INCREASING RECRUITMENT AND RETENTION OF WOMEN IN ENGINEERING AT THE GRADUATE SCHOOL LEVEL

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Background

The proportion of women in science and engineering steadily decreases at the bachelor, master, and Ph.D. level. Although there was a slight increase in the number of women enrolled in graduate school through the Fall of 1993, women in engineering received 16.1% of bachelor's degrees, 15.7% of master's degrees and 9.7% of doctorate degrees in 1993 (EWC, 1993). Hall and Sandler (1983) note that female students often suffer a decline in academic and career ambitions during their college years, which is reflected in lower self-confidence about their chances for success, as well as in the lower probability that females of equal ability and achievement to males will apply to graduate school.

Vetter (1994) points out that (1) women are more likely than men to have to support themselves, and are much less likely than men to obtain federal support for graduate study; (2) men are more likely than women to get their support in the form of research, rather than teaching assistantships; (3) women are more likely than men to seek a master's degree without planning to continue further graduate study; and (4) women graduate students in engineering are less likely to complete their degrees and more likely to take longer to do so than their male peers.

Hollenshead et al (1994), at the recently sponsored Alfred P. Sloan Foundation CURIES Conference, outlined a number of institutional practices that appear to contribute to this unbalanced and inequitable situation in the sciences and engineering. A few of these practices include: admissions policies that place undue emphasis on the GRE, which is currently a major topic of debate revolving around gender bias in standardized testing; documented evidence that female graduate students experience less frequency and quality of interaction with faculty than their male peers; gender differences in the types of financial support awarded to doctoral students in science and engineering; informal norms that set up conflicts in personal and professional roles, such as balancing family and career; and the micro-inequities, isolation and sexual harassment.

Both Hollenshead (1994) and Widnall (1988) discuss an institutional problem, referred to as the "hidden curriculum". Widnall describes this process of graduate education as one in which the student has access to a variety of structured professional experiences designed to enhance self-confidence and build independence. She notes that these experiences include opportunities to present and defend research results in regular and productive group meetings, to evaluate and critique the work of peers, to formulate and carry out research tasks of increasing importance, to participate in dialogues and debates about scientific and technical issues, and to discuss future career plans as they relate to current interests and activities. Faculty do not make much of the process explicit to the student, and as a result, this "hidden agenda" is reflected in a lack of student understanding.
Widnall suggests that this hidden agenda is valuable in developing strategies to increase the recruitment and retention of female students. Very few institutions in the country have established targeted programs to recruit and retain female science and engineering students in graduate school (Wadsworth, 1992). There are a handful of exemplary programs throughout the country, including: University of California, Berkeley's Electrical Engineering and Computer Science Department; University of Michigan's Women in Science and Engineering Program; and Carnegie Mellon's Associate Provost's Initiatives. Widnall (1988: 30) recommended that targeted intervention programs needed to be established at the point of initial career choice and during the graduate school years. Six years later this same recommendation is surfacing at the National Science Foundation, the Alfred P. Sloan Foundation and many other significant organizations dedicated to improving the professional and human climate of our graduate schools for all students.

**Purpose**

Although the University of Washington has higher proportions of females enrolled and graduating from graduate school than the national norms, (22.7% of the Master's degrees and 11.5% of the doctorate degrees in 1993), the inequities in the proportions of females is still striking. In an effort to address this issue, the Women in Engineering (WIE) Initiative designed, developed, implemented and evaluated a "pilot program" focused on increasing the recruitment and retention of female engineering students in graduate school by (1) providing information through seminars, panel discussions and advising; (2) dispelling myths; (3) providing role models; (4) providing a supportive community, and; (5) offering encouragement.

**Initial Planning**

In an effort to identify the potential needs of the students and appropriate interventions, the WIE Initiative held three separate focus groups with faculty, graduate students and undergraduate students. The faculty group, in drawing from its own experiences, suggested practices which would target informal communication, "the hidden curriculum", and departmental level recruiting. It also committed to making conscious efforts to recruit talented female undergraduate students. The graduate student group discussed issues it faced and suggested the program include informational seminars and panel discussions, as well as opportunities for social interactions. The third focus group of undergraduate students discussed what it knew about graduate school and what it would like to know. The group felt information on financial aid and application procedures would be valuable as well as a discussion of the need for receiving an advanced degree and its importance. The results of the focus groups set the direction of the program.

**Design and Implementation**

**Organizational Setting**

The Graduate Student Program is organizationally located within the WIE Initiative, which offers many programs and services. As an integral part of WIE, the Graduate Student Program is able to draw on support from the existing organizational resources and at the same time to enhance the services provided by the organization as a whole. Many of the students involved in the Graduate Student Program are already involved with WIE in various other programs.

Female students are recruited from the University of Washington's ten undergraduate engineering departments. The students who attend informational seminars on graduate school are often participants of the Peer Mentoring Program, the Professional Mentoring Program and
the Community College Transfer Program. The Peer Mentoring Program matches freshmen and sophomores with upperclassmen. The Professional Mentoring Program matches upperclassmen with female engineers working in the Seattle area. The Community College Transfer Program aids students in making the transition from a community college to this four year institution. After transferring, students are usually juniors and represent a pool of potential graduate students.

Other services offered through WIE for retention of graduate students include personal counseling and brown bag lunch discussions. Female graduate students may use counseling to help resolve personal issues, which may hinder them from completing their degree. When several students share the same issues, the issues may be the subject of the brown bag lunch discussions. Finally, all female engineering students receive a quarterly newsletter, the WIEPRESS, which provides information about the various WIE activities and other topics of interest.

The next two subsections will discuss the recruitment and retention components designed to pilot the Graduate Student Program.

Recruitment Components

An informational seminar for undergraduate students entitled, Your Guide to Graduate School, is presented each quarter. This seminar covers myths, choosing a school, application procedures, financial aid, future trends, and resources. Examples of resources displayed include the University of Washington's application for graduate school, the GRE application booklet, the ASEE Directory of Engineering Graduate Studies and Research. In addition to these resources, copies of the seminar transparencies, a list of fellowships, graduate school brochures, and the business card of the WIE Assistant Director are given to each student.

The business card is included in the resource materials to assist students in contacting or making appointments for academic advising. Students are helped with writing statements of intent, completing department applications, and locating financial aid sources. A statement of intent is a letter required by the University of Washington and other institutions, in which students explain their reasons for pursuing an advanced degree, how they see the degree fitting in with their long term goals, and why they are choosing a particular university.

Four methods of marketing Your Guide to Graduate School seminar are used. First, three weeks before the event, postcards are sent to all female juniors, seniors, and fifth year students within the College of Engineering. Current addresses are obtained from the Registrar's Office. Second, about one and one-half weeks before the event, flyers are created and posted in all the engineering buildings, library, and career center. Third, the Center for Career Development includes an advertisement for this seminar in its quarterly newsletter. Finally, the WIE Staff personally invites people to attend the event. It is often this personal connection, established through other WIE programs and services, which encourages students to attend this seminar and invite others.

Retention Components

A Welcome Reception for incoming female graduate students is held in Autumn Quarter. Incoming graduate students have the opportunity to meet students with graduate school experience and to discuss their experiences. The reception begins with an informal panel discussion by students from several departments. A question and answer session follows. Representatives from each department, who have prepared specific information, answer questions which pertain to their department. A social reception, to which female faculty
are invited and food is served, concludes the event. After meeting the WIE Staff and other graduate students, students are invited to attend quarterly seminars and panel discussions.

Seminars and panel discussions focused on retention cover a variety of topics. Two examples were (1) How To Write A Research Proposal, and (2) How to Pursue a Job in Academia. The proposal writing seminar included information on proposals written for master's thesis and Ph.D. dissertations and for grantwriting. The academic job seminar discussion panel consisted of four faculty members. Two recently hired faculty members shared their experiences in searching for a job. Two tenured faculty members, involved in hiring process, shared their experiences and discussed what they look for in new hires. Handouts of the materials presented are given to students. In addition, letters are sent to all faculty members and graduate advisors, and flyers of upcoming events are sent to individuals to make class announcements and personal invitations.

The moderated electronic bulletin board is one additional method used for marketing Graduate Student Program events and other topics of interest. During the course of the year a postcard is mailed to all female graduate students, inviting them to be a part of the network. To subscribe, students simply send an e-mail to the WIE account. Any individual may submit information about other events or topics of interest. Then depending on the appropriateness of the information or event, pertinent information will be posted. In addition to events, notices from a variety of sources for faculty positions are posted.

Finally, advising is available for academic concerns. Common academic issues impacting the success of students include: how to change advisors without negatively affecting a career; advantages of research assistantships over teaching assistantships; and how to compete for fellowships or other sources of funding.

Although the focus of the Graduate Student Program is on female students, male students are welcome to attend all seminars and panel discussions. The Women in Engineering Initiative's mission statement is to "create an academic and social climate in engineering, which is equally conducive and encouraging to male and female students..." Some events focus on the development of a supportive community, while other events emphasize the development of an intellectual community, both of which are important.

**Evaluation**

An evaluation plan including both formative and summative components was designed in the initial stages of the Graduate Student Program. The purpose of the summative evaluation is to measure the impact of the intervention on increasing the recruitment and retention of female students in engineering, and to measure students' perceptions of the impact of the intervention on improving the quality of their graduate school education. Formative evaluation is included in order to measure student satisfaction and provide useful information in monitoring and revising the intervention program.

Typically referred to as a Needs Assessment, information from the focus groups provided guidance in the initial planning stages for identifying and selecting the specific activities and components of the intervention program. A questionnaire was designed to determine student assessments of the effectiveness of the intervention program in meeting their needs, of their satisfaction with the intervention program, and their perceptions of the impact of the intervention in facilitating their graduate education experience. The questionnaire will be administered at the end of the Spring Term. At the time of this writing, questionnaires are still being received and will be analyzed during the summer. Measures of increases in enrollments and degrees obtained will be gathered through the engineering departments, the Registrar's Office, and the Graduate School.
Future Directions

Although the analysis of the evaluation is not complete, the high participation rates and student interest has provided solid evidence of the need for the Graduate Student Program. Three additional components to the program are being planned for the upcoming Autumn Quarter: (1) mail a letter to all females newly accepted into graduate school outlining the resources available to them, in hopes of encouraging them to accept the University of Washington's offer; (2) design a mentoring program, matching undergraduate students interested in Graduate School with current graduate students; (3) prepare a resource book, containing sample statements of intent, and master's and Ph.D. proposals. Finally, the evaluation questionnaire will be modified to more accurately measure the impact of the program on increasing enrollments and retention.

References


