

## Increasing the Enrollment of Women in Engineering

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### Abstract:

Today, an important issue in academics is increasing the participation of women in engineering and sciences. It is well known that women are significantly underrepresented in scientific fields in the world, and engineering is no exception. In our college only 5% of pre-engineering and less than one percent of computer engineering students are women.

There are several reasons for attracting women to engineering such as the fact that more than 50% of consumers are women. If those designing the products are able to relate to the female section of the population, there is a better chance of selling the products. Industry needs women designers. Also, the women's talent can be used to improve the work environment. Women excel in verbal and interpersonal skills and are very good collaborators<sup>2</sup>. This paper will address several ways of attracting more women to the field of engineering.

### Introduction

Statistics from the U.S. Department of Education show that in 1998 -1999, women earned 57% of B.S. degrees, 58% of M.S. degrees and 43% of doctorate degrees<sup>1</sup>. More women than men earn associate, bachelors, and master's degrees. Also, the number of women receiving all types of degrees has increased at a faster rate than for men. Between 1989-90 and 1999-2000, the number of bachelor's degrees awarded to men increased by 8 percent, while those awarded to women rose by 26 percent<sup>1</sup>. However, in 1999 – 2000, women earned only 19.5% of B.S. degrees, 19.7% of M.S. degrees and 14.3% of doctorate degrees in engineering and engineering related technologies<sup>1</sup>. As can be seen from the statistics, women are underrepresented in the engineering field.

Fifteen years ago during the computer, microelectronics, and aerospace boom, there were concerns about a shortage of engineers. Everyone was thinking that the solution was to attract women to engineering. However, because of corporate restructuring and productivity increase for engineering activities, some people thought that there was no more need for so many

engineers. So, the question that one might ask is: “Do we still need to attract women to engineering?” The answer is definitely “yes!”<sup>2</sup>.

There are several reasons for attracting women to engineering such as the fact that more than 50% of consumers are women. If those designing the products are able to relate to the female section of the population, there is a better chance of selling the products. So, we need to have women designers. Another reason for attracting women to engineering is to employ the best engineers and scientists in order to keep our leadership in technology. Microsoft Chief Technology Officer, Nathan Myhrvold, said: “There are breakthrough ideas we are waiting for someone to have. The smaller the number of people in industry, the fewer of those ideas we will get. That’s more in focus in our industry because growth is directly related to human talent<sup>3</sup>”. To employ the best engineers, if we can attract more women to engineering field, we will have a larger pool of candidates to choose from. Another reason is that the women’s talent can be used to improve the work environment. Studies has shown that women excel in verbal and interpersonal skills and are very good collaborators<sup>2</sup>. In order to attract talented women to engineering, the effort should start at home and elementary schools. Parents should be given training as how to treat their daughters at home. Those trainings could be given to the society by good television programs. Elementary school teachers also need training as how to treat girls and boys in their classrooms. In the following sections we will look at actions that can be taken in middle schools, high schools, universities, and industries in order to attract more women to engineering.

### **Role of Middle and High Schools**

Some of the measures that can be taken in middle schools and high schools to encourage girls to become interested in science and math are:

- Research has shown that teachers receive little or no training in gender equity from schools of education<sup>4</sup>. The first step is to revise the curriculum of education, in order to better train the teachers to be sensitive to gender issues in their classrooms. A competitive nation cannot allow girls to write off math and sciences as exclusively male domain. Teachers will need to be prepared to deal with this issue. We need to educate teachers on different learning styles and on achieving gender equality in the classroom. The teachers should be trained and have the mentality that it is ok for girls to go into science and engineering fields. “Studies have shown some differential treatment of girls in schools. Some teachers tend to address technical questions to boys. At middle schools and high schools, teachers can work to encourage participation of women in science by providing assignments that highlights the contributions of female scientists. A useful assignment would be a research paper in which students profile a woman who historically or currently has made an important contribution to science.”<sup>5</sup>
- Content analysis of textbooks has shown that some are sexist and promote sexual stereotyping<sup>5</sup>. Review the content of textbooks for sexist remarks and sexual stereotyping.
- Having more female teachers in math and science classes for role model purposes.

- Training counselors in high schools to encourage girls to take more math and science courses.

## **Role of the Universities**

In order to attract and retain women in the engineering departments, the following actions need to be taken:

- Hiring more female faculty for role model purposes.
- Inviting guest speakers to talk about the role of women in engineering
- Developing support groups by establishing E-mail discussion list among female students, faculty, and staff.
- Maintaining a close relationship between women faculties and students by selecting women faculties to advise women students.
- Improving the departmental atmosphere by means of educating faculty about different learning styles and achieving gender equality in the classroom through workshops.
- Faculty should be equally demanding with students regardless of gender. Women students do not need, and do not like, to have preferential treatment.<sup>2</sup>
- Faculty should be supportive of the student's professional choices. They do not want to hear sexist remarks like: Maybe software is better for a woman.<sup>2</sup>
- Providing academic and professional support for women students by creating tutoring programs targeting women students.
- Regular visits to high schools by women faculty to encourage young women majoring in engineering.
- Giving engineering scholarships to young women in high schools.

In our department, to retain our freshman female students, we have hired senior female students as tutors for freshman courses. We feel this is going to help us retain our female students better.

## **Role of the Industry**

The way women are treated in industry can play an important role in attracting women to the engineering fields. When one asks women students why they have chosen engineering, they often refer to the challenge: the challenge of mastering such difficult and complex subjects, of solving practical problems, of creating things that work<sup>9</sup>. Since mostly very good and talented women go into engineering programs, they are often top of the class and they rise to the challenge<sup>2</sup>. The real challenge for a woman engineer comes when they start working. "To be a minority in a male dominated profession implies all kinds of barriers"<sup>9</sup>. It is the culture of engineering; sometimes with competition opposed to cooperation; sexist perceptions and attitudes; and salary discrepancies that makes working environment very difficult for women<sup>9</sup>. The most important step is to change the way women are treated in the industry as an engineer. A woman engineer is usually underestimated by her colleagues. Women engineers should be given all the opportunities at work such as training and assignments as their male counterparts. Even if the atmosphere in high schools and universities changes, it is not going to attract women students to engineering

unless the industry atmosphere changes. Some of the measures that can be taken by industries in order to attract more women engineers to the field are:

- Making sure that women engineers are not underpaid
- Providing educational opportunities
- Exciting work be assigned to women
- Flexible working hours
- Family leave programs
- Intolerance of sexual harassment and sexist attitudes

### **Summary and Further Research:**

At a time that 57 percent of B.S. graduates are women in the United States, only 20 percent of graduates are women in the engineering fields. This paper discusses ways of improving the participation of women in engineering. In a paper by Adams<sup>7</sup>, it is indicated that the percentage of female graduates in Mauritius, a developing country, is 48 percent in computer science and engineering and in Greece it is about 50 percent in computer science. Statistics from Iran, a developing country, also show that the number of female graduates in engineering, in 2000 - 2001 was about 30 percent, and the percentage of graduates in computer engineering, in 2000 – 2001 was about 40 percent<sup>8</sup>. Studying these numbers makes one wonder if culture is the cause of interest or lack of interest in engineering by women? More studies are needed to identify these cultural differences. Understanding why women in these countries are choosing computer science/engineering is going to help us understand why United States women are not. Statistics from other countries is a good source of information for these studies.

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