AC 2012-5361: COMMUNICATIONS STRATEGIES TO INCREASE RECRUITMENT OF WOMEN TO ENGINEERING

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Communications Strategies to Increase Recruitment of Women to Engineering

Abstract

In 2006, the College of Engineering at Colorado State University launched a program to attract women to its existing undergraduate engineering programs. The initiative included extensive surveying, reworking the College's website, a communications plan that included gender-segmented communications, and a student ambassador program focused on quality contacts with prospective students. As a result, undergraduate enrollments increased from 1,463 in Fall 2007 to 1,866 in Fall 2011, a factor of 1.28 increase. At the same time, the number of women in the freshman class increased by a factor of 2.04 and the total undergraduate female enrollment increased by a factor of 1.63. As a result the representation of women in our undergraduate program increased from a low of 14.6% in Fall 2007 (below the national average) to 18.6% in Fall 2011.

Introduction

The representation of women in undergraduate engineering programs nationally increased from 17.5% in Fall 2005 to 18.6% in Fall 2010 [1 – 6] (Figure 1). At Colorado State University, the representation of women in undergraduate engineering programs steadily declined from 18.1% in Fall 2002 to a low of 14.6% in Fall 2007. Our goal was to quickly reverse this trend and to meet or exceed national averages for female engineering enrollments. We considered several alternatives:

1. We evaluated the persistence of male and female undergraduate engineering students within the College of Engineering and within Colorado State University as a whole (Table 1). First-year persistence rates within engineering majors were very similar for male and female engineering freshmen entering between Fall 2001 and Fall 2005 (66.9% and 69.1%, respectively). Additionally, female freshmen completed their degrees in engineering within six years at a higher rate than male students (47.1% vs. 42.6%). As a group, women were retained within Colorado State at a higher rate than male students. Although we continued to develop programs to retain and graduate all of our students, it was clear that our persistence and graduation rates for male and female students were similar and increases in retention alone would not allow us to achieve our goal.
2. We evaluated our outreach programs for young women and girls. Although outreach programs are important, they have a long-term effect on enrollments and would have less likelihood of creating an immediate impact.
3. We evaluated our recruiting programs and observed rapid declines in the representation of women in our entering freshman class. Therefore, we focused resources and effort on improving our college recruitment programs.

Table 1. Comparison of Persistence and Graduation Rates for Male and Female Engineering Freshman Classes (entering Fall 2001 – Fall 2005)

Metric (5-Year Averages)	Within Colorado State University		Within CSU's College of Engineering	
	Female	Male	Female	Male
1st Year Persistence	90.2%	86.7%	66.9%	69.1%
6-Year Graduation Rate	75.7%	67.7%	47.1%	42.6%

The COE's recruitment program was developed to more appropriately reflect the attitudes and goals of a more diverse student body. It was designed to increase options for personalized communications with prospective students by adding social media, student ambassadors, and providing increased access to faculty, staff, and current students. Print- and web-based media were completely revised to reflect a broader range of student perspectives. We created a new living/learning community for engineering students and we created opportunities for prospective students to see our facilities one-on-one with current students.

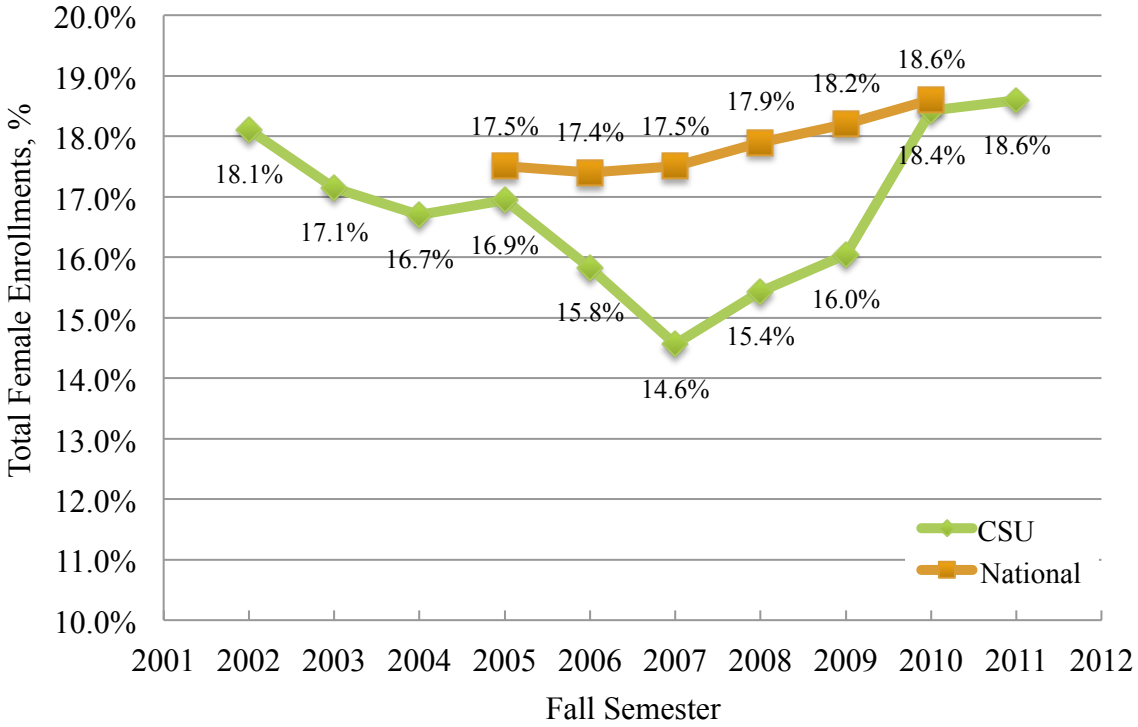

Figure 1. Representation of Women among Undergraduate Engineering Enrollments

Methods

The COE conducted a series of surveys of our freshmen, sophomores (midpoint), and seniors to redevelop our recruiting messaging. More than 550 students voluntarily participated in the survey (38% of total undergraduate engineering enrollment; 449 men and 108 women) (Table 2). Questionnaires allowed us to better understand the importance of various university characteristics as well as their identified life goals that led students to choose CSU and select engineering as a major.

Table 2. Summary of Survey Participation

Gender		Freshman Survey	Midpoint Survey	Senior Survey	Total
Male	Count	218	118	113	449
	% within survey version	79.9%	85.5%	77.4%	80.6%
Female	Count	55	20	33	108
	% within survey version	20.1%	14.5%	22.6%	19.4%
Total	Count	273	138	146	557
	% within survey version	100.0%	100.0%	100.0%	100.0%

We were able to disaggregate survey data based on major, gender, ethnicity, and residency. Survey results led to changes in communications and messaging to reflect a broad range of potential student viewpoints.

Questionnaires focused, in part, on students' life goals. Students were asked to identify whether a series of factors (such as helping others) were essential, very important, not very important, or not at all important in their decision to study engineering. Results that most directly affected our messaging appear in Figure 2.

- Both female (94.4%) and male respondents (85.7%) overwhelmingly indicated that helping others was essential or very important to them in selecting engineering as a major.
- Female respondents (77.5%) indicated that understanding other countries was essential or very important to them; 62.7% of male respondents stated that this reason was essential or very important to them.
- Female respondents (63.5%) indicated that environmental conservation and clean-up were important to them. This was important to about half of the male respondents.
- Both male and female respondents indicated that "being very well off" was an important consideration in selecting engineering as a major.

An additional series of true/false questions were asked to determine whether certain aspects of engineering or CSU were important in their college and major decision.

- Only 40.1% of female respondents indicated that they chose engineering to design, build, and "take stuff apart to see how it works." However, 68.8% of male respondents selected this as their top-ranked reason for majoring in engineering.
- The top three reasons for selecting CSU among both men and women (based on fraction of true statements) were CSU's academic reputation, friendly campus, and successful placement

of graduates in jobs. However, men and women differed in their remaining choices. Outdoor recreation and social activities were ranked 4th and 5th for male students, but were far less important to women. The likelihood of admission to good graduate schools and the size of CSU was ranked 4th and 5th by women.

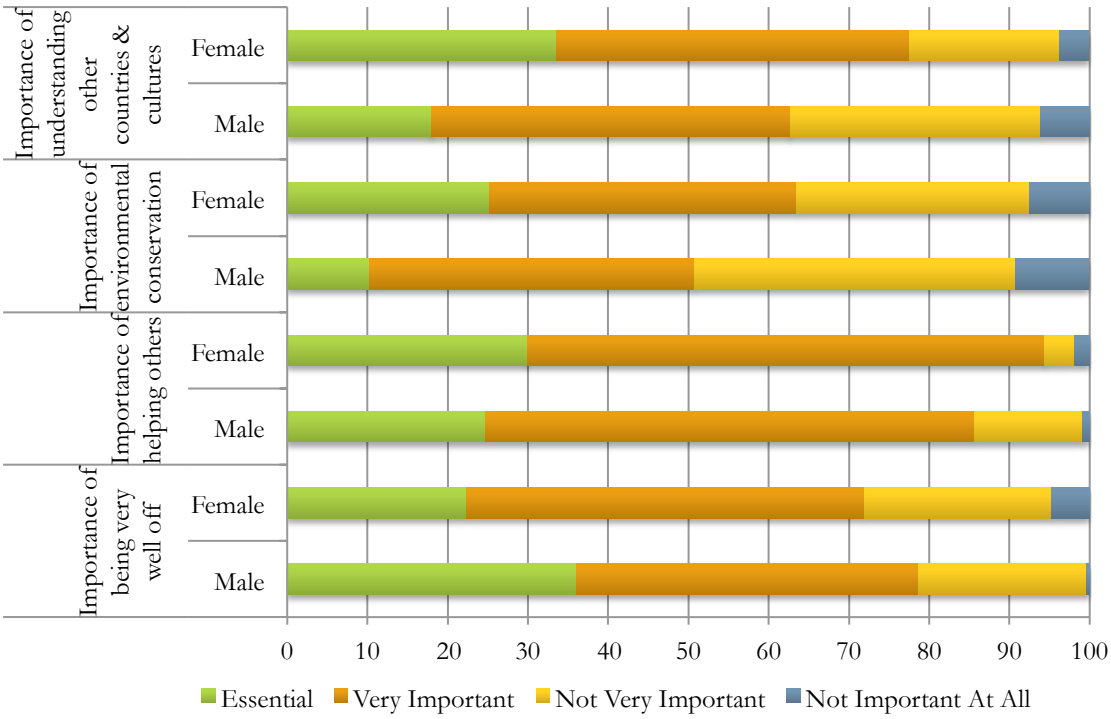

Figure 2. Example Responses Related to Life Goals and Gender

This information led us to redesign our website and recruiting materials to focus on factors important to both men and women. We adjusted presentations and messaging during one-on-one visits or large events to include information more appealing to women. We did not eliminate references that were important to men (such as outdoor recreation or design competitions), but instead added information about areas that were highly ranked by women (such as helping others, the environment, or working on important global problems). We continued to provide information about career opportunities, our academic reputation, friendly campus, and career placement, but we added information about the size of our campus and opportunities for graduate education to reflect female perspectives as well.

Our timeline for implementing the recruiting plan appears in Table 3. We segmented print communications based on three factors: (1) gender, (2) residency, and (3) major. Letters to female high school students entering their senior year focused on key factors identified within the survey. For example, letters sent to women might include a photograph of a female engineering student with a child in El Salvador (during a service learning activity). A similar recruiting piece for prospective male students might include a photograph of a male student participating in a design competition. Student ambassadors were paired with prospective students by gender, major, geography, and outside interests. We tried to connect every potential female

undergraduate student with a current female student ambassador via e-mail, phone, or during their college visit. We used social media (Facebook and Twitter) extensively to communicate with prospective students. Through the recruitment season, Facebook communications were typically our staff posting events, trivia questions, and college news. During the month of May, we started to step away, and the prospective students (typically led by posts from women) began dominating the site, comparing class schedules, room assignments, and they even started posting their own trivia without our intervention.

Our primary strategy was to recruit students as individuals instead of as a group, recognizing that survey data were simply indicators of the range in viewpoints and that these data could not be generalized by gender or ethnicity. We hypothesized that reflecting more diverse interests and viewpoints would allow us to recruit a more diverse student body.

Table 3. Timeline for Implementing the Recruiting Plan

Academic Year	Activity
Fall 2005	First incoming freshman class enter in chemical and biological engineering (chemical engineering degree eliminated)
Fall 2006	Established an undergraduate recruitment committee with representation from every department and major
Fall 2006	Conducted first surveys and developed recruitment plan
Summer 2007	Began collaborating with Admissions Office to secure prospect inquiry data and created our first recruitment database
Fall 2007	Launched multiple communications primarily focused on high school seniors (added first student ambassador, revised and developed new publications and messages, began staging phone-a-thon calling sessions where current students call prospects, etc.)
Fall 2007	Opened a living/learning community for the College of Engineering
Fall 2008	Launched new college website
Fall 2008	Began mailing segmented letters to prospective students (entering their senior year in high school)
Fall 2010	Launched undergraduate major in biomedical engineering
Fall 2010	Created first Facebook site for the Class of 2015
Fall 2010	Launched a web-based recruitment tool that allows for assignments to be made based on gender, state or zip, engineering academic interest, etc. The tool also allowed us to begin to effectively communicate more "introductory" messages to high school juniors and sophomores.
Fall 2011	Secured 100 current student volunteers to host prospective students and their families on our visit day, providing tours of residence halls, participating in panels, escorting families across campus, displaying student projects, etc.

The implementation of our recruiting strategic plan required an annual financial investment. In addition to normal investments in web development or the development of publications and recruiting materials, the College of Engineering created additional staff positions. This included a half-time director, a full-time staff member focusing on student visits and contacts, and a half-time events coordinator. Currently, the COE employs 11 student ambassadors, six women and five men (totaling approximately 90 hours/week). Student ambassadors host student tours, place telephone calls to prospective students, e-mail prospective students, write letters for our segmented mailings, respond to inquiries, tweet, update databases, and staff recruitment events in lead roles. Ambassadors typically make contacts with high school sophomores, juniors and seniors as well as prospective transfer students.

Results and Discussion

During the 2007/2008 academic year, applications from all student groups increased dramatically. In one year, applications from female prospective students increased by 46%. Applications from male prospective students increased by 16%. Applications from other targeted groups such as minority students and nonresident students also increased by 33% and 27%, respectively.

The representation of women among the 2007 freshman class reached a low of 12.5% in Fall 2007 (Figure 3). In Fall 2008, the representation of women in the freshman class reached 17.1% and the number of female students in our freshman class doubled (51 to 108) in just three years. The representation of women in our freshman class increased to a high of 22.5% in Fall 2010.

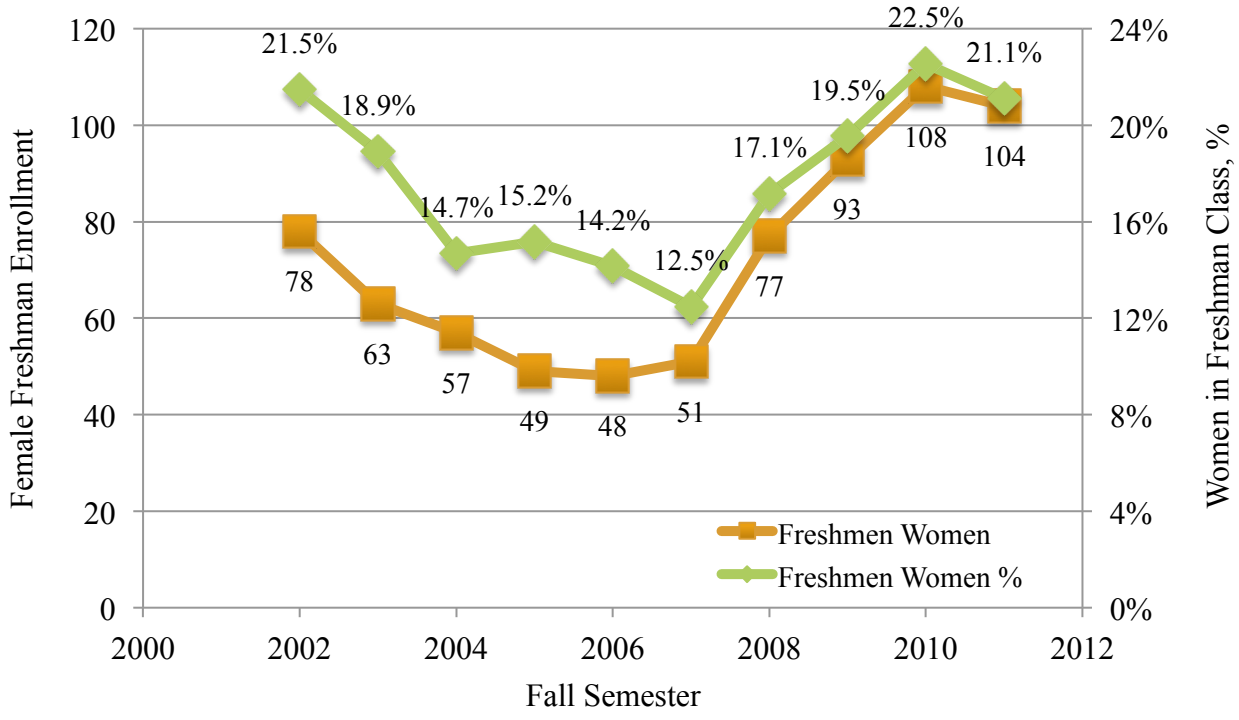

Figure 3. Enrollment Trends Among New Freshmen

Enrollments of men and women were normalized to enrollments in Fall 2007 to reflect changes due to our recruitment program (Figure 4). Enrollments increased substantially for both men and women. However, the increase among female students was most pronounced: a factor of 2.04 increase within the freshman class and 1.63 for total enrollments (compared to 1.09 and 1.22 for male enrollments in the freshman class and total undergraduate student body, respectively). Additionally, the slight decline in female enrollments between Fall 2010 and 2011 can be attributed to increased efforts to recruit students from other targeted groups. This provides further evidence of the correlation that our recruiting efforts directly impacted numbers of freshmen women.

Although national enrollment data are not yet available for Fall 2011, enrollment growth can be compared for the period between Fall 2007 and Fall 2010. Nationally, female engineering enrollments increased by a factor of 1.24 [3, 6] over this three-year period. Therefore, we would expect some increase in female enrollments. However, female enrollment increases within CSU were much larger than observed nationally. Our female enrollment increases during this same period was a factor of 1.54 for total female enrollments and 2.12 for freshman female enrollments. Therefore, the implementation of this program had a positive effect.

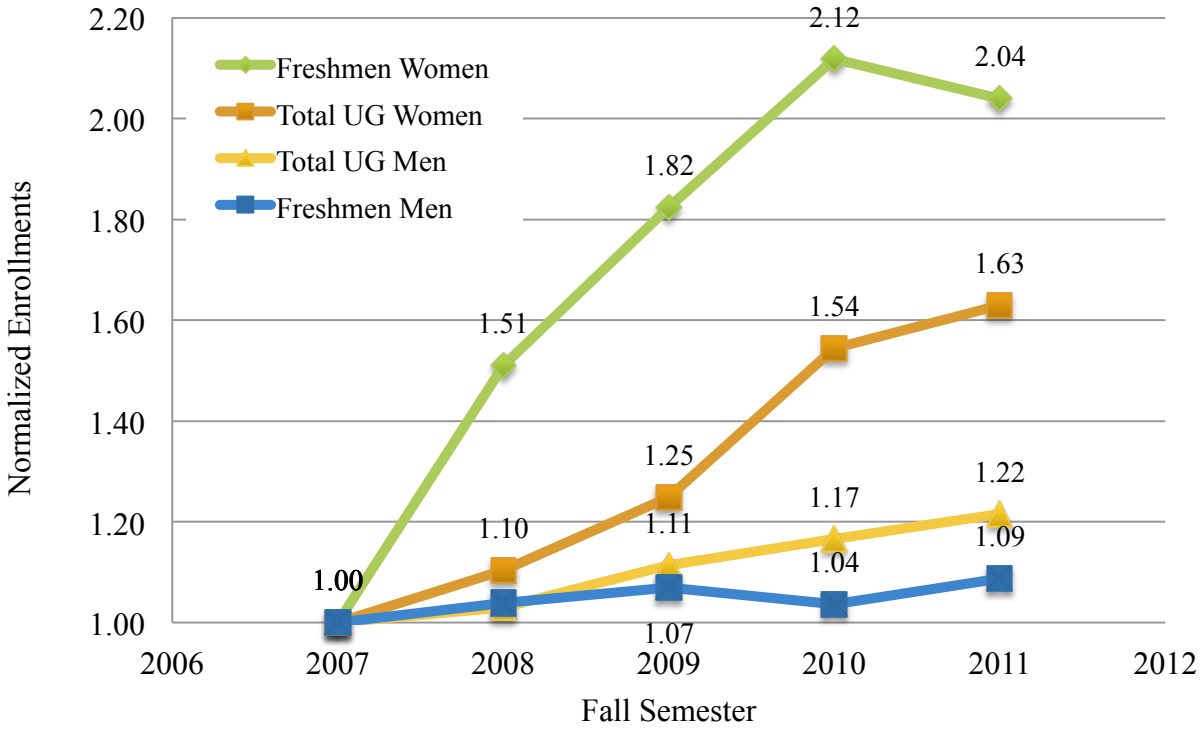

Figure 4. Freshman and Total Enrollments Normalized to Fall 2007 by Gender

Development or elimination of degree programs would be expected to affect enrollments. During the period between Fall 2007 and Fall 2011, relatively few program changes occurred:

- The chemical engineering program was eliminated and replaced by a new major in chemical and biological engineering. Prior to this change, women represented an average of 46% of

total chemical engineering enrollments at CSU. This decreased to an average of 32% when the program was changed to chemical and biological engineering. This decrease is consistent with the national representation of women among graduates of chemical engineering or biological engineering baccalaureate programs. Although we created a program that is typically less attractive to women, we grew the program substantially and the number of women increased (Table 4).

- We launched a new biomedical engineering major in Fall 2011. This resulted in an increase of 33 female students (Table 4). Although this increase affected enrollments in 2011, the increase in women in the freshman class observed in Fall 2010 (factor of 2.12 increase) (Figure 4) was unaffected by the launch of biomedical engineering.
- As expected, degree programs that traditionally have higher representation by women had the largest increases in female enrollments (Table 4): biomedical engineering (33), chemical and biological engineering (24), civil engineering (23) and environmental engineering (16). Programs such as mechanical, electrical, and computer engineering typically have fewer female students. They contributed 14, 4, and 5 additional female students, respectively, between Fall 2007 and Fall 2011.

Table 4. Enrollment Increases by Undergraduate Major

Major	2007 Female Enrollment	2011 Female Enrollment	Female Enrollment Increase	Female Fractional Increase	Contribution to Total Increase
Biomedical (established FA'11)	0	33	33		24.6%
Open Option (undecided)	5	13	8	2.60	6.0%
Computer	4	9	5	2.25	3.7%
Environmental	26	42	16	1.62	11.9%
Engineering Science	13	20	7	1.54	5.2%
Chemical and Biological	46	70	24	1.52	17.9%
Civil	53	76	23	1.43	17.2%
Mechanical	49	63	14	1.29	10.4%
Electrical	17	21	4	1.24	3.0%
Total	**213**	**347**	**134**	**1.63**	**99.9%**

Conclusions/Summary

An annual investment in recruiting, coupled with implementation of a strategic plan built on personal contacts and communications that reflect diverse student interests, led to a substantial increase in the diversity of our undergraduate class. This was particularly evident for female undergraduate students. The representation of women in our freshman class doubled over a

three-year period and total female enrollments increased by 63% between Fall 2007 and Fall 2011.

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