

WOMEN IN COMPUTING: THE ROLE OF SOCIAL TECHNOLOGIES

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ABSTRACT

The computing disciplines and the computing profession continue to appear gender segregated; despite limited progress, the number of women in computing still remains a minority. Differences persist at all levels, particularly when women attempt to reach higher levels of the corporate hierarchy. Today's social networking and friendly-computing provide an opportunity to redesign curricula to better engage young women in pursuing degrees and careers in computing. This may in turn increase participation and engagement and transform the study of computing from an isolated experience to an always-connected and socially-rich one.

Keywords: Glass-ceiling, gender and computing, Web 2.0, social networking

I. INTRODUCTION

The computing disciplines and the computing profession continue to appear gender segregated. Goshal and Passerini [2005] conducted a review of key issues and drivers of gender segregation in computing and found that, even if some data and trends show a slightly improved scenario, the number of women in computing still remains a minority. Differences persist at all levels, particularly when women attempt to reach higher levels of the corporate hierarchy. Extensive research and literature describes barriers to increased women's participation in science and technology. Glass-ceiling phenomena and disappointing success rates in achieving leadership positions in industry continue to populate the press.

Nor are there many women in engineering and science in academia. Female participation rates in computer science courses across US and Europe at all levels (undergraduate, Masters, and PhD) have actually declined quite dramatically through 1980s and 1990s [Lander and Adams, 1997; Panteli et al., 1999]. For instance, the number of women enrolling in computing courses fell from a high of 28% in 1978, to 13% in 1995, and down to 9% in 1998 [Booth, 1999]. In other words, the computing discipline continues to mainly attract men to educational courses and, subsequently, to more senior technical positions in the industry.

We argue that today's social networking software and friendly-computing environments such as MySpace, Facebook, Yahoo and Google groups, and Windows Live Spaces provide an opportunity to redesign curricula to better engage young women in pursuing degrees and careers in computing. Web 2.0 and increasingly easy-to-use technologies that enable people to effortlessly join discussion groups and share information offer new possibilities for media-rich collaboration experiences (for example, video, audio and interactivity-driven, as well as "location aware" functionalities) beyond the existing and duller mostly text-driven communication tools. This may in turn increase participation and engagement and transform the study of computing from an isolated experience to an always connected and socially rich one.

II. LITERATURE REVIEW: EARLIER STUDIES ON KEY GENDER ISSUES IN COMPUTING

Earlier studies have shown that the reasons for the ongoing gender segregation in computing can basically be traced to three key factors:

- 1) The marketing and pedagogic design of computing curricula;
- 2) The exclusion of women from important and influential networks; and,
- 3) The difficulty in gaining 'true' legitimacy as an expert in fields such as IT & IS.

1) The marketing and pedagogic design of computing curricula

Part of the problems in the marketing and recruiting outreach to female graduates relate to the course content and how it is presented and taught. As Booth [1999] comments: '*Few women yet see IT as a desirable profession, which is a reflection of its techie image*'. The computer culture and the socially constructed discourse that surrounds computing are often not-neutral. In addition, Robertson et al [2001] noted that the lack of female in the computing arena also perpetuates to teaching and research positions. Women constituted only 13.4% of lower level teaching and research posts, falling to 6% at senior levels across University computing departments in the UK. About 18% of computing departments did not have any women faculty [Grundy 1996]. Since it is these very departments that are responsible for the pedagogical design and marketing of computing courses, the lack of women, particularly in influential positions, must be considered a critical issue. If there are too few female academics within the field, then it follows that their presence and influence in designing gender-friendly curricula will be minimal.

2) The exclusion of women from important and influential networks

While female student numbers are small and appear to be falling, there is an even greater problem in terms of women actually working in the computing profession in industry. Networking has always been recognized as a crucial element in career progression. Because of such poor women representation and limited existence of women networks, it becomes difficult for the few female executives to affect changes to the current status quo. Meyerson and Fletcher [2000] noted that women encounter difficulties in both entering and progressing in a computing career. For example, the percent of women corporate officers in Fortune 500 companies in 2005 is only 16.4%. While formal and informal networks for women are emerging in corporations, such as Novartis Pharmaceutical, Goldman Sachs and others, to bridge the networking gap, knowledge creation and mentoring needs still exist, especially in science-related disciplines and careers. There are still not very many women in leadership positions in industry and government. According to a 2007 study from the

American Association of University Women [AAUW, 2007], women who work in computer science positions one year after graduation earn on average 37 percent more than women in other fields such as education, legal and administrative positions. In few words, when pursuing a computing career, women earn substantially more than what they would earn in other positions. Yet, women total only 29 percent of the computing workforce, while they constitute about 72 percent of workers employed in administrative positions.

3) The difficulty in gaining 'true' legitimacy as an expert in fields such as IT and IS

A number of studies have shown that women in the computing industry often encounter problems associated with patterns of communication between genders that can make some aspects of IS/IT projects or research problematic. The academic literature presents examples that when attempting to negotiate access, let alone trying to gather useful data, a female researcher is confronted with communication barriers. According to Robertson et al. [2001], these barriers do not apply in the same way to their male research fellows. In addition, women often exacerbate these differences by undervaluing their own ability to succeed in a computing field. In her study on software use, Hartzel [2003] found that men tend to have significantly higher self-efficacy as opposed to women. This is even more evident in the computing field: men have higher *computer* self-efficacy than women. Supporting self-efficacy is important because it affects one's willingness to invest efforts into purchasing, learning and using specific software applications.

III. RESEARCH QUESTIONS: HOW TO CHANGE WOMEN'S ATTITUDE TOWARDS IT/IS?

We intend to use this research to explore whether providing more information on the newer and more engaging career opportunities (see for example the ACM web site with its gender-friendly marketing materials about computing jobs and programs) and changing curricula to include new courses on social and ubiquitous computing may impact or even reverse these trends.

Our first research question is: *Can we change curricula to become more gender-friendly? And how?*

Based on the earlier discussed findings on the pedagogical and marketing limitations of IS/IT study programs, we intend to identify solutions to the curriculum design issues. The American Association of University Women [AAUW, 2000] conducted a study that showed that women are not necessarily computer phobic but they prefer occupations that are more socially inclined. Most of the women are unaware of the social implications of computing and more creative career paths are not evaluated.

Our second research question is: *Can digital networks and social networking technology play a role in changing perceptions about computing and thus potentially contribute to engaging a higher number of women in the discipline? Can they contribute to increasing women self-efficacy in technology use?*

In order to understand the overall gender issues in IS/IT, considerable attention needs to be given to the interrelationships that exist between communication processes, social networking and self and collective perception on technology efficacy (to address point 2 and 3 discussed earlier). Increasing connections and communication practices might help increasing participation. Today's technology enables higher interactivity and an always-connected presence that may empower women to return or embrace computing. For example, telecommuting and mobile wireless applications reduce physical distances. Women may be able to connect to virtual communities and peers by participating in blended learning and working environments that are becoming less constrained by physical presence.

IV. RESEARCH METHODOLOGY

We intend to answer the two research questions above in two ways. First, we will review and catalogue interdisciplinary programs that are showing

successful women's involvement. For example, the London School of Economics (LSE) has been able to increase the number of women enrolling in computing courses by introducing 'home science' across programs. Also, by changing the computer science curriculum and the admission procedures, Universities could replicate Carnegie Mellon's success in increasing the percentage of women entering the School of Computer Science from 7% in 1995 to 42 % in the year 2000 [Goshal and Passerini, 2006]. Based on this review, we will provide recommendations for changes.

In future research, we will incrementally solicit a dialogue around these same issues among women academics and professionals that are part of different digital networks, such as DigitalEve, Systers and Webgrrls. These sites have the goal to provide a sense of community and support to women working in computer science and/or new media and do offer some networking, mentoring, and advancement opportunities that have the potential to create cross-sector friendships. We will continue this dialogue by targeting feedback from women attending professional computing conferences. With this research, we hope to open a serious debate on gender-unbiased curriculum changes that may inform upcoming curriculum changes. We also hope to play a bigger role by sharing findings with the AIS education and curriculum teams that are working on the BSIS and MSIS redesigns.

V. REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that

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