

# Women in the IT Profession

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## INTRODUCTION

Women have been involved with information technology (IT) since the 19<sup>th</sup> century, when Ada the Countess of Lovelace served as the first programmer of Charles Babbage's analytical engine. Grace Murray Hopper's contributions to COBOL and computing several decades ago are considered so significant that an annual conference is held in her honor (see [www.gracehopper.org](http://www.gracehopper.org)). In fact, the earliest computer programmers tended to be women more often than men (Panteli, Stack & Ramsay, 2001). As the IT field progressed, however, it evolved into what many still view as a male-dominated domain, some say due to its increasing association with power and money (Tapia, Kvasny & Trauth, 2003). Today, women are estimated to make up nearly half of World Wide Web users (Newburger, 2001), but this has apparently not translated into a proportionate participation in IT careers.

IT managers must recruit and retain a skilled and diverse workforce in order to meet the needs of increasingly global enterprises where cross-cultural, heterogeneous workgroups are the norm. However, numerous sources (Computing Research Association, 1999; ITAA, 2003) agree that the proportion of females to males selecting and completing degrees in IT-related fields is declining. Not only are women missing out on career opportunities, the IT profession is also missing potentially valuable alternative perspectives on system design (Woodfield, 2002).

Furthermore, the worldwide digital divide is more extreme for women than men (Hafkin & Taggart, 2001). In many developing countries, women's access to computers is even more limited than men's, and Internet usage statistics, where available, suggest that the majority of users are male. However, IT is an important driver for economic development and should provide women with new opportunities to better their circumstances, provided

that a variety of challenges, such as technical education and social and political norms, can be addressed (Hafkin & Taggart, 2001).

Even in more developed countries, females face well-documented (Margolis & Fisher, 2002; Von Hellens & Nielsen, 2001) obstacles all along the pipeline, beginning as early as middle school and continuing through college, graduate school, and industry. Solutions to recruiting and retaining women in IT may serve other underrepresented groups as well, making IT classrooms and IT workplaces more congenial and ultimately more productive environments for everyone.

## BACKGROUND

Part of the challenge of recruiting and retaining women in IT stems from the changing nature of IT work. IT is defined for the purpose of this article as an umbrella term that encompasses a variety of job categories that continue to evolve, as hardware, software, and methods continue to increase in sophistication. Traditional professional IT job categories included programmer, systems analyst, system administrator, and software designer. Earlier investigations into women and computing suggested that IT work by its nature was a poor fit for females, seen as solitary and boring, a stereotype that apparently still exists today (AAUW, 2000a). However, as the field has evolved, and as IT has become more integrated into most business organizations and into the work and home lives of many individuals, a wider variety of IT work has emerged. Today, in addition to earlier job titles, IT work also includes software engineer, business analyst, database designer, database administrator, network analyst, network administrator, Web developer, Web engineer, human interface designer, project manager, applications developer, security administrator, and help desk technician.

University curricula have also evolved and expanded to provide formal education, skills, and knowledge suited to these new job types. Entry into the IT field can come from numerous directions, including electrical engineering, computer engineering, computer science (CS), several flavors of information systems (IS), and a more narrowly defined type of IT that focuses on fourth-generation language application development and maintenance. A majority of the data and research studies that point to the precipitous decline in women in IT, however, focuses narrowly on computer science and engineering only (Wardle & Burton, 2002).

## THE IT PIPELINE: CHALLENGES AND OPPORTUNITIES

### Early Influences

A growing body of educational research documents a variety of factors that influence female attitudes, perceptions, and behaviors toward computers in K-12 (e.g., AAUW, 2000b; Taggart & O'Gara, 2000; Whitley, 1997; Young, 2000). In addition to general socio-cultural trends that appear to dampen girls' enthusiasm and self-efficacy regarding math and sciences around middle-school, girls seem to be influenced by:

- low interest in male-oriented computer games;
- teacher, parental, and peer attitudes that stereotype computing as male oriented;
- lack of access to and experience with computers, leading to lower self-efficacy;
- perceived usefulness, or lack thereof, of computers to themselves and to society;
- lack of IT role models and mentors.

These variables have been grouped into two main categories: environmental and individual. Environmental variables are those which make up the context within which career decisions are made, such as school or work, while individual variables are characteristics of individuals, such as aptitudes and preferences (Woszczyński, Myers & Beise, 2003). Both interact to influence the choices and behaviors of individual girls and women (Trauth, 2002).

### College, Graduate School, and the IT Workplace

Some of these same factors apply as women move into college and graduate school. Often due to less previous experience with computers and less preparatory

coursework, women continue to experience ambivalence about their interest and abilities in IT, in spite of equal performance regarding computer skills. They often encounter hostile academic environments (Margolis & Fisher, 2002; McGrath-Cohoon, 2001), and their career choices are often influenced by work-family balance concerns.

In the workplace, women are employed at lower levels, make less money, are more likely to leave their organization than men (Baroudi & Igbaria, 1994-1995; Igbaria, Parasuraman & Greenhaus, 1997), and may even be channeled into "softer" positions considered more suited to women, and coincidentally have lower status, are lower paid, and are less visible (Panteli et al., 2001). Some of this may be related to the assumption that women tend to be younger, less experienced, and spend less time in the workplace due to opting out of traditional career paths to raise families, preferring part-time or more flexible options when returning to work. The few studies that have controlled for differences in variables such as age, education, and work experience have shown mixed results (Baroudi & Igbaria, 1994-1995; Igbaria et al., 1997).

Academic institutions and business organizations alike are realizing that they need to supplement earlier efforts that focused on recruiting more women into the field with more attention to retaining them, once there, in school and in the workplace (Tapia et al., 2003). Again, it is expected that both environmental and individual variables will interact to determine outcomes for women.

### Interventions and Solutions

A growing body of literature is providing a range of useful approaches to addressing these challenges (e.g., Wardle & Burton, 2002). One way of addressing the problem is to focus on individual factors, that is, change the individuals, by changing attitudes, dispelling stereotypes, improving preparation, and increasing experience with computers. Suggestions aimed at K-12 levels and beyond include:

- Providing more (and more equal) access to computing resources.
- Designing girl-friendly games and applications, to encourage more experience with computers which leads to higher self-efficacy.
- Creating videotapes and other positive media images that demonstrate women in professional IT roles, thus changing attitudes.
- Encouraging girls to take more courses that adequately prepare them for IT-related college majors.

Taken to an extreme, this approach implies that in order to succeed in this male-dominated field, women must become more like men. An alternative perspective,

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