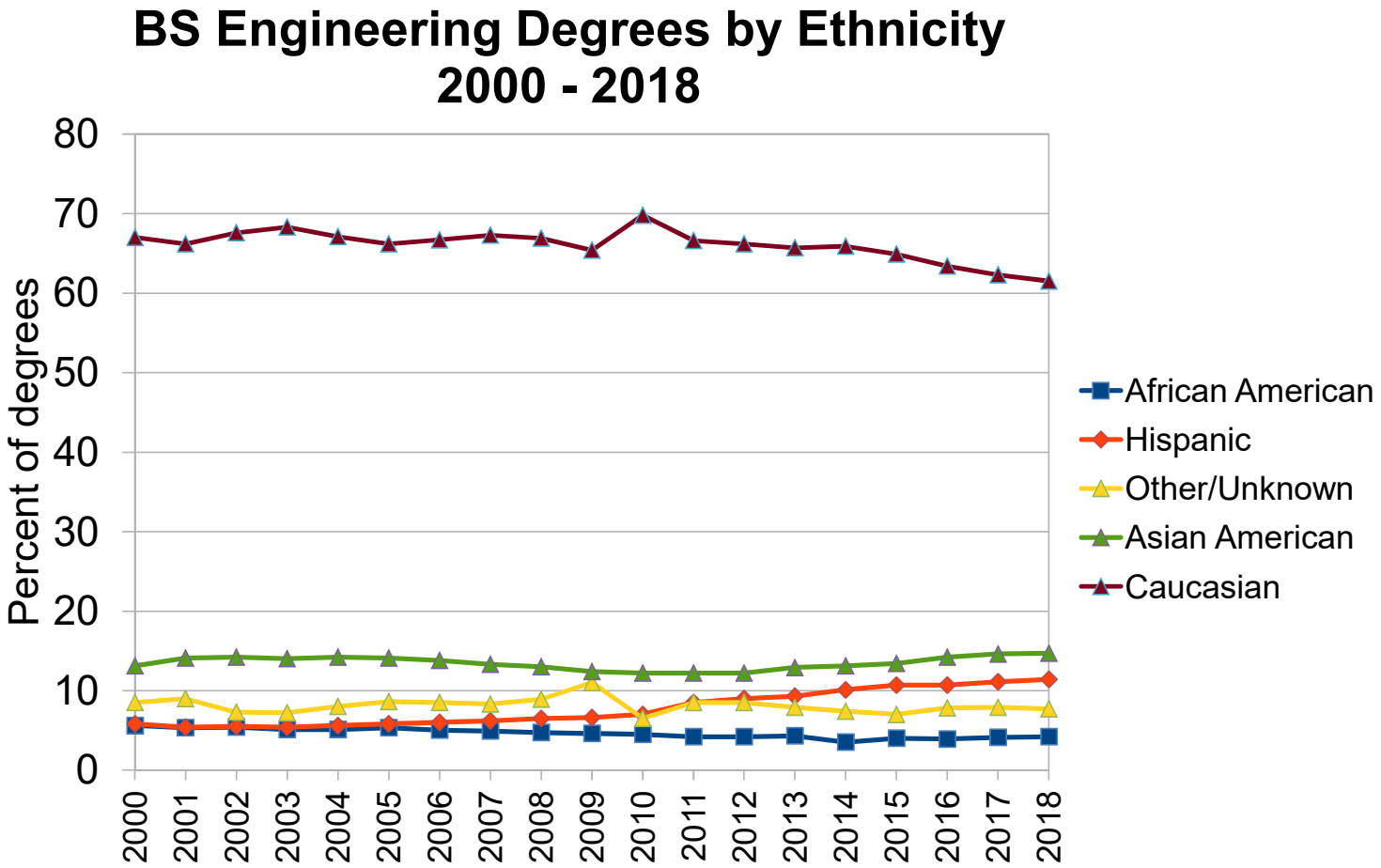

BS Engineering Degrees by Ethnicity
2000 - 2018
Percent of degrees
80
70
60
50
40
30
20
10
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
African American
Hispanic
Other/Unknown
Asian American
Caucasian

FIGURE 3-C

Science and engineering bachelor's degrees earned by Hispanics or Latinos, as a percentage of degree field, by field: 1996–2016

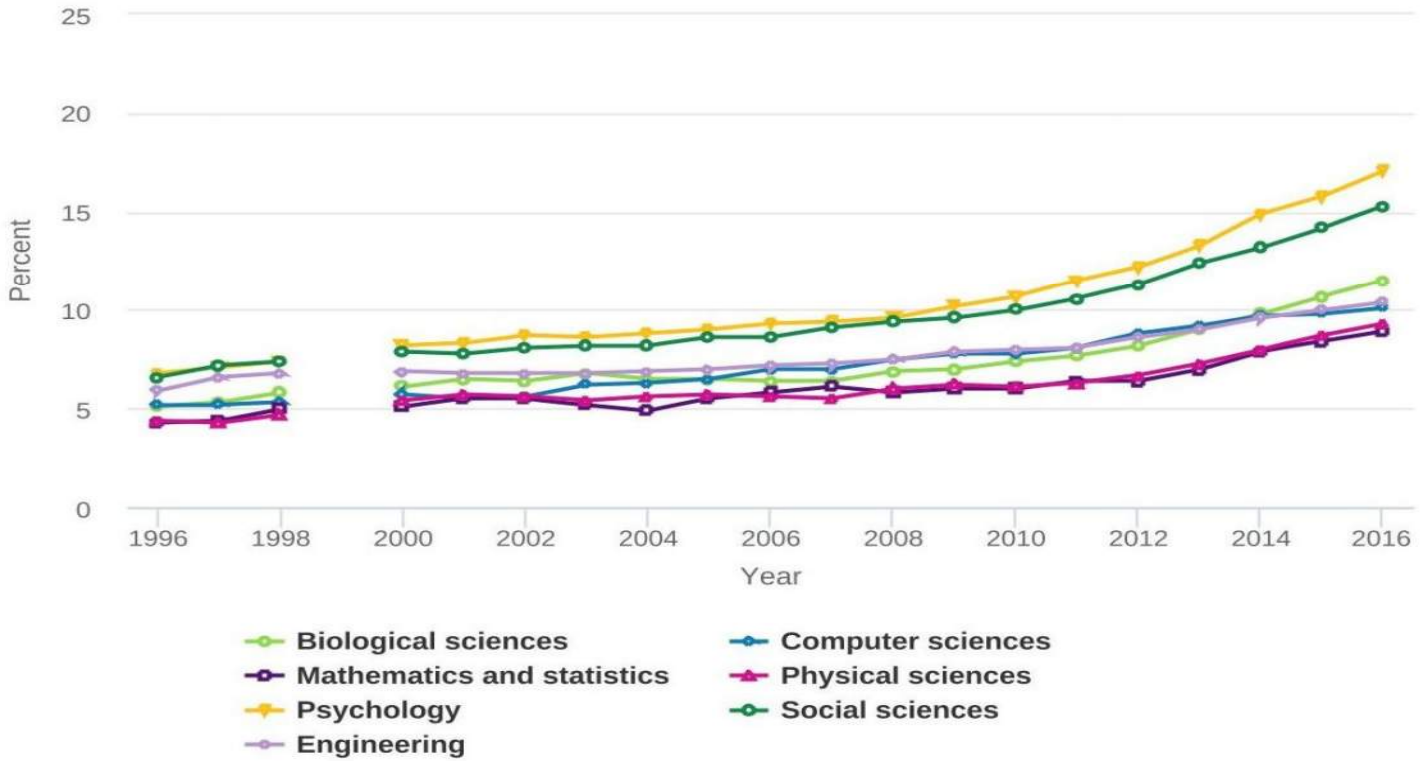
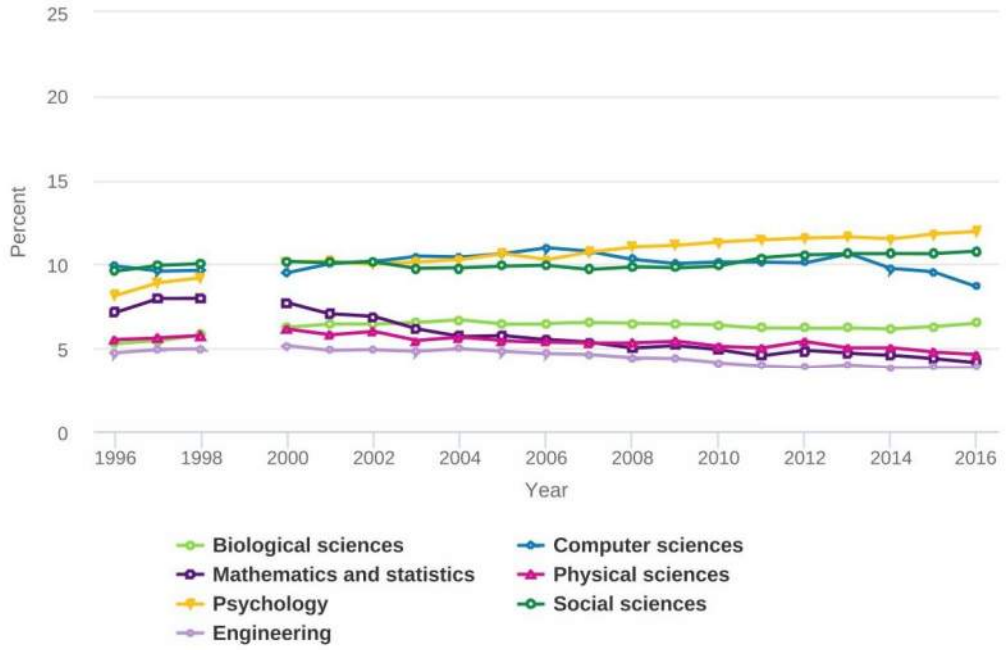


FIGURE 3-E

Science and engineering bachelor's degrees earned by blacks or African Americans, as a percentage of degree field, by field: 1996–2016



Note(s)

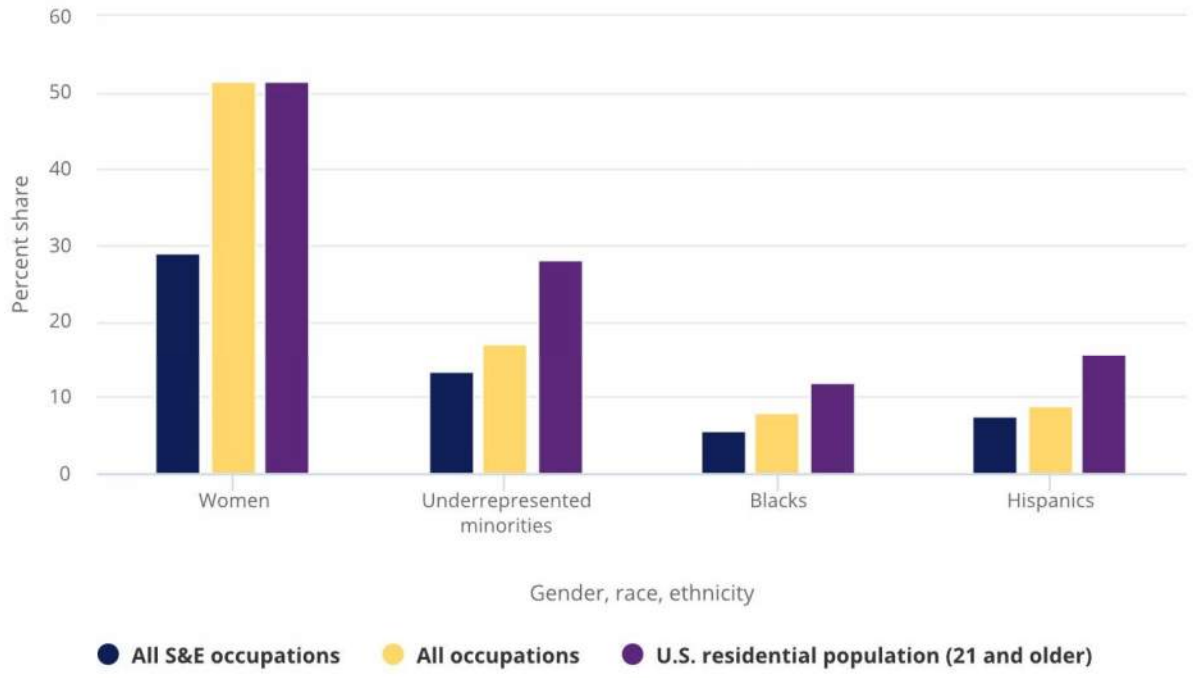
Data not available for 1999. Biological sciences includes agricultural sciences. Physical sciences includes earth, atmospheric, and ocean sciences. Data are for U.S. citizens and permanent residents only.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, unrevised provisional release data. Related detailed data: WMPD table 5-3.

FIGURE 6

Women, underrepresented minorities, blacks, and Hispanics in S&E and all occupations: 2017



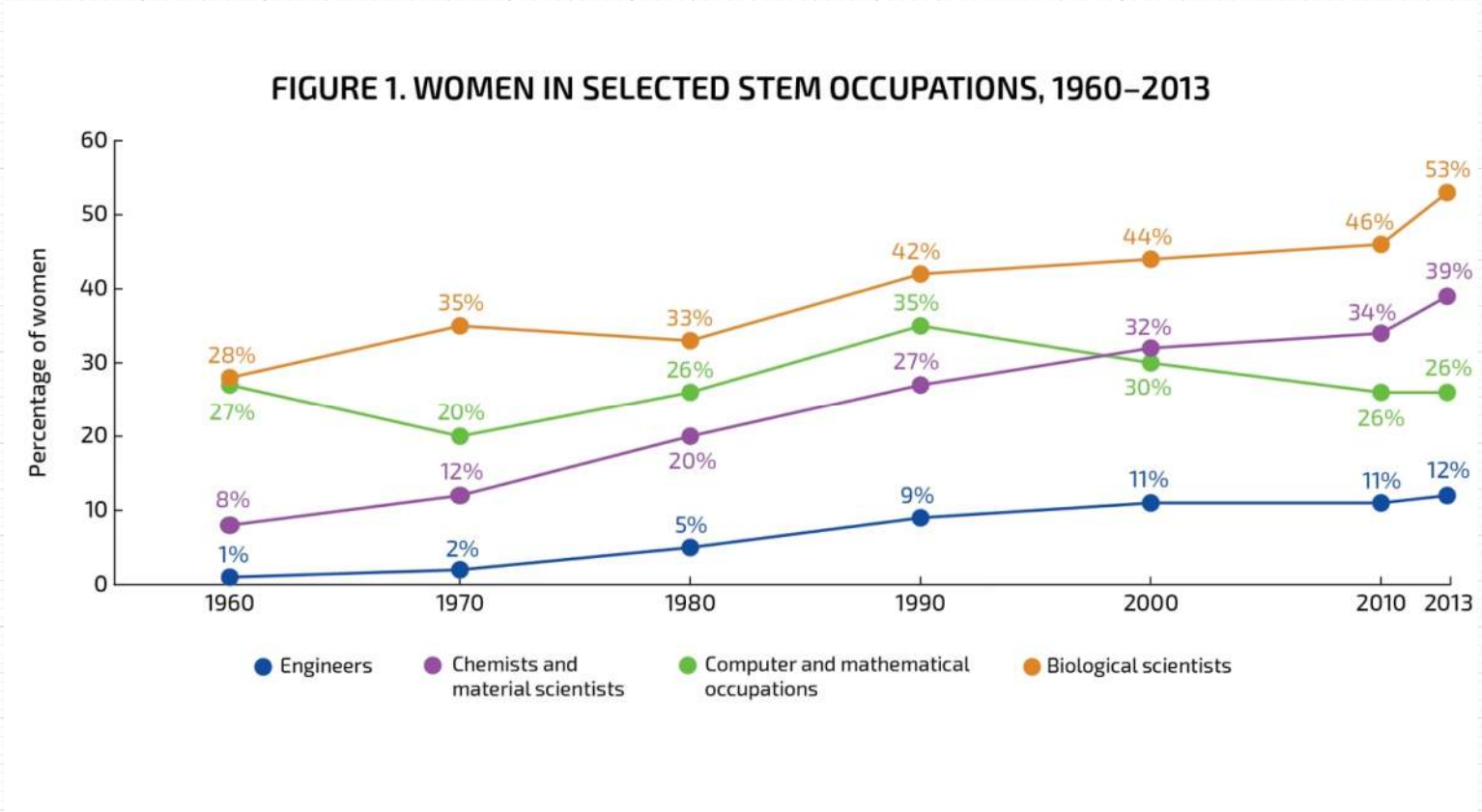
Note(s)

Underrepresented minorities includes individuals who are black, Hispanic, or American Indian or Alaska Native. The S&E and all occupations data are for those with a bachelor's degree and above. The U.S. residential population data are for those at all education levels.

Source(s)

NCSES, 2017 NSCG; Census Bureau, 2017 ACS public use microdata.

Indicators 2020: Labor Force

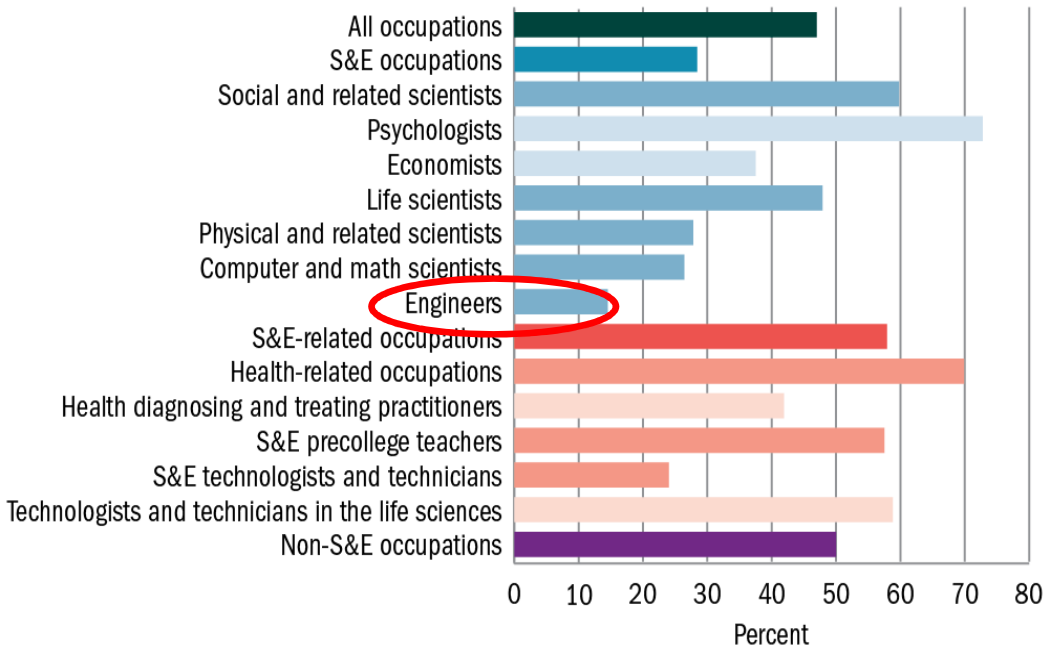


Source: AAUW, 2015, Solving the Equation

VIRGINIA TECH

swe Society of Women Engineers

Employed women scientists and engineers, as a percentage of selected occupations: 2015

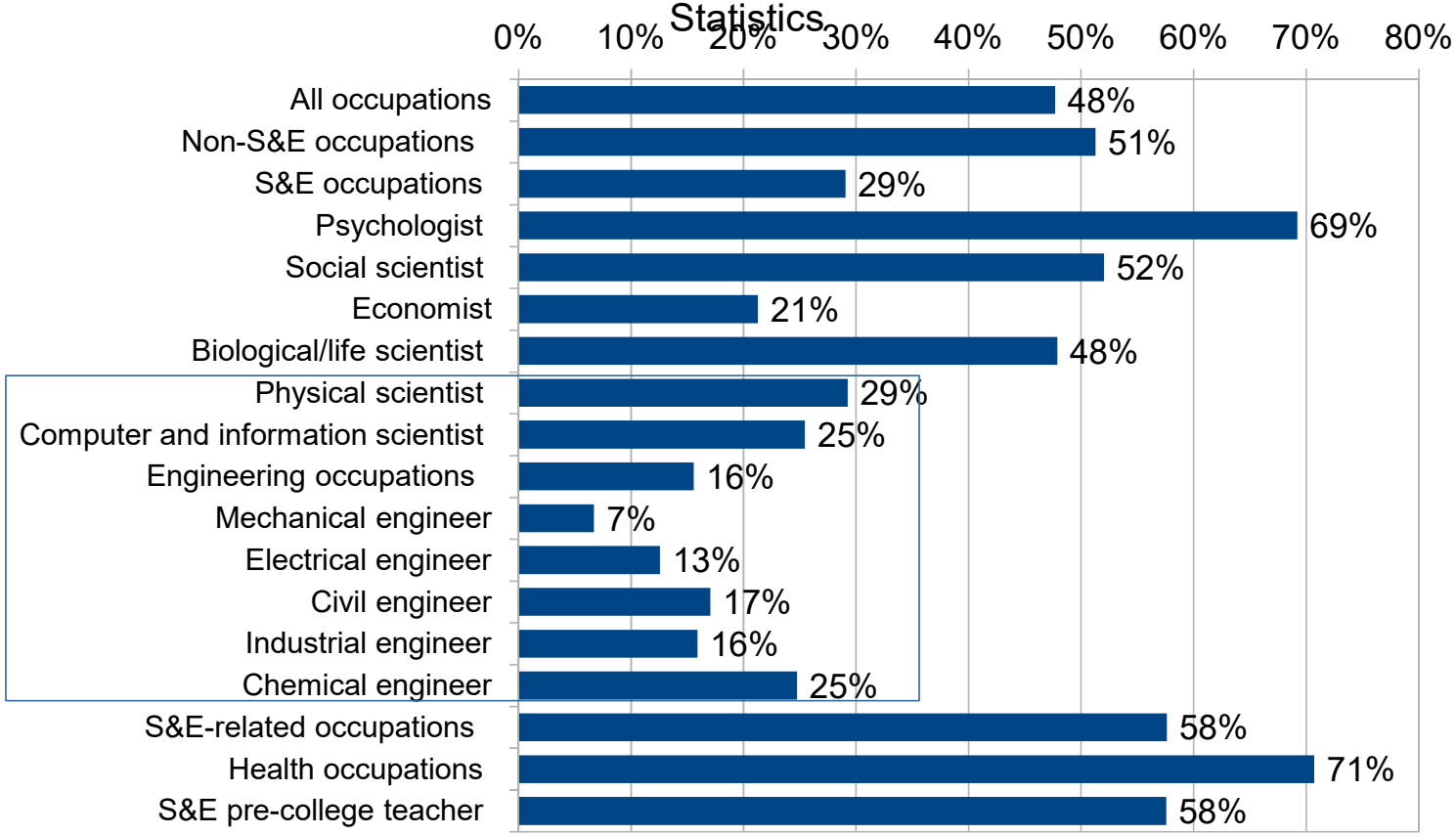


Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017

VIRGINIA TECH

swe Society of Women Engineers

Employed Women Scientists and Engineers as % of Selected Occupations 2017
National Science Foundation Center for Science and Engineering Statistics



Women make up
12%
of the
engineering
workforce.

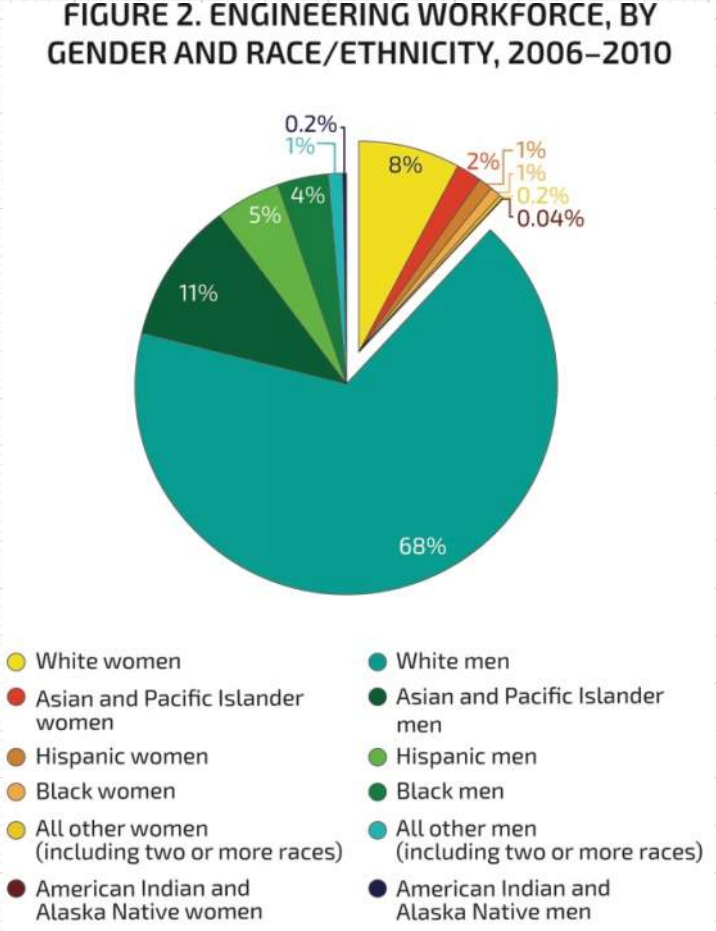


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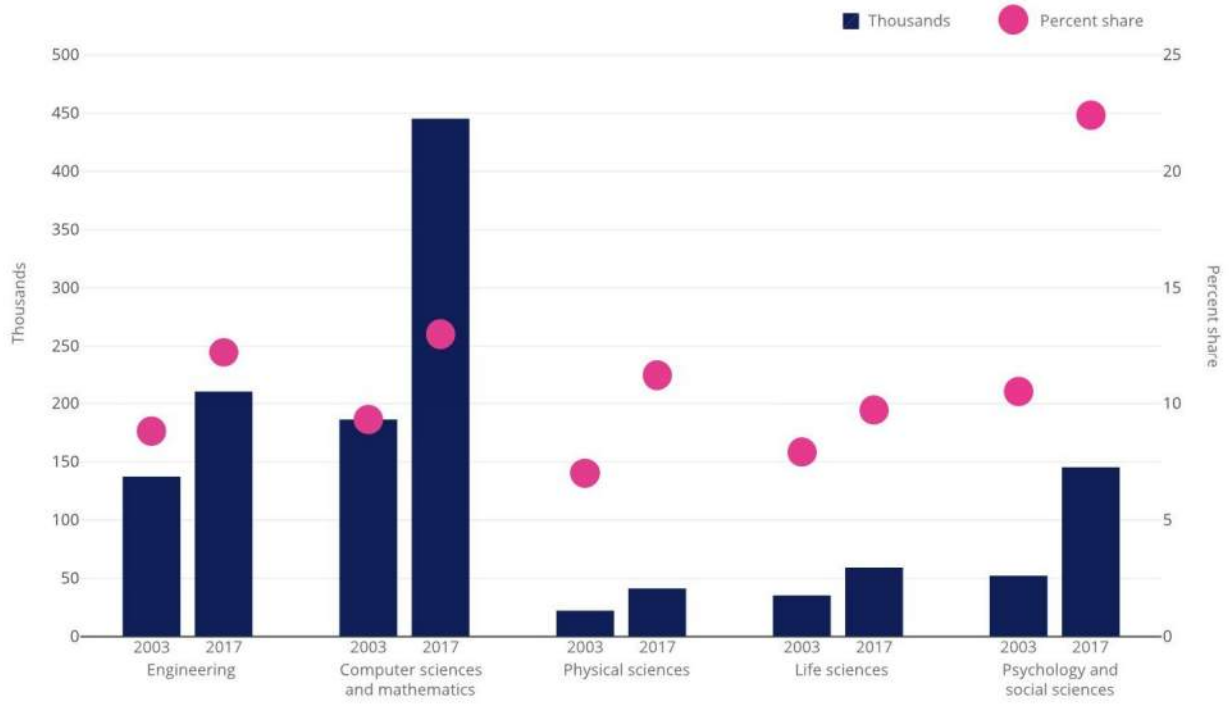
FIGURE 8

Underrepresented minorities in S&E occupations, by broad occupational category: 2003 and 2017

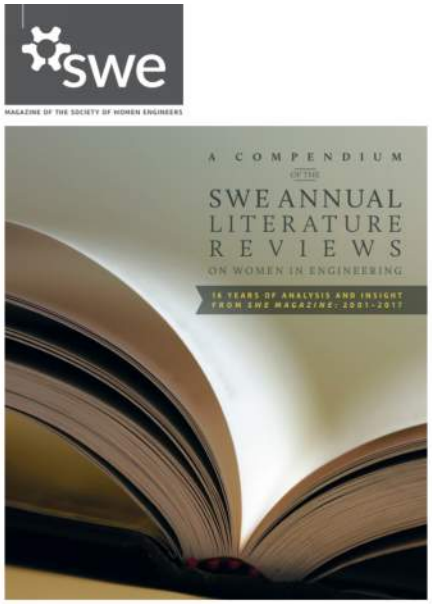


Note(s)
Underrepresented minorities includes individuals who are black, Hispanic, or American Indian or Alaska Native.

Source(s)
NCSES, 2003 SESTAT and 2017 NSCG.

Indicators 2020: Labor Force

What does the research tell us?



https://research.swe.org/literature-reviews/

Literature review

- What's included?
  - Scholarly literature (journal articles, dissertations, conference proceedings)
  - Reports from governments and NGOs (NSF, AAUW, National Academies)
  - Books (scholarly and sometimes non-scholarly)
  - Other (movies, mass media coverage)
- Systematic database search
  - ProQuest, EBSCO, Google Scholar
- Read, summarize, organize, prioritize

Literature review: themes

- Interest in engineering
- Engineering as a career choice
- Experience in engineering education
- Engineers in the workforce

No gender achievement gap in math overall

- Reardon, S.F., E.M. Fahle, D. Kalogrides, A. Podolsky, and R.C. Zarate (2018). “Gender Achievement Gaps in U.S. School Districts” (CEPA Working Paper No 18-13). Retrieved from Stanford Center for Education Policy Analysis: http://cepa.stanford.edu/wp18-13.

Women do not drop out of engineering programs at a higher rate than men

- Waychal, P.K., C. Henderson, and D. Collier (2018). “A Systematic Literature Review on Improving Success of Women Engineering Students in the U.S.” ASEE Annual Conference, Salt Lake City.
- Shi, Y. (2018). The puzzle of missing female engineers: Academic preparation, ability beliefs, and preferences. *Economics of Education Review*, 64, 129–143.

Both women and men leave full-time STEM employment after the birth of their first child, but women are more likely to leave (43% vs. 23%)

- Cech, E.A. and M. Blair-Loy (2019). The Changing Career Trajectories of New Parents in STEM. *PNAS* 116(10): 4182-4187.

Employer support is important

- Singh, R., Zhang, Y., Wan, M. (Maggie), & Fouad, N. A. (2018). Why do women engineers leave the engineering profession? The roles of work–family conflict, occupational commitment, and perceived organizational support. *Human Resource Management*, 57(4), 901–914. https://doi.org/10.1002/hrm.21900

- “Engineering is quintessentially colorblind and class-blind and gender-blind – it just happens to be occupied consistently by middle-class straight White able-bodied men.”
- Secules, S. (2019). Making the Familiar Strange: An Ethnographic Scholarship of Integration Contextualizing Engineering Education Culture as Masculine and Competitive. *Engineering Studies* 11(3): 196-216.

Women are making progress in engineering, but research shows that structural and cultural barriers remain

Sources and Resources

- ASEE: https://www.asee.org/papers-and-publications/publications/college-profiles
- NSF: https://www.nsf.gov/statistics/
- AAUW: https://ww3.aauw.org/research/solving-the-equation/
- STEMMing the tide: https://sites.uwm.edu/nsfpower/
- SWE: https://research.swe.org/
- National Academy of Engineering 2001 workshop report https://www.nae.edu/77739.aspx