Young Women and Persistence in Information Technology

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INTRODUCTION

The underrepresentation of women in science, technology, and engineering careers is of growing national concern (Vesgo, 2005; National Academy of Engineering, 2002; National Science Foundation, 2004; National Research Council, 2001). While the information technology (IT) workforce appears to be becoming more diverse in terms of race and country of birth, it is becoming less diverse in terms of gender (AAUW, 2000; Malcom, Babco, Teich, Jesse, Campbell, & Bell, 2005; NSF, 2004; Vesgo, 2005). This trend is of particular concern, since women may face unequal access to rewarding IT careers, while society and the IT workforce suffer without the valuable contributions that women might make through the creation of new information technologies (Cohoon, 2005; Freeman & Cuny, 2005).

Past studies have highlighted a tendency of talented young girls to enroll in less rigorous mathematics courses beginning in the middle grades (e.g., Kerr, 1997) and have hypothesized that this lack of preparation creates a barrier to science, technology, and engineering disciplines. In response to the increased under-representation of women in IT, Girls on Track (Got), a year round enrichment program and summer camp, was created in 1998 to encourage talented middle school girls to persist in taking college-bound courses in math, science, and computer science through high school. It was our conjecture that some of these well-prepared girls would later become creative future IT workers.

We have undertaken a longitudinal study of approximately 200 girls who were enrolled in the NSF funded 1999-2001 Girls on Track program, with the goal of creating a model of persistence of these young women into IT careers. This study is now in its seventh year. In this article, we present our somewhat surprising findings. It would appear that talented young women, though prepared and able, are not choosing to pursue IT careers. We suggest some ways the thinking about IT may need to change to encourage broader career-level participation.

BACKGROUND

The demand for information technology workers is projected to surpass demand for all other occupations through 2012 (Sargent, 2004), yet overall enrollments in IT-related fields continue to decline (Zweben, 2005). The percentage of women in IT has also continued to decline (Malcom et al., 2005; Vesgo, 2005). The reasons for this are not well understood, although the "dot-com bubble" deflation in the 2000 may play a part (Malcom et al., 2005). In recent years, the achievement gap in mathematics and science has been closing as more women select advanced courses in high school science and mathematics (National Science Board, 2000). However, enrollments of young women in computer science courses and advanced placement (AP) exams in high school continue to remain low (AAUW, 2000; CCAWM, 2000; Freeman & Cuny, 2005).

Some researchers examine girls' experiences from the middle grades to high school for the root causes of women's underrepresentation in IT. For example, Freeman and Aspray (1999) note that girls

have less experience with computers and perceive IT-related work to be solitary and competitive, requiring long hours and unsafe working environments. During this age range, many girls become more involved in extra-curricular activities and take less rigorous courses (Kerr, 1997). At the same time, girls lower their career aspirations between the middle grades and high school (Kerr, 1997), through choosing less competitive careers and post-secondary institutions. Since the rigorous preparatory courses for prestigious fields, including courses in advanced math, science, and technology, are often filters for technical fields, these factors may have a strong influence on women's participation in IT. Our previous findings indicate that parental influence may also be a strong factor in girls' choices (Howe, Berenson, & Vouk, 2005).

Several studies that explore recruiting and retention of women in undergraduate IT curricula have reported factors that positively influence the enrollment and persistence of women in IT-related fields. Margolis and Fisher found that prior class experiences, as well as interest in computers and the promise of the field, were primary motivators for majoring in computer science (2001). In the first national study exploring gendered outcomes in undergraduate computer science programs, Cohoon found that faculty attitudes and behaviors could have a powerful influence on gendered attrition. Factors significantly correlated with higher retention rates for women include: having sufficient faculty, responsiveness to the job market, and faculty who mentored for the purpose of retaining underrepresented minorities (Cohoon, 2005). The availability of same-sex peer support and professional experiences are also important factors in women's retention in computer science programs (Blum & Frieze, 2005; Cohoon, 2005).

Recent results from efforts to gender-balance the undergraduate program at Carnegie Mellon indicate that fundamental misconceptions about computer science, as opposed to gender differences, may be the root cause of the under-representation of women in IT, as well as the declining interest in computer science overall (Blum & Frieze, 2005; Vesgo, 2005; Zweben, 2005). Computer science, Blum and Frieze (2005) argue, is not equal to programming, although the advanced placement exam in computer science reinforces this unfortunate misconception.

In January 2005, Freeman and Cuny identified several areas where efforts could make a difference in broadening participation in computing, including defining computer science to override popular misconceptions, training faculty in cross-cultural mentoring, providing research experiences for undergraduates, and working with K-12 teachers to define computer science curricula.

A recent study sponsored by the American Association for the Advancement of Science and the Commission on Professionals in Science and Technology includes an insightful discussion of the complexities of the IT educational and employment markets, and recommends policies to support the increased diversity of the IT workforce (Malcom et. al, 2005). These recommended policies include a change in admissions criteria—by shifting the emphasis from programming experience to problem solving skills that are relevant to IT/CS. Four year institutions should offer more career guidance and workplace experiences, as well as opportunities for nontraditional students to take courses online or while working full-time. These recommendations align with findings at Carnegie Mellon, where these types of changes have been effective in increasing the participation of women to about a third (Blum & Frieze, 2005), while national averages of participation for women are less than 20% (Vesgo, 2005).

GIRLS ON TRACK: INSIGHTS

Girls on Track, a program funded by the National Science Foundation (NSF #9813902) from 1999-2001, was created in response to the need to increase women's representation in IT-related careers. The Girls on Track program provided1 year-round enrichment for mathematically high achieving girls in grades 7 and 8. We define high achieving girls as those selected to take Algebra I on the "fast track," thus enabling them to take Advanced Placement Calculus in high school, a necessary preparation for college courses in mathematics, sciences, engineering, or computer science. The age range was 11-13, with about 60% Caucasian, about 30% African American, and about 10% Asian.