

# Factors that Influence Women and Men to Enroll in IT Majors

**Claire R. McInerney**

*Rutgers, The State University of New Jersey, USA*

## INTRODUCTION

Because of the ubiquitous nature of information technology, there is a continuous need for IT professionals. There has been a steady growth in the information technology industry as well as an increase in the use of information technology. However, the number of qualified technology workers has not kept up with the demand for technology-skilled labor. One reason for the workforce shortage is that women are underrepresented. Not only are there many fewer women in the IT workforce, but there are fewer women entering and graduating from traditional technology-related academic programs like computer science (CS), computer engineering (CE), and systems science. In 1986, approximately 36% of the U.S. graduates in CS and CE were women; in 2004, 17% were women (Bryant & Irwin, 2001; Carver, 1999; Zweben, 2005). Of those earning doctoral degrees in 2004 only 18% were women (Zweben, 2005). Given that 51% of the total population is women, these statistics give a vivid explanation of why there is a shortage of IT workers.

## BACKGROUND

In the United States in 1999, four core IT occupations—computer scientists, computer engineers, systems analysts, and programmers—employed over 2.2 million people (United Engineering Foundation, 1999). In 2004, only 0.3% of incoming freshman college women and 2.8% of men expressed an interest in majoring in computer science, according to the Higher Education Research Institute (n.d.). The numbers of students interested in engineering are also down despite U.S. Commerce Department reports that show 70.2 % of all vacant positions in science and engineering between 2002 and 2012 (a

total of 1.6 million jobs) will be in information technology. All programmers and others who work in IT professions do not have university degrees; however, education remains a critical factor in preparing the IT workforce. In 2002, the number of students pursuing doctorates in computer science in the top 50 U.S. research universities fell to the lowest number in 12 years (Foster, 2005).

The small (and declining) numbers of women enrolling in IT-related degree programs in universities should be a cause of concern (Kossuth & Leger-Hornby, 2004). Parents of daughters might be concerned because high-paying IT jobs are not available to young women without academic credentials. Industry managers could be concerned that the underused potential of women professionals limits needed skills in the IT workplace such as organizational expertise, an understanding of customer service, and the ability to work collaboratively. With inadequate preparation for the IT field, women can miss out on opportunities for creative work, the chance to influence the IT field, and professional work that can be financially rewarding.

With limited numbers of women in positions in which software is being created, the female perspective in software products will be underrepresented. The consequence is that girls and young women may be less interested in the field of technology because the software, games, technology products, and so forth do not appeal to them.

## FACTORS THAT INFLUENCE ENROLLMENT IN IT MAJORS

### Career Interest

Although it is fairly common today to have more than one career in a lifetime, the choice of a university discipline and the subsequent career is one of the

most important decisions that one will ever make. Men and women choose careers based on several cognitive and affective factors including the following:

- Deeply held values
- Self-knowledge
- Knowledge of careers (Niles & Harris-Bowlsbey, 2002). There are also societal factors that influence career choice. As Margolis and Fisher note (2002), women often express an interest in a balanced lifestyle that may include having children and giving attention to home and family. When they see computer science and other technology-related careers as requiring a singular focus on sitting at a computer and programming all day and far into the night, the cost is too great for them.

An academic major is often related to the career a student will pursue after graduation. In a study intended to learn what students and teachers viewed as effective recruitment techniques and the factors that influence students to enter technology education programs, students indicated that they decided on a major while in high school rather than waiting until entering the university (Gray & Daugherty, 2004). Students may change their minds once they are at the university level, but many make the decision before applying to and matriculating in a university.

### **IT Career Choice**

What are the factors most likely to influence a student to choose to enroll in an IT-related major? There is a strong connection between the quality of science and mathematics teaching and success in these subjects in high school and a student's interest in majoring in science and/or engineering. In a six-nation study (Australia, Canada, China, England, Japan, and Portugal), Woolnough and Guo (1997) found that science and math teaching had to be supportive, at an appropriate level of difficulty, and intellectually stimulating in order for students to be influenced to study the subjects at the university level. Secondary students in the study were also influenced to major in science and/or engineering (considered a traditional IT-related field) when they were involved in science competitions, had science-

related hobbies at home, and perceived science and IT-related professions as satisfying, bringing high status, and having good salaries.

Success in mathematics in primary and secondary school is often seen as an influential factor in becoming interested in computer science and other information technology-related subjects. Computers by their very nature are computational, and the study of computing in precollege programs has often resided in mathematics departments. In a study that examined students' perceived ability in mathematics, researchers found that gender, years of high school mathematics, math self-efficacy, and math anxiety predicted choice of a science- or math-related college major (Hackett, 1985).

A Brazilian study of high school students found five underlying factors related to students' choices of an undergraduate major. The five factors that were found to be significant after interviewing over 1,000 senior high school students included liking the activity, family members' influence, previous experience in the field, access to information about the field, and the state of the job market. The researchers found that males mentioned family influence most often, and female students mentioned liking the activity related to their intended college major most often (Alchieri & Charczuk, 2003). In Ireland, McQuillan and Bradley (1999) conducted a study of 91 19-year-old first-year female university students to learn about women's underrepresentation in computing majors and careers. They found that women students were influenced to choose computing-related majors through career advice, university-based communications, the promise of excellent career prospects, the encouragement of family members, an interest in computer technology, and generic reasons such as the belief that computers are the way of the future. The results of this and other international studies outlining influences on selecting a major are summarized in Table 1.

In a study supported by the U.S. National Science Foundation, researchers at Rutgers University interviewed 41 men and women undergraduates enrolled in IT-related majors to determine the factors that influenced them in the choice of an IT major and career. The students from computer science, computer engineering, and information technology and informatics (ITI) listed the following as influential in their decision to study information technology.

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