

GENDER DIVERSITY ISSUES AT THE UNIVERSITY OF CENTRAL FLORIDA

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Introduction

The Women in Engineering (WIE) Program at the University of Central Florida (UCF) conducted a survey of all female undergraduate students enrolled in the College of Engineering during the Fall 1994 semester. The purpose of the survey was to assess the educational climate for women students within the College of Engineering.

Gender diversity and retention issues were also investigated. The analyses explored differences in gender, race, classification, major, grade point average (GPA), age, and historical entry type. This research is an important step in identifying and eliminating gender inequities in engineering education at UCF. The overall goal of the WIE effort is to increase the percentage of female engineering students and graduates.

Methodology

Female Engineering Student Experience Survey

From the College of Engineering student database, mailing labels were generated for the target population. The questionnaires along with an introductory letter were mailed at the beginning of the Spring 1995 semester. Students were requested to return the forms by mail or to a designated drop box in the Engineering Dean's Office. All forms returned by March 12, 1995 were included in the study.

Gender Diversity and Retention Study

The statistical analyses were performed using the UCF student records database. Fall semesters, for alternate years beginning in Fall 1986, were chosen as entry points; summer semesters were excluded from the study because of the typically low student enrollment. A minimum of four years was thought necessary in evaluating graduation rates. Therefore, all the undergraduate students who began their program of study at UCF at the start of academic years '86, '88, and '90 were tracked through Fall 1994.

Female Engineering Student Experience Survey Findings

Seventy of the 369 female undergraduate students enrolled in Fall 1994 responded to the survey. This represents a response rate of 19%. More responses were received from Juniors than any other class; 18% of the enrolled seniors responded, 37% of the juniors, 20% of the sophomores, and 2% of the freshmen.

Approximately 87% had decided on a major upon application to UCF. Thirty seven percent (37%) went on to change their major; none of them switched out of engineering. Within the College of Engineering, mechanical engineering had the highest departure rate; aerospace engineering and electrical engineering shared second place for departing inter-college transfers. Environmental engineering was the most popular new major for engineering students and non-engineering students alike; just over one-third (35%) of those who changed majors opted for environmental engineering. Electrical engineering and civil engineering gained equal numbers of transfers to rank second as new major. Students had switched from psychology, liberal studies, mathematics, biology, and journalism. Approximately 65% said they "will not change major," and 14% said that "lack of employment opportunities" would make them change.

Slightly more than two-thirds (69%) were happy with their academic performance. The dissatisfied students expressed the desire to improve their GPAs. Full-time work was given as a major contributing factor to substandard academic performance. More than half (54%) of the students find class schedules discouraging; other discouraging factors were: difficulty of course work (29%), lack of support from faculty (24%), and gender discrimination (20%). Students, more so than faculty, were cited for gender discrimination. Poor teaching was listed as another discouraging factor. Given the opportunity to change one thing in their engineering educational experience, the most popular responses were: better teachers, better advisement, availability of introductory courses, and begin the program earlier.

Students were encouraged due to: high interest in the discipline (59%), too much time invested (33%), supportive faculty (31%), positive academic environment (24%), and female role models (21%). Job opportunities, defying gender stratification, and challenge of the discipline were given as other factors which have been encouraging. The students thought more encouragement could come from: better advisement, more helpful and approachable faculty, better attitudes and teaching skills from faculty, friendlier [administrative] office staff, smaller class sizes, more team projects, and better laboratories and equipment. Parents (80%) and other family members (60%) were most responsible for encouraging students in their major. Sharing third place were teachers or counselors, and professionals in the field at 51%.

These female undergraduates at UCF had chosen engineering because of: personal enjoyment (71%), good pay (57%), availability of jobs (54%), and personal talents (47%). Other reasons given for their choice included: "the opportunity to help improve people's lives," and the need for "something challenging, interesting, and unlimited in growth possibilities... to do for a living." UCF was chosen primarily because: the desired program or major was available (69%), its urban location (39%), the overall cost (36%) and the reputation of the departmental program (26%). One-fifth were attending UCF because of its proximity to home. Others were there due to academic scholarships received, friends in attendance, and dual enrollment with high school.

Students felt that lack of contact with women in scientific fields, possible conflicts between career and family, inadequate academic or career advising, lack of encouragement from teachers or counselors in high school, and women's lack of confidence that they can handle work in the field were contributory factors to the underrepresentation of women in science, mathematics, or engineering technical fields. Personal problems included lack of contact with women in the scientific fields, inadequate academic or career advisement, limited mentoring experiences, lack of information about work in scientific fields, and limited opportunities for meaningful internship experiences in the field. Open-ended comments cited upbringing and socialization as important factors.

Gender Diversity and Retention Study Findings

Tables 1 and 2 provide summary results from this study. The cohorts are described below in separate paragraphs.

Fall 1986 Undergraduate Engineering Entrants

Of the four hundred and twenty entrants, 81% were Caucasian and 91% were United States citizens. Freshmen accounted for 39% of the incoming engineering undergraduates and juniors 37%; there were 18% seniors and 6% sophomores. Florida community college transfers represented 43% of the Fall 1986 entrants, while 36% were beginning college for the first time.

Electrical engineering was the declared major for 34% of the students, mechanical engineering for 13%, computer engineering for 11%, and civil engineering for 8%; the remaining 34% were enrolled in aerospace engineering, environmental engineering, industrial engineering, engineering technology, or general engineering (major pending). Two hundred and thirty nine students went on to graduate by Fall 1994 from UCF, representing 57%. More than 40% of the students in the disciplines of electrical engineering, civil engineering, and industrial engineering graduated.



There was one female student, representing 2% of the female population, with GPA greater than 3.75, while twelve male students, representing 3% of the men, demonstrated academic excellence. Approximately 6% of the women and 4% of the men had GPAs between 3.5 and 3.75.

Fall 1988 Undergraduate Engineering Entrants

Three hundred and ninety three students began their program of study at UCF in the Fall of 1988. Seventy nine percent were Caucasian and 93% were United States citizens. Equal percentages (39%) entered as freshmen and juniors; there were 19% seniors and 3% sophomores. Florida community college transfers accounted for 48% of the Fall 1988 entrants, while 36% were beginning college for the first time.

Electrical engineering was the declared major for 25% of the students, mechanical engineering for 17%, civil engineering for 10%, and computer engineering for 9%. Two hundred and twelve students went on to graduate by Fall 1994 from UCF, representing 54%. More than 60% of the students in the disciplines of aerospace engineering, industrial engineering, and electrical engineering graduated; at 57%, environmental engineering also surpassed the overall graduation rate.

Average grade point average for the female students was 2.964, while the males averaged 2.603; this difference was statistically significant at the 0.05 level. One male student had a perfect 4.0 GPA. There was one female student, representing 2% of the female population, with GPA greater than 3.75, while four male students, representing 1% of the men, demonstrated academic excellence. Almost 8% of the women and 5% of the men had GPAs between 3.5 and 3.75.

Fall 1990 Undergraduate Engineering Entrants

Fall 1990 witnessed 451 new engineering undergraduates. Caucasians represented 78% and U.S. citizens 88%. Juniors were the most represented incoming group, accounting for approximately 45%; there were 41% freshmen, 12% seniors, and 2% sophomores. Florida community college transfers represented 45% of new engineering undergraduates, while 39% were beginning college for the first time.

Electrical engineering was the declared major for 25% of the students, mechanical engineering for 14%, environmental engineering for 10%, computer engineering for 10%, and civil engineering for 9%. Of the Fall 1990, beginning UCF engineering students, 156 (35%) had graduated from UCF by Fall 1994. The graduation rate (after four years in

engineering) for women was 30%, and for men 36%. Civil engineering realized a 50% level, while electrical engineering students graduated at the 38% level.

Eight percent of the females had GPAs greater than 3.75, while 3% males demonstrated academic excellence. Equal percentages (6%) of men and women had GPAs between 3.51 and 3.75. A higher proportion of men were on academic probation - 9% vs 7% women.

Table 1
Female and Male Engineering Entrants: Are They Different?

	Fall 1986		Fall 1988		Fall 1990	
	Female	Male	Female	Male	Female	Male
Enrollment	47	373	51	342	88	363
Age	30	30	29	29	27	26
SAT Math	528	570	578	581	550	598
GPA	2.691	2.620	2.694	2.603	2.837	2.690

Table 2
UCF Retention Statistics as of Fall 1994

	Fall 1986		Fall 1988		Fall 1990	
	Female	Male	Female	Male	Female	Male
% Enrollment	11	89	13	87	20	80
% Graduated	60	57	67	52	30	36
% Failed	4	11	2	12	6	7
% Departed*	34	31	26	29	36	26
% Still Enrolled	2	2	6	7	28	31
% Retained#	62	59	73	59	58	59

* Other than graduation or failure

(% graduated + % still enrolled)

Remarks

A typical survey respondent was a Caucasian, single, 26 year-old, full-time environmental engineering student, who worked on a part-time basis, had a GPA of 3.15, and was satisfied with her academic performance. She attended high school in Florida and took advanced level courses in Mathematics and Science. This student first became interested in engineering during high school or in college and was primarily encouraged to pursue an engineering career by parents and other family members. She had chosen UCF because of availability of engineering program; she was resolute about not changing her major which had been decided prior to enrollment at the university.

The main factors for choosing engineering were: personal enjoyment, good pay, availability of jobs, and personal talents. The most discouraging factors in engineering were: class schedules, difficulty of course work, lack of support from faculty, and gender discrimination. The most encouraging factors cited were: high interest in the discipline, too much time invested, supportive faculty, positive academic environment, and female role models. In general, the students strongly felt that lack of contact with women in the scientific fields, and possible conflicts between career and family are big deterrents to women entering technical fields. They also cited inadequate academic or career advising, and limited mentoring experiences as being personal problems.

The retention study revealed that early academic difficulties were experienced mainly by majors in aerospace engineering, computer engineering, and electrical engineering. Among the ethnic groups, African American students found engineering most challenging during the initial two semesters. Beginning college students experienced early difficulties with course work, and the juniors who transferred from community colleges were academically well prepared. The male retention rate remained consistently at 59%. Female retention rate peaked at 73% for the 1988 entrants; 67% of these students had graduated by Fall 1994. Graduation rates indicate that one-third of all the engineering students receive bachelor degrees within four years; about one-half within six years; and fifty seven percent after eight years in the program. Electrical engineering and environmental engineering majors surpassed the overall graduation rate. Males dominate aerospace engineering, mechanical engineering and computer engineering; they account for approximately 86% of the enrolled students in those majors. The women are mainly attracted to industrial engineering and environmental engineering, representing more than 20% of the enrollees. Female students accounted for about 15% of the engineering undergraduates, and were performing better academically, even though they had entered UCF with lower SAT Math scores than the male students.

Conclusions

Female engineering undergraduates at the University of Central Florida are being retained long-term at higher rates than males. These women still face discrimination and discomfort from fellow students. Career concerns include balancing career and family, lack of contact with women in the scientific fields, and limiting mentoring experiences.