

## **Why Students Leave Engineering: The Unexpected Bond**

**Authors:** Lorraine Fleming, Kimarie Engerman, and Dawn Williams

**Source:** 2006 American Society for Engineering Education Conference

The following research study and analysis is part of an in-depth, longitudinal study funded by the National Science Foundation through the Center for the Advancement of Engineering Education (CAEE). This study was conducted as part of the CAEE research activity called the Academic Pathways Study (APS).

### **Implications of Findings**

Our study indicates that student support regarding retention should be strongest in the freshman year, since many students decide to exit the engineering program and change majors during their first year. Institutions can assume a proactive role by first identifying the reasons for students' departures from their engineering programs, and then developing intervention programs to specifically address these reasons.

### **Method and Background**

The APS is studying 160 undergraduate engineering students (approximately 40 students from each of 4 campuses). The APS looks carefully at the lives of these students during the first three years of their college experience with an emphasis on the challenges they face (e.g., skills, identity, commitment) and how they handle those challenges.

**Institutions can assume a proactive role by first identifying the reasons for students' departures from their engineering programs, and then developing intervention programs to specifically address these reasons.**

Our team believes that students must strive to meet three learning goals to succeed: to master a new set of skills or knowledge, to do better than others, and to be accepted by others. The first year student trying to achieve these goals must deal with the complex interrelationship among these goals. The motivation to study engineering can disappear or be greatly diminished when there is a break or potential break in this interrelationship. For example, a student who fails a class is not making successful progress towards earning a degree. Students who are unsuccessful in making progress towards these goals typically leave engineering and do not earn degrees in engineering.

It has also been shown that many students abandon engineering because of grade-related issues. Performance in calculus courses, a prerequisite for engineering courses, is believed to be the largest obstacle for first-year students in engineering programs. Research findings indicate that a student's persistence in mathematics courses correlate strongly with their liking mathematics and confidence in the mathematics skills. However, other factors may influence a student's attitude and motivation to persist.

## **What We Found**

This study shows that concern about financial issues, particularly maintaining financial aid, also has an impact on a student's persistence in engineering. Many students need financial assistance to attend college and students seek scholarships and grants to help defer tuition cost. Quantitative studies of college students have found a direct relationship between financial aid and retention. Students with sufficient financial assistance who did not have to work were more likely to persist towards a degree than those who did not have aid.

This study focuses on the students who decided to switch to non-engineering majors after only one year. Three case studies of students from one institution are presented. These case studies include data from structured interviews conducted during the student's second semester before they decided to switch majors, coupled with ethnographic exit interview data gathered once their decisions to leave were final.

Our research team found four major issues that led to students leaving engineering majors: 1) lack of faculty guidance/advisement, 2) lack of community engagement, 3) scholarship/financial dilemmas, and 4) course difficulty in the areas of calculus I and II. The latter two factors echo earlier work but were particularly intriguing because of the unanticipated connection that we discovered between them.

All three of these students had been awarded competitive academic scholarships. Two of the students experienced difficult academic transitions from high school mathematics (where they had top grades and very high SAT scores) to college level mathematics. These students left their respective engineering programs after their first year with 3.46 and 3.60 grade point averages (on a 4.0 scale). The third student left the engineering program and lost her scholarship with a 2.46 grade point average after failing calculus. What happened to the third student was the greatest fear of the other two. Would their difficulty in a core engineering course (calculus) affect their ability to maintain their required GPA and thus result in loss of their scholarship? Even though engineering is perceived as one of the most rigorous majors in undergraduate education, all of these students entered the university enthusiastic about becoming an engineer. However, many students left before they were exposed to the heart and soul of the discipline, not necessarily because of failure, but out of fear of failure.

The outcomes of these students indicates these students' enrollment in college is contingent upon financial assistance through merit-based scholarships. Since they were awarded these scholarships, their academic potential and efforts to become an engineer were recognized. But in this case, students abandoned the engineering major simply to maintain their scholarships. This finding is disturbing because we see students choosing a major, not based on interest or aptitude, but based on minimizing the risk of losing their financial support. The fact that the engineering community may be losing some of its brightest workers is even more disturbing.

[www.engr.washington.edu/caee](http://www.engr.washington.edu/caee)

June 2007