

What are "Women in Engineering Programs"?

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Abstract

Women in Engineering Programs, as administrative units within engineering schools, can play an important role in solving problems related to recruiting and retention. A program, staffed with one or more full-time professionals, can provide programming for a variety of groups of women: pre-college, undergraduate, graduate, alumnae, employers, and faculty. Creation of a Women in Engineering Program can improve the quality of life at a particular institution. Since the program is owned by the institution, Women in Engineering Programs are different from other similar programs.

Introduction

During the years following World War II, returning veterans swelled enrollments in colleges and universities, including those of engineering schools as shown in Figure 1[1]. In ensuing years, the children who were born became known as the Baby Boomers, and their numbers have impacted many facets of our culture, including engineering enrollments. As the Baby Boomers have moved beyond traditional college age, there has been growing concern among engineering administrators of how to maintain enrollments. One option is to attract members of underrepresented groups as students.

An underrepresented group in this sense is a demographic group whose presence in engineering schools is much smaller than its presence in the general population. This is in contrast to a minority group which refers only to its representation in the population. An underrepresented group, however, can actually be a majority. In this case, women are an example of such a group: Despite representing slightly over 51% of the U.S. population in the 1990 census, they held only 9 percent of engineering jobs in 1992 [2, 3]. If more young women enrolled in engineering programs, they could make up for a decrease in the total number of 18-22 year olds that is affecting enrollment.

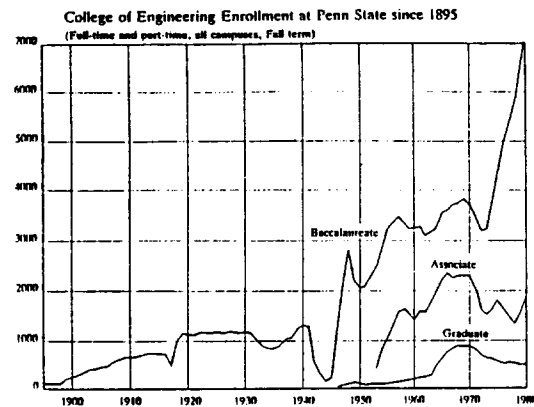


Figure 1. Engineering Enrollment at The Pennsylvania State University [1]

The purpose of this paper is to discuss Women in Engineering Programs (WEPs). In particular, the way that they can influence recruiting and retention of undergraduate and graduate students will be described. Additionally, the wider impact that WEPs can make on the development of female faculty and alumnae will be discussed.

Historical Background

In the late 1960's, women became more interested in attending universities and developing careers in professions which had traditionally been the realm of men. Institutions which first became co-ed during this time, such as the Ivy League schools, achieved an enrollment that was about half male and half female within a few years. While this general trend occurred in certain professions, such as medicine and law, it did not hold true for engineering [4, 5].

Figure 2 shows the percentage of engineering degrees received by women in the 30 year period from 1965 to 1995 [4]. The bachelor degree figures in particular can be interpreted as an average enrollment for the previous five-year period. So, in the early '70's, women comprised about 2-3% of under-

graduate engineering students. This increased rapidly to about 10% in the late '70's and 15% in the early '80's. During that time, it was assumed that this trend would continue until the enrollment of women in engineering approached 40-50%. However, the '80's saw enrollment of women in undergraduate engineering programs plateau at around 15-16% as shown in Table 1. To deal with the issues associated with the rapid increase in enrollment and subsequent plateau, some of the larger engineering programs created formal Women in Engineering Programs during this period.

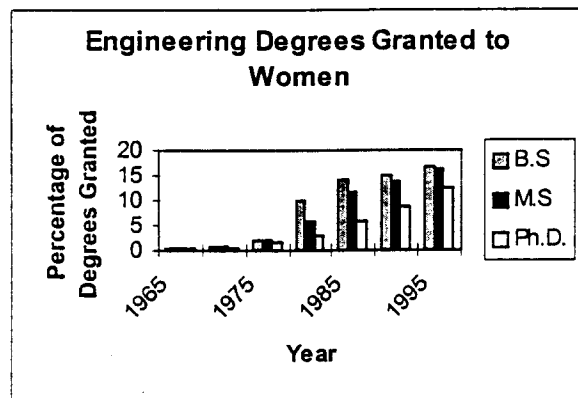


Figure 2. Percentage of Engineering Degrees Received by Women in 1965-1995 [4]

The WEP at Purdue University was created in 1969 [6], and it is one of the oldest such programs in the country. The objectives of this WEP [7] are

- ▶ to provide career information and encouragement to pre-college women to continue achievement in math and science and consider engineering as an appropriate career choice.
- ▶ encourage women to matriculate at Purdue University in the Schools of Engineering.
- ▶ ensure a climate in the Schools of Engineering which allows young women to reach their full potential.
- ▶ provide opportunities for women engineering students to develop leadership skills that can be utilized in their future lives.
- ▶ encourage undergraduate women to consider graduate education among their options upon graduation.

- ▶ maintain open communication with alumnae and their employers to encourage their continued participation in and support of the WEP.

From this list, it can be seen that this WEP works with the following groups: pre-college, undergraduate, graduate, alumnae, and employers. In the following sections, the role that a Women in Engineering Program can play with each of these groups will be discussed. Additionally, some thoughts will be presented regarding the interaction of female faculty with WEPs.

Table 1. Undergraduate Engineering Enrollment

Year	Total	Female	% Female
1982	403,390	62,328	15.5
1983	406,144	64,649	15.9
1984	394,635	62,659	15.9
1985	384,191	61,602	16.0
1986	369,520	57,612	15.6
1987	356,998	55,471	15.5
1988	346,169	54,772	15.8
1989	338,529	54,538	16.1
1990	338,842	55,915	16.5
1991	339,397	57,656	17.0
1992	344,126	60,599	17.6
1993	337,817	60,693	18.0
1994	328,463	60,931	18.5

Constituencies

Pre-College—Recruiting

Working with pre-college girls and boys to make them more aware of a career in engineering will undoubtedly relieve enrollment problems. While children see a number of career choices, such as doctors, lawyers, and teachers, in their daily lives or on television, all but a few connect the term "engineer" with the person who drives a locomotive. Many technical societies have recognized this as a problem and have created programs to go into the schools and introduce children to engineering. It is very important to begin this activity before adoles-

cents begin to choose elective courses in high school and choose not to take math and science courses.

WEPs can add to other engineering programs by bringing women into the classroom and representing engineering as an acceptable and appropriate choice for women. Both girls and boys need to see such representation. So, WEPs can serve a vital role by linking practicing women engineers and programs that need them.

When students reach high school age, WEPs can make a special effort to recruit girls who have shown interest in math and science by inviting them to campus, providing information about curricula, and encouraging them to enroll at specific institutions. This can be done through camps or workshops for groups of young women to provide a positive introduction to a specific engineering program.

Undergraduate—Retention

Once students are enrolled in an engineering program, the next major task is to keep them there until they earn an engineering degree. Faculty are often concerned that increased retention is the code word for grade inflation. But in many cases, creating a positive environment or climate in the classroom will help to create a feeling of belonging to a community and the overall self-worth which will go a long way toward increasing retention. If the classroom environment is not conducive to learning by all types of students, retention becomes an even bigger challenge. Trying to identify and discontinue inferences and examples based on stereotypes is one small way of addressing classroom climate issues. Women students are more likely to succeed if they feel that they belong in the classroom as much as their male counterparts. For example, asking a female student if she is in the correct room on the first day of class is probably not a good way to introduce yourself to the student.

Outside of the classroom, being part of a study group can have a positive impact academically and also create a sense of community. It may be difficult, however, for a female student just arriving on campus to feel comfortable joining a group that is predominantly male. Formally assigning study groups, especially for the younger students, will help with this issue, particularly if the groups are formed so that no one who is "different" is isolated.

WEPs can help to deal with these issues by creating mentoring programs and social gatherings

which help women freshman engineering students to meet other women engineering students. They can also provide settings where students can meet the faculty on an informal basis and begin to make connections with all levels of the university.

Graduate—Reducing Isolation

If the bars representing bachelors degrees in Figure 2 represent undergraduate enrollment in the previous years, the bars for advanced degrees represent the same women achieving higher levels of education. However, at the graduate level it is common for students to only know and be involved with a small number of colleagues working in the same laboratory. For women going through an undergraduate program where they represented 15-20% of the enrollment, this may be the first time that they are the only woman in a particular class or working on a particular research project and they may feel completely isolated from other women.

Again the WEP can help by creating opportunities for women graduate students to meet others like themselves as well as female faculty. This interaction will allow graduate students to share non-technical information about things like the process of defending a thesis, choosing an advisor, and pursuing external funding.

Alumnae

Alumni play an important role in the life of every institution of higher education. Their successes and failures are a reflection on the education that they have received. Additionally there is increasing pressure for generating finances from alumni giving. Usually alumni need to have some type of relationship to their engineering school. The WEP can provide a more personal relationship with alumnae who may not have felt connected when they were students. This relationship can be developed and nurtured through activities such as reunions, conferences, and the creation of an e-mail list-serve for alumnae.

Alumnae are also valuable role models for male and female students. Among other things, they, like their male counterparts, often demonstrate that you can be a successful engineer without having a 4.0 GPA as a student. Electronic mentoring programs can be established between students and alumnae who can provide information about life as a practicing engineer, balancing work and family issues, and employment opportunities.

Faculty

Many engineering schools without formal WEPs manage to implement many of the activities mentioned above. However, in that case, there is often an expectation that these activities will be carried out by the female faculty, providing them with an additional workload over and above that expected of male faculty. Since most female faculty are young and untended (again following the enrollment trends in Figure 2), these additional service activities may be resented when they take time away from teaching and research.

The creation of a formal WEP will remove this burden from the female faculty. Additionally the WEP can provide opportunities, such as informal lunches and other get-togethers, for interaction among the female faculty who are usually isolated in the different departments of the school of engineering.

Women in Engineering Programs vs. Society of Women Engineers

Many institutions which do not have formal WEPs do have a chapter of the Society of Women Engineers (SWE). The question of whether these are duplicate programs must be addressed. While there are major overlaps between the two organizations, there are also subtle but important differences between them.

The mission of the Society of Women Engineers is to

- ▶ stimulate women to achieve full potential in careers as engineers and leaders
- ▶ expand the image of the engineering profession as a positive force in improving the quality of life
- ▶ demonstrate the value of diversity

While the first portion of the mission statement could be interpreted as retention and the second could be interpreted as recruiting, the Society of Women Engineers, as a national organization, is not about building a relationship between a group of women and a particular institution. The amount of control and direction that can be given to a WEP is much greater than that which can be exerted on a student chapter of SWE. SWE works to address issues which affect the entire engineering profession, but a WEP works to address issues at a particular institution. The fact that SWE on any given campus is run by student volunteers and a WEP is run by a professional staffperson again emphasizes the difference between

the two groups. There is a higher probability that a WEP will be consistent in its efforts.

Discussion

Women in Engineering Programs play an important role in helping engineering schools with recruiting, retention, and alumnae development. When they are effective, they can help reduce feelings of isolation among students at both the undergraduate and graduate level as well as among female faculty. By reaching out to this large segment of the population which has not traditionally been involved in the engineering profession and may not have a clear understanding of what engineering is, WEPs can have a significant impact on our future as a profession.

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Dr. Beth Todd graduated from Penn State University with a BS degree in engineering science in 1981. Before attending graduate school, she worked in nuclear reactor core performance at Bettis Atomic Power Laboratory. She earned an MS degree in applied mechanics in 1986 and a Ph.D. in mechanical and aerospace engineering in 1992 from the University of Virginia. She is interested in applying mechanical analysis to problems of the human body. She has completed biomechanics research projects for NASA and the US Air Force. Prior to her current position as an Assistant Professor in Mechanical Engineering at the University of Alabama, Dr. Todd was an instructor at GMI Engineering & Management Institute in Flint, Michigan.

GAIL QUEEN

Gail Queen graduated from The University of Alabama with a BS degree in Mathematics in 1990. Before attending graduate school, she worked for Blue Cross/Blue Shield of Mississippi as an actuarial analyst. She earned an MA in Pure Mathematics in 1995 from The University of Alabama. In 1996 Gail became the first Director of the Women in Engineering Program at The University of Alabama. Currently she also serves as Director of Engineering Student Recruitment for the College of Engineering.