Interest in Engineering: Importance of Classroom Experiences

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Abstract

Attrition is a problem that affects all engineering programs in the United States. Although the statistics on student retention vary by academic institution, in general, for every two students that begin in an engineering program, only one graduates. The phenomenon of attrition is complex, and several research approaches have been undertaken to understand the reasons to switch out of engineering and to identify predictors for students' non-persistence. The overall goal of this study is to characterize the phenomenon of attrition in a first year engineering program. This paper identifies positive experiences that influences students' interest in pursuing a degree in engineering. In general, it was observed that increases in interest in engineering were mainly associated with engineering classroom experiences. Specific engineering related classroom events that led to increases in interest were identified and will be discussed in this paper.

Keywords

Retention, Engineering, Classroom Experiences

Introduction

Attrition is a problem that affects all engineering programs in the United States. Although the statistics on student retention vary by academic institution, in general, for every two students that begin in an engineering program, only one graduates. The phenomenon of attrition is complex, and several research approaches have been undertaken to understand the reasons to switch out of engineering and to identify predictors for students' non-persistence (Hartman & Hartman, 2006; Marra, Rodgers, Shen, & Bogue, 2012; Moller-Wong & Eide, 1997; Ohland et al., 2008; Pascarella & Terenzini, 1980).

The main purpose of the study is to identify experiences and event that lead to increases in interest in engineering in first year engineering students. The role of in class and out of class experiences in promoting students' interest in engineering was addressed. Specific in class and out of class experiences associated with students' increase in interest were identified. Institutions searching from ways to improve students' engineering experience will benefit from attending this presentation.

Methodology

Student Cohort: 1070 engineering students (20.12% females and 79.88% males) enrolled at a large land grant university in the mid-Atlantic region participated in this study. Two separate student cohorts, students that began in engineering in fall 2013 and in fall 2014, were analyzed in this study. This study was acknowledged by the WVU-Institutional Review Board (IRB).

Survey: Three surveys administered at the beginning and end of the first semester in college, and at the end of the second semester in college were used to assess students' interest in engineering and to identify events and experiences that lead to an increase or decrease in interest in engineering. In the survey, students were asked to indicate if they have experienced an increase, decrease, or no-change in interest in pursuing a degree in engineering. Those students that indicated a change in interest, were further asked to identify events and experiences that led to this change in interest.

Data Analysis: The data obtained was analyzed based on the change in interest experienced at the end of the first and second semesters, with some students indicating that they experienced an increase in interest in engineering, others experienced a decrease in interest in engineering, and some experienced no-change in interest, relative to the beginning of the semester. For those students that experienced a change in interest, the investigators also analyzed their responses in terms of what led to this change in interest.

Results and Discussion

Gender Distribution and Pre-college characteristics: All first semester engineering students at this large land grant university in the mid-Atlantic region begin their education in a first year engineering program, before moving to an engineering major. As Table 1 indicates, most participants were male with an average high school grade point average (GPA) of 3.68 ± 0.37 (mean±standard deviation), ACT and SAT math scores of 27.40 ± 3.33 and 621.70 ± 67.81, respectively.

Table 1: Gender distribution and pre-college characteristics of participants

Parameter	Statistics
Gender	79.88% Males 20.12% Females
High School GPA	*3.68±0.37
SAT MATH scores	*621.70±67.81
SAT COMBINED scores	*1181.50±123.90
ACT MATH scores	*27.40±3.33
ACT COMPOSITE scores	*27.17±3.20

* Mean ± standard deviation

Change in Interest in Engineering: As Figure 1 illustrates, at the end of the first semester in college, approximately 40% of the students reported experiencing an increase in interest in engineering, while approximately 11% of the first semester participants reported a loss of interest in engineering. This increase in interest reported by first semester students (see Figure 1) was consistent for both student cohorts (2013 and 2014 cohorts). Since no major differences (increase in interest, reasons to change interest) were observed in results obtained for the 2013 and 2014 cohorts, both cohorts were analyzed together.

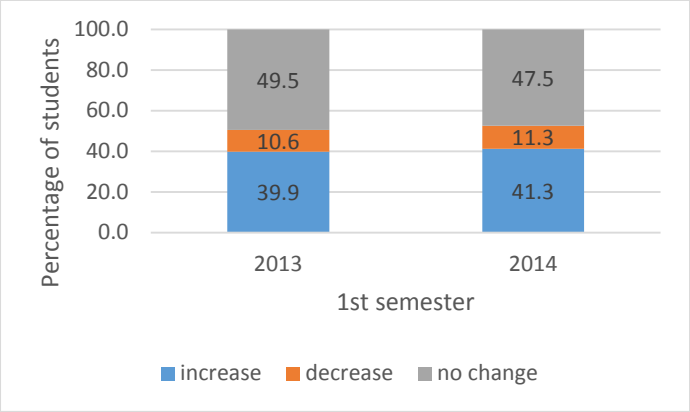

Figure 1: Changes in interest in engineering at the end of the first semester

An increase in interest was also reported by the second semester students, where approximately 38.5% of the students indicated experiencing the increase in interest (data not shown). In general, for the whole study, a small percent of students (9.25%) experienced a decrease in interest as a result of their first and second semester experiences.

In terms of gender differences, as Figure 2 illustrates, at the end of the first semester, a slightly larger percentage of female reported an increase in interest in enginering in comparison with males. This increase in interest was also observed in second semester students, where again, a slightly larger percentage of females reported an increase in interest in comparison with males (data not shown).

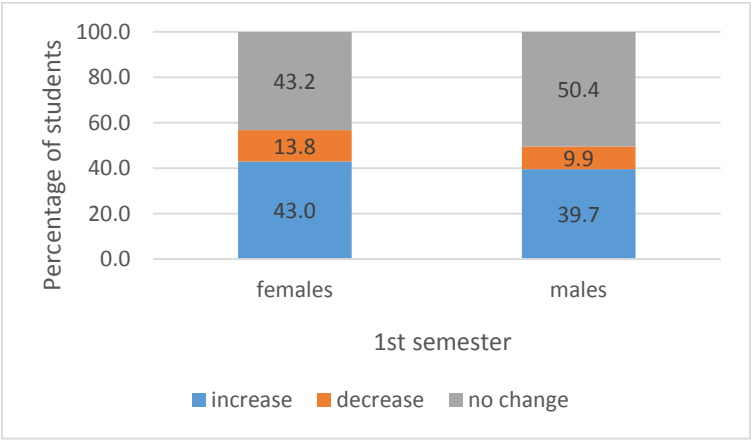

Figure 2: Change in interest in engineering in females' vs males

When asked about events and experiences that lead to the increase or decrease in interest in engineering, Table 2 summarizes responses obtained from first semester students. For events and experiences that led to an increase in interest, student reported academic success, project work, teamwork, and gaining knowledge about what engineering is as some of the main reasons for the increase in interest. For these students, events and experiences that led to a decrease in interest included: academic difficulty, lack of help from professors, and a difficult curriculum densely packed (see Table 2).

Table 2: Pushes and pulls: what retains and what repels students from engineering

PUSHES	PULLS
• Low grades • Academic difficulty • Lack of help from professors • Proudness of students and teachers • Curriculum is difficult and densely packed	• Academic success • Career opportunities • Enjoying math classes • Help from the professors • Course work and projects • Interest in problem solving • Knowledge about what Engineers do • Departmental visits, events and fests • Technological advances in Engineering • Interaction with Engineers and Professors • More understanding of what engineering is • Exposure to more possibilities in the field of Engineering

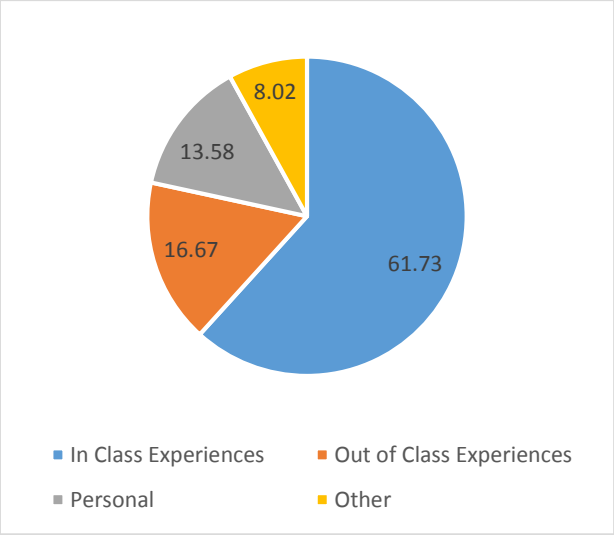

Figure 3: Reasons for increase in interest in engineering at the end of 1st semester in an engineering program

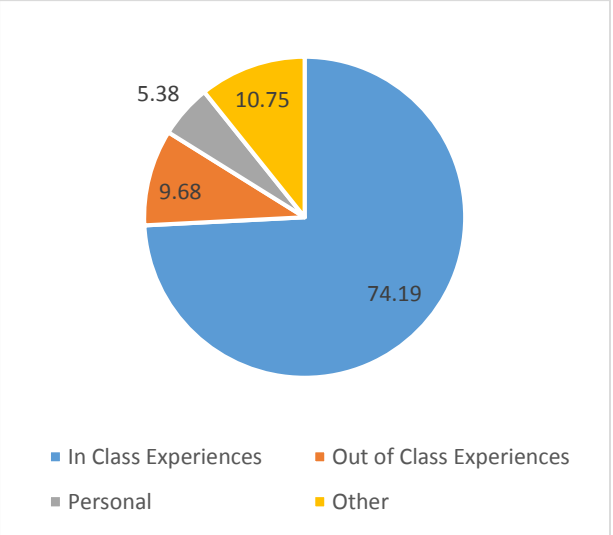

Figure 4: Reasons for increase in interest in engineering at end of 2nd semester in an engineering program

Since a significant number of students experienced an interest in engineering by the end of both semesters, the goal was to understand which experiences were meaningful to them. The study classified the experiences mentioned by students as: in class, out of class, personal, and of other source (non-related to in class, out of class, or personal experiences). This classifications led to an understanding that in class experiences significantly contributed to the increases in interest in engineering. For instance, 61.73% of the 1st semester students and 74.19% of the 2nd semester students experienced an increase in interest in engineering due to in class experiences.

In this study, classroom experiences were further categorized as engineering class experiences, non-engineering class experiences, and unknown source. During both semesters, most of the students experienced an increase in interest due to the engineering class experiences (data not shown). This led to believe that engineering classroom experiences are important to maintain students' interest in engineering. Although good grades in math and sciences courses are important and normally reinforced in the engineering curriculum, from a student perspective, engineering classroom experiences matters. Further studies must be conducted to understand the relationship between engineering classroom experiences and student retention in engineering.

Conclusions

Students are introduced to engineering concepts and to the profession mainly through engineering classroom experiences. These classroom experiences are essential not only to prepare students for engineering, but also to foster the development of an engineering identity, which has been linked to retention in engineering. In this study, engineering classroom experiences are shown to be important to promote students' interest in engineering. Currently, the investigators are examining the relationship between interest in engineering and student retention in engineering.

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