Gender, Race, Social Class and Information Technology

Abstract

The issue of the underrepresentation of women in the information technology workforce often has been studied without consideration of the diversity among women. This diversity includes race, ethnicity, and social class/socioeconomic status and provides a useful perspective in approaching gender and Information Technology (IT). The following article explores the diversity within women from the perspectives of race, ethnicity and social class. It is organized around the origins of gender and racial gaps in IT jobs and in schools, computer access and social class/socioeconomic status, and race/ethnicity intersections with gender.

INTRODUCTION

The issue of the underrepresentation of women in the information technology workforce has been the subject of a number of studies and the gender gap was an issue when the digital divide dominated discourse about women's and minority groups' use of the Internet However, a broader view is needed. That perspective would include the relation of women and IT in the communities in which they live as well as the larger society. The information society that has emerged includes the United States and the globalized economy of which it is an integral part.

Women and minorities such as African Americans and Latinos are underrepresented in computer science (CS) and other information technology positions in the United States. In addition, while they areno longer numerically underrepresented in access to computers and the Internet – as of 2000, (Gorski, 2001) - they continue to enjoy fewer benefits available through the medium than white boys and men. The following article explores the diversity within women from the perspectives of race, ethnicity and social class in North America, mainly United States.

The technology gender and racial gap persists in education and in the IT workforce. A broader and deeper look at women's position in relation to the increasingly techno-centric society reveals that women may have reached equality in access, but not equity in academic study and job opportunities.

BACKGROUND

Linebarger (2003) pointed out three traditional digital divide constructs: 'family socioeconomic status', 'location of access to new technologies' and 'gender/race' for school age children. Inequities tend to appear along both social class and gender lines, with male students and students from high socioeconomic status backgrounds well positioned to outpace female students and students from lower socioeconomic backgrounds in terms of computer skills and knowledge (Lockard, Abrams, & Many, 1987).

1. Equality in Access, but No Equity in IT Jobs

The gender digital divide refers to the gap in access rates between men and women (Gorsky, 2001). Based on this traditional gender digital divide definition, the gender digital divide gap has narrowed to reach "access equality." In 2002, 83 percent of American family households owned a computer (Corporation for Public Broadcasting, 2004). About the same proportion of adult men and women had access to home computers. The digital connectedness of American families was increased through home computer ownership. In 2001, 59 percent of American people had connections at home. By the end of 2000, women surpassed men to become a majority of the United States online population (Gorski, 2001)

The societal race and gender gaps in the United States as a whole have narrowed in the past 10 years, but in the IT field, the gender gap generally appears to be wider at all levels

of employment. Overall growth in these IT occupations was so strong during the decade of the 1990's that women working in IT continued to increase through the year 1996. According to D'Agostino (2003), in 1996 women were 41 percent in the IT field. The ITAA (2003) recorded a decline to 34.9 percent by 2002.

The situation is worse in highly professional positions such as computer programmers and computer systems analysts, where women tend to lag far behind men. The Table 1 shows how women are overrepresented in lower IT positions while there are few women in professional computer science fields.

Table1: Representation of Women in various IT jobs in 2002.

Information Technology Occupations	% Men	% Women
Computer systems analysis and scientists	72.2 %	27.8 %
Operations and systems researchers and analysts	51.3 %	48.7 %
Computer programmers	74.4 %	25.6 %
Computer operators	53.2 %	46.8 %
Data entry keyers	18.3 %	81.8 %
Total IT occupations	65 %	35 %

(Source: Bureau of Labor Statistics)

However, the potential exists for this situation to change. Kvasny (2003) reports that minority women in low-income communities perceive IT as a means of escaping poverty while highly educated, middle-class and professional women regard IT as offering fewer opportunities for advancement. Kvasny suggests that IT and gender studies recognize the diversity within women.

2. Gains in Access, but Loss in Computer Science Major

The problem of underrepresentation of women in IT starts from the math and science pipeline at school. Through high school, girls are less likely than boys to enroll in computer science classes, and the disparity increases in programming courses.

The American Association of University Women (AAUW) commissioned early studies on the gender gap in education (1992, 1998). The first study noted the barriers faced by children from lower socioeconomic status. It also pointed out African American girls had fewer interactions with teachers even though they tried to initiate such interactions. By the latter AAUW study, the issue of technology had emerged. The report noted that a gender gap had begun to appear in computer science classes. Girls made up only a small proportion of students in such classes and the gap widen between grades eight and grades eleven. The study reported that boys exhibited a higher degree of self-confidence about computer skills than girls.

According to the National Council for Research on Women (2002), by the eighth grade, Latinas score higher in math than their male peers; and by twelfth grade they do better in science than Latinos, but they are outperformed by their male peers on the Math SATs.

A more alarming situation is the trend of fewer women entering the field of computer science. Between 1985 and 2002, women went from earning 36 percent of the computer science bachelor's degrees (D'Agostino, 2003) to only 20 percent in 2002 (Taulbee, 2004). Even when women choose computer science as their major, their relative (compared to men) lack of preparation for the coursework and male dominated classroom climate forces them to drop out of the program (Margolis, 2003).

Table 2: Computer Science Degrees by Gender

	Bachelor's	Master's	PhDs
Male	80.6%	73.6%	83.2%
Female	19.4%	26.4%	16.8%

Table 3. Bachelor's Degrees in Computer Science Degrees by Race/Ethnicity and Sex of Recipients. 2001 (Source: Taulbee, 2003)

Race/Ethnicity	Male	Female
White, non-Hispanic	18,479 (78%)	5,296 (22%)
Underrepresented Minorities	3,892 (59%)	2,663 (41%)
Black, non-Hispanic	2,182 (53%)	1,906 (47%)
Hispanic	1,519 (69%)	680 (31%)
American Indian or Alaskan Native	191 (71%)	77 (29%)
U.S. Citizens and Permanent Residents Unknown Race/Ethnicity	1,492 (73%)	549 (27%)
U.S. Citizens and Permanent Residents, Total	28,013 (73%)	10,517 (27%)

Table 3 shows the distribution of bachelor's degrees in computer science by the race/ethnicity of the recipients for 2001. Analysis of the figures from a gender perspective reveals some interesting patterns. One is that the gender gap is greater among white women than women from underrepresented minorities. Generally, African American and Native American women and Latinas earn more than their share of science and bachelor's degrees than men in their respective groups (National Council on Research for Women, 2002).

White women earned 22 percent of the computer science bachelor's degrees conferred on white males and females, while underrepresented minority women earned 41 percent of the CS bachelor's degrees conferred on minority males and females. Among African American CS bachelor's degree recipients, the numerical gap is almost non-existent, less

than 300 out of a total of just under 4100. The gap between Latino/Hispanic males and female bachelor's recipients is much larger than that among African Americans, 839 out of a total of 2,199. The picture is similar for American Indian CS bachelor's recipients, with a 29 percent female to 71 percent male ratio.

Why don't girls' recent gains in access to technology translation into long-term advancement in college majors and careers? Gurer and Camp (2002) noted that attitudes, computer experience, computer games, mentoring and role models, self-confidence, computing environments, societal influence, teacher and family encouragement, all-female environments, perceived difficulties in balancing work and family are some factors contributing to the problem. The nerd image of the field, the fact that computer games are targeted mostly at boys, the perception of computing careers as boring, and the lack of role models for girls are a few reasons pointed out by Margolis and Fisher (2000).

Cohoon (2001) points out that despite beliefs espoused by some in computer science that women have deeply ingrained traits that suit them less for study and practice of computer science than men, female underrepresentation in computer science could be avoided. Gilbert has observed the importance of support systems for immigrant groups studying computer science and suggested that underrepresented groups in the U.S. could benefit from such practices (Loftus, 2004).

TECHNOLGY ACCESS AND SOCIAL CLASS/SES

Here technology access will be discussed from two perspectives. One is computer access and the other is Internet access. Table 4 shows computer usage by 5-17 year-olds, either at home or at school by their parents' education and by income (NCES, 2003). A large gap exists between children whose parents have the least and the most education. Rates of students using computers at school are fairly even among students from high-income families and those from low-income families, each 75.2 percent and 85.4 percent, respectively. Schools have played a key role in access equality for students of different backgrounds.

Table 4 Computer Usage, Ages 5-17, 2001 Source: NCES, 2003

		Home	School
Income	average	65%	81%
	>$75,000	89%	85%
	<$20,000	31%	72%
Parent's education	Didn't finish high school	26%	Not available
	Has post graduate degree	90%	Not Available

According to the National Center for Education Statistics (NCES, 2001), in 1994, 20 percent of public schools in low income areas enjoyed Internet access while 35 percent of all public schools had such access. By 2000, the figures were 94 percent and 98 percent, respectively.

Of those who use the Internet, 78 percent access it from home, compared to 68 percent from school. Thirty five percent of students from families with income of less than $20,000 access the Internet at home, while 52 percent do so at school (NCES, 2001). Again, schools have played an important role in narrowing digital divide by providing equal access to students from different class backgrounds.

When girls are compared to boys in terms of computer access, Internet access, the time spent on computers and Internet and computer activities, they are not much different (National School Boards Foundation, 2000). In fact, Linebarger and Chernin (2003) show that among children between 4 and 8 years old, boys use computers more than girls, but use Internet less than girls do.

What affects girls the most with respect to the digital divide is their SES, similar to the case for boys. There is research on correlations between gender and social class or SES and computer access. Davies, Hancock and Condon (2003) reported that there is little difference in access to home computers and access among families with high SES for boys and girls and but there is about a 10 percentage difference in home computer and Internet access between boys and girls in lower SES families.

Usage of home computers varies by social class or SES. Fifty percent of the children from high-SES families with home computers used word processing, compared with only 24 percent of the children from low SES families with computers at home (NCES, 2001).

Parents' SES influences students' attitudes toward computers and eventually contribute to widen the technological gender gap. Shashaani (1994) reported that family SES affected sex differences in attitudes towards computers. In general, gender-differential attitudes are more pronounced in the lower socioeconomic group and SES has a stronger effect on girls than boys. Both girls and boys perceive the gender stereotypes about computing held by their parents, and such attitudes inversely affect girls' own attitudes.

FUTURE TRENDS

From a societal perspective, while girls' and women's use of computers and the is on a par with use by boys, it is yet to be seen if the comparable patterns of usage in the future will translate into equitable academic and professional outcomes. The computing environment, starting from the home through elementary, middle, and high schools must be made more encouraging (Cohoon, 2001 & Margolis, 2000). Further research on family SES with gender needs to be done. In addition race and gender interactions have not yet been a central theme among researchers, but research sponsored by the National Science Foundation is altering the research priorities. The findings by researchers such as Kvasny (2003) that working class African American women see opportunities in computer-related or IT careers in contrast to middle class white women's perceptions of obstacles in the compute science pipeline need to be explored in further research.

CONCLUSIONS

While school provides good access to all students and computer access is theoretically equitable between the sexes, complex social factors serve to limit girls' participation both in school and at home. Technology is more than physical resources; it is intertwined with social and cultural factors that differentially affect interactions. These include family computer cultures and encouragement, psychological access, social identities and the setting for the technology use, to name a few.

The traditional definition of "digital divide" no longer paints an accurate portrait of technology. The whole picture needs to be evaluated from a broader perspective. As computer prices continue to fall, lower SES families or schools in low SES areas may have greatly narrowed the traditional digital divide, but further gains may be difficult.

Simple class and economic predictions cannot be made, even within the white American segments. The process becomes much more complex as race and ethnic characteristics are included.

GLOSSARY

Digital Divide – the condition of unequal access to computer-related resources, varying along the demographic dimensions of age, gender, race and ethnicity, education, income, and nationality.

Diversity – in a social and cultural context, the presence in a population of a wide variety of cultures, opinions, ethnic groups, socio-economic backgrounds, disabilities, and sexual preferences.

Information Technology (IT) - a term that encompasses all forms of technology used to create, store, exchange, and use information in its various forms. Graduates of computer science majors may seek IT jobs.

Math/Science Pipeline – a phenomenon where the number of female students, students with lower socioeconomic status, and students of color in proportion to white males in advanced math and science progressively declines during high school.

Social Class – a category of people who have generally similar educational histories, job opportunities, and social standing and who are conscious of their membership in a social group that is ranked in relation to others and is replicated over generations.

Socioeconomic Status- the economic, social and physical environments in which individuals live and work, as well as demographic and genetic factors. Measures for SES may include: Income or Income Adequacy, Education, Occupation, or Employment.

Underrepresentation- a situation in which members of a group by color, race, sex, or ethnicity (but not all) constitute a lower percentage of the total number of people within the category in the job market, or in schools.

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