

Faculty Mentorships for Female Participation in Computer Science

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Introduction

The importance of mentorship programs in general and for women in particular has been widely recognized. Several mentorship programs have been implemented. Still, the percentage of women enrolled in Computer Science undergraduate programs and the percentage of women employed in the Computer Science technology field is discouraging.

In our experience, it would appear that women were more interested in computer science in the early days than in recent times. This is despite an increase in diverse Computer Science career opportunities, many with high earning potential.

Although both the federal government and many universities have contributed significant resources to address women's lack of interest in the hard sciences [1], most efforts have not had long-term success according to the statistics we cite below.

The current situation for women in computer sciences

According to statistics published by the NSF, the percentage of women earning degrees in computer sciences in the United States has decreased from 2002 to 2012. In Figure 1, we present a graph of the statistics provided by the NSF study ("Women, Minorities, and Persons with Disabilities," 2014).

The decrease in the number of women earning Associate degrees in computer sciences is statistically significant, with degrees earned dropping from 12,662 to 8,814 between 2002 and 2012; as a percentage of total Associate degrees earned in the computer sciences between 2002 and 2012, the numbers have decreased from 36% to 21% [2].

Earning Bachelor's degrees in computer sciences, the numbers for women have decreased significantly from 13,690 to 8,730; as a percentage of total bachelor's

degrees earned between 2002 and 2012, the numbers have decreased from 28% to 18% [2].

Earning Master's degrees in computer sciences, the numbers for women have increased slightly from 5,640 to 5,840, but as a percentage of total Master's degrees earned in the computer sciences the numbers have decreased from 33% to 28% [2].

Earning PhD degrees in computer sciences, the numbers for women have increased from 171 in 2002 to 361 in 2012 [see Figure 1]. Despite this appreciable increase, as a percentage of total PhD degrees earned in the computer sciences the numbers have decreased from 23% to 21% [2].

The percentage of women employed in the U.S. computer workforce in 2011 was 25% [3].

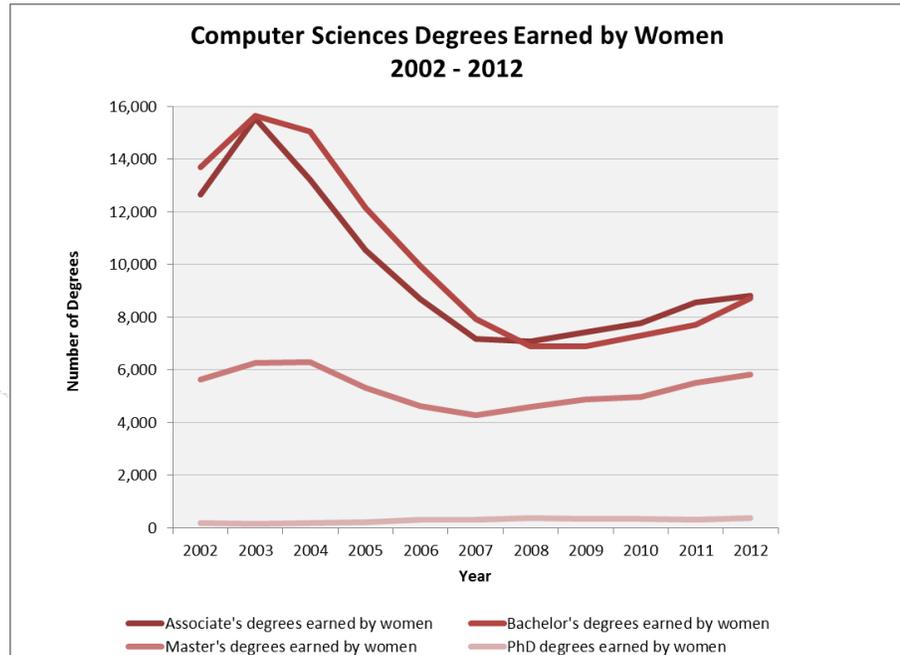


Figure 1 Computer Sciences Degrees Earned by Women [2]

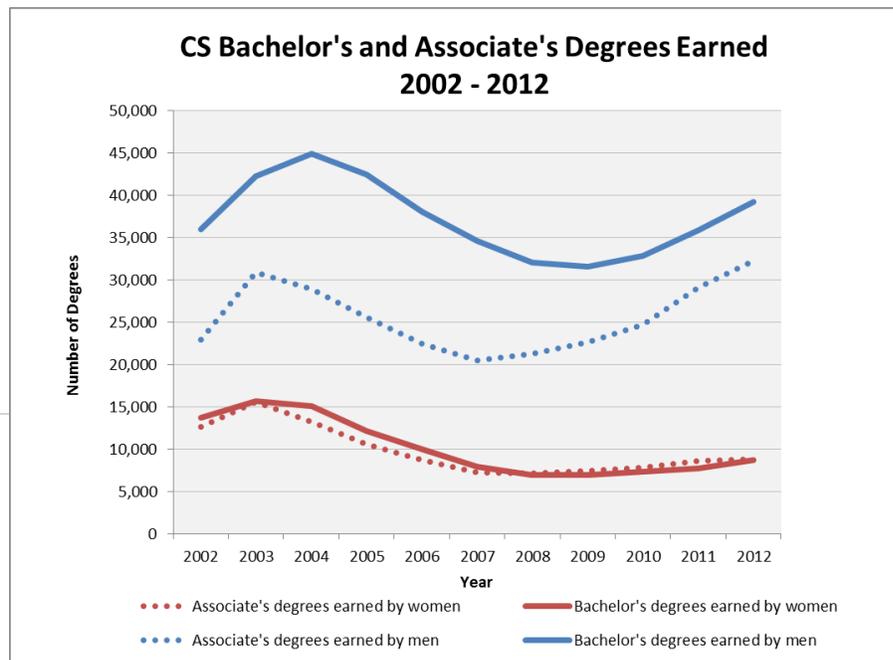
Women in the technical fields in the United States earn \$0.86 for every \$1.00 earned by men [4].

Trends in degrees earned by women

We use the NSF data to examine the Computer Science Bachelor's and Associate's degrees earned by men and women from 2002 to 2012.

In Figure 2, we note the dips in Bachelor's and Associate's degrees awarded to men and women in the Computer Sciences in the 2008 timeframe. The period from 2009 through 2012 shows a decidedly strong recovery in the number of Computer Science degrees earned by men, but only very modest recovery for women.

In 2012 we see Associate's degrees earned by men in the Computer Sciences actually exceeded the



peak number of degrees earned by them in 2003, while the number of women earning the same degree shows little change from the low point in 2008. Since students who earn Associate's degrees feed into Bachelor's degree programs, this news is discouraging.

For men, we see steady increase in the number of both types of degrees earned. This is not the case for women; we see a

Figure 2 Computer Science Degrees Earned [2]

trend begin in 2007 where the number of Associate's degrees awarded lags the number of Bachelor's degrees awarded. This trend continues through 2012.

Current mentorship programs

Mentorship programs for women in STEM fields are popular. In particular, MentorNet is a national program that has successfully paired undergraduate female students with Internet mentors that are chosen by the students from a list of potential mentors [5]. The Association for Women in Computing also promotes networking and mentorships for technical and career-oriented CS students. Statistics provided by these programs indicate that mentorship is a valuable tool [4]. Logically, mentorship programs should build on themselves, with mentored students learning from their experiences and providing similar support for new students. According to the previously cited statistics, however, more of these programs, using perhaps different mechanisms or addressing a different (younger) student body, are needed. We offer some suggestions:

The authors of this paper have found informal mentorships important and perhaps crucial to their education and training in the computer sciences. As a result, we established a structured but low-keyed approach to mentorship programs.

- Face to face mentorships are promoted. We feel that personal relationships are important.

- The relationships are one-to-one.
- Group meetings are planned at least once a semester for students to compare experiences.
- We take advantage of the fact that an alumna whose experience was positive at a school and who has developed a successful career is frequently motivated to support the school and its students.
- We have the full support of our Computer Science Industrial Advisory Board. For example, the company of one of our Board members recently has provided successful internships for four of our women students. Another board member (an FDU graduate) has offered to help publicize our results. A different board member (an FDU graduate) has helped write this paper. Yet another board member has a strong relationship with principals of local high schools and offered to distribute our pamphlets to those schools.
- We have a long tradition of successful CS alumnae. We are facilitating virtual and face-to-face mentorship opportunities through the establishment of a website (developed by one of our alumna) to help students connect to alumnae [6]. We will assemble these pages for recruitment, as well as for encouragement of high school students.
- Both male and female mentors are welcome.

Based on our experience, we believe that women should be exposed to the computer sciences early in their education. We focus on these students.

Faculty Mentoring Makes the Difference

Although several mentorship programs have been implemented, still, the percentage of women in the computer science fields remains low. We propose that mentorships be developed at the most basic levels; we provide guidelines from our personal experiences.

About the Authors

Dr. Gertrude Levine is a Professor of Computer Science at Fairleigh Dickinson University. She earned her PhD from Stevens Institute of Technology. Since 1990, she has been publishing a column on reusable software components in Ada Letters. She publishes research on anomalies of conflict, recently including service degradations.



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