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ABSTRACT

This paper presents a survey of the techniques used by 29 engineering colleges that have been successful in recruiting and retaining women engineering students. Eight techniques are described for increasing the enrollment of women, including publicizing techniques, counseling efforts, hiring women faculty, and recruiting at the high school level. (MLH)

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RECRUITING AND KEEPING WOMEN ENGINEERING STUDENTS

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Introduction

Many universities are currently trying to increase the number of women enrolled in engineering colleges. These universities may be motivated to increase the percentage of women in what has traditionally been a male career or they may be motivated to increase total enrollment and see women as a potential source of additional students. Whatever the motivation, universities across the nation are seeking effective techniques both to identify women engineering majors and to keep them as students past their freshman year.

This paper presents a survey of the techniques used by 29 engineering colleges which have been sucessful in recruiting and keeping women engineering students. We obtained the data for this survey by sending a letter to the Dean of Engineering at each of the 42 schools with the highest enrollment of women engineering students according to the Society of Women Engineers' Report on Women Undergraduate Engineering Students Biennial Survey 1959-74. Each of the 42 colleges had 30 or more women engineering students during the 1973-74 school year. The universities of which the 42 colleges are a part are listed in Appendix 1 and the individuals who responded to our letter are given in Appendix 2. Our letter had open-ended questions and we have attempted to highlight some of the responses in this paper.

Our survey is presented under eight headings which we have identified to categorize the proven techniques used to attract women to engineering. These recruiting efforts may be in part responsible for the national increase in the percentage of women engineering graduates shown in Table 1. If your university is hoping to increase its enrollment of women students, we encourage you to pursue the eight activities proposed here. Success will be based on a combination of commitment, technique, luck and hard work.

1. Make a commitment to recruit and keep women engineering students.

The College of Engineering should set as a goal to increase the number of women engineering students and graduates. The Dean should support this goal by allocating resources and funds to implement affirmative action programs and by recognizing those faculty members and administrators who participate in these programs. Several universities have appointed one or more individuals to coordinate the recruiting and counseling of women students. Michigan Technological University has organized an advisory committee composed of women faculty and students to discuss solutions to problems facing women students. Iowa State University has established a committee to implement ways to inform both female and male students on the advantages of a career in engineering.

In sending out our survey letters for this paper, we addressed them to the Dean of Engineering at each university. In many of the replies the Dean responded personally or he was able to refer the letter to a designated individual within the college administration. We interpret this response to be due to the fact that the Deans are informed on the affirmative action efforts at their schools and recognize the participating individuals. The letters exhibited personal sincerity and a college commitment to increase the number of women students.

2. Publicize your engineering program to prospective women students.

Once you have made a commitment to attract women students, the next step is to communicate information about your engineering program to prospective women students. Several universities have published brochures which deal specifically with women engineering students at their university. These brochures show pictures of women students engaged in the usual engineering educational activities and present career opportunities for women. We have included a list of the titles of the brochures we received from respondents to our survey in Appendix 3. The University of Arizona reported that it revised its brochure, which is distributed to all students, to describe engineering in non-sexist terms and to include pictures of women students. The College of Engineering at the University

of Wisconsin - Madison cooperated with other colleges at the university to prepare a brochure on non-traditional career choices for women. Several universities reported that they included publications from Society of Women Engineers and Engineers Council for Professional Development when answering inquiries from women.

In your publicity, stress the strong points of your university. It is not clear what aspects of a university or engineering program will attract women students. Duke University and Tufts University commented that some women prefer to go to a university which has a strong liberal arts program so that they will have an opportunity to select courses outside the traditional engineering areas. Tufts University also reported that some students hope to use their engineering degree as a foundation for a degree in law or medicine. Vanderbilt University feels that women are attracted to specific engineering programs and the University of Washington related that women are particularly interested in bioengineering and environmental areas. Iowa State University reported that many women are interested in architecture which is a part of their College of Engineering. Other universities report that women also consider the more general criteria of low tuition, proximity to home, or general reputation. It is difficult to predict what factors will influence students to

attend a particular university, but an accurate description of the strong points of your program is usually the best publicity.

If students make an inquiry after receiving the literature, be sure to make an individual response. The admissions office of the university will probably receive most of the inquiries and you should ask them to forward all names to you for an additional reply. Georgia Institute of Technology and Worcester Polytechnic Institute make an effort to provide an individual reply to each inquiry. Michigan Technological University requests that a senior woman in Mechanical Engineering write a handwritten response and has found this to be very effective.

Some universities have tried additional publicity techniques. For example, Kansas State University and the University of Wisconsin-Madison have provided television announcements on opportunities for women engineers. The Ohio State University has produced a film "Real People, Real Jobs" which interviews four recent graduates including one woman and one black man. Worcester Polytechnic Institute ran an ad in Ms. magazine with the headline "When you were 17 ... would you have considered becoming an engineer or computer scientist?" They report a small volume of letters in response to the ad but they hope that this type of publicity will reach a wider audience which will hopefully include parents and teachers as well as prospective students.

3. Recruit prospective women students at the high school level.

Career guidance information should be distributed to students while they are still in high school. Several universities have organized visitation teams composed of faculty and students to tour high schools in the vicinity of the university. Columbia University and the University of Washington attempt to send women students to their own high school to recruit. Princeton University selects schools to visit that have a strong math and science curriculum and includes three all girls schools in its visits. Michigan Technological University and Georgia Institute of Technology include visits to Junior High Schools. Michigan Technological University has had a National Science Foundation grant to do research on attitudes among eighth grade girls towards engineering. Martha Sloan, who participated in the research at Michigan Technological University was the editor of the February 1975 issue IEEE Transactions on Engineering Education on women in engineering. Georgia Institute of Technology presents a demonstration program in science classes and speaks on opportunities in science and engineering. The visitation teams from the University of Washington and the University of California-Berkeley go to area community colleges. Stanford University sends a representative to other universities to interview prospective graduate students.

On-campus events can provide a valuable exposure to the university for both women and men students. Some universities have one day programs consisting of morning and afternoon sessions plus a planned luncheon. These programs can be math contests and science fairs, such as the ones sponsored by the South Dakota School of Mines, where outstanding students can compete and be recognized for their achievements. Northwestern University and Ohio State University hold programs that are more specifically aimed at opportunities for women. Advertisements of these programs are sent to women students, high school counselors and teachers. Some universities have more extensive programs during the summer. The University of Wisconsin-Madison, Michigan Technological University and North Carolina State University sponsor summer workshops for women high school students. The University of Illinois at Urbana-Champaign conducts National Science Foundation and Junior Engineering Technical Society summer institutes and makes an effort to find qualified women to attend. The University of Illinois also sponsored a two-day conference during October 1973 on the topic of women in engineering. The more extensive workshops require a greater commitment of financial and personnel resources; but most of the universities feel the workshops have been successful in recruiting highly qualified students.

4. Counsel women students after they arrive on campus.

Once a student has decided to study engineering, the college should make an effort to keep her as a successful student. It is important to counsel students as soon as they arrive on campus. Most campuses admit new students directly into the college of engineering and assign them immediately to a counselor. There appears to be two opinions on whether women students should be assigned to women counselors. For example, at Northwestern University all women engineering freshmen are assigned to a woman counselor. At Oregon State University and Princeton University, no special attempt is made to pair women students with women counselors.

Many universities have students schedule an engineering orientation course during the first term to introduce various engineering careers and services of the college office. At the University of Wisconsin-Madison a woman faculty member is in charge of this course and at the University of South Florida, a woman teaches some of the sections. Arizona State University uses a creative design project in the introductory course and reports that women students enjoy being involved in this activity. Most of the universities made an effort to maintain contact with new students and several used both an orientation course and an individual advisor.

Several universities pointed out that women have about the same or lower attrition rates than men. Academic failure does not appear to be as significant a factor for women as for men. This conclusion was confirmed in the letter from Mary Diederich Ott of Cornell University, who has conducted a survey of enrollment and attrition data for engineering students. Most women who leave engineering do so because of a change in career objectives. Counselors should present the opportunities available to women engineers and should portray an engineering career as accurately as possible. General Motors Institute provides work experience periods for all students and reports that the women who leave the program usually do so because they do not want the type of life as indicated by their experiences. Not all women would be happy in an engineering career and if they recognize that their career objectives lie in a different area then the counselor or college has still performed a service for that individual.

5. Establish a student section of the Society of Women Engineers.

A student section of the Society of Women Engineers (SWE) can provide an opportunity for the woman students to get to know one another and to discuss common experiences. Several SWE sections sponsor an activity, such as the picnic at the

University of Illinois at Urbana-Champaign, early in the fall to introduce the new women students to their current membership. It was observed on several campuses that women enjoy meeting other women students and are much more likely to participate in organizations than their male counterparts. Cornell University made a survey of a group of freshman students and found this conclusion to be supported by their data.

The SWE members can help in recruiting efforts by participating in on-campus programs and high school visitation teams. Current students can be especially effective in communicating with students on a one-to-one basis. The SWE sections at Columbia University and Ohio State University hold coffee hours or teas and give tours of the school. The University of California-Davis SWE section sends letters to women applicants relative to available scholarships. The faculty advisor to the SWE section can coordinate the student efforts to insure the quality and accuracy of the recruiting.

6. Hire women faculty and administrators.

Women faculty members and administrators can serve as role models and counselors for women students. When a student asks "Can a woman achieve a successful career as an engineer?", the most effective answer is to introduce her to successful women engineers. Universities should seek women with qualifications that will make them an asset to their faculty.

Virginia Polytechnic Institute and State University has recently added two women faculty members and feels that they help to recruit women students. Universities can also invite women engineers from industry to participate in campus programs and recruiting efforts. Carnegie-Mellon University provides opportunities for students to talk to upper class women, industrial representatives, and prospective employers and finds that these sessions particularly help students who are undecided on a major. The University of Minnesota surveyed some of their women students and recognized a need for role models among this group.

Women students often appreciate the opportunity to discuss with women faculty and advisors career objectives. Most young women still seek the traditional goal of marriage and children, but also want to pursue career goals. Topics such as combining a career and family and reentering a profession after several years absence often come up in discussions among women. Finding solutions to problems dealing with career objectives is one technique for assisting engineering freshman become engineering graduates.

7. Recognize outstanding women students.

The college should provide recognition and publicity for outstanding women students in the engineering program. Several universities have honors assemblies or banquets where students

are recognized for membership in Tau Beta Pi or for other awards. Georgia Institute of Technology presents outstanding entering freshmen a certificate and a small cash prize at a dinner honoring students. The University of Illinois is able to present a cash award to the outstanding woman engineer from the Women's Auxiliary of the local Society of Professional Engineers. This fall, Illinois expects to be awarding ten $500 grants to freshman women. The Society of Women Engineers also presents scholarships on the national level to outstanding women students. Most of the college awards should be awarded from the entire student population and the criteria for the awards should be reviewed so that all students are considered on an equal basis.

8. Publicize opportunities for engineering graduates.

The good news about engineering is that most graduates will be able to get challenging, financially rewarding jobs. Compared to the more traditional fields for women: secretarial, education, and nursing, engineering provides a higher average salary. The job market tends to go in cycles and students may have heard horror stories about engineers not being able to find jobs. Engineering has a good record over the years and employment opportunities appear to be improving. Women engineers are especially able to find jobs with the affirmative action emphasis of many industries. The SWE section at

the University of Washington publishes a brochure listing the qualifications of women students who are seeking employment to help insure that women students will find jobs.

Conclusion

All of the universities that we surveyed reported success in recruiting women students. Michigan Technological University, University of Minnesota, and Virginia Polytechnic Institute and State University reported that their enrollment of freshman women doubled from fall 1973 to fall 1974. General Motors Institute and Stanford University wrote that women constituted over 10% of their total enrollment. Princeton University has 15% women in its freshman and sophomore classes with a 10% average enrollment. Vanderbilt University mentioned the highest percentage of total enrollment at 15%. General Motors Institute had the highest number of women students among the respondents with 304 total during 1974-75.

The success of these schools should encourage other universities wishing to increase the enrollment of women to attempt to recruit more women. We recommend the eight steps presented in this paper as our synthesis of the techniques used by successful schools. It is difficult to predict that any technique will be equally successful at another school, but these techniques do represent the best starting point for schools that wish to emulate success in recruiting and keeping women engineering students.

TABLE 1

Percentages by School Year of the Total Number of Engineering Degrees Awarded to Women

School Year(s)	B.S.	M.S.	Ph.D.
1949-61	0.3	0.3	0.9
1961-62	0.4	0.4	0.3
1962-63	0.4	0.3	0.8
1963-64	0.5	0.3	0.4
1964-65	0.4	0.4	0.5
1965-66	0.4	0.6	0.4
1966-67	0.5	0.6	0.4
1967-68	0.6	0.7	0.4
1968-69	0.8	0.7	0.4
1969-70	0.8	1.1	0.7
1970-71	0.8	1.1	0.6
1971-72	1.1	1.6	0.7
1972-73	1.2	1.2	1.0
1973-74	1.8	2.5	1.1

Data for this table was compiled from articles in the November 1968, February 1969, January 1970, February 1971, April 1973 and January 1974 issues of Engineering Education and from statistics appearing in The World Almanac.

APPENDIX 1

The following 42 universities lead the nation in the enrollment of women engineering students according to the Society of Women Engineer's Report on Women Undergraduate Students Biennial Survey 1959-74. Some schools which do have high enrollments of women may not be included in the list because they did not respond to the SWE survey.

Arizona State University
The University of Arizona
University of California-Berkeley
University of California-Davis
University of California-Los Angeles
Carnegie-Mellon University
Clarkson College of Technology
Columbia University
Cornell University
University of Colorado
University of Delaware
Duke University
University of Florida
General Motors Institute
Georgia Institute of Technology
Heald Engineering College
University of Illinois-Chicago Circle
University of Illinois-Urbana-Champaign
Iowa State University
Kansas State University
Michigan Technological University
University of Michigan
University of Minnesota-Twin Cities
Montana State University
North Carolina State University-Raleigh
Northeastern University
Northwestern University
Ohio State University
Oregon State University
Princeton University
Purdue University
South Dakota School of Mines and Technology
University of South Florida
Stanford University
Texas A&M University
Tufts University
Vanderbilt University
Virginia Polytechnic Institute and State University
Washington University
University of Washington-Seattle
University of Wisconsin-Madison
Worcester Polytechnic Institute

APPENDIX 2

We wish to acknowledge the following individuals who corresponded with us concerning their programs for women in engineering.

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APPENDIX 3

Several universities sent us copies of brochures which they had prepared to help recruit women students.

"Meet These Engineers"	University of California-Berkeley
"Engineering Add Lib"	University of Illinois at Urbana-Champaign

(This brochure has been reprinted by the ECPD under the title: "Womengineer")

"Reflections . . . Women in Engineering"	North Carolina State University-Raleigh
"Women in Engineering"	Ohio State University
"Consider the Possibility"	Stanford University
"Women Engineers at Vanderbilt"	Vanderbilt University
"Women Want to Talk With You"	University of Washington-Seattle