Research Brief
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Will I Succeed in Engineering? Using Expectancy-Value Theory in a Longitudinal Investigation of Students' Beliefs

Authors: Holly Matusovich, Ruth Streveler, Heidi Loshbaugh, Ron Miller, and Barbara Olds
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Earning an engineering degree is viewed as a challenging undertaking. So what drives engineering students to continue to navigate the difficult path? Many researchers have asked this question as evidenced by an exceptionally large number of literature citations containing the terms "engineer" and "motivation." Yet, the answer remains uncertain. The expectancy-value framework proposed by Eccles has the potential to enlighten persistence choices.

Implications of Findings

Results of this study can inform curricular change by providing fundamental information on the experiences of the college student. By showing ways in which students' expectancies of success as engineers are shaped by their classroom, campus, and internship experiences, this study provides a broader context for curricular change.

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The results suggest the need to authentically expose students to a variety of engineering career possibilities so they can develop accurate perceptions of what engineers do, the skills needed, and their own abilities. The results also suggest that students need help bridging the gap between the relevance of what they are learning in the classroom and what they will be doing as engineers in the future.

Method and Background

Multi-case methodology is used in a qualitative longitudinal examination of expectancy of success. This study uses the expectancy-value model of achievement motivation (proposed by Eccles) as the framework for evaluating students' perceptions of success. Expectancies can be defined as one's belief as to how well he or she will perform on an upcoming task or in a future event (additional detail and a diagram of the model can be found in the full paper at the link below).

This study is part of the larger Academic Pathways Study of the multi-institution, multi-method Center for the Advancement of Engineering Education. The overall broader purpose of APS is understanding undergraduate student experiences as they learn engineering.

Expectancies in this study focused on students' beliefs about their ability to be successful in their chosen fields of engineering. Case study methodology is used to qualitatively and inductively examine longitudinal interviews collected over four years with four students (2 male and 2 female) to address the following research questions: How do students characterize success in their given engineering field? How do these characterizations develop and change with time? Do students believe they have the characteristics that they define as important to success? A unique aspect of this study is that it looks at success as defined from the student perspective rather than an externally imposed definition of success.

Participants in this study were from Technical Public Institution (TPub, a pseudonym) who attended the institution from fall 2003 to spring 2007. TPub students were recruited through a variety of methods for the larger APS study. Volunteers were selected to intentionally over-sample for underrepresented groups and were paid for participation. Participants were selected from an 8-person subset of the original 40 students participating in APS at TPub. These students participated in semi-structured interviews, ethnographic observations, and informal conversations in addition to the on-line, semi-annual surveys. The interview protocol included a loosely structured framework of guiding questions prompting the students to think about topics central to the overall APS objectives if such topics did not arise naturally in conversation. Participants are identified by pseudonyms in this paper.

What We Found

Responses to the question, "How do students characterize success in their given engineering field and how do these characterizations change with time?" were not engineering specific as much as they were based on the individual's personal experiences. In first-year interviews, the skills students cite as important for success may come from previous jobs (not always related to engineering) or other significant life experiences. For example, Joe identifies communication as an important skill for success in engineering and reports that he learned good communication skills through his many years as a Boy Scout. As the students take engineering classes, participate in campus activities, and complete internships, their beliefs about the skills needed to be successful engineers change. For example, two of the students, Max and Hillary, have extensive internship experiences. Their beliefs about the skills needed, and their evaluations of themselves against those skills are more concrete after these internships, and are grounded in their own personal, authentic experiences.

Students' experiences are also important in helping them asses their own skills against the skills they believe are important. For example, Hillary uses a specific case from her internship as she describes her need to learn to ask for help: "...Because in class you have everything you need to know in the, in the problem statement to solve the problem. And, in the real world, you don't. You're going and talking to the geologists..."

Student responses around the question "Do students believe they have the characteristics that they define as important to success?" varied among the participants. Max and Hillary developed beliefs about the skills needed for success that are grounded in experiences similar to those they hope to pursue as professionals. They also have more evidenced-based evaluations regarding their skills – they can identify what they do well and what they need to improve. In contrast, Anna is unsure of what she wants to do for a career, has a lack of confidence in her laboratory skills, and still has a positive expectancy of success in engineering even though it is hard for Anna to assess her abilities against a set of skills she cannot define.

Applying these results to Eccles' model, it is possible to begin fleshing out the interconnections of factors hypothesized to contribute to expectancy of success. These data inform only certain aspects of the model (see the full paper for a modified diagram of the model based on these results). The main modification portrays how students' interpretations of classroom, campus, and internship experiences can also impact their beliefs about the skills needed to be successful engineers.