Exploring Gender and Self-Confidence in Engineering Students

A Multi-Method Approach

Debbie Chachra
Franklin W. Olin College of Engineering, Needham, MA

Deborah Kilgore
Center for Engineering Learning and Teaching
University of Washington, Seattle, WA
Academic Pathways Study
Center for the Advancement of Engineering Education

- Large-scale study of undergraduate engineering students
- 3 cohorts of engineering student participants
- 1 cohort of early career engineers
- Research on the engineering learning experience from the student perspective
- Multiple methods, including surveys and interviews
Longitudinal survey data

- survey administered over four years
- powerful study design (gender, time)
- committed, successful students
- 45 females, 62 males
Self-confidence: math and science

How would you describe your...

- math ability?
- science ability?
- ability to apply math and science to solve real-world problems?

- Likert-scale responses
- Repeated measures ANOVA (gender, time)
Self-confidence: math and science

Normalized construct score vs. time (years in college)

- Men
- Women

Normalized construct score:
- Y-axis

Time (years in college):
- X-axis

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5
Self-confidence: open-ended problem solving

- Creative thinking is one of my strengths.
- I am skilled at solving problems that can have multiple solutions.
- How would you describe your critical thinking skills?
- Likert-scale responses
- Repeated measures ANOVA (gender, time)
Self-confidence:
open-ended problem solving

![Graph showing normalized construct score over time (years in college) for men and women. The graph indicates a slight decrease in scores for both genders over time, with men generally having a higher score at each time point.](image-url)
Qualitative Analysis
The gendered experience

- **Sheer numbers are intimidating:** “As the minority, maybe women feel a little bit more intimidated or maybe, you know, have something to prove in a more male-dominated field”

- **Women worry more about how they appear:** “Usually guys are like, ‘I don’t care, I’ll just ask a question, and even if that is like, you know, a really bad question, if — even if people think it’s a stupid question, they don’t care, you know, they just ask the question…. if I think too much, I cannot ask the question, but if I stop thinking and say that I don’t care, I can be like a guy, too.”
The gendered experience

**Women ought to be self-confident:** “I think any girl is just as capable as any guy doing engineering, but I've never seen one try. Even the girls that were in my department, they just seemed like they didn't think they should be there… With more scholarships available, extra help, student societies, things like that, girls’ continued lack of confidence is basically their fault.”

**There really is bias:** “It's kind of something that you just get the idea that this is the case without thinking about it. And then it kind of creeps into your conscious thought about things, and you're like wait a minute, that's crazy. And you have to actively say, no, that's not right. Girls are as good as guys at engineering.”
Presentation of self as an engineer

“I'm a hard worker. And a fast learner.”

“I think I've had a pretty wide experience, wide range of experience already…”

“I would want you to know what I’m interested in doing.”
Why the differences?

- Actual differences in ability? (no evidence for this)
- Gender schemas: engineering as a male domain
- Identity threat among female engineering students
- Perception of ‘special privileges’ for female students
- Social norms of communication
What can we do?

- Keep working to change the culture
- Create educational experiences that are not contingent on level of self-confidence
- Other ideas?
Acknowledgments

Ozgur Eris, Olin College
Larry Ludlow and Camelia Rosca, Boston College
Helen Chen, Krista Donaldson, Sheri Sheppard, Stanford University
Ken Yasuhara, Cindy Atman, Yi-Min Huang, University of Washington

Center for the Advancement of Engineering Education
Colorado School of Mines, Howard University,
Stanford University, University of Washington

This material is based upon work supported by the National Science Foundation under Grant No. ESI-0227558. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

http://www.engr.washington.edu/caee/
APS longitudinal cohort
40 undergraduates × 4 institutions

by race/ethnicity
- Caucasian
- Asian American
- African American
- Latino
- Other/Unknown
- Native American

by gender
- men
- women

by citizenship
- U.S.
- non-U.S.