

# The Woman Problem in Computer Science

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## INTRODUCTION

The longstanding concern about the absence of women in science and engineering in most Western countries has led to much research (see, e.g., Etzkowitz, Kemelgor, & Uzzi, 2000; Zuckerman, Cole, & Bruer, 1991). Today, this is all the more striking since women constitute the majority among students at most Western universities (Quinn, 2003). This article will briefly review research that analyses the lack of women in computer science, with a focus on higher education.

## BACKGROUND

The substantial attention given to gender aspects of computer science reflects the significance of computers as a gateway to the emerging information society and the concern about a gendered digital divide. Women should take part in the design of this key technology, not remain users (Bjerknes & Bratteteig, 1987; Green, Owen, & Pain, 1993; Perry & Greber, 1990). The issue has been addressed by many women computer scientists, struggling to get more women into computing. Particularly in the U.S., a range of organisations and private initiatives have dealt with women and computing issues (Henderson & Almstrum, 2002). Australia and many North-European countries have also witnessed many such initiatives, often originating within government bodies.

## MAIN THRUST OF THE ARTICLE

The so-called woman problem in computer science was discovered in the early 1980s through observations that young women took less interest in computers than young men (e.g., Dambrot, Watkins-Malek, Marshall, & Garver, 1985). Also, complaints that

computer science offered a chilly climate to women students began to surface. Women students and faculty were perceived as women rather than as professionals, they were often treated as invisible, they met with patronising behaviour, and their qualifications were doubted. Also, their social environment was characterised by misplaced expectations, unwanted attention, and even obscenity (Barriers to equality 1983).

The main issue has been the question “why so few?” The explanations invoked may be classified in different ways (Ahuja, 2002; Cronin & Roger, 1999, Dryburgh, 2000, Littleton & Hoyles, 2002, Wilson, 2003). Striking metaphors have been employed to portray the situation, like “the incredible shrinking or leaking pipeline” or “the Silicon Ceiling.” For the purposes of this article, contributions have been categorised under the following headlines, which summarize the varied understanding of the woman problem in computer science:

- Women’s deficits
- Deficits in the educational practices of computer science and its student culture
- Discriminatory practices and other minority problems
- The masculine image of computer science

In the following sections, I will review research relevant to each of these categories. Please note that some contributions may belong to more than one of the categories, even to all of them.

## Women’s Deficits

Research has claimed that women have weaker computer knowledge and lesser computer experience, rendering an image of women as more computer anxious (Brosnan, 1998), less confident about their computer skills (Beyer, Rynes, & Haller, 2004; Borge, Roth, Nichols, & Nichols, 1980; Maccoby &

Jacklin, 1974), lacking self-efficacy in relation to computer science (Durndell et al., 2000, Galpin, Sanders, Turner, & Venter, 2003), alienated or just not interested in computers or computer science (Rasmussen, 1997; Siann, 1997; Symmonds, 2000). In this way, an emerging deficit model has become empirically grounded in comparisons with men's use of computers. Women were seen as deviant because men were regarded as the norm (Kramer & Lehman, 1990).

Consequently, a main argument has been that women needed to catch up with men by gaining access to computers and the related set of technical skills (Gansmo, 2004). In this manner, computer science was understood as a neutral set of skills to be acquired. Getting women into the discipline was a matter of "compensatory strategies," like providing better information and encourage girls and women to enter the field (Cronin & Roger, 1999; Henwood, 2000).

Turkle (1988) claimed that women's computer reticence emerged from their unwillingness or even fear to engage with a machine that was seen as intimate. However, her study of the early emerging Internet culture (Turkle, 1996) suggests a change, since women seem as eager as men to perform on the net.

### **Deficits in Educational Practices**

Deficits in educational practices have been identified as obstacles to women to succeed and remain within computer science. Particularly the view that women, more than men, need to learn in a meaningful, goal-oriented and contextualised way, has been a common critique against programming courses. They have been seen as repetitive, playful, and meaningless exercises (Balcita, Carver, & Soffa, 2002; Countryman et al., 2002; Margolis & Fisher, 2002). To raise the quality of computer science teaching seems important to recruit and retain women students. This goal may be achieved by employing faculty that enjoy teaching undergraduates and by maintaining a stable faculty (Cohoon, 2002), by employing better qualified faculty, and by using more resources to hire teaching assistants and to provide better technical facilities and support (Lagesen, 2005; Margolis & Fisher, 2002; Roberts, Kassianidou, & Irani, 2002). To supply more women role models

is generally seen as vital (Richardson & Kavanagh, 1997; Roberts et al., 2002; Townsend, 2002). Also, the importance of networking and support communities has been emphasised (Gabbert & Meeker, 2002).

### **Discriminatory Practices and Other Minority Problems**

As mentioned, being a minority of women in an environment dominated by men is observed to be a major problem for women in computer science (Berg, 2000; Dambrot et al. 1985; Spertus, 1991; Teague 2000). Minority problems are diverse and include discrimination and sexual harassment (Dambrot et al., 1985; Kanter, 1977; Spertus, 1991).

### **The Masculine Image of Computer Science**

Many scholars have explored the assumption that computer science is masculine and consequently a turn-off for women. It has been argued that the discipline has emerged from and is associated with institutions and practices usually perceived as masculine, in particular mathematics. Many recognize this as the parent discipline of computer science (Dambrot et al., 1985, Gressard & Lloyd, 1987; Mahony & van Toen, 1990). When mathematics is unattractive to women, arguably, computer science would be too (Kvande & Rasmussen, 1989; Mahony & Van Toen, 1990; Stepulevage & Plumeridge, 1998). A parallel argument is that computer science technology grew out of the military (Edwards, 1990; Mörtberg, 1987).

Some has advocated to broaden the scope of computer science, from the belief that this would attract more women (Salminen-Karlsson, 1999). To include social and organisational aspects of technology, social issues, and contextualised computer science has been assumed to make computer science more woman-friendly (Clegg & Trayhurn, 1999; Henwood, 2000; Siann, 1997). There are observations that computer science programmes located in social science or humanities environments have a much higher proportion of women (Kvande & Rasmussen, 1989).

A different approach to the presentation of computer science as masculine emerged through the 1990s, when one became concerned with its culture.

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