A Shortage of Technology Job Candidates and an Abundance of Women in the Workplace: Why the Dilemma?

Beverly Davis
Purdue University

Abstract

Despite the feeling that women's entrance into the workplace has been for the better, the economic status of women in the workplace remains lower than that of men (13). Recent evidence shows that the gender gap in earnings is increasing after a period of decline (13). This gap is partly due to workers in female-dominated occupations being paid lower average wages than workers in male-dominated occupations. J. A. Jacobs found that the most common explanation for occupational sex segregation is that women choose different occupations because they are socialized to prefer different types of work from men (10). Sex-role socialization plays a crucial role in the reproduction of gender inequality in the workplace (10). The American Association of University Women (AAUW) shared a recent study that concurred with these findings and found the girls they surveyed were not told directly they were not competent in technology and were not deterred from taking computer classes, however, they felt there were subtle messages that deterred them (1). And this disturbing trend continues through college and leads to the increasing gender gap in workplace earnings. The aforementioned AAUW study discovered when girls were asked to describe a person good with computers; a majority of those interviewed described a man. In a 1997 survey of 652 college-bound high school seniors in Silicon Valley, Boston and Austin, Texas, 50% of both male and female students said that the field of computer science was geared toward men (15). Yet, Prism (2000) recently reported that at least 800,000 Programming and Information Technology jobs could not be filled for lack of candidates (14). Unfortunately, the industry has failed to tap into 50% of the workforce: women. Prism reported that only about 20% of IT Professionals are women and in 1996-1997 only 33% of undergraduate degrees in computer and information sciences were awarded to women. Prism (2001) also reported that there are plenty of women in the general workforce, however, they do not have the technical skills to thrive in the new technology-driven economy (11). The article warned that facing this shortage of workers means the nation cannot remain competitive in the global marketplace. This topic will be explored in depth and suggestions and recommendations will be offered.

I. Women and the Workplace

Women have influenced workforce trends drastically in recent years. For example, in the United States, the labor force participation rate for women (i.e., the proportion of all adult women who were employed or seeking employment) increased from 43% in 1970 to 60% in 1998 (13). However, during the same period of time, the labor force participation rate for men decreased from 80% to 74%. As a result, the proportion of women in the labor force (i.e., the proportion of all adults employed or seeking employment who were women) increased from 38% in 1970 to 46% in 1998. There have been similar trends reported in other countries. And interestingly enough, 87% of women surveyed felt that the presence of women in the workplace has been a change for the better and 78% of men surveyed agreed (18). But where are women working today? And are they catching up economically with the men in the workplace?

Despite the feeling that women's entrance into the workplace has been for the better, the economic status of women in the workplace remains lower than that of men (13). Recent evidence shows that the gender gap in earnings is increasing after a period of decline (13). This gap is partly due to workers in female-dominated occupations being paid lower average wages than workers in male-dominated occupations. The most common explanation for occupational sex segregation is that women choose different occupations because they are socialized to prefer different types of work from men (10). Girls who are encouraged to play with baby dolls and learn to take care of others may become elementary school teachers and nurses while boys who play with building blocks may become engineers (10). Author, J.A. Jacobs reported that occupational aspirations of young men and women are roughly as segregated as the occupational structure. Therefore, this author concludes, many believe that sex-role socialization plays a crucial role in the reproduction of gender inequality in the workplace (10).

Recent reports from the American Association of University Women (AAUW) said that female students account for only 17% of high school students who take the College Board's Advanced Placement exam in computer science to seek college credit (1). In addition, it says that women earn only 28% of the bachelor's degrees in computer science and make up only 20% of information technology professionals. The overall findings suggested that girls are not fearful of technology but disinterested in the male-dominated computer culture. Girls who criticized the computer culture claimed that the violent software games and other programs associated with computers are designed for a culture dominated by adolescent males. Therefore, the study concluded that instead of trying to make girls fit into the existing computer culture, the computer culture must become more inviting for girls. *Time* magazine recently talked to Dr. Breazeal, a woman robot designer, who noted that she is a distinct minority (16). Dr. Breazeal stated that the reason girls avoid the sciences is that they do not get enough support growing up. She added that girls aren't necessarily discouraged but they are not encouraged either. The AAUW study concurs with this statement for they found that the girls they surveyed said they were not told directly they were not competent in technology and were not deterred from taking computer classes, however, felt there were subtle messages that deterred them. For example, there are few positive role models. And most computer camps are designed with boys in mind. Boys are encouraged to tinker with computers and most of them own computers. This gives them more time to master the technology needed to succeed in school. Dr. Breazeal believes that more girls would be attracted to the hard sciences if they realized how creative they could be. She feels that technology is flexible enough to allow for self-expression and she feels that it is a fulfilling career. Looking back to the AAUW study, when girls were asked to describe a person good with computers, a majority of those interviewed described a man. In a 1997 survey of 652 college-bound high school seniors in Silicon Valley, Boston and Austin, Texas, 50% of both male and female students said that the field of computer science was geared toward men. Studies have continued to show that early socialization may determine the jobs women and men consider socially acceptable and that gender has been shown to influence job-search strategies (15).

There is a paradox in comparing male and female wages in the workplace today. Although the gap has narrowed, women still only earn 76.5 cents on the dollar compared to men (3). Recent survey findings of *Working Women* Magazine and found the paradox is in some industries including occupational therapists, advertising executives, and physicists, the women average higher wages than their male counterparts (3). For example, advertising is a female-dominated business where the idea is more important than the technological skills needed in many industries. Women are also gaining in the areas of law, medicine, and business but unfortunately, the U.S. science, engineering, and technology workforce is "comprised mainly of white males, with small percentages of women and minority group members." (11). An author in *Time* magazine recently described our current societal digital divide well:

> "Technology has moved so fast that a new upper class-composed largely of the same white, affluent, college-educated males that make up the old upper class-has spurted ahead of the rest of society, mostly because they have the time and money necessary to acquire and understand the tools of the digital revolution. This is not merely an apocalyptic vision. Members of this digital class are already banking and trading stocks over high-speed internet connections and whipping out wireless Palm Pilots while others wait in sluggish teller lines with pockets full of Post-it-notes. Buy online and you generally avoid sales tax; if shopping in the real world your only option is, you pay the full whack. By 2004, there will also be a digital divide between 29 million households with super-fast broadband Internet access and the on-line equivalent of the middle class-those who still lumber along on 56K modems. Taken all together, these tiny day-to-day advantages potentially add up to a class gap of Dickensian proportions." (16).

As technology dominates every facet of our lives, the lack of females interested in technological careers is astonishing and frightening to many. Females at all levels have been labeled techno-phobic but it is apparent that the problem runs much deeper. It has been established that we are not encouraging girls into the technological fields. The implications can be seen as we take a closer look at the technologically-driven workplace.

II. Technology and the Workplace

The World Future Society (7) recently offered a list of the emerging careers and job opportunities of the next 10-25 years. A few of those that made the list are artificial intelligence technician, computational linguist, computer microprocessor technician, cryonics technician, electronic mail technician, fusion engineer, materials utilization specialist, and robot technician. The AAUW report found that girls know little about the range of careers that involve technology so they cling to stereotypes that computer careers are tedious, unchallenging, and antisocial. The report shared the conclusion that girls need to be better educated about the range of career options that use technology. For instance, very few of these girls will imagine themselves working in technical industries yet government labor and economic indicators predict this is one business sector that will create most new jobs over the next 10-15 years (8). Economists believe that 70% of the good jobs in the current and future American economy will not require a four-year college degree; rather, they will require some form of additional training and education such as technical training certificates (8). And by the year 2005, U.S. businesses will need more than one million new high-tech workers. Not only does America have an educational shortfall for a large part of its population, it is also schooling too many in its better-educated segment for the wrong occupations (8). A well-educated work force is essential to the country's success economically in the global market, yet girls are systematically discouraged from courses of study essential to their future employability and economic well-being (1). Even the positive statistics seem to reveal questionable workplace segregation. Research shows that between 1975 and 1995, the percentage of women in managerial and professional specialty occupations in the American workforce increased significantly (15). In 1995, women accounted for 43% of managerial and related employment, nearly double their share in 1975. There were noticeable differences, however, in the functional areas women chose (or were channeled into). Women were much more heavily represented in service occupations, as were men in precision production, craft, and repair occupations. Even women who make it to the board of directors or to the position CEO were more likely to be put on public affairs committees while men were regularly placed on compensation, executive and finance committees (15). It should be noted that certain functional areas such as finance and information systems are associated with more career opportunities (15).

Technology will play an ever more important role in shaping the workplace of the future, as computers get smarter, faster, smaller, and so inexpensive that everyone can own one (5). Jobs will demand information system know-how. In the future, most workers' primary activities will involve information technology and workers will have to gather, create, manipulate, store and distribute information related to products, services, and customer needs. Computer networks will be interconnected with information systems that will affect all industries; workers who cans step into the new job categories created by these networks and their implementation will be strong in demand (5). For example, in the 21st century and beyond, the majority of employees hired by manufacturers will be college graduates, or will have job specific, post-high school training. Many manufacturing jobs that depended upon a strong back will be replaced by jobs conducted from a computerized workstation (5). Females must be enlightened to this reality and educators, parents, and counselors should be trained to dispel myths that technology careers are male-centered careers.

III. Women and Technology

Those who have the latest technology and know how to use it are moving forward at an unprecedented rate and those who don't are declining at the same dizzying pace (12). Educators will be challenged to help students discover how technological skills are essential in any walk of life and that the development of technology skills are very much like professional insurance policies (12). Females will need to be encouraged to seek the technological fields as avenues of opportunity in any area of their choosing.

Stroh and Reilly found that even though women are earning more than half of the bachelor's degrees earned in the United States, there are noticeable differences between women and men in their fields of study. For example, in 1994, over 75% of the degrees in library science, home economics, health sciences, public affairs, and education were awarded to women. In comparison, over 70% of the degrees earned in engineering, military technologies, and computer and information sciences were awarded to men (15).

At least 800,000 Programming and Information Technology jobs can't be filled for lack of candidates (14). Yet the industry has failed to tap into 50% of the workforce: women. Only about 20% of IT Professionals are women and in 1996-1997 only 33% of undergraduate degrees in computer and information sciences were awarded to women (14). There are plenty of women in the general workforce, however, they do not have the technical skills to thrive in the new technology-driven economy. Facing this shortage of workers means the nation cannot remain competitive in the global marketplace (11). These statistics concur with Dr. Breazeal, the female robot designer, that girls need positive role models. Engineering schools with high numbers of female students say the best way to attract female students is to increase female faculty members. These faculty members serve as role models and mentors to women students. One female professor at Tulane University agreed in that role models in faculty send immediate and visible confirmation that as women they wouldn't be out of place and dispel myths that if they pursue engineering as a career they will be one female out of 300 men. Even female faculty members lack support systems. Nancy Leveson, computer science faculty member at MIT feels lonely and isolated as only one of eight female professors in the department of 40 in computer science (9). She believes that the problem will only get worse as she has seen a notable decrease in female students. This is a regressive trend that will need immediate consideration. A step in the right direction may be through some positive promotional models of technology and science initiatives designed to attract females into these fields.

IV. Advocates of Technological Initiatives

Instead of trying to make girls fit into the existing computer culture, the computer culture must become more inviting for girls (17). There are positive examples of technology promotional campaigns to do just that. For example, recently the Girl Scouts of America launched a high-tech curriculum to teach girls math, science, and technology. This program is called "Bridging the Gap" and encourages exploration in web design, digital photography, and Internet usage by making learning fun. This is encouraging as we see some of the major influential institutions take positive steps by recognizing there is indeed a gap and that void can be filled by offering the guidance girls need in future career choices. Another example of advocacy is the Women in Engineering program at Purdue University that holds summer camps to encourage middle school girls into the sciences and technologies. These camps offer classes in web design and even robot creation. The girls are encouraged to make career decisions at that age so they can plan a curriculum in high school that would prepare them for college courses in engineering or technology. These are just two examples of the minor but growing campaign to encourage girls into technology and engineering careers.

Even marketers are recognizing the need to encourage girls into technology. Although their ultimate goal may be financial, they have recognized that girls have been turned off by technology that promotes gory and violent computer games and gear. Girls who are attracted to technology are attracted when it is social and involves relationships with others. One toy consultant remarked that the conventional wisdom is that girls don't like high-tech toys but the truth is girls like it but they want it to express who they are (6). Girls are interested in technology as it relates to them socially and many toy executives are frantically researching to gain insight into what girls want from technology. This insight is the key to the technology and science fields that have a shortage of future workers and need women to successfully compete in the global market. An example of a proactive approach in this area is IBM. This company offers technology camps in the summers for middle school girls. They introduce the camp attendees to women who have successful technology careers. Why do they do this? They want to have qualified people to hire in the future. Since women are half the workforce and so few go into technology fields, Linda Scherr, chairwoman of IBM's Women in Technology Program, predicts many companies could go out of business because they won't be able to hire the skills they need to successfully operate their businesses. Ms. Scherr said that we are on the brink of disaster in this country and this will be a major challenge for businesses in the future (1).

V. Recommendations and Conclusion

As stated previously because girls know little about the range of careers that involve technology, they cling to the stereotype that computer careers are tedious, unchallenging, and antisocial. The American Association for University Women found that girls do not lack the capabilities to gain the skills desired in technological careers, they just choose not to pursue those skills. We can learn from their insights. They feel that technology or computers are directed at boys and there is too much violence in the computer games and technology toys that are mostly developed with boys in mind. The girls reject the violence, redundancy, and tedium of computer games and they dislike narrowly and technically focused programming classes. Many girls interviewed remarked that they picture geeks in windowless offices toiling at a keyboard for hours. Girls have shown that they are capable of using technology as they are equal in computer use for leisure such as surfing the Internet and chatting on e-mail.

The recommendations from this study should be obvious by now. Girls have "we can, but don't want to" attitudes towards technology. This can and should be changed as some institutions have recognized and have already implemented programs addressing this issue. The recommendations include:

1. The perception girls have about technology needs to be changed. Perception is a form of categorization or structuring utilized to simplify our experiences. We simply categorize people so they fit our conceptions. Girls have the perception that technology is for "geeks" and antisocial males. Perceptions are not easy to change but a few "Barbie" hand-held computer games won't change this perception. More of the camps like Purdue University and IBM sponsor will make the difference. At these camps, an important part is having women speakers share their experiences and successes in technology disciplines. Girls need to see more female educators and faculty in the sciences and technology disciplines as well. These women need to actively mentor girls at K-12 and university level

2. Computers must be integrated in all curriculum at the K-12 level. This will go a long way in changing the perceptions girls have about technology. The girls should also be educated on how technology skills can be used in many different disciplines. If girls can see technology used in disciplines they enjoy, they will be more receptive to other possibilities.

3. As my research pointed out, boys are encouraged more by parents, educators, and through activities such as after school programs and summer camps for computers. This has got to change. We have seen many positive steps as with the Girl Scouts of America. More of this outreach needs to take place. Sex-role socialization leads to occupational sex segregation. The sex-role socialization that encourages girls into nurturing roles and boys into building and creative endeavors is the catalyst to the disparity we see between male-dominated and female-dominated occupations.

4. K-12 educators must have training to recognize subtleties in the classroom. Girls need to be encouraged as much as the boys into technology and towards computers. This message should then be shared with parents of the children who must also realize the subtle messages they send their female children. As pointed out in this paper, girls aren't necessarily discouraged from pursuing science and technology but they usually are not encouraged. Educators and parents must recognize the interests and talents of their children and actively encourage them into these areas.

5. As with most of our society, the computer and technology fields are male-centered. This recognition is important so that we design the computer culture to be genderless and more inviting for girls. As the AAUW study found, boys and girls use technology differently. Boys like the games and girls gravitate towards artistic areas and chat rooms. Again, girls are typically more social find isolating computer careers boring and uninviting. Girls enjoy teamwork and this could be creatively incorporated into the technology and science curriculum.

New technology will continue to transform the way we live, work and function in the global economy. The demand for engineers, scientists, technicians will exceed the available candidates this country will have to offer unless there is an investment in the female half of the workforce that will satisfy the demand. It is time to realize that female participation in technology will be the key to success in the future. As it has many times over, discussion about or country's successful participation in the global market turns our attention to our educational system. The focus must now be on the negative effects of occupational sex segregation and the roots of this issue that begins with sex-role socialization.

Bibliography

1. American Association of University Women Webpage: http//:www.aauw.org How Schools Shortchange Girls (1992). Executive Summary.
2. American Association of University Women Webpage: http//: www.aauw.org
3. Barakat, M. (July 4, 2000). Women continue to narrow pay gap with men, survey finds. South Bend Tribune. 128th year, #118, P. B5.
4. Burke, J. (December 4, 2000). Inventors and Inventions. Time.
5. Challenger, J. A. (September-October, 2000) 24 Trends Reshaping the workplace. The Futurist.Pp. 35-41.
6. D'Cinnocenzio, A. (September 18, 2000). High-tech gadgets for girls. South Bend Tribune. P. B1.
7. Futurist (2000). Special Report: Forecasts for the Next 25 Years, p. 6.
8. Gordon, E.E. (July-August, 2000). Help wanted: Creating tomorrow's workforce. The Futurist. Pp. 48-52.
9. Gray, P.B. (February, 1999). Bug Zapper. Working Woman. Pp. 52-55.
10. Jacobs, J. A. (1999). The Sex Segregation of Occupations. Handbook of Gender & Work. Pp. 125-141. Ed. G. N. Powell. Sage Publications. Thousand Oaks, CA.
11. Mannix, M. (March, 2001). Getting it. Prism,pp. 14-20.v. 10. No. 7.
12. Marx, G. (March-April, 2001). Educating Children for Tomorrow's World. The Futurist. Pp. 43-48.
13. Powell, G.N. (1999). Handbook of Gender & Work. Sage Publications. Thousand Oaks, CA.
14. Prism (October, 2000). Wanted: More Women in Engineering and Science. P. 10. v. 10. No. 2.
15. Stroh, L.K. & Reilly, A.H. (1999). Gender and Careers, pp. 307-324. Handbook of Gender & Work. Pp. 307-324. Ed. G.N. Powell. Sage Publications. Thousand Oaks, CA.
16. Taylor, C. (December 4, 2000). "Digital Divide: So Close and Yet So Far." Time. Pp. 121-125.
17. Woodall, M. (January, 16, 2001). Women Avoid Computer Culture. South Bend Tribune. South Bend, IN.
18. Wurman, R.S. (1999). Understanding. TEDx Publications, Newport, RI.

BEVERLY DAVIS

Beverly Davis is an Assistant Professor at Purdue University at South Bend/Elkhart, IN. Professor Davis teaches courses in leadership, conflict management, management of change, human behavior, training, gender and diversity, quality, and occupational safety and health. She is the Assistant Program Chair for the Manufacturing Division of ASEE and belongs to the Midwest Academy of Management, The Association/International Association of Management, the American Society for Quality, the International Society for the Exploration of Teaching Alternatives, the World Future Society, and the American Psychological Association.