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A Case Study of the Variables for Women's Success in Engineering and Computing

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Title

A Case Study of the Variables for Women's Success in Engineering and Computing

Abstract

There is a huge shortage of skilled workforce in the engineering and computing related industries. According to the BLS data women have consistently constituted less than 10% of the workforce in the construction industry, which exemplifies the under representation of women in this field. This qualitative research aims at helping women sustain in engineering workforce, empower them in the choices they make to enter and success in the industry, and look at ways to create a safe and encouraging environment for women to survive and thrive in the workforce. This is believed to be possible through creating platform to educate men and women in shared leadership context, providing education and career development for women in engineering and computing, offering practical ideas for educators and employers seeking to foster gender diversity, and facilitating access to training and retraining programs.

THE VARIABLES FOR WOMEN'S SUCCESS IN ENGINEERING AND COMPUTING

Discipline Based Educational Research
23.Feb.2017

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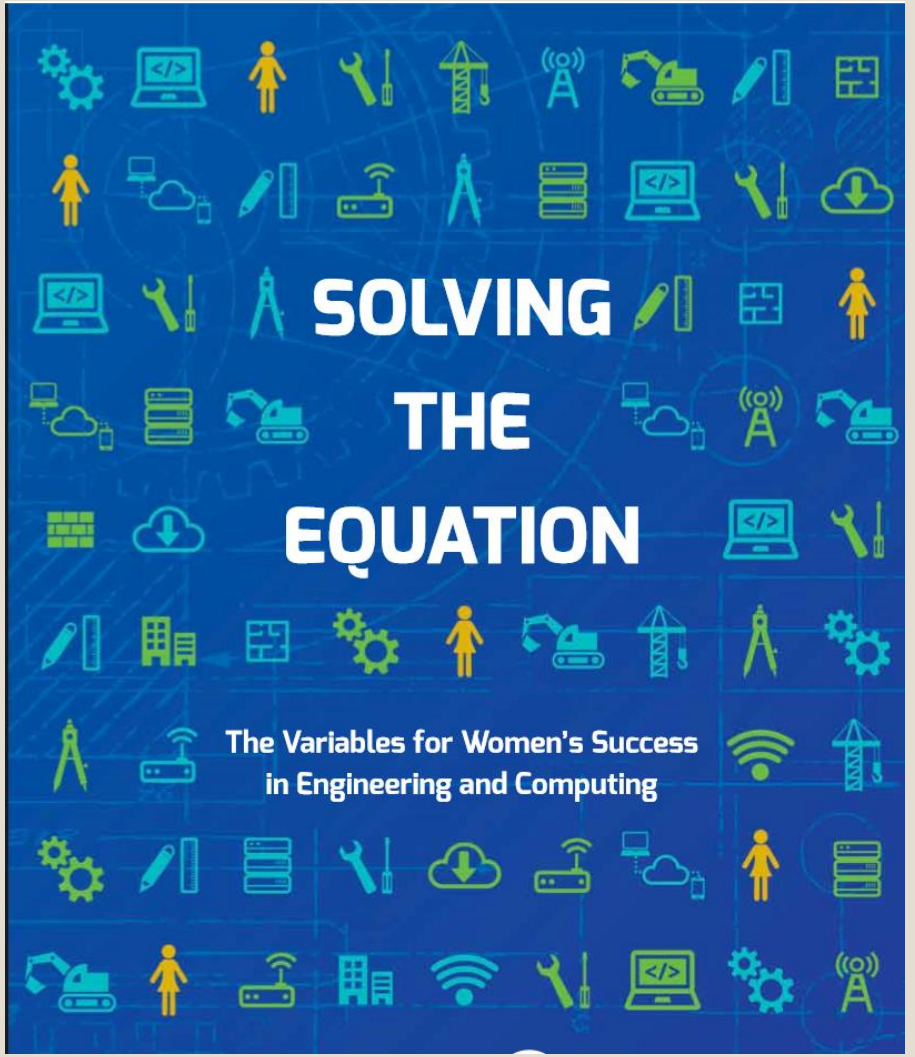
Agenda

- Literature review
  - Examples
  - Statistics
- Qualitative study of women
- What we can do?
- Future work

Topics

- Chapter 1. Women in Engineering and Computing
- Chapter 2. Why So Few?
- Chapter 3. Gender Bias and Evaluations
- Chapter 4. Gender Bias and Self-Concepts
- Chapter 5. Stereotype Threat in the Workplace
- Chapter 6. Making the World a Better Place
- Chapter 7. College Environment and Curriculum
- Chapter 8. Persistence and Sense of Fit
- Chapter 9. A Workplace for Everyone
- Chapter 10. What Can We Do?



Women in Engineering and Computing

- **2013 only 12% of working engineers are women**
- **Combating stereotypes and biases:** gender bias, stereotypes threat

❖Employability, salary

❖Social conversations **vs** research-related conversations

❖Female role models in engineering and computing can help shift implicit biases for both women and men

- **Emphasizing social relevance: Communal effect**

❖ Women are more likely than men to prioritize helping and working with other people over other career goals.

❖The perception and, in some cases, the reality that engineering and computing occupations lack opportunities to work with and help others may in part explain the underrepresentation of women in these fields

Women in engineering and computing

- **Cultivating a sense of belonging**

❖Combination of stereotypes, biases, and values, women often report that they don't feel as if they belong in engineering and computing fields.

❖Sense of fit with the idea of "being an engineer"

- **Changing the environment: college, workplace**

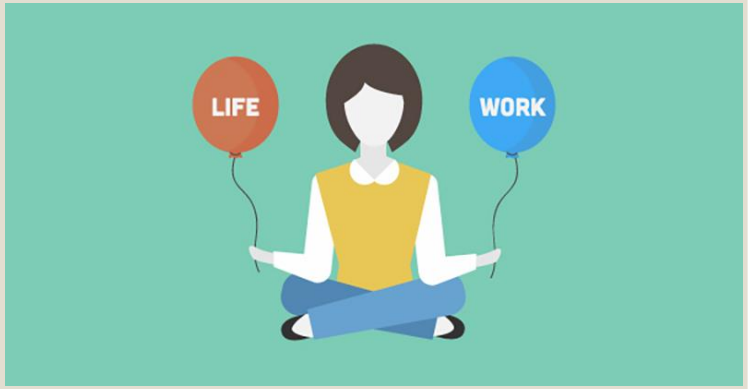
❖ Changing the environment in college and the workplace appears to be a prerequisite for fully integrating women into these fields.

Example: changing the college environment

- Harvey Mudd College:

The college president and college-wide support, Harvey Mudd increased the percentage of women graduating from its computing program from **12 percent to approximately 40 percent in five years**. This dramatic increase was accomplished through three major changes: revising the introductory computing course and splitting it into two levels divided by experience, providing research opportunities for undergraduates after their first year in college, and taking female students to the Grace Hopper Celebration of Women in Computing conference.

Example: changing The work place environment



- Women who leave engineering are very similar to women who stay in engineering. The differences the researchers found were not in the women themselves but in their workplace environments.
- Women who left engineering were less likely to have opportunities for training and development, support from co-workers or supervisors, and support for balancing work and non-work roles than were women who stayed in the profession.

Hospitable work environments:

- **Clear paths for advancement**
- **Gave employees challenging assignments that helped develop and strengthen new skills**
- **Valued and recognized employees' contributions**

Women in selected STEM occupations, 1960-2013

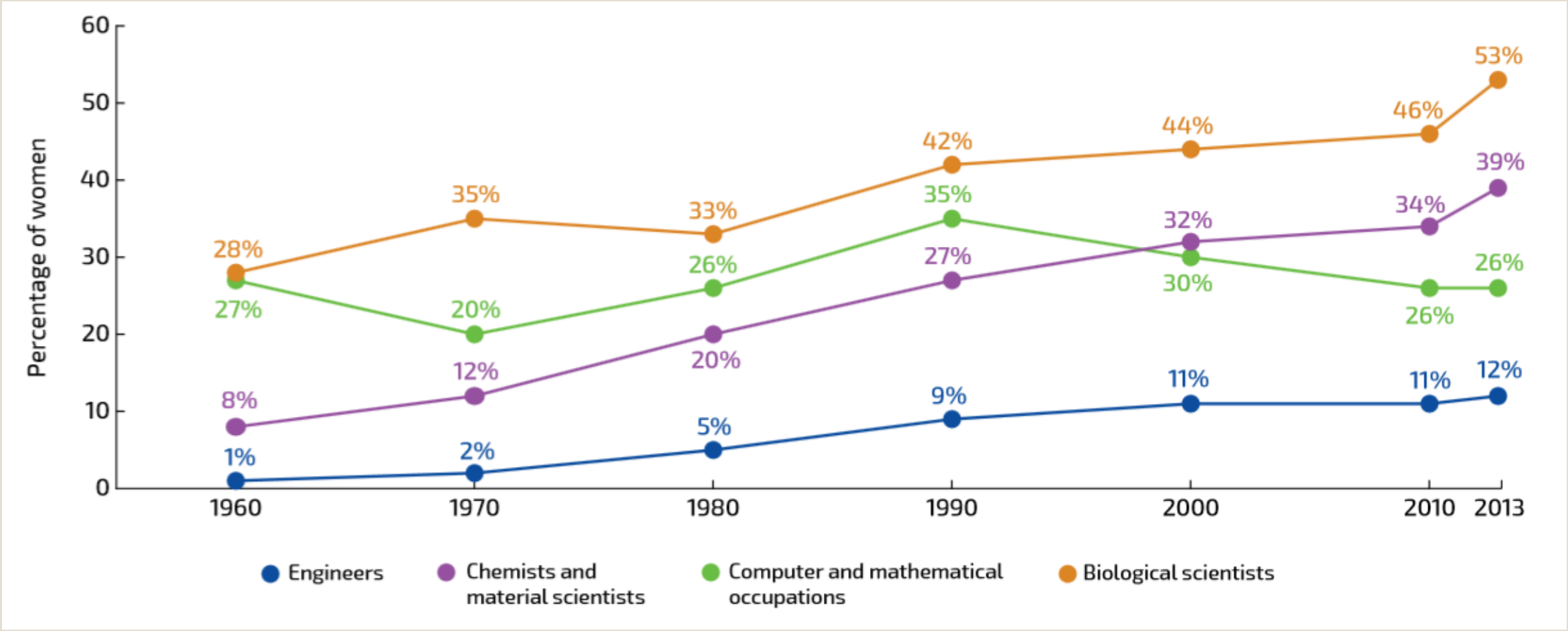
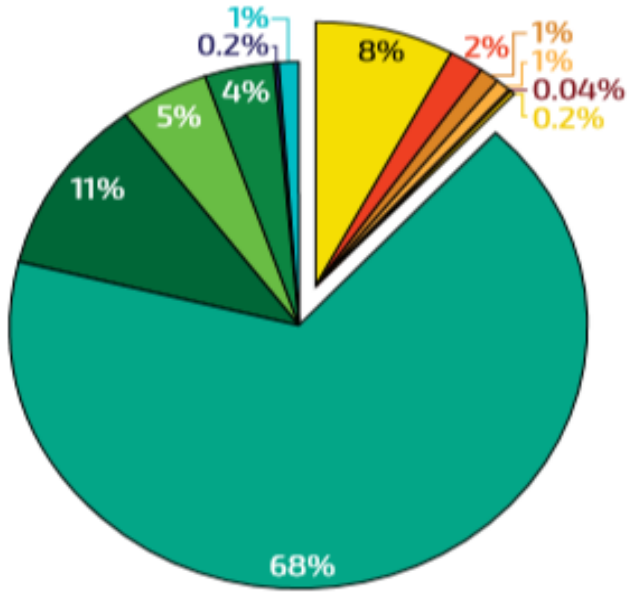


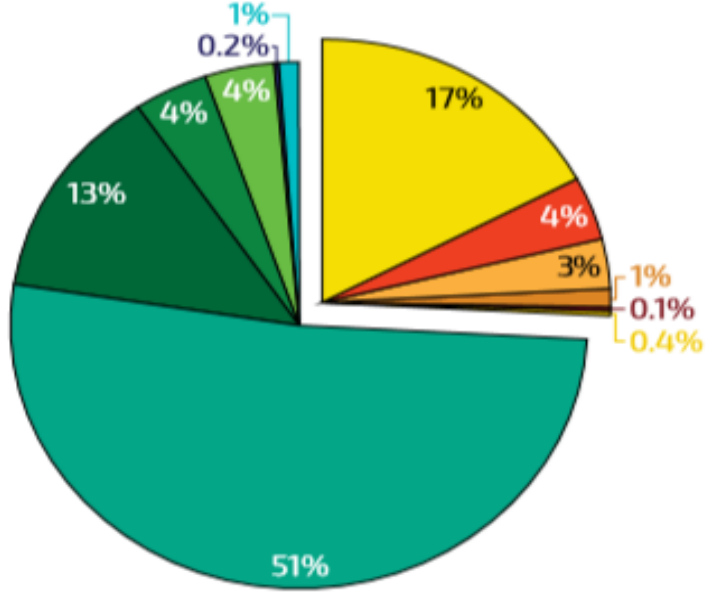
FIGURE 2. ENGINEERING WORKFORCE, BY GENDER AND RACE/ETHNICITY, 2006–2010



- White women
- Asian and Pacific Islander women
- Hispanic women
- Black women
- American Indian and Alaska Native women
- All other women (including two or more races)
- White men
- Asian and Pacific Islander men
- Hispanic men
- Black men
- American Indian and Alaska Native men
- All other men (including two or more races)

Source: AAUW analysis of U.S. Census Bureau (2011a).

FIGURE 3. COMPUTING WORKFORCE, BY GENDER AND RACE/ETHNICITY, 2006–2010



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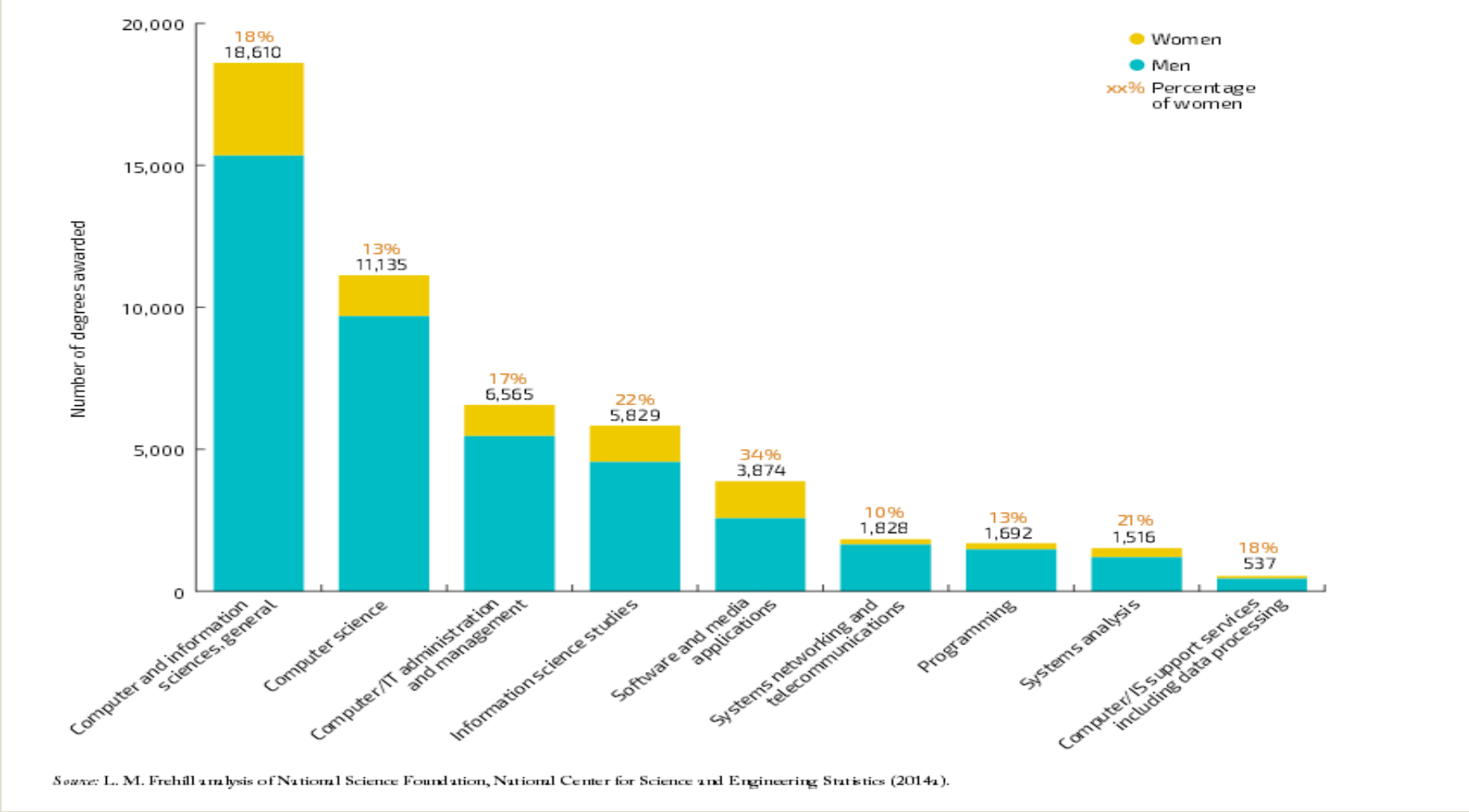
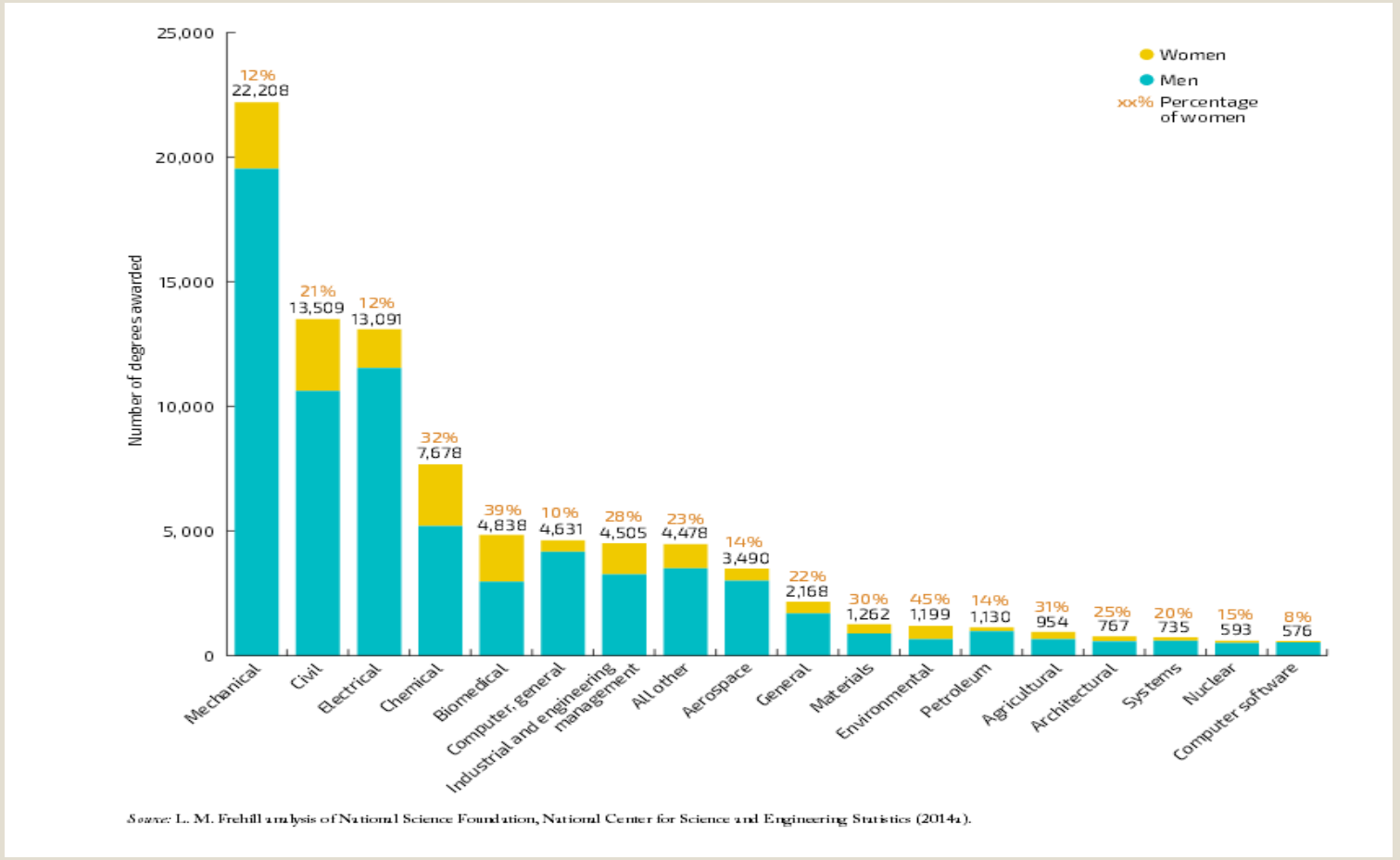
Bachelor's degree awarded in computing, by gender and discipline, 2013



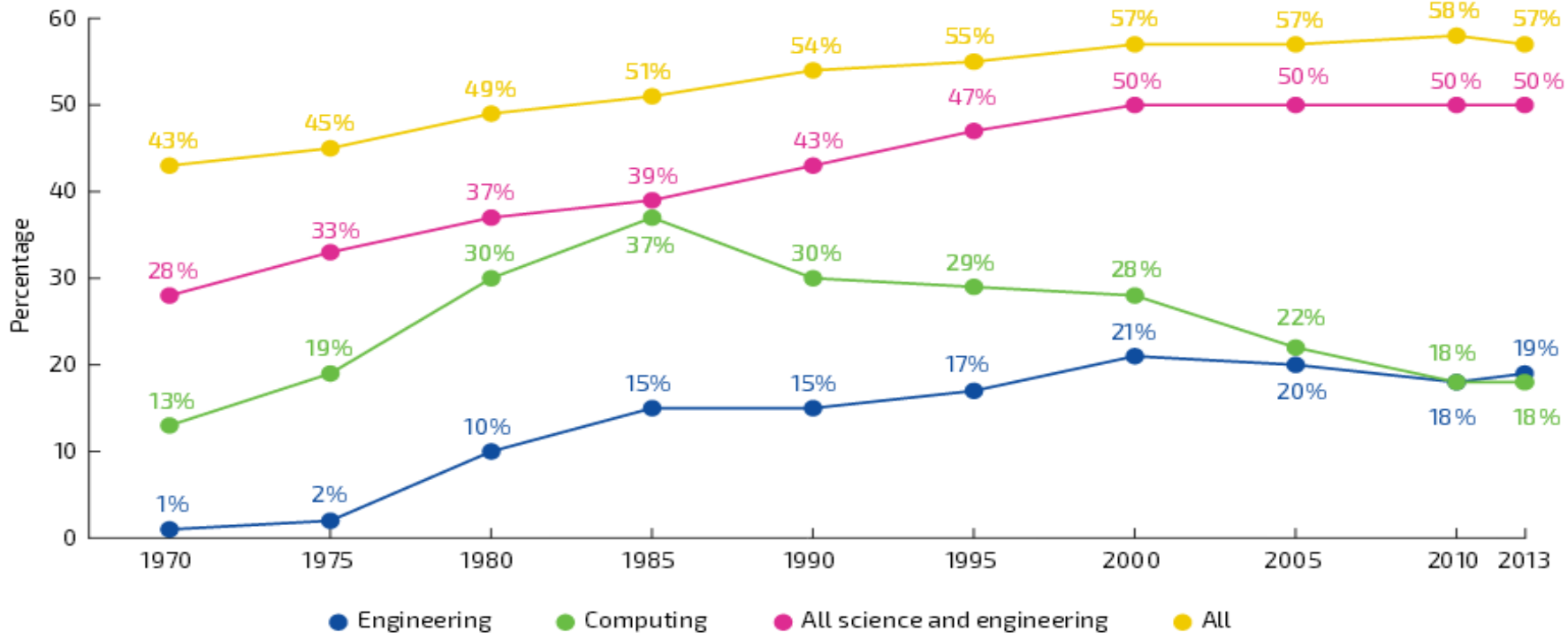
Source: L. M. Frehill analysis of National Science Foundation, National Center for Science and Engineering Statistics (2014a).

Bachelor's degrees awarded in engineering, by discipline and gender, 2013



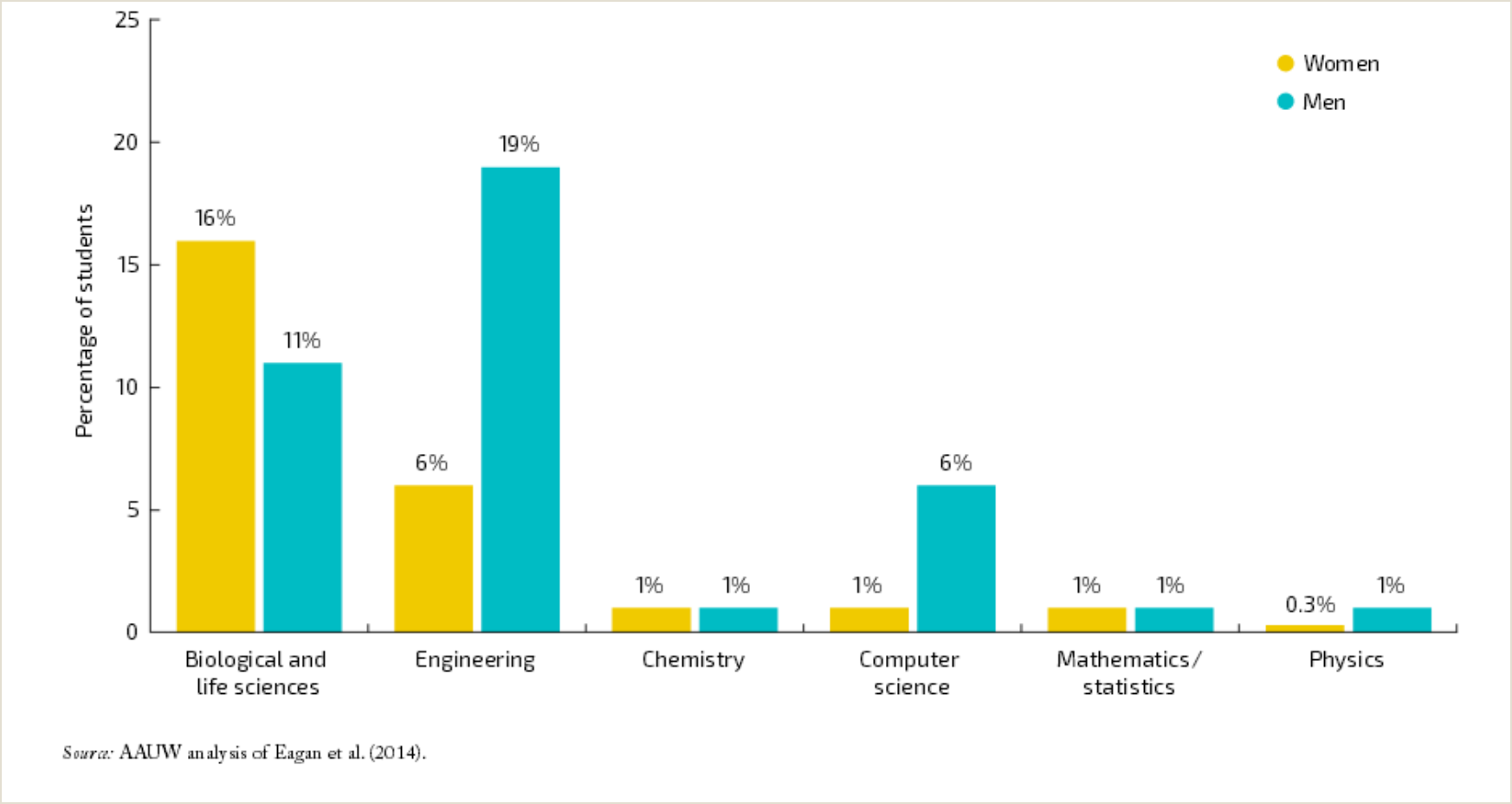
Source: L. M. Frehill analysis of National Science Foundation, National Center for Science and Engineering Statistics (2014a).

Bachelor's degrees earned by women, selected fields, 1970-2013



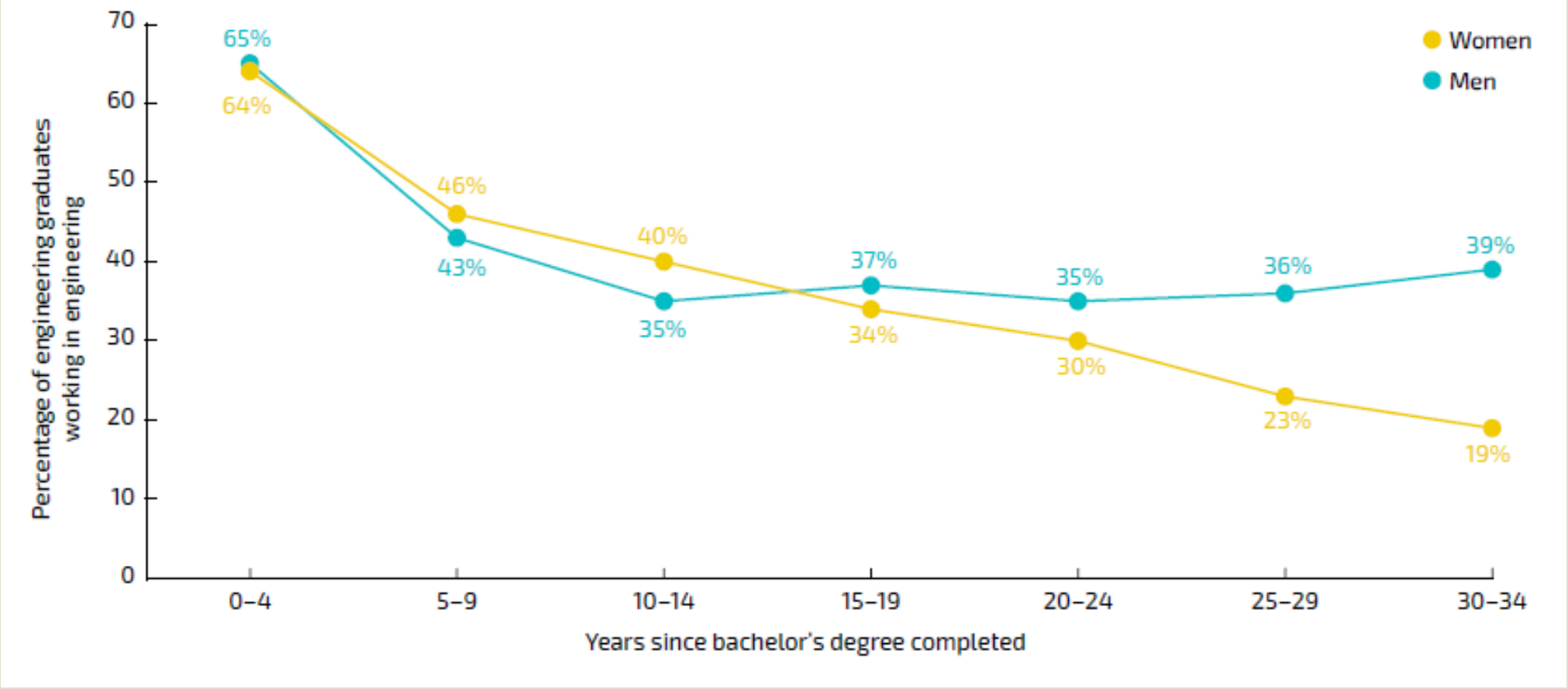
Note: "All science and engineering" includes biological and agricultural sciences; earth, atmospheric, and ocean sciences; mathematics and computer science; physical sciences; psychology; social sciences; and engineering.
Source: L. M. Frehill analysis of data from National Science Foundation, Division of Science Resources Statistics (2013), and National Science Foundation, National Center for Science and Engineering Statistics (2014a).

Intent of first-year college students to major in STEM fields, by gender, 2014

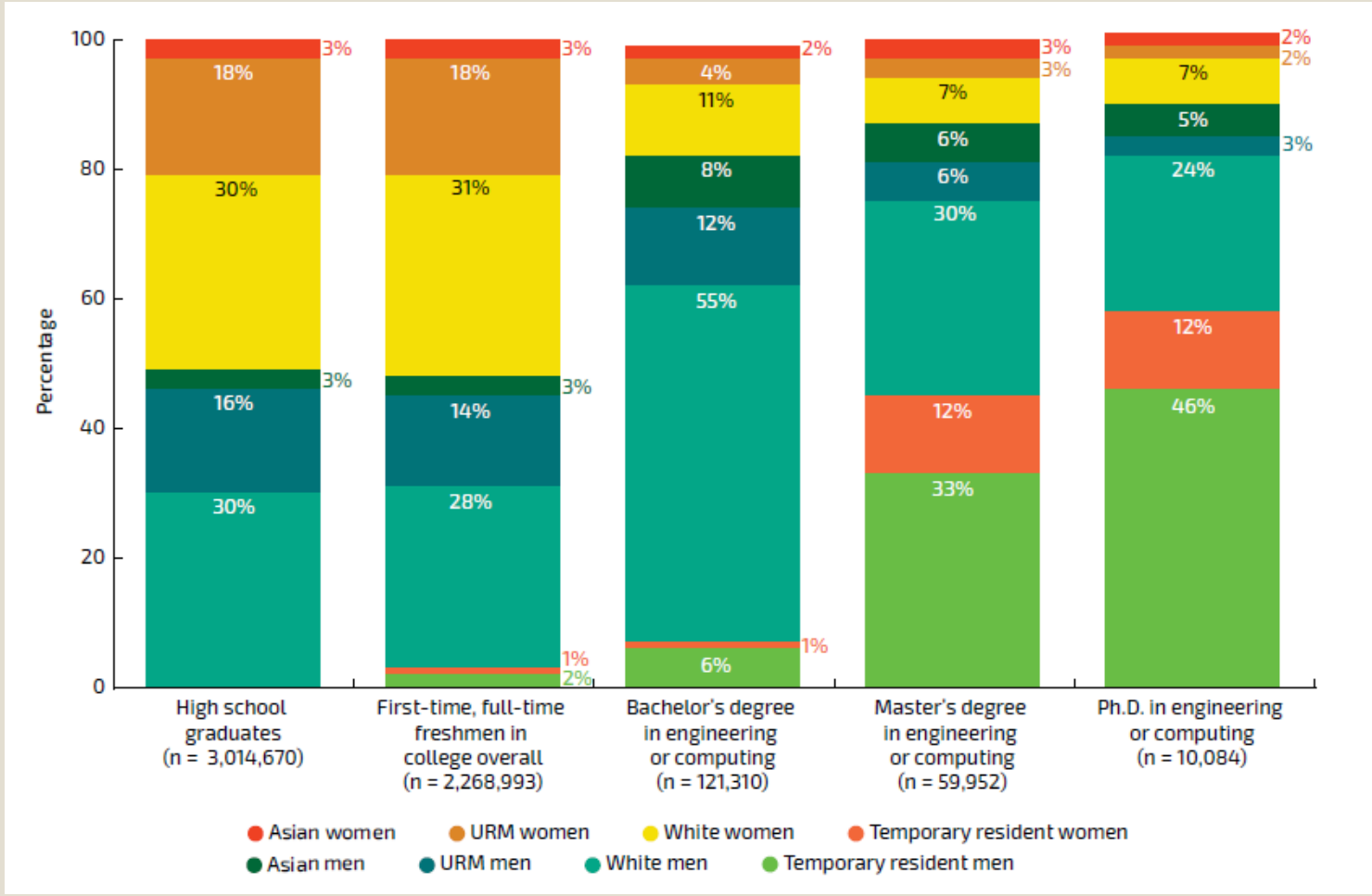


Source: AAUW analysis of Eagan et al. (2014).

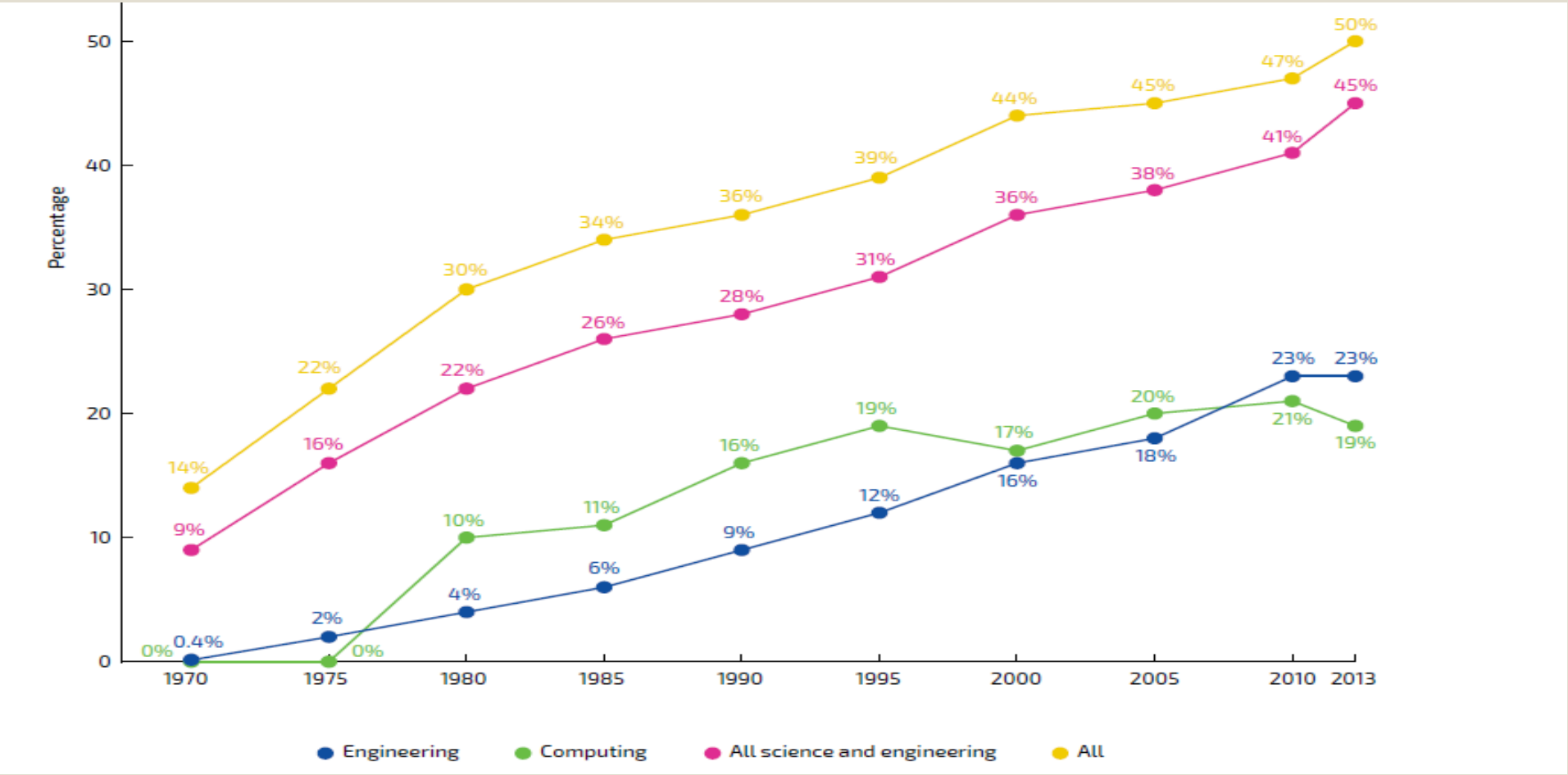
Retention in engineering, by gender, 2010



Student population from high school to doctorate in engineering and computing, by race and gender, 2012



Doctoral Degrees Earned By Women, Selected Fields, 1970–2013

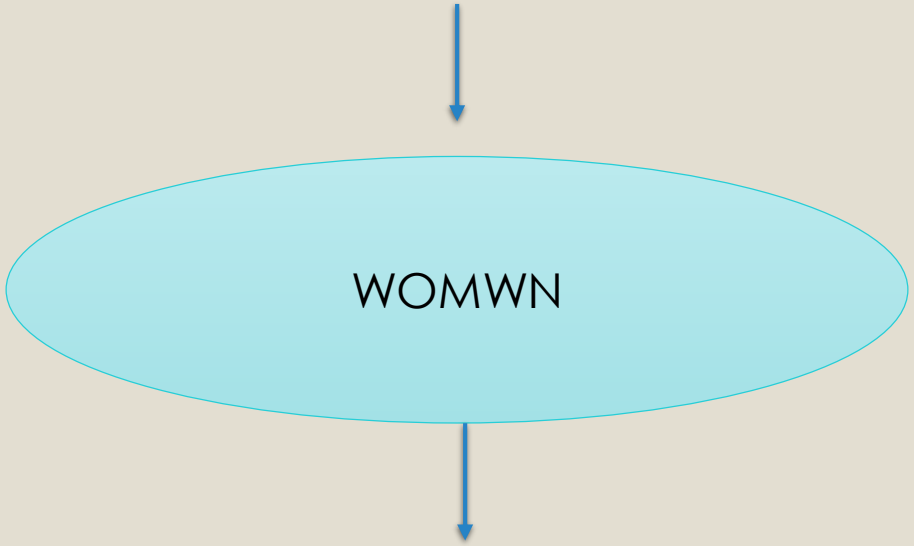


Why so few?

- Structural and cultural barriers
- Narrow focus
- Isolation: lack of voice , lack of support
- Stereotypical surroundings
- Social networks less helpful for women
- Work-life balance issues

Stereotype threat

Negative stereotype about a group to which they belong



Disengagement from fields

What can we do?

- **Reducing the influence of bias:**

Remove gender information from candidate evaluations

Introduce effective diversity initiatives

- **Make engineering and computing more socially relevant**

Incorporate communal values into college curriculum and culture

Incorporate communal values into workplace

- **Cultivate a sense of belonging**

Alleviates stress in the workplace

Introducing to Eng. And computing at early age

For Men Working in Engineering and Computing

- Seek opportunities to serve as a **role model** for girls and young women considering engineering and computing.
- Refuse to participate on all-male **conference panels**. Encourage conference organizers to recruit at least one female panelist.
- Share with students at all levels how you work with and help people.

For Women in Engineering and Computing

- Seek a support network. Some possibilities include participating in a Society of Women Engineers chapter, the Sisters e-mail list(hosted by the Anita Borg Institute for Women and Technology), or a women-in-engineering or computing group on campus or at work.
- Prioritize working in jobs that allow you to work with others on socially relevant problems if you place a high value on communal goals.
- Seek opportunities to serve as a role model for girls and young women considering engineering and computing careers.
- Share with students at all levels how you work with and help people.

For Administrators

- Require researchers who receive federal funds to participate in bias training.
- Require all undergraduate students to take at least one computer science course, no matter what their major.
- Provide opportunities for female students in engineering and computing to develop a support network of other technical women.
- Offer and promote dual-degree programs for students interested in engineering or computing who also have strong interests in other fields.
- Engage in active public relations campaigns that make it clear to young women that engineers and technical professionals work cooperatively with others on problems that have impacts on the well-being of people.

Case study

- Huge shortage in the construction workforce
- Experience of female students or employers in construction majors in order to gain an understanding of ways to sustain and improve their existence in the workforce.
- The population of the research are from **Community Colleges in Nebraska**

- ***Keywords*:** case study, women, construction industry, qualitative study

Developing the Research Question

- BLS: **less than 10 million Americans**
- According to the BLS data (BLS 2008, 2009, 2010, 2011), women have consistently constituted **less than 10% of the workforce** in the construction industry
- This qualitative research aims at helping women sustain in construction workforce, empower them in the choices they make to enter and success in the industry, and look at ways to **create a safe and encouraging environment** for women to survive and thrive in the workforce.
- Literature gap

Related Literature

- For this section a data base search has been done. Total number of 63 articles were founded in the searched sources including: ASCE, google scholar, Scopus, science link in the data base of UNL libraries. The articles are both quantitative and qualitative methods. In 2004, the U.S. Education and Training Administration (ETA), a division of the U.S. Department of Labor, reported that an additional 1 million workers would be needed in the construction industry during 2002–2012 (ETA, 2004).

Research Question

- The **central research question** of this study is:
  - What are the experience of the women in construction and being a part of the workforce?
- **RQ1:** What perceptions do women in construction have regarding their work environment?
- **RQ2:** How do women describe their success or failure in the construction workforce?
- **RQ3:** How women are encouraged to stay in the construction workforce?
- **RQ4:** What are some of the strategies to adopt to the current male-dominant construction industry culture for women?
- **RQ5:** How women feel studying and working in a male-dominant field?
- **RQ6:** Why a few number of women are willing to study and work in the construction field?

References

- Solving the equation: the variables for women's success in engineering and computing. Published by AAUW, retrieved from www.aauw.org, Nov.2016
- Women in construction: tapping the untapped resource to meet future demand, Cindy L. Menches, P.E., M.ASCE1; and Dulcy M. Abraham, A.M.ASCE2

Thank you for your attention!

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