A Psychosocial Framework for IT Education

Janice A. Grackin
State University of New York at Stony Brook, USA

INTRODUCTION

The most recent U.S. national statistics available indicate that among those earning degrees in engineering in 2000-2001, women made up only 18% of bachelor's degrees, 21% of master's degrees, and 17% of doctorates (NCES, 2003). A similar pattern emerges among those earning degrees in computer and information sciences, with women awarded only 28% of bachelor's degrees, 34% of master's degrees, and 18% of doctorates in those areas in 2000-2001 (NCES, 2003).

These and related statistics suggest a continuing gender imbalance in engineering and computer and information science education, academic pathways that lead to careers which are among those traditionally accorded higher prestige and greater financial reward than traditionally "female" occupations (Kennelly, Misra, & Karides, 1999). The situation is particularly dire in computer and information science education. According to testimony at a recent congressional hearing, although the proportion of computer science graduates who were women increased steadily from 14% in 1972 to 37% in 1984, from 1984 to 2000 those numbers began to steadily decline again and are currently at less than 28% (Borrego, 2002).

If computer and information technology education draws only from the 49% of the population which is male, the resulting gender imbalance is bound to translate into a shortage of trained IT personnel to fill existing positions. The aging IT workforce means that employers will need to fill not only new positions but those vacated by retiring personnel over the next twenty years (Jackson, 2004). The sheer number of technical professional positions to be filled now and in the foreseeable future makes it imperative that we tap the entire pool of young talent through early implementation of formal and informal strategies that encourage girls and young women to develop technical interests and skills and to enter technical training and post-secondary computer and information science education programs.

BACKGROUND

Although the factors associated with educational and career choices are complex, the relatively small numbers of young women choosing to pursue education and careers in technology and engineering may be directly related to *psychosocial* factors, such as a lack of professional *role models* (Smith, 2000). In simplest terms, a role model is someone who shares substantial characteristics of the observer and by extension is doing something the observer could do. The presence or absence of same-sex role models may transmit to individuals a powerful message regarding the *gender congruity* of various pursuits, including education and careers. The absence of female role models in computer and information science therefore limits the number of young women entering these education pathways, resulting in a situation where neither the academic presence nor the corporate representation of women increases.

As mentioned in the previous section, the number of women in computer and information science fields is not increasing and has, in fact, decreased over the last twenty years (Women Yield High-Tech Field, 1998). Insufficient numbers of women IT academics and field practitioners means that newcomer access to senior women who can provide *psychosocial* and *career mentoring* (Johnston, 2002) is adversely impacted. Of course, young women coming into the IT education and career pathways can and do find mentors among academics and field practitioners of both sexes. However, in light of the minority status of women as a group in computer and information science, female mentors may be better equipped to guide new female entrants through the social and professional vagaries of the educational

and career process (Smith, 2000). Senior women who have successfully weathered the process may be able to impart specialized knowledge regarding *coping* and adapting, especially important for newcomers. Minimal presence of female mentors may be one cause of the previous decade's female exodus from computer and information science fields.

GENDER IDENTITY, CULTURAL EXPECTATIONS, AND COGNITIVE SCHEMAS

That there are proportionately fewer women currently working in or choosing to enter computer and information science fields may be due in large part to gendered cultural expectations (Smith, 2000) and the *gender schemas* associated with them.

Kohlberg's (1966) theory of development describes the acquisition of *gender constancy* as a process not completed before children reach the age of five or six. It is at this point in psychosocial development that children understand that being male or female is immutable, just as they begin to integrate the gendered cultural expectations that have swirled around them since before birth and to internalize a *gender identity*, that is, a strong sense of what it is to be male or female.

From these pervasive expectations, culturally derived cognitive *schemas* are built. At this point, children begin to categorize their world in more constrained ways, using schemas or frameworks into which information can be sorted automatically in order to efficiently organize and process the huge amount of incoming information about the world. Gender schemas are comprised of experienced and culturally defined elements of human "femaleness" and "maleness," including aptitudes and behaviors, for comparison to anything that might be defined as or characteristic of female or male.

Perceptions of *gender roles* are culturally driven (although there is a fair amount of cross-cultural correspondence) and so the resulting gender schemas for "maleness" and "femaleness" are generally shared by members of the same culture. In the case of a particular educational or career path, a culture defines the skills required for associated pursuits, and these skills are often associated with aptitudes believed to be inherently and dispositionally "male" or "female." In this way, certain careers come to be perceived within a culture as traditionally appropriate for women (e.g., "nurse") or for men (e.g., "engineer"). These culturally defined *gender role schemas* are internalized by individuals over the course of their development, reinforced along the way by the popular media and by the attitudes and behaviors of parents, teachers and peers (Smith, Jussim, & Eccles, 1999).

The cultural expectations regarding various groups can rise to the level of *stereotypes*, setting the stage for individual members of that group to experience what is known as *stereotype threat* (Steele, 1995, 1997). In performance situations where individuals are aware that a negative group stereotype exists, the anxiety produced can adversely affect performance for a variety of reasons unrelated to ability (Steele, 1995, 1997; Threats Within, 2004). Girls and young women find themselves in a stereotype threat situation any time they are performing with technology in general and computers in particular (Cooper & Weaver, 2003). The anxiety produced may negatively affect cognition and performance, resulting in performance that does not truly reflect abilities. Girls may come to doubt their own abilities and out of a need to preserve their own self-esteem they may then dissociate from technology, embracing the prevailing gender schemas that inform us that this is a male domain and that technology competence is unimportant for females.

Impact of Gender Role Schemas on Educational Choices

Given the strength and pervasiveness of cultural expectations, it comes as no surprise that gender-related schemas become quite rigid over time. Such appears to be the case with computer and information science. In western cultures particularly, skills and aptitudes associated with these educational and career paths have come to be perceived as traditionally male, and as a result, girls and young women may not consider computer and information science appropriate pursuits for females (Colley, Gale, & Harris, 1994). The very "culture" of computers has become associated with male values (AAUW, 2000), forcing girls to choose between technology pursuits and their basic gender identity or "femininity."