A First Year Engineering Student Survey to Assist Recruitment and Retention

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Abstract
In recent years the recruitment and retention of engineering students, especially underrepresented minorities and women, have received increased attention in the United States. Underrepresented minorities and women are the largest untapped resources available to help maintain and/or increase engineering enrollments and to ensure a diverse engineering working force. In order to understand better and to serve their first-year students in the School of Engineering, a survey is administered to these students each semester at Arizona State University (ASU). In addition to basic demographics, the survey asks for information on when and why students chose to study engineering at ASU, what recruitment events they attended and which were most effective, how many contacts the student had with ASU, how many hours per week they work, and predictions of success in graduating from ASU with an engineering degree.

The data is analyzed to give direction for more successful recruitment and retention efforts, including advisement about course and work loads. The results are further analyzed to determine if recruitment efforts have differential success when the target population is men, women, underrepresented minorities, students who considered another university, local residents, traditional-age, or community college transfer students. The results of this analysis are being used to guide recruitment and retention efforts of our engineering students, especially women and underrepresented minorities. While not exhaustive, this paper contains a discussion on several of the survey items. The survey, although developed for ASU, can be customized for any individual institution.

Introduction
There is reason to be concerned with the recruitment and retention of engineering students. The 1995 freshman survey by the Higher Education Research Institute shows that interest in engineering careers has reached its lowest point since 1975 [1]. Only 6.4 percent of these freshman plan to become an engineer. This percent of interest was nearly double in 1982. This survey showed that if we consider 100 typical freshman, 54 would be female and 46 male. Of those 54 females, only one would plan to become an engineer and of the 46 males, only five would plan to become an engineer.

The College of Engineering and Applied Sciences (CEAS) at Arizona State University (ASU) is concerned with the recruitment and retention of our students, especially underrepresented minorities (African American, Hispanic and Native American) and women in the School of Engineering. In order to better understand and to serve our new students, a survey was administered to these students during their first year in our college. Almost all of our engineering first-year students and some transfers enroll in ECE 100, Introduction to Engineering Design, during their first or second semester in the College. Enrollment is capped at 360 each semester, plus 40 students who were enrolled in a special Campus Match Program in the Fall. The students enrolled in ECE 100 during the Fall of 1995 were surveyed late in the semester during a regular class period and the students enrolled in ECE 100 during Spring 1996 were surveyed early in the semester. In the Fall of 1995, the School of Engineering had 457 new freshman and an additional 141 new sophomore transfers. Some of those students withdrew during the semester and some did not return for the spring semester and other students entered engineering during the spring semester. We collected 514 surveys (251 in the fall and 263 in the spring): 327 were new freshman students and 187 were transfers. Thus, our surveys represent data from a large percentage of our new students. Close to 70% of the students volunteered their social security number, so we will be able to do longitudinal studies on those students, compare their performance with their predictions of success in graduating from ASU with an engineering degree, and examine factors that increase or decrease attrition or that can be used as retention predictors.

Demographics
The average age of our students as of August 21, 1995, was 20.2 years in the fall group and 20.1 years in the spring group. Of the 514 students surveyed, 113 were women (22%) and 83 (16%) were underrepresented minority students (10% were Hispanic, 3.5% Native American and 2.5% African American). Although more underrepresented minorities were in the spring survey, the difference was not statistically significant. These
percentages are roughly equal to those of the total undergraduate enrollment. The 187 transfer students (36.4% of the total) were mostly from the community college system (71%) and a statistically significant smaller number of university transfers enrolled in ECE 100 in the spring semester than in the fall semester (46 compared with 18). The community college transfers averaged 49 transfer hours with an average GPA of 3.28. University transfers averaged 59 transfer hours with an average GPA of 3.04. Of the transfer students, 23.5% were women (about the same as non-transfers) and 24.5% were underrepresented minorities (larger percentage than among non-transfers, but not statistically significant).

The Role Model Factor

One of the best ways to influence a student to choose engineering as their major field is for them to have a family member or know a friend who is or was an engineer. It has been shown in other surveys [2] that a large percentage (40%) of the undergraduate women engineering students had a family member who is or was an engineer. This was also true of the women in our survey: 45% of the 113 women students had a family member who is or was an engineer. About half of those had a father who was an engineer. Ten percent of the women had an engineer mother. An additional 21% of the women, who did not have an engineer family member, had a friend who was an engineer. These percentages were approximately the same as for the men: 47% had an engineer family member and an additional 20% knew a friend that was an engineer. Only 40% of the underrepresented minority engineering students had an engineering family member and an additional 12% knew an engineer friend. Only 36% of the underrepresented minority students who had an engineer in the family had an engineer father. An engineering uncle was the commonly named engineer relative in addition to immediate family members. While only about one-third of the non-minority men and women did not have this type of engineering role model, nearly half of the underrepresented minority students did not have an engineer family member or friend.

When Engineering Was Chosen

In general, students with an engineering family member or friend tend to choose engineering as a field of study earlier than those without a role model. Thirty-seven percent of the students with an engineering family member or friend had chosen engineering by their sophomore year in high school. Only 26% of the students who had no engineering family member or friend had done so by that time. For students with the engineering acquaintance, 15% made the decision in their junior year, 15% in their senior year, and 33% did not choose engineering until they were in college. On the other hand, 19% of those with no role model chose engineering in their junior year, 23% during their senior year, and 32% while in college. Only 29% of transfer students had decided on engineering by their junior year in high school. During their senior year another 15 % chose engineering, but 55% of them made that choice in college, usually a community college.

Why ASU Was Chosen

The students were asked to identify all of the reasons for which they chose ASU. The majority of students (58%) chose ASU because of its reputation as a good engineering school. The next important reason was that ASU was close to home or in-state (50%). The next most important reasons were: good climate/weather (39%), reasonable tuition/fees (30%), availability of scholarships/financial aid (29%), a good friend was attending ASU (20%), and that ASU had a good academic atmosphere (18%). Women and minority students ranked scholarships/financial aid higher (35% and 41%, respectively) than did men (27%). Students who considered another university did not rank close to home/in-state (44%) as high as did students in general. Students who didn’t consider another university considered close to home (62%) and good engineering school (57%) as more important than the average student did.

Recruitment Participation

To evaluate recruitment participation, each student was asked to mark all recruitment activities in which they had participated. Sixty-four percent of the female and underrepresented students attended the New Student Early Registration/Orientation Program at ASU. Only 33% of the men attended, but this event was the most attended for all three groups. The recruitment activity with the second most participants for all three groups was an ASU Campus Tour. Fifty-four percent of the minority students participated in this activity, while 38% of the women and only 30% of the men did this activity. The ASU New Student Orientation, which is a retention as well as recruitment activity, was third most attended event by the women and men: 24% of the men and 32% of the women attended. Although 33% of the minority students attended the New Student Orientation, this event was the fifth most attended for this group. The event with the third highest percentage participation for the underrepresented minority students was a Mathematics/Science Honors Summer Program for Minority students. The fourth most frequented activity for men was a visit to CEAS labs and facilities (20%). This activity also ranked fourth for minority students.
(38%), but fifth for women students (14%). The fourth most frequented activity for women was an ASU table at a high school (22%). This activity was ranked sixth by the men (12%) and seventh (26%) by the minority students. Other recruitment activities worth noting are: ASU speaker from CEAS (16%) was sixth on the list for men, eighth for women (7%) and minorities (18%). Engineering Day held for high school students was attended by 11% of the men, 13% of the women and 28% of the underrepresented minority students. Fifteen percent of the underrepresented minority students had participated in MESA (Mathematics, Engineering and Science Achievement).

The events attended most by transfer students were ranked almost the same as those for men. The participation of transfer students in recruitment activities, as would be expected, was much lower than non-transfers. For example, 47% of the non-transfer students had taken an ASU Campus Tour, while only 30% of the transfer students participated in this event. Over half of the students who came to ASU from outside of the Phoenix area participated in the New Student Program and a Campus Tour. These out-of-city students attended the Student Orientation at the rate of 43%. A larger percentage of these students (22%) had heard a speaker from ASU. Older students (22 and older) participated in the recruitment events at about the same rate as men overall, except that some listed “professional organizations” as a recruitment activity in which they participated.

**Recruitment Effectiveness**

To evaluate recruitment activity effectiveness, the students were asked to rank the top three recruitment events they attended which were influential in their decision to choose to study at ASU. Not all of the students who attended activities gave a ranking and not all students giving the ranking gave all three. We tallied how many times an activity was marked as influential (whether ranked first, second or third). Under this system, the most effective recruitment activity was the ASU New Student Early Registration/Orientation Program for the men (40%) and women (39%). This activity was the second most influential for minority students (33%). The most influential activity for the underrepresented students was the Math/Science Honors Summer Program for Minority Students (38%). Since the ranking of the effectiveness of a recruitment activity is correlated to the number of participants in each activity, it is noteworthy when the effectiveness rank is higher than the participation rank for any group of students. The ASU Campus Tour and a visit to CEAS labs/facilities were judged very effective by men and underrepresented students. Women were also influenced by the ASU Campus Tour, but the third most influential activity for them was the ASU table at a High School College/Career Fair.

Transfer students ranked the effectiveness of recruitment activities very similarly to the non-transfers. There were four exceptions. A visit to CEAS labs/facilities was not ranked as effective as a recruitment tool as by non-transfers. This is probably due to the fact that fewer of the transfer students had toured the ASU labs. Transfer students were also less likely to have had the opportunity to hear an ASU speaker from Engineering, to have seen an ASU table at a High School College/Career Fair, or to have participated in the MESA Program or the Math/Science Honors Summer Program for Minority Students, and therefore these activities were not as influential in their decision to major in engineering at ASU. Half of the 14 “older students” attended a New Student Orientation and went on a campus tour. Two of these students felt that their professional society was very influential in their decision to come to ASU. Nearly half of the students from outside of the Phoenix area considered the ASU Campus Tour as an effective recruitment tool. The New Student Orientation was considered effective by 44% of these students. A larger percentage of these students felt the Student Orientation was more influential to them than other groups, but fewer of them considered a visit to CEAS labs and facilities an effective recruitment activity. Their evaluation of the effectiveness is largely correlated to their participation in the events. A tour of the campus was considered the most effective recruitment tool by students (42%) who considered another university. Of all the students, 35% considered the tour an effective recruitment activity. Students who did not consider another university rated a visit to CEAS labs or facilities higher (38%) than the average (27%), but rated an ASU campus tour (20%) lower than the average surveyed student (35%).

**Employment and Retention**

In a study “Why Undergraduates Withdraw From ASU During a Semester,” the three primary reasons were: employment demands, financial problems and family problems [3]. The first two reasons seemed very reasonable to the conductors of the study since approximately two-thirds of ASU undergraduates were employed at that time. Our survey showed that 55% of the survey engineering students were employed. More specifically, 57% of the men, 49% of the women and 55% of the underrepresented minority students were working. Furthermore, 25% of the students were working over 20 hours per week. In particular, 23% of the women and 20% of the underrepresented minority students were working over 20 hours per week. On the average,
students working over 20 hours per week carried a class load of 13 semester hours. Considering that each class hour can well require three hours of work, these students were committed to nearly a 60 hour minimum work week. Students working over 30 hours per week also carried 13 semester hours, and thus were committed to a minimum 103 hour work week. In fact, our survey showed that all students, working or not, carried approximately 14 semester hours. Only non-working men carried more (15 hours).

There are two main facts and an observation that emerge from this data. First, students are overcommitting themselves to work and school. Advisors need to call this to the attention of students when they work and go to school. Second, students should realize that other students who are not working are taking approximately the same course load as those working and thus have more time for studying and projects. A third consideration, depending on the job, is that sometimes job demands can increase during the semester, leaving the student with no choice but to drop out of school. In the 1990 ASU Withdrawal Survey, 24% of the students surveyed said that employment demands played a very important role in their withdrawal from ASU.

Conclusions

An analysis of the recruitment activities showed that the events with the most effectiveness were the ASU New Student Early Registration/Orientation Program, the ASU Campus Tour and a visit to CEAS labs/facilities. One exception to this was that the underrepresented minority students considered the Math/Science Honors Program for Minority Students the event most influential (38%) in their decision to enroll in engineering at ASU. A second exception was that an ASU table at a High School College/Career Fair was judged the third most effective recruitment activity by women (24%). Since an ASU Campus Tour was judged the second most effective recruitment activity by both men and women, we should try to include this event whenever we have potential students on campus. Since about half of the students will have chosen engineering by their junior year of high school, we need to expand our recruitment efforts to students in the middle schools. On the other hand, over half of the transfer students did not choose engineering as a major until they were in college. Since many of our transfer students come from local community colleges, we need to continue our recruitment efforts there.

About half of the students new to CEAS work, and no matter how many hours they work, still carry about a 13 or 14 semester hour load. This is close to the same load carried by non-working students. Advisors need to discuss the actual work load commitment for school with these working students. Employment demands is a leading cause of students dropping out of school. We need to continue to emphasize our strong points in recruiting: we are a good engineering school with a great climate and reasonable fees.

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References