

Engaging K-12 Students in Technology as a Career: Differing Expectations

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New technologies 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 expansive female and minority segment of the workforce. *Prism* recently reported that over 800,000 Programming and Information Technology jobs will not be filled for lack of candidates (7). Systematically, occupational sex segregation, an ingrained computer culture, and the digital divide threaten the goal achievement of providing the predicted one million new high tech workers we will need to succeed in the global market. Higher educational institutions, businesses, and government have all sounded the alarm and attempted to thwart this future catastrophe. The American Association of University Women (AAUW) recently reported female students account for only 17% of high school students who take the College Board's Advanced Placement Examination in computer science to seek college credit (1). In addition, this report tells us women earn only 28% of the bachelor's degrees in computer science and make up only 20% of information technology professionals. Only 1.7 % of bachelor's degrees awarded to women in 1998 were in engineering (8). And in addition, black and Hispanic college attendance rate is well below average. Of the black and Hispanic students who do attend, only 3.1% of blacks and 4.9% of Hispanics pursue engineering programs (8). 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 in our society (6). At institutions of higher education, many technology educators are developing programs designed specifically for K-12 student populations. In this segment, we will discuss the differing student needs and approaches needed to attract and interest female and minority K-12 student populations.

Girls and Technology

The aforementioned AAUW study asked K-12 girls to describe a person good with computers and a majority of those who responded described a male. In a 1997 survey of 652 college-bound high school seniors in Silicon Valley, Boston, and Austin, 50% of both male and female students said the field of computer science was geared toward men (11). The AAUW study found girls knew little about the range of careers involving technology and continued to cling to the stereotype that computer careers are tedious, unchallenging, and antisocial. The report concluded girls needed to be better educated about the range of career options available in technology. For instance, few girls could imagine themselves working in technical industries, yet government labor and economic indicators predict this is one business sector creating the most new jobs over the next 10-15 years (4). Two pronounced reasons for this stereotype exist; sex role socialization and forcing girls into an existing unsuitable computer culture.

Sex Role Socialization

Studies continue to show early socialization may determine the jobs women and men consider socially acceptable and that gender has been shown to influence job-search strategies (11). The most common explanation for occupational sex segregation is women choosing different occupations because they are socialized to prefer different types of work from men (5). Girls are socialized into nurturing roles and boys are encouraged into building and creative endeavors. Author Jacobs observed, "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." Over time, most computer camps have been designed with boys in mind and most boys are encouraged to tinker with computers. In fact, in 1994, over 75% of the degrees awarded in library science, home economics, health sciences, public affairs, and education were awarded to women while over 70% of degrees earned in engineering, military technologies and computer and information sciences were awarded to men (11). K-12 programs designed to interest girls in technology programs should be aware of the subtleties girls face in the classroom and at home; girls aren't necessarily discouraged from pursuing science and technology but they are not encouraged either. Programs should offer insight into potential future technology careers and dispel female negative perceptions of technology. Girls should 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.

Transitioning the Computer Culture

One detractor to engaging girls in technology programs is the pre-existing computer culture. The AAUW study found girls do not lack the capabilities to gain the skills desired in technological careers; they just choose not to pursue those skills. Girls reject the violence, redundancy, and tedium of computer games and they dislike narrowly and technically focused programming classes the study reported. Girls simply have a "can but don't want to attitude." They are capable of using the computer for leisure such as surfing the web and chatting on e-mail. Instead of trying to make girls fit into the existing computer culture, the computer culture must become more inviting for girls (12). There are a few positive examples of "technology as a career" promotional campaigns. One is the Girls Scouts of America who began offering badges in digital photography, web design, and Internet usage. Purdue University, among other institutions, has a "Women in Technology" summer camp where girls are encouraged in such activities as web design and robot creation. At these types of camps, girls are encouraged to make career choices early that would prepare them for college courses in engineering or technology. It is this type of interaction that will dispel the negative stereotypes and interest girls in technical, math and science programs. K-12 programs designed to interest students in technologies, must recognize the need for genderless activities. One interesting example of this level of engagement can be found at the IBM Women in Technology summer camps for girls. At this camp, girls are introduced to women who have successful technology careers. Why does IBM invest in such activities? They want qualified people to hire in the future (1). Since women are half of the workforce and so few go into technology fields, IBM

predicts many companies will go out of business because they will not be able to hire the skills they need to successfully operate their businesses. Even marketers have begun to realize the computer culture must become more inviting to girls. Marketers have recognized girls are attracted to technology when it is social and involves relationships with others. One toy consultant remarked that the conventional wisdom is girls don't like high-tech toys but the truth is girls like it but they want it to express who they are (3). Although the ultimate goal of marketers may be financial, the lessons learned are models we can all emulate. Designing of programs to engage and interest K-12 girls must center around social events. Possibly, team projects would include computers and specially designed creative endeavors would interest girls in technology as a future career.

Minorities and the Digital Divide

There are differing needs and expectations when targeting the minority segment of the K-12 population as well. A recent Reuter's study of 1900 people, found 47% did not have Internet access in their home (9). Another study specifically focused on the digital divide. This study found that 23.5% of black households and 23.6 of Hispanic households had Internet access while the rate in white households was 46.1% (2). This study showed there is a major gap between whites and people living in cities being more likely to have computers and Internet access than minorities or those living in rural areas. *The Futurist* recently warned, "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 (6). Without ready access to computers and the Internet, say educators, students are less likely to develop the skills and knowledge base that would lead them to study engineering programs (10). Because there is a clear lack of gender and minority diversity in technology programs, Congress established the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET) (8). In the commission's study, it was clearly noted that eliminating racial inequity in the public school system would guarantee all K-12 children have access to schooling preparing them for college. This in turn would increase numbers of minority students in higher education and most certainly the numbers interested in technologies would increase as well. The CAWMSET report recommended intervention efforts targeted at underrepresented groups at the high school level. Again, most educators confirm that without ready access to computers and the Internet, students are less likely to develop the skills and knowledge base that would lead them to engineering, science, and technology programs.

One suggestion shared in the *Prism* article was to "build a bridge" (10). When attempting to engage and interest minority students into technologies, one must realize those who are economically challenged may need to do some "catching up." The "building a bridge" means allowing free time on computers and the Internet with someone available to answer questions. This article noted students who are exposed to computers and offered free time will become literate at an accelerated rate. There are indeed differing expectations when designing and engaging some minority students through K-12 programs. One may wish to offer free time or activities that will afford

disadvantaged students time to catch up on basic skills. If the program also includes girls who have avoided the computer culture, this approach may be helpful for them as well.

Diverse Approaches to K-12 Engagement

As it has many times over, discussion about our country's successful participation in the global market turns our attention to our educational system. Technology educators, having recognized the shrinking pool of qualified candidates, attempt to engage K-12 students into the technologies. The focus is not on granting credit or developing specific skills, but to simply gain interest in technology as a career. There is typically a lack of immediate and observable success, however, as previous statistics have shown the participation of girls and minorities in technology will be the key to our country's success in the future. Although the immediate success is not always observed, longitudinal success will be guaranteed when programs are designed to meet the individual needs of students. As this research has shown, this means transitioning the computer culture, recognizing the subtleties of sex role socialization, and accounting for differing inequalities of technological achievement. By individualizing programs, faculty will ensure programs are meaningful to all participants and be investing in the future of technology programs and our country's participation in the global market.

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