

# Retaining Women in Undergraduate Information Technology Programs

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## INTRODUCTION

While the experiences of women in computer science (CS) are well documented (Cohoon, 2001, 2002; Computing Research Association, 2002; Margolis & Fisher, 2001), information technology is a relatively new discipline (Denning, 2001; Mitchell, 2002) and does not enjoy the same level or scope of inquiry. This study focuses on women in undergraduate IT programs and attempts to identify the factors involved in the attrition of women from these programs. In Phase 1 of this study, all freshman IT and CS women as well as a random sample of IT men at an eastern university (15,000 students) were interviewed and asked about their experiences in the IT program. These interviews were qualitatively analyzed, and the results are currently being used to develop a national survey of women in undergraduate IT programs. The primary research question of this study is, What factors are most influential in the decision of female students in IT undergraduate programs to enter these programs, and, where applicable, what factors most influence their decision to leave the programs during their first year of study?

## BACKGROUND

Attrition in both undergraduate and graduate programs has been shown to be significantly different across academic disciplines; Cohoon (1999) demonstrated the differences between gendered attrition rates in CS and Biology. As a result, IT programs will not necessarily have attrition rates that are comparable to (or based on the same factors as) those in CS. While the literature contains numerous examples of research into gendered differences in CS, these examples are not sufficient to identify issues in the IT population, but they are more than adequate as a foundation for this inquiry.

## Literature Review

In one of the earliest large-scale studies of differences in educational attainment by sex, Alexander and Eckland (1974) confirmed what many women already knew then and now: “a relatively strong and unmediated depressant sex effect remained for the educational attainment of women ...” Based on a longitudinal study of 2,077 women who were high school sophomores in 1955 and a follow-up in 1970, the results indicated that even with controls for a wide variety of variables (background, performance, self-esteem, etc.), evidence suggested that sex was negatively related to college attendance and achievement in school.

To explore a more generic model of academic persistence, Tinto (1974) suggested a model predicting the “degree of fit” between an individual and college as strongly related to persistence and retention. Tinto based his model on the continuum of changing commitments and experiences of students based on the assumption that students entered school with specific backgrounds and varying levels of commitment to completion. His development of five different factors causally related to persistence provided the basis for subsequent research into gendered attrition: (a) background (family, gender, high school), (b) initial commitment (commitment to graduation or academic major), (c) academic and social integration, (d) subsequent goals and commitment, and (e) withdrawal decisions (persistence).

Pascarella and Terenzini (1983) conducted a longitudinal study from 1976 to 1978 of 1,457 students to examine Tinto’s theory. Students were surveyed at three data points to collect information about their freshman-year experience. Interesting differences between men and women appeared in the effect of initial goal commitment. While both men and women demonstrated that initial goal commitment positively influenced subsequent goal com-

mitment, women also demonstrated a strong relationship between initial goal commitment and both social integration and persistence. Significantly, social integration appeared to have a stronger influence on female persistence than did academic integration (with the reverse being true for men).

Stage (1989) followed suit with an exploration of the Tinto model using another longitudinal study conducted between 1984 and 1985. Focusing on motivational orientation as related to initial commitment, Stage recognized seven categories (certification, cognitive, community service, change, social, recommendation, and escape), with the majority of respondents being classified into the three largest subgroups: certification (i.e., the goal is to earn a degree or get a job), cognitive (the goal is to learn and grow), and community service (the goal is to gain skills and experience in helping people). In the certification and cognitive categories, gender appeared as significantly correlated to social integration.

In 1997, with the publication of "The Incredible Shrinking Pipeline" (Camp, 1997), an examination of the decline of female enrollment in CS was underway with urgency. In 1997, Fisher, Margolis, and Miller also examined the experiences of women in CS using factors like persistence and motivation. Interestingly, Fisher et al. decided to let the students speak as "expert witnesses in their own world." West (2002) also talked with women (in this case, in an introductory programming course). Additionally, *Unlocking the Clubhouse* (Margolis & Fisher, 2002) was highly influential in both discovering and describing the experience of women in an undergraduate CS program.

Other studies like Beyer et al. (2003), Liu and Blanc (1996), and Scragg and Smith (1998) have also employed survey methodologies to gain data and insight into the experiences of women in CS.

## **MAIN THRUST**

### **Methodology**

The underlying technique for data collection and analysis of interview results in Phase 1 is the sense-making model developed by Brenda Dervin (1992). This technique is based on situating individual deci-

sions and choices along a continuum of time and space. In other words, as students journey through their academic experiences, they encounter what Dervin calls "gaps" that force the successful bridging of these gaps or decisions to pursue completely different paths (thus skirting the gaps). Troublesome situations (Dervin & Clark, 1987) are defined as "any situation ... where a person faces some kind of gap preventing a movement ahead." Conversely, helps are defined as those experiences, people, activities, thoughts, ideas, and/or resources that successfully bridge any gaps.

The interview technique allowed for asking open-ended questions that focus on what Dervin (1992) considers the significant questions. For example, what stopped this person from accomplishing goals, what information or bridges were sought, and what assistance was ultimately necessary or lacking? Based on the situation, the gap, and the help, a sense-making triangle encircles experiences and provides a context for examination and discussion. This sense-making triangle forms the basis of the time-line interview. In the interview, students are asked about their experiences and, using open-ended questions, encouraged to talk at length about the situation, the gaps, and the helps.

### **Study Design**

In Phase 1 of the study, 33 respondents were invited to participate (10 IT women, 13 CS women, and 10 IT men). One hundred percent of freshman women in both the IT and CS programs agreed to participate. The 10 men who agreed to participate were randomly selected from the entering freshman class of 200 freshman men. Each participant agreed to sit down for a face-to-face interview in the fall and spring quarter, as well participating in e-mail exchange during the winter quarter. This design allowed for three data-collection points. Respondents were given a cash incentive for the fall and spring interviews. All interviews were taped and transcribed for later analysis.

For the second phase of the study, two surveys are underway. Beginning with the ACM SIG-ITE membership list, schools offering a BS in information technology were identified and solicited to answer a demographic survey about their IT programs. Questions in this survey included faculty, student, and

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