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Strategies for bridging the gender gap in technology use : from education to the workplace

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Strategies for bridging the gender gap in technology use : from education to the workplace

Abstract

This literature review is about strategies for bridging the gender gap in technology use in the classroom and the workplace. The research done on the subject indicates that a gender gap does exist in the classroom and the workplace. Women and girls have not been encouraged to participate in classes or training that will prepare them to make the transition from the classroom to the workplace. The conclusion of this review suggests several methods to aid instructors and employers in bringing about equity in the classroom and the workforce. The implementation of diversity training, mentoring, and role modeling are just three of the methods suggested by the research.

STRATEGIES FOR BRIDGING THE GENDER GAP IN TECHNOLOGY USE:
FROM EDUCATION TO THE WORKPLACE

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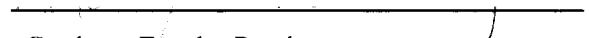
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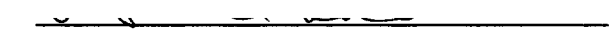
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ABSTRACT

This literature review is about strategies for bridging the gender gap in technology use in the classroom and the workplace. The research done on the subject indicates that a gender gap does exist in the classroom and the workplace. Women and girls have not been encouraged to participate in classes or training that will prepare them to make the transition from the classroom to the workplace. The conclusion of this review suggests several methods to aid instructors and employers in bringing about equity in the classroom and the workforce. The implementation of diversity training, mentoring, and role modeling are just three of the methods suggested by the research.

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INTRODUCTION

The purpose of this literature review is to determine whether a gender gap exists in technology use in the classroom and the workplace. This review will also seek solutions to bridging the gap and thereby creating equity in both the classroom and workplace. In a study by Sadker (as cited in Butler, 2000) there is a *new* gender gap that exists in technology usage in the classroom. The statement implies that a gender gap existed in the past. However, the focus of this review is on the current status of gender and equity in the classroom and the workplace.

According to Gurian and Ballew (2003), the gap that exists between males and females may be caused by learning differences. His research further suggests that brain development, structure, chemical and hormones, and function differences may be other contributing factors to how each group learns.

The research on workplace and gender gap is just as alarming as the gap in the classroom. It is necessary to examine whether a gap exists in technology use in the classroom or the workplace. According to Gatta and Trigg (2001), most females who work with technology are trained for clerical positions, while their male counterparts are trained for technical positions. Technology is continually evolving and our future generations will probably depend solely on it. It is vital to prepare all students in the areas of math and science to become technically literate as they move from the classroom to the workplace. This presents one of the major problems that exist in technology use and the gender gap in the workplace. According to Donaldson (2000), women who do succeed in the areas of technology, still have to fight in a male-dominated society. Women are often hired for positions in data entry and other low paying capacities.

The reviewer's intention is to address several questions: What is a gender gap? How do differences in learning affect teaching strategies when preparing students to enter the workplace? Does a gender gap exist in adult learners? What are some contributing factors and barriers to the gap? What strategies can be used to eliminate the gap? The focus of this literature review is to bring awareness to the problem and to encourage instructors and employers to include women and minorities in the training process for technology use.

METHODOLOGY

This reviewer used several methods when gathering information to research this paper. The University of Northern Iowa's Rod Library UNISTAR and ERIC (Silver Platter) databases, Wilson Web, Google, ProQuest (ABI/INFORM Global), and the ABI/Business databases were accessed to retrieve the information for this paper. Other resources used in the review were books and full text articles retrieved from these databases. There were a number of key words used during the search to locate the information included in this review. Some of those key words include: (a) gender gap in technology, (b) classroom and technology, (c) technology and the workplace, (d) equity in the classroom and workplace, (e) gender gap in technology in the classroom and workplace, (f) discrimination in the workplace, (g) gender bias, gender bias in the classroom and workplace, (h) and education and bias. The information selected for the review is based on how the content related to the subject, previous research, and whether the information is current. In order to verify the validity of the information, the reviewer searched Google to find other articles or books published by the authors.

The reviewer chose materials from articles and books that are current and relevant to the gender gap in technology use and the effect seen in the classroom and the workplace.

ANALYSIS AND DISCUSSION

It is important to examine whether a gap exists in technology use in the classroom or the workplace. Technology is continually evolving and our future generations will depend on it. It is imperative that all members of the workforce are well equipped as they move into this era of the technology explosion. One of the ways of preparing for this event is by including both males and females in all phases of the hiring and training processes.

Gender Definitions

The first step in analyzing and discussing a *gender gap* is to define *gender gap*. The American Heritage Dictionary of Idioms (1997), define it as “a broad difference between men and women” (p.1). The phrase was used first to define the differences in males and females voting preferences. Now it is used to define differences that exist between males and females. The American Heritage Dictionary of the English Language (2000) defines it as “a disproportionate difference, as in attitudes and voting preferences between the sexes” (p.1). Using these as an acceptable definition, then a gender gap exists in education when male students are given preference over females or females over male students.

According to Goldin (n.d.), the workplace refers to a gender gap as “systematic differences in the outcome that men and women achieve in the labor market” (p.1). These differences are recognized in the percentages of men and women in the labor force, the types of occupations they choose, and the differences in the average incomes of men and women. The economic gender gap has been a major issue in the women’s movement and for economists.

Sex and gender are sometimes used to imply that they are one and the same. However, according to the American Association of University Women (AAUW) (1995), sex is used to make a distinction between males and females. Gender on the other hand implies how society measures what is or is not expected of males and females. Those designations at times can become overlapped and the meaning is blurred.

Measor and Sikes (1992), have a broader definition of sex and gender:

Sex refers to the most basic physiological differences between men and women—differences in genitals and in reproductive capacities. Physical differences like height and secondary sexual characteristic might be added to the list.

Gender refers to all differences between men and women other than the basic physiological ones. Gender refers to specific social and cultural patterns of behavior, and the social characteristics of being a man or woman in particular historical and social circumstances. Gender is made by society. (p. 5)

These two definitions may sometimes be used interchangeably to define the roles woman and men are expected to emulate in society. Educators and employers may be influenced by this stereotypical message in steering women away from careers in technology.

The last concept addressed is gender identity and sex roles. According to Measor and Sikes gender identity refers to “self-concept or one’s own self of being male or female” (p. 5). Sex role refers to “the patterns of behavior and the aptitudes and attitudes that society expects from people simply because they are male or female” (p. 5).

Classroom Interactions

The American Association of University Women (AAUW) (1992), commissioned a report that revealed that girls have not received full educational opportunities in the

school system. In the classroom, it was noted that teachers were less attentive to girls than the male students. It did not matter if the teachers were males or females.

The AAUW created a second study and report (1994) and discovered that the gap in math and science was just as wide as reported in 1992. The report indicated that this was in part due to the influence that teachers have on girls as to how the girls view themselves and their future careers. According to the AAUW report, schools play a major role in why girls fail. There is a strong correlation between the message transmitted to girls and boys as to what is expected of them. These messages are biased when boys are recognized and praised for their accomplishments and girls are not recognized for their accomplishments. At this stage in their lives, these actions can be quite devastating to young girls and to their self-esteem. When girls set goals and attempt to achieve them their self-esteem could be affected if the girls are not encouraged to achieve those goals.

When girls believe that teachers and other adults imply that girls cannot do what girls know they can do, many of them shy away from trying to accomplish their goals. The indication is that learning is affected by what occurs in the classroom as well as by what is taught in the classroom.

The 1994 AAUW study also states that classroom interaction with teachers and students will determine whether a school will become a functioning community. The school as a community determines how students evaluate the teachers, other students, and themselves. Once students make the distinction of what is important, students will respect the boundaries of where the rights of others begin and their rights end.

Teachers play a major role in the effectiveness of classroom interactions. The report indicates that over the last decade teachers typically respond positively to boys

more often than to girls. Other messages that were transmitted showed that teachers communicated differently with boys. The boys were asked more questions that would produce active learning. These questions would be either theoretical or open-ended allowing for them to receive feedback. The girls were not given the same opportunities to participate in the discussion as the boys. A subsequent AAUW report (1995) offered that boys called out answers more frequently than girls and the teacher acknowledged the boys more frequently. When girls chose to answer a question they were told to “Please raise you hand if you want to speak” (p.118). The indications are that the questions posed were geared toward the learning styles of the boys.

According to the 1994 AAUW report, there are differences in learning styles of males and females. The report shows the disproportionate negative practices of teachers’ interactions with female students versus those with male students and the disproportionate comments made by the teachers. Some of these actions can be seen as early as pre-school and continue into institutions of higher education.

It was noted by some researchers that *teacher-student interactions* did not distinguish between areas of interest. Nevertheless, there are suggestions of teachers demonstrating “gender-biased behavior...while others promote more...equitable interactions” (p. 121).

One area of interest implying bias is science classes where according to the report males are likely to receive more attention than girls. While math classes are not as biased toward females the tendency to prefer males is prevalent in both.

There are other implications of inequalities in teachers’ and students’ interactions in the classroom, based on research by Measor and Sikes, (1992). Two of those

inequalities are the limited expectations and opinions the teachers have of the students. Some of these concepts are based on ethnicity and social status. According to the report, teachers perceived females to be more accepting to compliance than male students. The teachers believed that females were willing to accept whatever was asked of them. Teachers also make assumptions that the students of ethnic backgrounds overall accomplishments and attainments are lower than students of the majority background.

Research further indicates that when it comes to time and attention, potential is not the problem since boys still get more attention than girls. Indications are that boys are more likely to control the seating arrangement in the classroom, choose the activities for the playground, and manipulate the amount of time the teachers will spend with them. Evidence of this dominance is also seen in children before they enter the school environment (Measor & Sikes, 1992). To solve this problem, that is destroying the potentials of our young females, educators need to participate in workshops designed to teach them how to equip themselves for this ever-evolving era. The teachers must realize that everyone has a different style of learning, especially when it comes to addressing the gender issues. In order to compensate for those styles educators must include the different learning styles in their teaching strategies (Measor & Sikes).

Furger (1998) found that female students are less likely to invest their time in computer use because they do not have confidence in their knowledge of computer concepts. Males are more apt to view the computer as a *toy* while females view the computer as a *tool*. Females use computers for personal use or in the workplace. Males on the other hand see the computer as a gadget, that can be taken apart to investigate its inner components or as a playmate.

In the study by Salter (n.d.), gender-bias is just not an elementary, middle, or high school problem. It continues into the “higher educational systems” (p. 1). Salter’s theory is based on “interactions between psychological and environmental types” (p. 1). His theory is that there are two types of processes people use. People use either *sensory* or *intuitive* processes when acquiring knowledge. “Sensory processors take information through their ‘five senses’ and tend to be concert learners.” “Intuitive processors inclinations are usually based on ‘*sixth sense*’ and or more theory centered” (p. 1).

To understand the environmental types, gender and personality have to be taken into consideration. Salter’s research reveals that “females tend to consider the needs of others before self when making a decision” (p. 2). These findings are just the opposite for men.

Minorities

According to the AAUW (1995), research on the interactions of “gender with race, ethnicity, and /or social class” (p. 122) is limited. However, information does suggest that boys received more consideration when interacting with teachers than girls. The overall indication is that White males received more consideration than males of other ethnic backgrounds. When African-American boys did receive attention from teachers, they were told “that’s good, but... (p. 122). Interactions between African-American girls and teachers occurred less often even though attempts to interact were made by the girls. These incidents occurred more often with African-American girls than all the other boys or girls. The African-American girls were discouraged more than other students even if they had higher scholastic accomplishments than boys.

Research shows that African-American girls perform as highly as Caucasian boys

and teachers ascribe this to girls working hard, and take for granted that Caucasian boys are just not meeting their expectations. These are some of the barriers facing many minority students entering educational institutions. These barriers follow minorities as they enter pre-school, and continue throughout their academic years. This may point to why African-American girls do not value their scholastic accomplishment as much as African-American boys value theirs (1995).

According to Subramony (2004), instructional technologists continue to disregard the importance of diversity among learners in the field. Subramony determined that no United States doctoral programs in Instructional Technology (IT) include any cultural diversity courses in their core curricula. He did find a few elective courses were available in some other “educational program such as educational policy, and educational leadership” (p. 20). Subramony also noted that the presenters at the “2003 Association for Educational Communications and Technology Convention in Anaheim, California,” (p. 20) did not address the issue of diversity.

Subramony, notes that research shows problems that exist in the field of technology are the result of *ethnocentric* attitudes portrayed by middle class Caucasian educators, trainers, and IT professionals. These individuals evaluate society based on their own social standards, and they are either insensitive or uninterested in seeking an understanding of other cultural differences. (p. 22). Until educators, trainers, and IT professionals have a change in their attitude, they will continue to see an alienation of minorities in the field.

According to Brown (2001), women and minorities have difficulty accessing math and science skills, and are not encouraged to improve their computer abilities in the field

of technology. There is also a declining number of this *under-represented* group who are entering and staying in the field.

Learning Styles

Addressing learning styles, Gurian and Ballew (2003) describe a number of differences in *deductive* and *inductive reasoning* between boys and girls. Males usually think in terms of generalities. Girls on the other hand begin the process with details and more distinct concepts are added as the process continues. The study indicated that in deductive reasoning males do better on “multiple choice tests such as SATs” (p17).

Males are better abstract thinkers than females and are able to master a concept without the aid of a physical object. Females learn better by using concrete objects especially in the area of math when solving a problem. Girls usually have better listening skills than boys and they are more likely to grasp the smallest of details when presented with an assignment. Boys are more likely to ask for further interpretations because they do not have the listening skills that the girls possess. In terms of language skills, Gurian and Ballew’s study shows that girls’ verbal communication is developed at an earlier stage than boys. Girls are able to use more words in expressing themselves. Males are limited in expressing themselves and tend to use more messages that are implied. It is important for instructors to know the differences and to format their classes to include these differences. The differences in learning styles do not stop at the elementary, secondary, or high school level (Gurian and Ballew).

Differences continue to exist at the college level for adult learners in technology use. The adult learners have different characteristics than children and they learn in a completely different context than children. Bridging the gap should be a goal in the

teaching strategies of every teacher, according to Gatta (2001). One such teaching strategy is to encourage females in the areas of math and science because many females lack the skills to compete with their male counterparts in the workplace.

In order for instructors to be successful in teaching adults, they must be well informed as to the context within which adults construct knowledge. Adults are participatory in nature and need to be given the liberty of choosing areas of discussions that appeal to them (Lieb, 1991). Upon entering an educational institution, adults have a plan of action in place to reach their objective. Adults are more likely to set goals that are realistic and attainable in a shorter period of time than younger students. This is possible because adults are able to draw on their knowledge base and other relevant experiences (1991).

Lieb states that “motivation” (p.2) is an important characteristic of adult learners. Adult learners need to be motivated to engage in building new relationships, to collaborate with other instructors or mentors, to participate in programs that will promote community awareness, seek to attend to their personal needs, include flexibility in daily activities to prevent repetitiveness, and to learn for one’s own satisfaction. There are also barriers to motivating adults in the learning process. Those barriers include “lack of time, money, confidence, or interest, lack of information about opportunities to learn, scheduling problems, and problems with childcare” (p.2).

Learning is a life-long process and individuals learn at their own pace. In order to stimulate and develop adults’ learning, instructors need to provide “positive reinforcement” (p. 3). Instructors must have some type of relationship with the learners in order to motivate them to receive new ideas. There must also be an inviting

environment wherein the student does not feel intimidated. Instructors must use instructional strategies that will assist students in processing and retaining the information received. The last step in the learning process is transference. Again, it is imperative that learners can relate the instructions to something meaningful and comparable to their already acquired knowledge (Lieb).

Workplace

The report presented by Gatta (2001) looked at wage differences and determined that this is one of the most contributing factors in causing the gender gap. According to the report, “women on an average earn 85 percent of men’s salaries in the technology field” (p.17). There are tendencies for women to feel that their work is devalued in comparison to that of men. Women are usually praised for their role as the primary caregivers in the home, but there is no compensation included in the package. Women’s work is often characterized, home first and then the job no matter what position they hold in the workplace.

According to Srinivas (n.d.), online networking has become popular for many companies and entrepreneurs. The World Wide Web has been an avenue for resolving many issues, sharing ideas and information, and reaching the global community. With the availability and access to information using the Web, there is a growing class who does not share in this wealth of knowledge. Education and training are not equally accessible to women as they are to men due to “societal barriers, stereotyping, government barriers, and structural barriers” (p.8).

The study conducted by Redwood and Shade (as cited in Srinivas, n.d.), found that “discrimination, sexism, racism, xenophobia, unemployment, underemployment, and

poverty...the glass ceiling is one manifestation of the perpetual struggle for equal access and equal opportunity” (p. 7) in the workplace. These actions are possible because of the lack of women role models and mentors. There is a need to include a multicultural group of workers in the organizational structure. These inequities indicate the need for diversity orientation training in educational and workplace locations. Women do not have access to information to be effective players in *development activities*. Even though women receive the information, they do not actively participate in the development part of how the information is used. When women are educated in technological issues and are taught to effectively translate and use the information, they can be an instrument to bring about prolong individual growth (Srinivas). Women play key roles in sustaining and continuing the family’s heritage and customs. The need for implementing *gender-sensitive* training in technology in education and the workplace is necessary to provide equal access to women in both arenas.

Women must have equal access to information technology in order to develop their skills to compete in this technological society. This empowerment will fortify women’s capacity to combat negative portrayals of women in the workplace and the field of technology. Even when Subject Matter Experts (SMEs) were brought in to institute diversity in the workplace they were unable to accomplish their goal. Females brought in as SMEs encountered another hurdle due to their “lack of expertise, equipment, and insufficient finance or policy support from the governing body” (p. 7.). Equity in the workplace goes far beyond job roles and performance, but includes relating to and being sympathetic to the assets and limitations in a *gender partnership* (Srinivas n.d.).

Gregory (2003) indicates that many people living in the United States believe that

equity between men and women has been achieved in the workplace. He notes that the appointment of a female to head one of the leading companies in America gives the impression that the gap is closing. Gregory believes that the appointment of one female is insufficient in a society comprised of many corporate giants. Even though the past thirty five years have seen many improvements in equality, “sex discrimination-blattant, subtle, and covert-continues to plague working women” (p.5).

Barriers

There are a number of barriers facing women and minorities in the classroom and the workplace. Some of the barriers include sexual harassment, unequal access to education and technology, and physiological differences.

Sexual Harassment

Sexual harassment and physical attacks by males are common occurrences in the school. “Sexual harassment has been considered normal behavior in the relationship between men and women at school and in the workplace throughout history” (Measor & Sikes, 1992, p. 118). These actions are illegal however; the old adage that *boys will be boys* is usually the way these actions are handled. Since the Columbine incident; no tolerance, anti-harassment, and bullying policies have been introduced into the schools to help curb some of these actions.

A study conducted by Gurian and Ballew (2003), determined that victimization in schools is primarily male to male and is usually in the form of violence. However, sexual harassment is primarily toward females and is perpetrated more on females by “teachers, parents, coaches, school staff, and other students” (p.28). Gurian and Ballew’s theory is that hormonal changes in males are the cause of the increased rage seen in the males.

Males are “brain-and testosterone-driven and they tend to lash out physically and with more sexual aggression” (p.28).

This behavior is also seen in the classroom between male and female teachers. When confronted with a harassment situation, many female teachers accept this because they feel powerless. When complaints are lodged against the aggressor, there is the possibility the female will lose her position. Sexual harassment comes in many forms: teasing, insinuation, and personal comments are just a few (2003).

According to Measor and Sikes (1992), some activists’ viewpoint is that sexual harassment is about dominance and the degrading of women. It is also presumed that some males feel intimidated by the presence of females in the classroom and work environment. Research conducted by Sanders (1997), shows evidence of hostile classroom environments are promoting iniquities and sexual harassment. Teachers are not aware of the contributions they (teachers) make to these behaviors. The behaviors are often in the forms of “eye contact, body language, and verbal expressions” (p. 3). Because teachers are not conscious of their actions, it is impossible to rectify the problems. Problems will continue to exist in the classrooms when boys are allowed to harass girls sexually because this is seen as typical conduct for boys. These actions will cause female students to suffer educational deficiencies throughout their educational process.

Education and Technology

Research conducted by Cole and Conlon (1994), gives further credence to the problem of gender-bias in technology in the classroom. The problem is not limited to one geographical location, but it encompasses other areas of the world. The research

conducted by Cole and Conlon was based on classrooms in Scotland and England. The focus of the research was on access to curriculum, course design, teachers' attitudes and teaching styles, and language. When addressing access to curriculum, evidence points to girls not having any tangible experience as a major problem in the classroom. Girls do not have the same opportunities that boys have in accessing computers in the home or at school. It is noted that "boys were six time more likely to have a computer at home than girls" (p. 2). This gives boys more access and familiarity with how computers work and they are more likely to understand the technological language. Knowledge and accessibility provide the boys a sense of security and they are less likely to be intimidated by the technical aspects (1994).

Cole and Conlon (1994), believe that including Information Technology (IT) in the curriculum of every student is imperative, and it is beneficial to the educational progress of the students. In order for society to advance in this technological era, both males and females, Blacks and Whites, and all ethnic groups must have equal access to IT. In designing course studies, there must be a transformation of how information is delivered, education is perceived, and programs are evaluated so that girls will be given a fair chance to succeed in the technology field. Girls are less likely to embrace the technology field if teachers do not present information that is interesting and more *girl-friendly*. Gender related language is a hindrance to girls wanting to enter the technology field (Cole and Conlon).

Young girls and even some adult females see terms such as "abort, chaining, thrashing, execute, and kill" (p.4) as connotations of violent behavior according to Cole and Conlon (1994). Donaldson (2000), added other terms that are perceived by females

as violent and threatening including “Web Master, system crashes, hacking, flaming someone, trashing a file, and having a system to die” (p. 33.). Some of these terms are both threatening and representative of sexual metaphors to females.

Gatta (2001), believes that gender bias is more covert at the college level than in the elementary schools. Women in the areas of science and technology do not feel that the environment is as comfortable and inviting as it could be for women. The language used is considered to be masculine in character when referring to the user in giving examples. This can present a negative influence on females and at times cause them to change their major from science and technology.

According to Cole and Conlon, (1994), in order to improve the attrition rate of girls in technology, teachers’ “attitude and teaching styles” (p.3) must change. Placing labels on students is a typical reason many females do not enter the technology arena. Indications are that the opinions girls have of technology is that it is more masculine and less suited for girls. These perceptions are based on references teachers make to boys and girls. Sensitivity to the feelings of girls must be taken into consideration when addressing the problem of gender and technology in the classroom.

Teachers are not the only ones to put labels on students. According to Bravo, Gilbert, and Kearney (2003), recent studies show peer groups are influential in the decisions many students make regarding technology courses. Stereotyping is more likely to come from those with whom the students have an association.

Research done by Macleod, Haywood, Haywood, and Anderson (2002), suggested the number of female undergraduate students using computers in the United Kingdom (UK) has increased in the past decade. The research data collected was used to

determine the ratio of female to male students using technology. The method used to collect the data was the use of short questionnaires. The information was collected before the students actually arrived at the university beginning in 1990 and ending in 1999. Students had to grade the questions based on a scale of one to five as to how relevant or vital it was to use a computer during their study at the University. In 1990 the gap between females and males using the computer was significantly wider. The ratio of male students to female students using the computer was “30% males to 15% females” (p.12). By 1999 the ratio was 65% for both male and female students (2002).

Interestingly, the attitudes of female students using computers were vastly different from male students using a computer. Females were more likely to use information and communications technology (ICT) for study and recreational purposes. Males on the other hand used ICT for recreational purposes more than for studying. The findings also concluded that female students were more likely to use a Macintosh while male students used a PC. There are also a cultural differences in the level of competency of the students. The last noted difference in the males and females was the level of confidence in the use of ICT. Males were more confident in working with ICT and this may be due to a majority of “males working in student technical support” Macloed et al. (2002).

According to Gatta (2001), there are many reasons that women are underrepresented in technology in educational programs. Some of the reasons are due to an unwelcoming atmosphere in the classroom, and in some instances bias is blatant, insinuated, or implied. Female faculty members who can be seen as mentors are underrepresented in the areas of science, math, and technology. Females need to have a

network system that is comfortable and inviting. Females often leave nontraditional majors simply because they have no one with whom they have a sense of connection. Many educational institutions lack mentors for females pursuing a careers in a technical field. The lack of this knowledge puts females at a disadvantage of knowing the possibilities of having a career in the field. Due to inferior instructional strategies found in technology curricula, women are at a greater risk of leaving the field of technology.

Chellman, Marra, and Roberts (2002), conducted a study on the relationship between gender, aesthetics, and computer hardware. One of the focuses of the study was the role gender plays in designing the components and software of the computer. An interesting point shown by the research was how deep the idea of masculinity has been integrated into the design and development of the computer. A question that is worth posing is what would the appearance of a computer be if females were given the opportunity to design one? Clearly they would be quite different because in contrast to men's thinking, females think of decoration and art when designing. Females would design computers that are more decorative instead of the standard grey. Chellman, Marra, and Roberts state that computers have been traditionally design by White males in the field of engineering (2002). The media's presentation of technology has contributed to women's perception that this is a man's world and women are not welcome. When featuring advertisements in technology with men and women together, most marketers depict the women in submissive roles. This can also be seen in the automobile industry and even within the home. As technology was introduced to the United States, researchers indicated that "marketers saw the woman as the stay at-home mother who would be the perfect target for television consumption" (p. 6).

The research conducted by Furger (1998) showed that parents can play a major role in how girls and boys view the computer. Children usually imitate the parents. If the parents are comfortable with using the computer and the Internet, children will also be more participative in classroom activities. It is especially important for mothers to be positive role models for their daughters. If the mothers are *tech savvy*, their daughters will more than likely follow in their mothers' footsteps and pursue courses and careers in technology.

Furger's study also showed that not having equal access to using the computer and technology in the classroom can generate extreme consequences to females. When there are not enough computers available in the classroom, the most forceful male students are the ones who gain access to them. Instructors can help the situation by making sure that all students have the same opportunities to the use of the computers. The study also noted "that girls in high school are more likely than boys to say they do not like math or science and doubt their abilities in both areas" (p. 156) and twice as many boys than girls say that math and science are courses they will pursue.

Physiological Differences

Allen, Gur, and Benbow's findings (as cited in Gurian & Ballew, 2003) identified that men and women learn and think differently. This study was focused on the brain's developmental process, how it is structured, and how it functions. The findings of the study indicated that girls acquire more *sensory* skills than boys in relation to smelling, hearing, and touching. Girls' verbal skills are also more developed than males during the developmental process. Males tend to be more developed in nonverbal skills at this stage. Another indication of the study is that the male brain has a longer developmental process

thereby giving them an advantage in analytical skills.

Gurian and Ballew's research also showed that chemical and hormonal differences were noted in the girls and boys. Boys are more irresponsible than girls because serotonin, the hormone that regulates disposition is secreted in lower amounts in boys than in girls. Males and females have the same type of hormones but there are dominant ones in each of the sexes. The females possess more estrogen and progesterone, the hormones linked to development and relationships; while the males possess more testosterone linked to sexual drives and anger. These hormones are the defining characteristics in dictating the distinction between males and females. As males begin to develop into puberty and the testosterone level rises, they become more aggressive. Girls on the other hand tend to see a rise in estrogen level indicating the onset of puberty and the menstrual cycle (2003).

The last noted differences between males and females according to Gurain and Ballew (2003), are functional differences. One of the interesting observations in functional differences is that the male brain is besieged by stimulants at a much faster rate than females. These actions are directly linked to less activity occurring in many places of the brain. Boys and girls adapt differently when it comes to audio and visual perceptions and girls are more advanced than boys in both areas. Interestingly, boys do better in classroom settings if they are seated toward the front of the class.

Strategies

The lack of skilled and specialized teachers in science and technology fields is a major problem within the school system, according to Gatta (2001). Teachers are self-conscious about integrating technology into the classrooms because of their limited

technical skills. It would not be an easy decision for the teachers to encourage students to enroll in these classes, if the teachers are insecure in teaching the class. It is vitally important that training in technology usage be included in the staff development curriculum of all teachers.

According to Macleod et al. (2002), students need to be educated in the nature and application of technology in their program of study and to concentrate on the subject matter in the initial period of the school year. Increasing female participation in the technical support area is another way to help females develop more confidence in using technology. Gatta's (2001) study further suggests that the field of technology is male dominated and this creates a lack of mentors for female students. She suggests that it is important for students at all levels to have someone for support, especially at the graduate level.

The lack of role models for female students in the technology field is because women hold a minority of faculty positions. The lack of representation of female mentors also hinders female students from acquiring the knowledge of career opportunities. It is important for women to have mentors and role models to maintain confidence in their ability to succeed in the field (Donaldson, 2000).

According to Norby (n.d.), mentors are needed in the classroom as well as the workplace to help close the gap. Students need someone who looks like them or who share some of the characteristics desired by the student. The study conducted by Esler and Esler (as cited in Norby n.d.), indicated that workplace role models are also needed in the workplace for women because on the *road to success* women are faced with many problems. Even with positive efforts on the part of the government, women are still

underrepresented in science and other fields of technology.

Chesler and Chesler (2002), reiterate mentoring as a strategy to “improving the presence, retention, and advancement of women graduate students and faculty in engineering” (p. 49). Mentors will also promote diversity and this will lead to more equal opportunities and fairer practices in academia. In order for mentoring programs to be effective and successful, educational and corporate organizations must be committed to giving “support, make the most positive value of gender and racial diversity, and engage people with different skills, styles and values in the effort to improve the organizational environment” (p.54). Changes in educational environments will enhance well-being and help retain females in the field of technology.

According to Furger (1998), the time has come when females are given the same opportunities as males to have access in this age of technology. This is the appropriate time when schools need to take a proactive approach in introducing girls to this age of technology. The home is the most appropriate place to begin the process of getting girls to think technology. Equal access for girls in the home is a must. Having a regular routine when family members can access the computer can do this. Priority should be given to family members needing to complete homework before those seeking entertainment.

Girls need to be given time alone to search the Web in order to make them more comfortable with technology. Choosing age-appropriate software will help to ease the stress many girls may feel during the investigative period. Girls should be allowed to choose software that is *girl friendly* in order to promote gender equity. One of the ways parents and teachers can promote gender equity is to select programs that feature males and females as principal players. These concepts must be transferred to the school in

order to get females interested in taking courses in math and science. The ability to acquire proficiency in *problem-solving and critical-thinking* is crucial in many of the current careers (Furger, 1998).

The study conducted by Brown (2001), indicated that academia could attract women and minorities by “appealing to their intellect and emotions” (p. 2). There are four ways Brown gives that will help to attract women and minorities in technology. The first, including technology in areas that are interesting to women and minorities, can motivate the group to become more familiar with different applications in using technology. Implementing cultural awareness in school curriculum will help to encourage African Americans into the field because of their strong connection to the community. Promoting *community outreach* through mentoring programs will also encourage women and minorities in the area of technology. (p. 3).

Second, Brown states that changing society’s attitudes is another concept to attracting this underrepresented group into the technology field. Research shows that from 1984 to 1996 the graduation rate for women receiving bachelor’s degrees in technology continually declined. Society must recognize the necessity to including women in technology.

The third way that will help attract women and minorities into the field of technology is to encourage them to take courses that include business. It is beneficial to businesses for technology to be a requirement in students’ curriculum because employees will need to be *tech savvy* to compete in the workplace.

The fourth way to attract women and minorities is to make sure career information is provided to them. Based on the research, the demand for computer scientists and

systems analysts will grow by 111 % between 1992 and 2005 and women and minorities must be provided this critical information. Students will need *real world experience* for this information to be useful to the students (p. 4).

Brown's study suggests that school systems within America are not equipping students properly to compete in this technological society. America is falling behind other nations in attaining PhDs and Masters in the field of Technology. Almost half of the PhDs and one third of the Masters go to graduates from foreign nations. American schools need to change how instructors teach and students learns. There must be a "collaborative and cooperative learning environment to have effective teaching strategies to promote learning through interactions with others" (p. 4).

Technology needs to be introduced to minorities and girls at an early age. Introducing them to the concept is vital in elementary school and continuing through high school. This will prepare students to enter college with sufficient knowledge to compete in math, science, and other technological subjects. Schools must be willing to provide role models and mentors for female and minority students. This will break down many forms of discrimination and stereotyping. Teachers need to promote equity in the classroom by providing access to all students. It is important that software in the classroom is without *gender and ethnic bias* (P. 5). Teachers who are well trained in how technology is used are a benefit to the continuing recruitment and retention of students. Without a well qualified instructional staff America will continue to suffer in this technology society (Brown, 2001).

The 1995 AAUW report offers that "schools need to begin at the preschool level in choosing activities that appeal to boys and girls" (p. 123). How classroom activities are

designed will affect the learning ability of all students. Teachers need to be sensitive to that fact. There are strategies that teachers can use in eliminating gender bias in the classrooms. Using multiple textbooks, removing bias expressions, and having the same expectations of boys and girls are a few examples.

According to Hughes (1998), empowerment and building the self-esteem of females are keys to the success of women in the field of technology. In order for students to receive favorable “benefits from innovative communication and information technologies, achievable goals need to be established” (p. 243). Setting goals that are practical and attainable must be put into place and exercised. In order to reach these goals for equity teachers must raise their expectations of the potentials of the female students to achieve effective educational results.

CONCLUSIONS AND RECOMMENDATIONS

The reviewer's conclusion is that a gender gap does exist in technology use in the classroom and the workplace. Based on the review, society as a whole is not doing well in promoting equal access to all of its members. Educators and employers must take an active role to create an environment that is inclusive of all members of society.

Educators need to listen to what female students are saying before engaging them to enter fields that are not technology oriented.

Classroom Interactions

Educators consciously or perhaps unconsciously interreact with boys differently than they do with girls. This conclusion is based on evidence gathered from the information on the type of questions teachers ask boys and girls, the responses teachers gave to the answers received, teachers body language, and the type of support and encouragement students received from the teachers (AAUW, 1995).

Males are encouraged to pursue courses and careers that are technologically oriented. Females on the other hand are encouraged to pursue careers that are perceived to be feminine, such as clerical and caregivers. Society has labeled these careers as what is standard for males and females (AAUW, 1995).

Teachers have different expectations for boys and girls. Boys are expected to have a higher rate of achievement than girls, even if girls have already out performed the boys. Teachers must realize that everyone has a different style of learning, especially when it comes to addressing the gender issues. In order to compensate for those styles educators must include the different learning styles in their teaching strategies, according to Measer and Sikes (1992).

Minorities

Gender and ethnicity played a role in how educators interacted with minority students. Teachers gave White males preferential treatment over all students and their expectations for minorities were lower than for White males, according to the 1995 AAUW report.

Research provided by Houston-Brown (2002) showed that African Americans' and Hispanics' perceptions of the lack of representation in the field of technology in the classroom and the workplace is real. There are a number of reasons that led to the lack of representation in the field, including high cost for taking courses and training, the economic status of many African Americans and Hispanics, and the lack of accessibility to computers in homes. These barriers caused minorities to be at a disadvantage when entering the educational system and the workplace.

Learning Styles

Gurian and Bellew (2003) found that learning styles do affect teaching strategies when preparing students to enter the workplace. Teachers may approach this problem by incorporating different techniques into their class format to help solve the problem. Based on the research boys learn from abstract ideas and concepts, whereas girls learn from using tangible evidence.

Girls have better sensory, listening, and verbal skill than boys. They are more sensitive to smelling, hearing, and touching. Boys react differently to hormonal changes than girls. Boys possess a hormone called testosterone which produces more sexual and aggressive behaviors (2003).

Gurian and Bellew indicated there is a vast difference in how adults learn and how boys and girls learn. Adults are more prepared as to what they want to accomplish when they enter the educational system. Adults take a more active part in their learning process. The dominance of men in technology does have an effect on the survival of women in the field. Many women are not equipped to handle the type of strategies men use in pursuing a career in a male-dominated field. Women have not been able to penetrate the *glass ceiling* in the corporate world.

Workplace

The conclusions of this review on the workplace is that women are paid much less than men for doing the same job, thereby creating a gender gap in the workplace. The *glass ceiling* is still in existence, to protect the power held by White men. Women do not have the same advantages afforded to their male counterparts and education and training are not equally accessible because of stereotyping and societal barriers. Women are seen as caregivers thus devaluing their abilities and potentials (Srinivas, n.d.).

The literature also shows that female Subject Matter Experts (SMEs) are necessary in the workplace and they must be given the same support and opportunities that are given to men by the governing body. Female SMEs are a great asset to any organization because they are the best role models in overcoming the shortage of women in key positions.

Barriers

Sexual harassment and physical attacks are major barriers to females in the classrooms. Harassment is not always sexual and physical, but may be in the form of teasing, insinuation, touching, and personal comments. Without interventions of the

educators and employers, this can be devastating to females in the classroom and workplace. Harassment of females in the classroom or workplace is about power and dominance, which society has assigned to male's characteristics (Measor & Sikes, 1992).

Equal access to education and technology in the classroom is difficult for women to achieve. Women are excluded from this arena through curriculum design, computer and software design, cultural indifference, and how terminology is used (Chellman, Marra, & Roberts, 2002; Donaldson, 2000).

There are not enough women as role models and mentors in the classroom or the workplace. The glass ceiling is still in existence and only a few women have been able to penetrate it. There is lack of women and minorities in the educational and training processes in the field of technology (Norby, n.d.).

Strategies

Educators need to implement strategies to encourage females and minorities to participate in science and math classes. Including diversity and cultural training in the classrooms can do this. Parents and educators must work together to achieve this goal through positive interactions with the students. Students must be given the responsibility of taking charge of one's own learning.

Mentors should be included in a part of the culture of the educational system and the workplace to attract female and minority students into male-dominated fields. Society need to make a collaborative effort to close the gender gaps in our schools and the workplace. Educational institutions and employers need to make use of females and people of Color mentors, role models, and Subject Matter Experts (SMEs) to encourage

females to enter the field of technology. This can be done if educators and employers take a proactive role in implementing diversity programs and training. These actions can provide a friendly environment for all students and employees in the workplace.

Educators can help to promote females and minorities by encouraging them to pursue careers in the area of technology.

Teachers must change their attitudes and strategies when interacting with students in the classroom. This should be a part of the teacher's staff development process.

Strategies to include diverse learning styles should be included in the curriculum to accommodate the different learning styles of all students. The last recommendation for educational institutions is to include math, science, and other technology courses as a requirement in all areas of study.

Finally, technology hardware and software should be designed in a gender-neutral format to ease the fears and negative perceptions females have regarding technology and its usage. If all the recommendations are taken to heart in both the educational system and the workplace, society will be a step closer in bridging the gender gap in technology use from the classroom to the workplace.

Summary

In the final analysis, the reviewer concluded that a gender gap does exist in the classroom and the workplace, especially in the area of technology. This determination is based on the definitions for gender gap and many noted differences that encompass the lives of males and females. A gender gap exists between males and females when different principles and practices apply in classroom and workplace activities or interactions. These differences can be seen when preferences are given to males or females. This literature review identifies that the differences that exist are preferences to the males while detrimental to the females.

Strategies that can help to bridge the gender gap include changing educators and White males' attitudes, including diversity training, and providing female mentors and role models in the classroom and the workplace environments. The attitude that White men are privileged based on their concept of superiority has to be changed.

Wages in the workplace need to be based on qualifications and not on association. The work performed by women and minorities should be equally valued as men are and they should receive equal wages.

It is the opinion of the reviewer that a gender gap does exist in the classroom and the workplace and strategies must be used to eliminate the gap. In a society that is so engrossed in the use of technology, it is imperative that educators and employers support women who are seeking careers in the field of technology in order for them to compete with their male-counterparts. Finally, the implementation of diversity training, mentoring, role modeling, equal access, and equal pay is a major step that educators and employers can take in bridging the gap and creating equity in their organization.

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