Gender Bias in Computer Courses in Australia

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INTRODUCTION

The participation of women in science and, more recently, in information technology (IT) has engaged researchers for more than 20 years. Despite extensive research and numerous practical interventions designed to address the relative dearth of women in IT, the problem persists. This is an important question since computing and computer competence are critical to ongoing developments of the "information revolution." Evidence from around the world suggests that despite female predominance in undergraduate enrolments (59% in Australia, 55% in America, and greater than 50% in many European Union countries), women are reluctant to pursue IT study at tertiary level (Rees, 2001).

Initial approaches to reverse this trend centered upon notions of equality and affirmative action, since the lack of significant numbers of females in the discipline was seen as inequitable. To alleviate the problem, intervention programs aimed at women have promoted information on technology-related careers, provided experience of computing work, and highlighted female role models. Other initiatives focused on helping women develop skills, attitudes, or background knowledge that women were thought to lack. These affirmative action measures, while commendable in fostering gender equality, were not sufficient in that they often served to reinforce the conceptions of IT as a masculine domain and, consequently, failed to attract women to IT. This suggests a need for an alternative approach—a reconceptualization of IT into an environment that women would naturally embrace. Such a need, in the area of tertiary computing education, motivated this study.

The aim of the study was to investigate, from the students' perspective, the perceived problems faced by female computing students at Victoria University in Melbourne, Australia; the study focused on problems related to the learning environment, particularly on direct and subtle gender-related problems encountered in the classroom, and special needs of female students.

BACKGROUND

Gender-Related Issues in IT Education

The underrepresentation and poor retention of female students in IT courses, including computer science, both in Australia and elsewhere, has been well recognized. The already low number of female students enrolling in computer science is usually further decimated by high attrition rates. This situation has often been attributed to gender differences in interests, motivation, experience, personality characteristics, abilities, self-efficacy, and socialization. These differences, which put females at a disadvantage in computing courses, stem from a variety of factors both external and internal to the institution offering the course. External factors include: the popular perception of the male-dominated computing culture, its particularly masculine character and, often, a "geek" image. The internal factors include: inadequate pedagogical techniques, stereotypical attitudes of lecturers and fellow students, and lack of proper institutional support (Fisher, 2003; Miliszewska & Horwood, 2002; Newmarch, Taylor-Steele, & Cumston, 2000; Nielsen, von Hellens, & Wong, 2001).

While external factors lower female students' self-confidence in their computing skills, abilities and accomplishments even prior to entering the course (Lazowska, 2002; Zeldin & Pajares, 2000), internal factors are likely to deepen existing negative impressions even further, and create new ones through:

- **Negative Classroom Experiences:** caused by assumptions of prior knowledge and hands-on experience with computers, stereotypical attitudes and interaction style (often patronising or aggressive) of lecturers, and fellow students

(Lazowska, 2002); lack of structured environment and detailed instructions (Crump, 2001); and, unwanted positive discrimination—in the form of easier assessment for instance (Nielsen, von Hellens, & Wong, 2001)

- **Inadequate Access to Computers in the Classroom:** often dependent on the level of aggressiveness of fellow students (Clayton & Lynch, 2002; Davies, Klawe, Ng, Nyhus, & Sullivan, 2000)
- **Unequal Participation in Class:** females are not: allocated equal time on computers, called on equally in class, assigned equally difficult tasks, or participate in the interaction between lecturer and students as often as males (Levenson, 1999)
- **Lack of Interesting Gender-Neutral Projects in the Course:** the course includes few goal-oriented tasks on which females could work in teams (Weinman & Haag, 1999); lack of problems and examples from diverse disciplines outside of computer science (Blank & Kumar, 2002; Cohoon, 2002)
- **Lack of Role Models and Career Advice:** few female lecturers and tutors, few female fellow students, "invisible" successful career women, stereotypical career impressions and a lack of information about computing as a career (Cohoon, 2001; Crombie, Abarbanel, & Anderson, 2001; Teague, 2002)
- **Inadequate Institutional Support:** lack of special programs that would enable females to learn computer basics and computer jargon, and help them feel comfortable around computers; lack of encouragement and mentoring on the part of the lecturers; lack of institutional support in gender-sensitive teaching (Crump, 2001; Cohoon, 2001)
- **Lack of Peer Support Groups:** lack of interaction between, and lack of support networks among, students in class (Springer, Stanne, & Donovan, 1999).

Despite the existing body of research, there is no consensus on the gender disparity in computer science and, while the reasons why females desert computer science are still unclear, female representation in the discipline continues to decline.

Gender and IT at Victoria University in Melbourne, Victoria

Participation and retention of females in computer science at Victoria University is a particularly elusive issue. Computer science appears to offer an attractive scenario to potential female students—gender-neutral curriculum, attractive career path, and high salary scale. Why then, are the trends in the opposite direction? Despite a range of initiatives created to encourage participation and improve retention of females in the computer science course, female enrolments have declined significantly in the recent years (from 31% in 1994 to 18% in 2004), and attrition rates soared (from 18% in 2000 to 40% in 2003—in the first year of the course alone).

Since various initiatives undertaken over the years failed to impact on these disappointing trends, the underlying problems appeared to reside elsewhere and new research was needed to guide retention efforts. It was decided to conduct a study that would focus on internal factors, particularly the classroom environment: of interest was the possibility of gender bias in the learning environment and its impact on female attrition rates.

Gender and IT: Student Perceptions

The objective of the study was to investigate issues pertinent to the pedagogy and content of computer science courses, as well as the classroom climate, with a goal to make the discipline more inclusive for female students. A multidisciplinary research team was formed in mid 2003 and funding for the study was secured from the government-sponsored Higher Education Equity Program (HEEP).

Four focus groups consisting of two single gender groups and two mixed gender groups were conducted: 32 students representing both genders and all year levels participated. The central topic of the focus groups was gender equity in the computing learning environment; the key question: "Why do female students drop out of the course?" The comments made by students during focus groups centered around issues of gender balance of both students and teachers, course content, resource access and collaborative activities:

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