Impact of Early Exposure to Engineering Practice on Retention Rates among Engineering Students

Matthew J. Traum*
Assistant Professor
Department of Mechanical and Energy Engineering
University of North Texas
PO Box 311089
Denton, TX 76203-1089

Sharon L. Karackattu
Research Coordinator
Planning and Advancement for Student Development
University of North Texas
PO Box 305358
Denton, TX 76203-5358

Christopher Heiden
Associate Director, Academic Services
College of Engineering
University of North Texas
PO Box 310440
Denton, TX 76203-0440

Abstract

Preliminary data critical to assessing the effectiveness of teaching new students about the careers of practicing engineers is presented and analyzed. A new course has been developed for mechanical and energy engineering (MEE) majors at the University of North Texas (UNT) that includes exposure to engineering practice as a significant component of the first-year experience. Through survey data collected from students enrolled in this course, we test the hypothesis that educating new engineering students about the responsibilities, activities, and projects they may encounter as practicing engineers will have a positive impact on retention rates.

Summary

The United States has magnified its call for professionals trained in science, math, and engineering; in response, many universities have bolstered their efforts to recruit and retain students in these fields [1]. With particular emphasis on the first year of college, engineering educators recognize the benefits and ultimate need to expose undergraduate students to engineering practice alongside the traditional pedagogical curriculum to enhance the education experience, help students make informed career decisions, increase student satisfaction, and decrease attrition rates [2].

Background

Conventional “first-year experience” courses focus on teaching college survival skills, providing orientation to campus resources, and building cohorts and communities of peers to support students as they embark on higher education. These foci are believed to improve student retention by providing or reinforcing critical skill sets, knowledge, and networks essential for the ensuing college years [3]. Nonetheless, the engineering education literature suggests a new approach and calls for studies highlighting the impact of redesigned courses on students’ early exposure to post-graduate engineering practice and careers. Most of these first-year engineering programs are geared toward integrated curricula to support students through the prerequisites of physics, calculus, and chemistry that account for much of the early attrition [4-8]. Other programs concentrate on first-year engineering design practice to give students “hands-on” experience and...
stimulate interest and retention [6, 7, 9, 10]. Here, we provide preliminary data critical to assessing the effectiveness of a unique first year experience concept: teaching new students about the careers of practicing engineers.

Undergraduate students express many reasons for their choice of a major discipline, especially engineering students. A large fraction of these students choose engineering for pragmatic reasons, believing that completion of an engineering degree will guarantee stable and abundant employment prospects with higher starting salaries [11]. Unfortunately, many of these students also elect to major in engineering by way of an “uninformed choice”[11]; that is, they envision an engineering degree as the means to fulfill childhood fantasies (such as spaceflight). Studies indicate that high school students typically have limited understanding of the activities and responsibilities undertaken by professional engineers [12, 13]. Moreover over 13% of students who ultimately leave engineering and over 6% of those who persist designated themselves as science, technology, engineering, and math (STEM) majors despite self-recognizing their insufficient comprehension of what their chosen discipline or career entails. In addition, students who leave the STEM disciplines express concerns about the job prospects, remuneration and lifestyle appeal associated with STEM careers that are not shared by students who persevere to graduation [11]. These data suggest that an introductory course designed to expose freshman engineering students to experiences faced by practicing engineers may assist in both informing them about career options and in motivating them to persist in engineering.

**Topic and Aim of the Presentation**

We report on an in-progress initiative for incoming students to the mechanical and energy engineering (MEE) major at the University of North Texas (UNT). A course entitled “Mechanical and Energy Engineering Practice” has been developed that includes exposure to engineering practice as a significant component of the first-year experience. Our new first-year experience course highlights activities and responsibilities that practicing engineers encounter after college as they join the engineering profession. Through data collected from students enrolled in this course, we test the hypothesis that educating new engineering students about the responsibilities, activities, and projects they may encounter as practicing engineers will have a positive impact on retention rates.

**Methodology**

Mechanical and Energy Engineering Practice is offered in a series of one-hour seminars. Classes are team-taught by the UNT MEE faculty in concert with five practicing engineers from local industry. Faculty share their careers as research engineers, and practicing engineers expose students to projects encountered in industry. The benefits are deemed mutual; students learn about engineering employment options, and faculty and practicing engineers have an opportunity to market their research and companies to the next generation of engineers. In addition, several interactive ethics seminars illuminate the underpinning principles and ethos adhered to by engineers in research, academia, and industry.

To gauge whether early exposure to engineering practice increases students’ comprehension of what their chosen discipline or career entails, an anonymous survey was prepared. This survey probes students’ familiarity with engineering practice, asks them to gauge their familiarity with engineering careers, and allows them to quantify their intention to continue as engineering students. All students enrolled in Mechanical and Energy Engineering Practice took this survey on the first day of class and then re-took the same survey on the last day. Differences in students’ survey responses before and after the class were compared to gauge the impact of exposure to engineering practice.

**Results**

We will present results from the student survey and illuminate the correlation between early exposure to engineering practice and students’ self-reported comprehension of what their future engineering careers may entail. We will also show that the students express an increased understanding of how the work of engineers positively impacts society. Finally, we will analyze the general effectiveness of teaching first-year undergraduates about the careers of practicing engineers upon students’ desire to persist in an engineering major.

In addition to reporting on the validity of our hypothesis, this presentation will also elucidate best practices gleaned from the experiences of faculty and industry co-teaching a first-year experience course together. This initiative also aspires to assist in developing solid partnerships between academia and industry and generating potential co-op and internship experiences for students as well as research collaborations for faculty.

**Future Directions**

Since no students have yet graduated from UNT’s program, comparison of retention rates among peer universities is not possible at this time. Once our program graduates its first undergraduate class in 2010, a cohort study will track retention and graduation rates of students exposed to the practice-focused course. This future study will allow comparison among UNT’s peer universities whose engineering students participate in a conventional first-year experience program versus our engineering-practice-oriented program to ascertain whether either approach improves retention.

**References**


Introduction

Conventional “first-year experience” courses focus on teaching college survival skills, campus orientation, and building human networks as a way to ensure student retention by reinforcing critical skill sets, knowledge, and networks for ensuing college years [3]. The engineering education literature calls for studies on how redesigned courses impact students’ early exposure to post- secondary engineering. This paper explores students’ early exposure to professional engineering as well as engineering and math (STEM) disciplines express concerns about the job prospects, remuneration, and lifestyle appeal associated with STEM careers not shared by their peers [11]. This suggests exposing students to practicing engineers and the daily activities of the engineering profession may both inform them about career options and motivate them to pursue engineering.

Methods

The Mechanical and Energy Engineering (MEE) Department at the University of North Texas (UNT) has offered a curriculum called MEE Practice I, which is offered in a series of one-hour seminars. Classes are taught by the UNT MEE faculty in concert with practicing engineers from local industry. Faculty share their careers as researchers and engineering, and practicing engineers expose students to projects encountered in industry. The benefits are deemed mutual; students learn about engineering employment options, and faculty gain valuable insights into the work of engineers and academia, thus enhancing the next generation of engineers. In addition, several interactive ethics seminars illuminate the role of ethics in the engineering profession.

Prior to this study, weeding” program will guarantee stable employment prospects with higher starting salaries [11]. Unfortunately, students also elect to major in engineering by way of an “uninformed choice,” that is, an engineering degree as the means to fulfill childhood fantasies. Studies indicate that high school students typically have limited understanding of the advantages and disadvantages of pursuing engineering. Furthermore, we report our findings indicating that upper-division students have left our engineering and, math, and STEM disciplines express concerns about the job prospects, remuneration, and lifestyle appeal associated with STEM careers not shared by their peers [11]. This suggests exposing students to practicing engineers and the daily activities of the engineering profession may both inform them about career options and motivate them to pursue engineering.


Differences in students' survey responses before and after the class (Figure 1) were compared to gauge the impact of exposure to practice.

Conclusions and Future Research

 Preliminary data from this study indicate that MEE Practice I provides many students with a realistic perception of the careers of practicing engineers and familiarizes them with the discipline. Many students also reported that participating in the “weeders” program motivated them to commit to engineering degrees. Further demonstration of these course benefits are encapsulated in comments drawn from student assignments in which they reacted to industry presenters (Table 3). For many students, the course serves as a positive, introductory experience and cements relationships with future peers and colleagues. At the same time, the data also reflect that the upper-division portion of the MEE major via a low-risk academic environment. We have introduced the term “soft weeding” to describe the process of self-selection from the “hard weeding” that students may experience as they struggle academically through required major-specific coursework. Future work includes longitudinal analysis of the impact of MEE Practice I on retention rates within the Department of Mechanical and Energy Engineering and propensity of students to engage in academic auxiliary programs including undergraduate research, professional societies, and career internships. The influence of MEE Practice I on retention rates in mechanical engineering will ultimately be compared against similar departments at UNT’s peer institutions that have no “first-year experience” program.

Thermal Fluid Sciences Group @ UNT
A Student Centered Research Lab

Reference


The Mechanical and Energy Engineering (MEE) Department at the University of North Texas (UNT) has offered a curriculum called MEE Practice I, which is offered in a series of one-hour seminars. Classes are taught by the UNT MEE faculty in concert with practicing engineers from local industry. Faculty share their careers as researchers and engineering, and practicing engineers expose students to projects encountered in industry. The benefits are deemed mutual; students learn about engineering employment options, and faculty gain valuable insights into the work of engineers and academia, thus enhancing the next generation of engineers. In addition, several interactive ethics seminars illuminate the role of ethics in the engineering profession.

Prior to this study, weeding” program will guarantee stable employment prospects with higher starting salaries [11]. Unfortunately, students also elect to major in engineering by way of an “uninformed choice,” that is, an engineering degree as the means to fulfill childhood fantasies. Studies indicate that high school students typically have limited understanding of the advantages and disadvantages of pursuing engineering. Furthermore, we report our findings indicating that upper-division students have left our engineering and, math, and STEM disciplines express concerns about the job prospects, remuneration, and lifestyle appeal associated with STEM careers not shared by their peers [11]. This suggests exposing students to practicing engineers and the daily activities of the engineering profession may both inform them about career options and motivate them to pursue engineering.

Conclusions and Future Research

 Preliminary data from this study indicate that MEE Practice I provides many students with a realistic perception of the careers of practicing engineers and familiarizes them with the discipline. Many students also reported that participating in the “weeders” program motivated them to commit to engineering degrees. Further demonstration of these course benefits are encapsulated in comments drawn from student assignments in which they reacted to industry presenters (Table 3). For many students, the course serves as a positive, introductory experience and cements relationships with future peers and colleagues. At the same time, the data also reflect that the upper-division portion of the MEE major via a low-risk academic environment. We have introduced the term “soft weeding” to describe the process of self-selection from the “hard weeding” that students may experience as they struggle academically through required major-specific coursework. Future work includes longitudinal analysis of the impact of MEE Practice I on retention rates within the Department of Mechanical and Energy Engineering and propensity of students to engage in academic auxiliary programs including undergraduate research, professional societies, and career internships. The influence of MEE Practice I on retention rates in mechanical engineering will ultimately be compared against similar departments at UNT’s peer institutions that have no “first-year experience” program.

Thermal Fluid Sciences Group @ UNT
A Student Centered Research Lab

Reference


The Mechanical and Energy Engineering (MEE) Department at the University of North Texas (UNT) has offered a curriculum called MEE Practice I, which is offered in a series of one-hour seminars. Classes are taught by the UNT MEE faculty in concert with practicing engineers from local industry. Faculty share their careers as researchers and engineering, and practicing engineers expose students to projects encountered in industry. The benefits are deemed mutual; students learn about engineering employment options, and faculty gain valuable insights into the work of engineers and academia, thus enhancing the next generation of engineers. In addition, several interactive ethics seminars illuminate the role of ethics in the engineering profession.

Prior to this study, weeding” program will guarantee stable employment prospects with higher starting salaries [11]. Unfortunately, students also elect to major in engineering by way of an “uninformed choice,” that is, an engineering degree as the means to fulfill childhood fantasies. Studies indicate that high school students typically have limited understanding of the advantages and disadvantages of pursuing engineering. Furthermore, we report our findings indicating that upper-division students have left our engineering and, math, and STEM disciplines express concerns about the job prospects, remuneration, and lifestyle appeal associated with STEM careers not shared by their peers [11]. This suggests exposing students to practicing engineers and the daily activities of the engineering profession may both inform them about career options and motivate them to pursue engineering.

Conclusions and Future Research

 Preliminary data from this study indicate that MEE Practice I provides many students with a realistic perception of the careers of practicing engineers and familiarizes them with the discipline. Many students also reported that participating in the “weeders” program motivated them to commit to engineering degrees. Further demonstration of these course benefits are encapsulated in comments drawn from student assignments in which they reacted to industry presenters (Table 3). For many students, the course serves as a positive, introductory experience and cements relationships with future peers and colleagues. At the same time, the data also reflect that the upper-division portion of the MEE major via a low-risk academic environment. We have introduced the term “soft weeding” to describe the process of self-selection from the “hard weeding” that students may experience as they struggle academically through required major-specific coursework. Future work includes longitudinal analysis of the impact of MEE Practice I on retention rates within the Department of Mechanical and Energy Engineering and propensity of students to engage in academic auxiliary programs including undergraduate research, professional societies, and career internships. The influence of MEE Practice I on retention rates in mechanical engineering will ultimately be compared against similar departments at UNT’s peer institutions that have no “first-year experience” program.

Thermal Fluid Sciences Group @ UNT
A Student Centered Research Lab

Reference