
AC 2012-4204: "OMG! THAT'S WHAT AN ENGINEER DOES?": FRESH-MEN DEVELOPING A PERSONAL IDENTITY AS AN ENGINEER

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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 in retaining engineering freshmen. 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 identify as an Engineer. This paper focuses on this last tenant.

Most engineering programs incorporate career exploration as one of the topics in their Introduction to Engineering course or a separate course or seminar. The Introduction to Engineering course is typically taught as either a discipline-specific course or a general course open to all engineering 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, we teach program/major-specific Introduction to Engineering courses, and—in the past—discussion of career exploration had been inconsistent, at best.

In the fall of 2010, by piloting a Freshman Engineering Career Exploration event, the Fulton Schools of Engineering made a commitment to help our freshmen develop a personal identity with their chosen degree programs and/or to help them explore other engineering majors. Our Engineering Career Center—already heavily engaged in career services for our students with very successful career fairs, career development programming, and strong industry relations—engaged our freshman students in the Engineering Career Exploration event which introduced them to industry partners and alumni in a career fair-type atmosphere. The Engineering Career Center had invited our 1,100 engineering freshman to attend that pilot Career Exploration Event to provide context to the entry-level courses that they were enrolled in. As pilots are meant to do, our 2010 inaugural event, though a tremendous success, taught us many lessons for planning the event for fall 2011.

This paper defines the rationale for conducting the Freshman Career Exploration Event and discusses how we implemented the lessons learned from our pilot event. In doing so, the paper also inspects the desired learning outcomes that governed the redesign of the event and details how the ASU Engineering Career Center partnered with Introduction to Engineering faculty to develop a three-pronged curriculum to create significant impact on our engineering freshmen. 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 second annual 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 freshmen 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 admits 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.

Besides 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 for our students to learn more about engineering careers including YouTube links to recent alumni from our programs describing their current work as engineers. Our engineering school has also invested in other programming including:

- engineering residential community (students live in a residential community for engineering freshmen with engineering programming)
- engineering student organizations (over 40 engineering student organizations are available for new students to participate)
- engineering undergraduate research program (we 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)
- engineering 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 conjunction with these initiatives, the Freshman Career Exploration event is intended to jump start our students' journey 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, the Fulton Schools of Engineering 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 with our industry partners, while they benefited through brand recognition and building relationships with future engineers.

The Second Annual Event

Given that the 2010 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 were many lessons learned. Feedback from students, faculty, industry representatives, and school administration greatly informed our planning for the second annual event in fall 2011.

The lessons learned from the 2010 Freshman Career Exploration Evening involve the following.

- The appropriateness of the venue
- Consistency of industry representation
- The value of the guest speaker
- Collaboration with engineering student success courses
- Improved assessment

Implementing the Lessons Learned

The appropriateness of the venue

In planning the 2010 Freshman Career Exploration Evening, the ASU 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 location just off-campus and within easy walking distance from the Engineering Residential Community. The venue was a converted multiplex movie theater 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.

As it turned out, the most common complaint about the 2010 Freshman Career Exploration Evening was that the space was too crowded for the number of students and industry representatives. For the fall of 2011, with the benefit of more planning time, the Engineering Career Center was able to reserve space in the Memorial Union which more than doubled the area that we had had the previous fall. However, due to the 17% increase in our freshman engineering class from approximately 1,100 in the fall of 2010 to nearly 1,300 in the fall of 2011 coupled with a much higher student and industry turnout rate at the event, we had already outgrown our venue by the time we opened the doors.

Consistency of industry representation

In 2010, 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 for that inaugural event, the ASU Engineering Career Center cast a wide net to our local industry partners and was able to recruit the attendance of 36 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.

Again, with a significantly increased planning timeline for the fall 2011 Freshman Career Exploration Evening, the Engineering Career Center was able to recruit a much richer representation of industry partners, increasing from 36 engineering companies in 2010 to 94 in 2011 and from 61 industry representatives to 215. Regardless of this increase, students still voiced that they would like to have access to yet more engineers in all areas, but most particularly in Biomedical Engineering.

The value of the guest speaker

For the inaugural event, the Engineering Career Center also invited a motivational speaker 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?” encouraged our engineering freshmen to follow their passion as they consider their career paths and choices. The speaker 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.”

Even though the presentation on pursuing your passion was well received by our students, our faculty and administration suggested that it might be more meaningful to invite an engineering luminary who could more directly address not just the notion of pursuing your passion but also the specific aspirations of our young engineering students. After considering many possibilities, the Engineering Career Center invited Max Nerheim to give the event’s opening address. Nerheim, who earned his doctorate degree in electrical engineering from Arizona State University and who serves as vice president of research and as technical fellow for Taser International, emphasized the importance of students’ pursuing their passion while also focusing on becoming life-time learners when he said that,

Students need to understand that success will take more than technical skills because many specific kinds of technical skills now become obsolete every several years. Learning how to learn and being capable of teaming with professionals in many other fields – both within and outside engineering – are essential in today’s fast-changing global economy. You have to be more than a good student getting good grades in classes. A true engineer is a collaborator and a master at teamwork.

Nerheim’s message was a potent one most particularly because he has lived and continues to live the pathway to continued success to which these young engineering students aspire.

Collaboration with ASU engineering student success courses

Our engineering school limits the capacity of its engineering student success courses to 19; therefore, in the fall of 2010 we conducted over 60 sections of the course in order to accommodate the entirety of our entering freshman class. For the inaugural Freshman Career Exploration Event, 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. Faculty members were free to engage to whatever extent they saw appropriate.

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 in 2010, 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.

In reflecting on the inaugural Freshman Career Exploration Evening, it occurred to us that the event seemed to have taken place in a vacuum with little actual and deliberate ties to other learning and developmental experiences that our engineering freshmen encounter. With this in mind while preparing for the 2011 event, the ASU Engineering Career Center developed a multifaceted freshman career exploration curriculum that plugged into the engineering success courses starting that fall. The Freshman Career Exploration Evening was simply one facet of the three-pronged exploration curriculum comprised of career research prior to the event, the event itself, and directed reflection and writing that help the students synthesize the overall experience. The exploration curriculum was assumed seamlessly into our overall undergraduate career development plan and was implemented through our engineering student success courses. Understanding that the engineering faculty teaching the success courses are not career development experts, the career exploration curriculum incorporated online components as well as face-to-face components in the classroom that were lead by our career center staff and our trained career peer coaches. Since the faculty has ultimate authority over their curriculum, they

maintained the option to engage in the career exploration curriculum to whatever extent they thought appropriate.

Improved assessment

We believe that our greatest shortcoming throughout the process of staging the inaugural Freshman Career Evening was our lack of formal assessment. Based on that shortcoming, the Engineering Career Center developed—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 developed simple Likert scale surveys to provide a more convenient means to assess student, industry, and faculty satisfaction levels with all aspects of the event. Students were also given the opportunity to provide open-ended input to inform the Engineering Career Center's preparation for future Freshman Career Exploration Events.

Meeting our objectives

The primary objectives of the Freshman Career Exploration Event are that, through facilitating the engagement of students with practicing engineers and professionals, students will learn about multiple engineering professions, gain a better understanding of their chosen majors, and will identify potential role models, mentors, and organizations in the process of developing relationships and an identity within these professional communities.

By means of a simple twelve-question survey we assessed students' preparation in advance of the event, students' interactions with industry representatives, their occupational knowledge, quality of information received at the event, confidence in their choice of major, and the perceived value of the overall experience. The following is a summary of the key findings.

Classroom connection

75% of survey respondents indicated they were required to attend the event as part of their engineering student success course. 66% reported engaging in some form of career investigation prior to the event such as reviewing the career module website, engaging in class discussions, conducting research, or preparing questions.

Interactions with industry representatives

On average, students visited with 5 different companies. Some reported as high as 20 company interactions and some as low as zero even though they had attended the event.

Occupational knowledge

When asked to rate “knowledge of careers related to your major” before and after the event, more than half (54%) self-identified as “not at all” or “somewhat knowledgeable” prior. After the event and after exposure to the curriculum, no students reported “not at all knowledgeable” and only 18% identified as “somewhat knowledgeable”. The remaining 82% responded as “knowledgeable” or “very knowledgeable” on a 4-point scale where 1= not at all knowledgeable and 4= very knowledgeable. This represented the average rate moving from 2.44 to 2.98.

Quality of information received

Just over 71% of the respondents indicated that the information they received from the industry representatives was helpful to very helpful, with over 28% of respondents indicating that the information was somewhat helpful. Only one respondent indicated that the information was not helpful at all.

Confidence in choice of major

Comparing confidence in choice of major prior to and after the event, on a 4-point scale of 1=not at all confident to 4=very confident, 41% reported being “very confident” after the event compared to 30% before; 46% were “confident” after compared to 54% before; and 13% were “somewhat confident” after compared to 16% prior. No one reported “not at all confident” in their choice of major before or after the event. The overall change in the average rating of confidence in major choice moved from 3.13 to 3.28 with the largest shift in being “very confident” in major choice.

Perceived Value of the event

When asked if the event should be mandatory, students who thought “no” edged out those who thought “yes” by a rate of 54% to 46%. However, when asked if they would recommend this event to future freshmen, 89% responded “yes.”

Looking ahead

The 2011 Freshman Career Exploration Evening and connected curriculum proved to be a tremendous success. With more than 1100 of our nearly 1300 freshman engineering students engaging in the curriculum and attending the event, we not only helped the vast majority of our first year students inspect their choice of academic major, we also provided them with yet one more experience that immersed them in the engineering culture. The event provided them the opportunity to step into the world of current industry engineers, research faculty, alumni, and other current engineering student—helping them create a sense of community, a sense of belonging—which encourages them to develop an identity for themselves as both current and future engineers.

Another indirect benefit of the event has been the development of new and more robust relationships with our industry partners and young alumni. We anticipate that these relationships will lead to new development opportunities, internships, guest speakers and mentoring. With these new relationships, our plans to follow-up the Freshman Career Exploration Evening with a job shadowing program in which our freshmen will have the opportunity to shadow a professional engineer for a day in their position.

Regardless of the success of this second annual career exploration event, we still have much work to do to provide our students the best possible learning environment and experience. One issue that we are addressing is, once again, the venue for the event. We believe it is important to keep the event on campus so students don't have the barrier of travel to keep them from attending, though this might not be possible. One possible solution is to hold the event in the Wells Fargo Arena, Arizona State University's basketball arena. It is likely, though, that the Arena might not even be large enough to accommodate our needs in 2012. With this in mind, we are also pursuing the possibility utilizing the convention facilities of a resort hotel which is contiguous to ASU's campus. We are also looking into providing a larger space for our event opening segment. Max Nerheim's opening address was a tremendously impactful way to set the stage for the evening, unfortunately not all of the students were able to be in the room at the time that he spoke due to space constraints. If we do, in fact secure the basketball arena for the 2012 event, this will provide the solution.

Although we were very successful in getting the number of industry representatives from the different engineering fields that we had hoped for, students were quite clear in stating that they would like to be able to tap into even more engineering professionals. With this being the case, we will recruit yet more engineers to speak with our students for the 2012 event. We will also be addressing a number of student traffic flow concerns—always an issue when attempting to accommodate a large number of students in navigating their way to meeting with a comparably limited number of representatives.

Regarding assessment, we are reviewing and refining our goals for the event, and our assessment tools will be adjusted and improved to capture those nuances. With having conducted the Freshman Engineering Career Exploration event twice, the timing will also be ripe to evaluate and assess the actual impact the event is having on student attitude and behavior. In the fall of 2012, we will assess the impact that the event may likely be having on student retention in (or leaving from) engineering majors, their progress toward graduation, and their choices to engage in experiential learning opportunities such as student organizations, service learning, and internships.

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 personal and career identity.

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