

Retention in a First Year Program: Understanding Why Undergraduate Students Lose Interest in Engineering

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Abstract—Despite all institutional resources allocated to improve student retention, attrition continues to be a significant problem in engineering education. Retention in engineering programs varies in the range of 40-60%. Institutions are recognizing the fact that students capable of completing an engineering degree are switching from engineering to pursue non-engineering disciplines.

The purpose of this study was to understand how the first semester experience influences students' decision to continue a degree in engineering. The goal was to identify the challenges faced by first time engineering students and to identify events and experiences that trigger a change of interest in pursuing engineering. The authors studied first semester engineering students enrolled at a large land grant university in the mid-Atlantic region. Several surveys administered at strategic time points during the semester were used to track level of interest in pursuing engineering and to identify key events that can be consider as precursors to leaving engineering.

An analysis of entrance surveys indicated a high level of interest in pursuing an engineering degree in most students surveyed. Key events, such as the first calculus test, triggered indecision in some of the students. Key events identified as precursor to leaving engineering are discussed, as well as the implications for potential intervention programs to address student interest as well as academic success in engineering.

Index Terms – Attrition, Engineering, First-Year, Freshman, Retention.

INTRODUCTION

Attrition is a problem that affects all engineering programs in the USA [1]-[8]. A significant number of students are not completing their engineering degrees; they are transferring into non-engineering programs or dropping from college. Attrition is observed at all levels, especially in students enrolled in the first four semesters in an engineering program.

Studies on retention have identified the lack of interest in engineering or in the engineering disciplines offered at the institution as a leading reason for the switch [4][5].

Furthermore, it was also found that those students that switched to a non-engineering program during the first semester were less likely to complete a degree in college. Although significant resources have been allocated to deal with attrition, the problem has not been solved [2][3].

The purpose of this study was to understand how the first semester experience influences students' decision to continue a degree in engineering. The goal was to identify the challenges faced by first time engineering students and to identify events and experiences that trigger a change of interest in engineering. This information is essential to devise strategies to assist student in the successful completion of their degree in engineering.

METHODOLOGY

This study includes data from 73 undergraduate students enrolled in their first semester of a freshman engineering program at West Virginia University (WVU). Participants were mostly men and completed three surveys administered at the beginning, middle, and end of their first semester in the institution. Participants also completed two reflective essays, administered at the middle and end of their first semester in the program. University databases were utilized to assess the end of semester grade point average (GPA) and the high school GPA.

Surveys

Questionnaires were administered at the beginning, middle, and end of the first semester in the program. The questionnaires were aimed at understanding the reason to select engineering as a discipline to pursue, students' perception of their first semester experience in college, and the level of interest in pursuing a degree in engineering.

Reflective Essays

Students completed two reflective essays administered at the middle and end of the first semester. In those essays, students wrote about the engineering discipline they planned to pursue, challenges faced during the semester, and how their first semester experience influenced their interest in pursuing a degree in engineering.

RESULTS

First Year Engineering Program: All engineering students at WVU must complete a common “first year experience” before moving to an engineering major. Students who are not calculus-ready at entry usually take 1.5 to 2 years to complete the courses required to move to an engineering major. All participants were enrolled in their first semester in college; at the time of the study none of the students have declared an engineering major.

TABLE 1
CHARACTERISTICS OF THE SAMPLE STUDIED

Parameter	Statistics
Gender	Male 69 Female 4
High School GPA (Mean \pm standard deviation)	3.54 \pm 0.53

Results from Survey and Reflective Essay: As Table 1 indicates, the participants were mostly male with an average high school grade point average (GPA) of 3.54 \pm 0.53 (mean \pm standard deviation). This female to male proportion is slightly lower than the ratio observed in our engineering program (10-15% of all engineering students in our program are females).

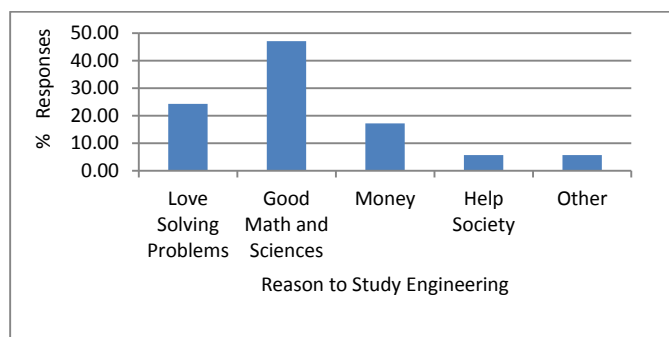


FIGURE 1
REASON TO STUDY ENGINEERING.

The initial survey showed that the main reason to select engineering as a career choice was because students considered themselves good in math and sciences (Figure 1). The second reason to study engineering was because students love problem solving.

At the beginning of the semester, the level of interest in pursuing a degree in engineering was high, with 22% of the students indicating that they were interested, but not sure yet (Figure 2). As Figure 2 illustrates, the percentage of students indicating “engineering is for me” was kept high during the semester (70-78% of the students). Fifty eight percent of the students reported that their first semester experience did not influence their level of interest in pursuing a degree in engineering; the remaining 41.9% of the students experienced a change of interest. Not only the level of interest changed, but also their selection of engineering

discipline to pursue, with 41% of the students changing their choice of which engineering discipline to pursue.

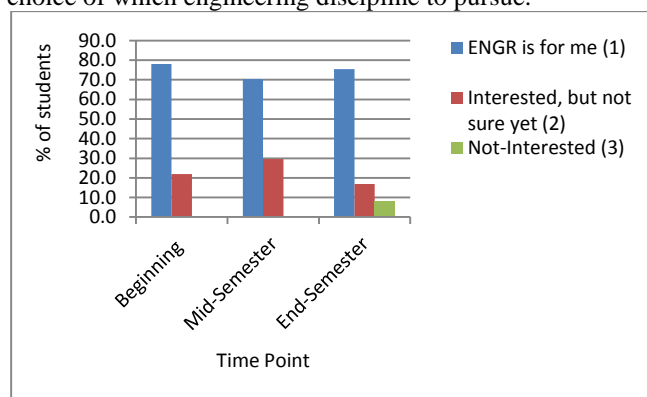


FIGURE 2
LEVEL OF INTEREST IN ENGINEERING ASSESSED AT THREE TIME POINTS DURING THE SEMESTER

At the end of the semester (as Figure 2 indicates) several students decided to switch to a non-engineering discipline. Table 2 summarizes the reasons reported by students for the change in interest. It was also found that some of the students that decided to leave the program were considering a second career choice at the beginning of the semester and were using the first semester to make a final decision on which discipline to pursue.

TABLE 2
REASONS FOR THE LOSS OF INTEREST IN ENGINEERING

Reasons
Academic difficulty
Wrong perception of engineering -Office (desk/paper) work
Inability to keep up with college load (study, take exams, multitask, organization problems)
Interest in a different career choice (non-engineering)
Faculty not supportive

Comments made by students that experienced a change in interested during the semester:

“My initial desired was in architecture, but the institution did not offer architecture major. I’m having difficulties in calculus 1, and realized that engineering is probably not the career for me.”

“I have chosen Geology to be my alternate career path. At first engineering really intrigued me but after a while I found it to be not as satisfying.”

“My interest in an engineering degree has changed. The workload and the difficulty of the work caused the change in interest. It was hard the transition from high school where not much work is required.”

When asked about the challenges faced during their first semester (see Table 3), students reported not knowing how

to study for exams, how to take exams, how to handle their independence, and some of them experienced homesickness. Some of the comments made by students can be summarized as:

"It took me until mid-semester to truly get myself into a system of study and note taking that I found to work well with me."

"Keeping the stress down has been a challenge, because all of the tests and exams are close in schedule."

"I got very homesick about halfway through the semester."

TABLE 3
CHALLENGES FACED BY STUDENTS

Challenges	
Academic	
–	How to study for exams?
–	How to take exams?
–	How to take notes?
–	Organization / Time Management
Study-Life	
–	Balancing social life and school
–	Learning how handle independence
Personal	
–	Stay motivated
–	Home sickness
–	How to handle stress

DISCUSSION

For students just starting college, the first semester is full of learning experiences and adjustments. Students not only need to learn how to balance their studies and social life, but they also need to learn how to study for tests, how to manage their time, how to organize their daily activities, and even how to work in groups.

This study provides a general view of the first semester experience for engineering students. From this study we learned that a significant number of first semester engineering students join the institution with a second career choice in mind and use the first semester to decide which discipline to pursue. We also identified the need for interventions that assist students with the skills needed to succeed in their courses. Students need to learn how to take tests, how to study for the exams, and how to manage time at an early point during their first semester.

For our engineering students, exposure to career fairs, department visitations, and student organizations, solidified student's decision to continue in engineering. For some of the students, the exposure to non-engineering disciplines was sufficient to trigger a desire to switch to a non-engineering program (data not shown).

Several scenarios caused a change in interest in pursuing engineering; academic difficulty was one of them, with

calculus 1 and chemistry being the toughest courses taken by our students. The study also showed that classroom experiences were important to maintain students' interest in engineering. For instance, in the reflective essays, students indicated that "Teamwork increased my desire in pursuing a degree in engineering", "The competition is a factor that I enjoyed much more than I had predicted. It helps to drive me much more than a basic problem with a single solution", and "This semester I have learned that I like being in charge of projects (project management)".

Some students experienced homesickness, while others had a hard time trying to adjust to a new system of note taking, lectures, and exams.

CONCLUSION

Students face a multitude of challenges during the first semester in college. As a result, some students persist in engineering, whereas others lose interest and decide to move to a non-engineering program. This paper not only documented challenges faced by students during the first semester, but it also discussed factors associated to the loss of interest. Academic difficulty led to a loss of interest, but was not the only reason found. Interest in engineering was also influenced by the material presented in their engineering courses. Extracurricular activities, such as career fairs and departmental visitations, also influenced students' interest. In summary, engineering programs must constantly engage engineering students, inside and outside the classroom, to maintain students' interest and enthusiasm in pursuing a degree engineering.

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