Research Brief
Center for the Advancement of Engineering Education
NSF Grant ESI-0227558

Exploring the Relationships Among Performance on Engineering Tasks, Confidence, Gender, and First Year Persistence

Authors: Jennifer Light, Russell Korte, Ken Yasuhara, and Deborah Kilgore
Source: 2007 American Society for Engineering Education Conference

Despite a decade of programs aimed at attracting women and minority students to engineering, enrollment in engineering programs continues to be flat or declining. High attrition during the first two years, and a lack of diversity in engineering students raise concerns nationally about maintaining a competitive edge and future technological advancement. The goal of this research is to contribute to ongoing research efforts to understand how students think about engineering, how they conceive of themselves as engineers, and how these understandings influence their practices as they develop into engineers.

Implications of Findings

Ramifications for first year programs may be to ease the transition from high school to college with emphasis on realistic expectations for performance. First year programs that bring this common gender issue to light may create awareness for both males and females along with successful study and learning techniques that equip future engineering students with both the cognitive and psychological awareness needed to complete their engineering degree.

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Method and Background

This exploratory study is based on data from the Academic Pathways Study, a longitudinal, multi-institution study of engineering student experiences directed by the NSF-funded Center for the Advancement of Engineering Education. The APS uses both quantitative and qualitative methods to elicit data regarding the undergraduate engineering student experience. Here we analyze data gathered in the first year from an engineering performance task and survey questions about students' self-confidence to conduct an exploratory study on possible relationships between these measures (for a full description of the methods used, please follow the link below).

What We Found

This exploratory study has shown that while men enter engineering report higher confidence in themselves than women, they do not perform better on an engineering task nor are they more likely to persist (beyond the first year, women were more likely to persist than men).

These findings are contrary to what the theory of self-efficacy would predict – that is, the greater one's belief in one's abilities to achieve the objectives, the greater one's chances are of achieving those objectives.

Expectancy theory suggests that lower self-confidence should increase the expected level of effort needed to study engineering. If women generally have lower levels of confidence in their engineering-related knowledge and skills, the theory states that they should expect to work harder to achieve the valued outcomes. Conversely, if men have higher levels of confidence in their engineering-related knowledge and skills, then they should expect less effort required to graduate.

Cognitive dissonance theory may explain why women have lower confidence levels yet perform and persist on par with men. We hypothesize that greater alignment between expectations and experience—less dissonance—requires less radical change in the individual. The finding that women perform engineering tasks equally as well as men and that they persist at equal rates than men, may in part be due to their lowered confidence at entry. Rather than experiences of disillusionment, women may be more realistic in the expectations of difficulty at the outset of the engineering program. Men had greater confidence in themselves going into engineering education, and therefore perhaps suffered more disillusionment than women as they experienced academic challenges in the first year of study. On the other hand, women's greater persistence may be a function of the perceived value of an engineering degree.

Other factors may influence the persistence of students besides gender. For example, due to the predominantly male culture in engineering, the women who choose to enter the field may have self-selected based on higher levels of commitment than their male counterparts. The women in this study may come into the program with higher levels of commitment that would manifest in higher levels of persistence. Even if this self-selection process plays a larger role, it is also likely that the roles of expectancy and cognitive dissonance play an important part of this self selection – an important area for future research.