
AC 2011-1518: HELPING FRESHMEN DEVELOP A PERSONAL IDENTITY AS AN ENGINEER

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Helping Freshmen Develop a Personal Identity as an Engineer

Abstract

Freshman retention is a top priority in nearly all engineering schools. Increased retention optimizes new-student recruitment dollars, decreases students' time to graduation, impacts school rankings, and helps to meet industry's increasing demand for engineers. Most researchers and experts in the field agree on a number of basic tenants of retention. Topmost are the tenants of creating community amongst freshmen, bonding freshmen with returning students, creating opportunities for meaningful interaction between freshmen and faculty both in and outside of the classroom, helping freshmen understand and internalize the vision and mission of the school, and helping freshmen develop a personal identity as an Engineer. This paper focuses on the latter.

Most engineering programs incorporate career exploration as one of the topics in the Introduction to Engineering course or a separate course or seminar. This Introduction to Engineering course is typically taught as either a discipline-specific course or as a general course open to all majors. In both cases the content and delivery of the engineering career exploration topic is heavily influenced by the faculty member teaching the class. In the Ira A. Fulton Schools of Engineering at Arizona State University, there are program-specific Introduction to Engineering courses in which discussion of career exploration is inconsistent.

This paper defines the rationale for conducting our Freshman Career Exploration Evening and discusses the desired learning outcomes that governed the design of the event. The paper also details how the Engineering Career Center partnered with Introduction to Engineering faculty to prepare the students through pre-event assignments and post-event self assessment to measure how the industry representatives impacted the students' outlook on their degree choice and the path to their careers. The logistics of the event including strategies for recruiting company participation are also discussed. The paper also analyzes the feedback received from students, faculty, and industry partners and how that feedback informed the lessons learned from this pilot event.

Background

Educators and industry alike have well documented their concerns about the future of engineering in the United States due to a decline of engineering graduates.¹ Increasing the number of engineering graduates requires both an increase in the number of students choosing to study engineering as well as an increase in engineering student retention. Engineering programs have struggled with retention issues for decades with many programs reporting that 30-40% of students leave engineering after the freshman year. Numerous studies indicate the many factors that impact retention in engineering, including (specific to this paper) a student's knowledge of

engineering careers and her or his ability to understand how the engineering curriculum relates to the skills necessary to be successful as an engineer^{2,3,4}.

Although some universities do not admit students into specific engineering majors until after their freshmen year, the Ira A. Fulton Schools of Engineering admit new freshmen directly into their engineering programs. In this way students immediately begin engaging with faculty in their discipline, and coursework is enriched with discipline-specific content. Although this approach obviously works well for students who are confident in their choice of major, it hinders students who need more exploration of engineering options. To support this need for career exploration there is limited content in our Intro to Engineering Courses. This content, however, is inconsistently delivered by our faculty leaving many students still lacking in their knowledge.

Outside of our Intro to Engineering classes, we have invested in numerous strategies for helping students learn more about engineering in general and the different fields that comprise it. We offer career coaching through our Engineering Career Center. We also provide links to our students to learn more about engineering careers including YouTube links to recent alumni from our programs describing their current work as engineers. The Ira A. Fulton Schools of Engineering have also invested in other programming including:

- Engineering residential community (students live in a residential community for engineering freshmen with engineering programming)
- student organizations (over 40 engineering student organizations are available for new students to participate)
- undergraduate research program (the Ira A. Fulton Schools of Engineering provide funding for students to conduct research with faculty.)
- Engineering service learning (freshman engineering students are invited to join teams of continuing undergraduate students who earn course credit by providing engineering solutions to challenges facing domestic and international not-for-profit agencies)
- freshmen engineering success class (all engineering freshmen take a one credit hour engineering success class taught by an engineering faculty member in class sizes limited to 19)
- E2 Camp (all first-time, fulltime engineering freshmen attend a three-day camp that engages them with faculty and continuing engineering undergraduates)
- numerous school and department-level welcoming and orientation activities

In the fall of 2010, the Ira A. Fulton Schools of Engineering made the commitment to help our freshmen develop a personal identity with their chosen engineering program and/or help them

explore others. We recognized the need to incorporate not only faculty inputs, but those of career specialists as well. Fortunately, Arizona State University has an Engineering Career Center that is already heavily engaged in career services for our students with very successful career fairs, on-campus recruitment events, and a strong internship program. With the inputs of the Engineering Career Center, we made a strategic decision to engage our freshman students in an Engineering Career Exploration Evening event which introduced our students to industry partners and alumni. The Engineering Career Center invited our 1,100+ engineering freshman to attend the career exploration event to provide context to the entry-level courses in which they were enrolled. In the process of describing the typical daily tasks and functions of engineers in particular fields, over 61 representatives from 35 companies also discussed with the freshman engineering students the importance of laying a sound academic foundation during their first year; the value of global experiences, community service, research, and internships; and the value-added aspects of attending graduate school.

The freshman career exploration event was intended to jump start our students' road to being engineers, to serve as one piece in a continuum of efforts to help our students build an identity as an engineer, and to reinforce the messaging they receive in their entry-level courses.. Based on the premise that "Informed and considered career decisions result in improved matches between people and their work"⁵, we developed the following specific goals for the Engineering Career Exploration Evening.

1. Students learn details from industry partners about their chosen field of engineering study as well as others.
2. Students learn to prepare for and conduct informal interviews with industry partners.
3. Students learn an array of career pathways from industry partners.
4. Students gain advice from industry partners regarding building their undergraduate engineering portfolio.
5. Students learn from industry partners the skills that are important to an engineer.

Besides the formal outcome intended for our freshmen, the Engineering Career Center utilized the event as a relationship-building opportunity while our industry partners benefited through brand recognition and building relationships with future engineers.

Staging the event

The venue

In planning the Freshman Career Exploration Evening, the Ira A. Fulton Schools of Engineering Career Center had to consider a venue that would serve up to 1,100 freshman students, as many

as 100 industry representatives, the engineering administrators who were key to drawing industry, and the various faculty who would drop in on the event. In researching appropriate venues, the Career Center found a venue just off-campus and within easy walking distance from the Engineering Residential Community. The venue was a converted theater complex that provided numerous rooms, lobby spaces, and auditoriums. Despite the size of the venue, we knew that the space would be tight, but we felt that it would accommodate our needs.

Industry partners

Taking into consideration the desired outcomes of the event, the Career Center planned to have at least three companies representing each of ten different engineering disciplines in order to provide the students with a significant sampling of information about their own chosen field of study as well as others in which they might be interested. Given a short planning timeframe the Engineering Career Center cast a wide net to our local industry partners and was able to recruit the attendance of 35 companies who sent a total of 61 representatives to talk with our students. Although we did not achieve an even distribution of representatives from all desired areas of engineering, we did get at least one engineer from each area of study.

The industry partners were informed that they would be staffing tables in a career fair atmosphere in which they would be grouped by the same or similar engineering disciplines.. We also provided the companies with the research questions assigned to students, and our list of goals for the event for them to prepare appropriately and help meet those expectations.

Guest presenter

The Engineering Career Center also invited motivational speaker, Brett Farmoloe, to provide multiple, 30-minute presentations throughout the three-hour event. The overarching message of the presentation “Pursue the passion: what should I do with my life?” was for the students to follow their passion as they consider their career paths and choices. Mr. Farmoloe had travelled throughout the country surveying individuals regarding their level of job satisfaction and how it related to how well their careers aligned with their passions.

Our students found this portion of the evening particularly beneficial. One student commented that “I liked the presentation a great deal and it made me have to rethink why I want to be an engineer. In rethinking, I found that I am truly passionate about my career choice.” Another student commented that “The part that I found most interesting during the Career Night was the presentation in the theater. Hearing about the adventures that the former college student went on made the career of an engineer so much more intriguing.”

Collaborating with engineering student success courses

ASU's Ira A. Fulton Schools of Engineering limits the capacity of its engineering student success courses to 19; therefore, we conduct over 60 sections each fall to accommodate the entirety of our entering freshman class. The Engineering Career Center collaborated with the numerous faculty in these courses by providing them with speaking points for announcing the event, informing them of the objectives of the event, suggesting that the faculty assist the students in preparing for the event by developing lists of questions the students might ask of the industry representatives, and providing the faculty with sample debriefing questions.

A number of the faculty chose to simply announce the event to their classes, letting their students know that it was an option for them to earn extra credit or simply an opportunity to add to their knowledge of engineering fields. The greater number of faculty, however, chose to make the event and the response paper a class assignment that was a portion of the students' final grade in the course.

Many of these faculty forwarded copies of the students' responses, or a compilation of the students' comments in their papers, to the Engineering Career Center so the students' input could be used to help formulate future events.

For our pilot Freshman Career Exploration Evening, we were pleased with the turnout of more than 610 engineering freshmen which was a good compromise between our two fears: that very few students would attend or that all 1,137 of our freshmen would show and overwhelm both our facility and our industry partners.

Meeting our goals

Although we did not formally survey our students regarding their level of satisfaction and impact, and we did not administer a pre and post survey to measure the students' gain from the event, the students' two-to-three page responses provided the Engineering Career Center with meaningful indications that we met our primary goals.

Goal 1: Students learn details from industry partners about their chosen field of engineering study as well as others.

The students' remarks in their responses to the event showed overwhelmingly that the industry representatives provided significant information that allowed the students to learn more about their chosen fields of study. The following comments are indicative of the responses we received.

“Many of the engineers I spoke to indicated that transportation engineers work in teams and that if I enjoy working with others to design solutions to everyday problems, I would enjoy being a transportation engineer.”

“The most surprising thing I found out last night was that I might not want to be a Mechanical Engineer. After talking to the Mechanical Engineer, I am not as sure that I want to do that in life. The biomedical engineer was very interesting to me. I am looking into it so I can take according classes.”

“The most surprising information I received was [that] it is possible for an Engineer to own their own business.”

“I have become more sure than ever in my choice of careers.”

Goal 2: Students learn to prepare for and conduct informal interviews with industry partners.

One of our desired outcomes was to teach our students how to prepare for informal interviews with industry representatives. Through the preparation suggestions that the Engineering Career Center provided to the faculty, our freshmen learned how to prepare questions for the representatives that would lead the students to achieving their desired outcome. The responses below represent the common theme that echoed throughout the students’ response papers.

“I had never really thought about what questions I might ask an engineer if I had the chance. Preparing to talk with the engineers last night made me think hard about what I didn’t know about the job of electrical engineering.”

“My mom and dad are both engineers so I thought I didn’t have to do much preparation for the career thing. Although I was able to come up with questions on the spot. I wish I had done a better job of preaparing (sic).”

Goal 3: Students learn an array of career pathways from industry partners.

We also wanted our engineering students to hear from industry representatives the path they took to becoming engineers. Given the diversity amongst our large freshman engineering class, we believe it is important for them to see the diversity in the engineering workforce and to hear the diverse stories of how those engineers had made their career choices and the paths that brought them to becoming engineers. From the comments of our students, it is obvious that they were impressed with the differing paths they heard about during the event. The students’ comments below represent the diversity that the students heard that night.

“(The representative) told me that he had been a doctor for more than twenty years when he decided to take engineering classes that would help understand and improve prosthetics.”

“He had flunked out of college when he was twenty and went to work on a construction crew. When he was twenty-four he went back to school to become a construction engineer and is now a project manager.”

“She told me about the poverty she lived in in Nogales, Arizona and about her math teacher who always told her she had a gift that would take her to special places.”

Goal 4: Students gain advice from industry partners regarding building their undergraduate engineering portfolio.

Another of our desired outcome was for our students to learn from industry representatives the experiences they should gain as undergraduates in order to enhance their portfolios, above and beyond the academic skills, in order to gain fulfilling employment when they graduate. The students were not surprised to hear that gaining engineering experience as an undergraduate was one of the most important additions they could make to their portfolios.

“The man from Boeing kept coming back to the importance of getting experience either through internships or competitive student organizations.”

“She said to join a student organization that focuses on doing the type of engineering you want to do.”

“Some of the engineers told me to get involved in community service. They said that employers are always looking for students who have given back.”

“Internships, internships, internships. Everyone I talked to said that internships are important because companies want to hire someone who has on the job experience.”

“What I found most interesting about career night was that all of those people there representing the companies they worked for were there to help promote the fact that they want students to apply for internships”.

Goal 5: Students learn from industry partners the skills that are important to an engineer.

Yet another of our goals was for our students to learn from current engineers what tools and skills are important for them to gain as undergraduates in order to broaden their career perspectives. ASU’s Ira A. Fulton Schools of Engineering focuses on the attributes of the Engineer of 2020. We were very pleased to see from our students’ comments that the industry representatives found those skills to be essential to the making of a complete engineer.

“She told me that good writing is essential. Good writing and good communication. Good writing can determine whether your company makes or loses millions of dollars.”

“Multiple engineers at the fair placed high importance on becoming skilled in managing and budgeting funds for their projects.”

“The two engineers told me that it is important to have experience working in teams made up of different disciplines. They said that 90% of the work engineers do is done in teams.”

“I heard from many of the representatives that it is important to get some type of global experience. It could be by working with students from different cultures or studying abroad.”

“‘Learn the software.’ The guy kept saying to me, ‘learn the software.’”

“‘Be an entrepreneur. Think like an entrepreneur, act like an entrepreneur, be an entrepreneur.’”

Other outcome

Students also commented on other outcome. Below are examples of a few.

“I learned in orientation that only 19% of engineering students are female. This concerned me because I wondered how I would be perceived and accepted in the workforce. During the career night, I was able to talk with female engineers and learned that women are highly valued in the engineering workplace.”

“Career Night was a very big highlight of my fourth week of attending school here at Arizona State University. Not only was I able to see what types of projects certain companies were working on, but I was able to talk to some of the individuals representing those companies about the type of work they did, their skills, and their career path from college to the present.”

“I think the most interesting part of the night was to see all of the different people from all of the engineering fields. Talking to them made me believe that I could get through this and eventually go into a career field that I will love”.

“I learned that the community and private sector will always need productive and successful engineers in order to keep society functioning in a positive way.”

Lessons learned

Given that the Freshman Career Exploration Evening was a pilot event and that the Engineering Career Center had little more than a month to plan and execute the event, there have been many lessons learned. Feedback from students, faculty, industry representatives, and school administration has greatly informed our planning for next year’s event.

The lessons learned involve the following.

- The appropriateness of the venue
- Consistency of industry representation
- The value of the guest speaker

- Setting the engineering context
- Collaboration with the engineering student success courses
- Improving assessment

Venue

The most common complaint about the Freshman Career Exploration Evening was that the space was too crowded for the number of students and industry representatives. For the fall of 2011, the Engineering Career Center has already reserved space in the Memorial Union which will provide nearly double the area that we had last fall and will provide even easier access for both students and industry representatives.

More consistent industry representation across all academic programs

Another drawback to the 2010 event was the fact that, though we had an appropriate number of companies and at least one representative of each engineering academic area, it would have been ideal to have numerous companies representing each area so the students had a much broader picture of each of those fields. With the dates and venue already set for the fall 2011 event, the Engineering Career Center has started the process of recruiting appropriate industry partners to help engage our next group of incoming freshmen.

Guest speaker

Even though Brett Farmoloe's presentation on pursuing your passion was well received, our faculty and administration have suggested that it might be more meaningful to invite an engineering luminary who can more directly address the aspirations of our young engineering students. The Engineering Career Center is currently examining the possibilities of inviting an engineering alumnus and superstar for our 2011 event.

Highlighting major engineering achievements

We have also received feedback from faculty and industry partners that it would be impactful to set the engineering context by highlight engineering achievements and products in all of the engineering fields so our students are engaged and excited about their chosen field of study by seeing and discussing the end product of the industry's efforts.

Collaborating with engineering success courses

In reflecting on the Freshman Career Exploration Evening, it occurs to us that the event seems to have taken place in a vacuum with little actual and deliberate ties to other experiences that our engineering freshmen encounter. With this in mind, the Engineering Career Center is developing a multifaceted freshman career exploration curriculum that will be plugged into the engineering

success courses starting the fall of 2011. The Freshman Career Exploration Evening will be simply one facet of that exploration curriculum. The exploration curriculum will then be assumed seamlessly into our overall undergraduate career development plan. Understanding that the engineering faculty teaching the success courses are not career development experts, the career exploration curriculum will incorporate online components as well as face-to-face components in the classroom that will be lead by our career center staff and our trained career peer coaches.

Assessment

We believe that our greatest shortcoming throughout the process of staging the Freshman Career Evening was our lack of formal assessment. For the event next fall, we will include as part of the career exploration curriculum a pre and post student assessment to easily determine any change in or confirmation of the students' perceptions of their chosen field of study. We will also administer simple Likert scale surveys to provide a more convenient means to assess student, industry, and faculty satisfaction levels with all aspects of the event. Given the research on the benefits of having students grapple with an experience enough to put the experience into writing, we will still ask students to compose a response paper as part of their career exploration curriculum.

Key to the assessment and evaluation process, we will better define and develop our desired outcomes develop appropriate means for assessing those. The ultimate outcome, however, is student retention in engineering. Future assessment will also measure retention, persistence, and progress to graduation—inspecting how the Freshman Engineering Career Exploration Evening will have played a role.

Conclusion

The primary thrust behind the Freshman Career Exploration Evening, and now the freshman exploration curriculum of which the Evening is one of several facets, is to help our freshmen develop a personal identity as an engineer. R.C. Chope, noted career development psychologist, indicates that “By providing opportunities which help engineering students promote exploration of who they are and what they aspire to become, students start to take significant steps in developing their career identity”⁶.

Granted, an engineer's identity is more than what he or she does as an occupation. To fully develop that identity also involves inspecting such aspects of one's inner motivations as a problem solver, an instrument of change, an inventor, a humanitarian, a global agent, and as a creative spirit. Yet, freshman engineering students exploring career possibilities and learning about the daily tasks involved in the various disciplines of engineering directly from current engineers provides them the context in which to inspect those deeper aspects of their own career identity.

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