The Roots of Self-Efficacy in Undergraduate Engineering

College of Education

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WHAT

To examine experiences related to self-efficacy for engineering, and to investigate any gender differences in the engineering domain

WHO

654 undergraduate engineering students from two large, public universities (73% men; 86% White)

HOW

Coded responses to a single open-ended question: *"What events have affected your confidence in engineering? How?"*

Mastery Experience

Prior experiences that serve as indicators of capability
(e.g., academic, cooperative/Internship, extracurricular, work)

72%

"**My co-op position** has greatly boosted my confidence, as well as starting my own company based off **a design and product I created**."

57%

"Doing well in challenging courses. **When I put in all the work and see the positive results**, it increases my confidence."

"**Failing my calculus class and having to withdraw made me feel like I can't do engineering**—that I'm not smart enough."

30%

Social Persuasion

Direct or indirect social messages about one's capabilities
(e.g., from family, parents, employers, peers, teachers)

9%

"I **hear from family and friends that I am good** at engineering."

"I made modifications to the method of construction and the design of the finished product. My professor said, **'Have you ever thought about becoming an engineer?'**"

76%

"**Asking certain professors for help has decreased my confidence** because I feel as if **they talk down to students** who do not understand a concept or misinterpreted how to solve it."

24%

Vicarious Experience

Viewing others' experiences and making comparisons
(e.g., modeling from adults, parents, peers; social comparisons)

63%

"**Listening to my dad speak about his work as an engineer** inspires confidence in my own work."
"**Higher grades relative to my peers** is an indicator for how well my skills suit engineering."

27%

"At the beginning of my freshman year, **I would always take longer to do problems or do the exams then the rest of the students** and it made my confidence in my skills decrease."

17%

Physiological State

Affective and physiological states that are interpreted as signs of capability
(e.g., excitement, stress, overwhelm)

8%

"Taking engineering courses through high school **gave me comfort** and background with the subject"

85%

"**I freeze up on tests.** My mind races and I have trouble recalling information when I feel pressure to do well."

2%

RESULTS

- The sources of self-efficacy are complex and intertwined (9% of responses were multiply-coded).
- Academic (40%) and internship experiences (7%) were the most frequent sources of self-efficacy.
- Most (84%) cooperative/internship experiences *raised* self-efficacy; only 48% of academic experiences did so.
- Other efficacy-relevant information included help availability, stereotype awareness, and practical applicability.

DISCUSSION

- Consistent with past research, enactive experience plays a key role in self-efficacy development. Course performance seems particularly influential.
- Practical application of engineering skills (e.g., internship) raises self-efficacy.
- Efficacy-relevant experiences are interconnected. Even those that are less frequent might be equally powerful in altering self-efficacy and career trajectories (Usher & Pajares, 2008).