To make the most of the information age, you need to be male, speak English and live in an industrialised country" (Holderness, 1993, p. 36).

Though several years have passed since this controversial statement was made, there is evidence that it remains true in many situations. It is our view that serious obstacles are still placed in the way of female students using computers, that can easily be removed by a teacher who is aware that they exist. In this article we raise a number of issues relating to gender equity in the use of information technology in schools, and suggest a number of measures that teachers can take to reduce potential inequities in the information technology classroom.

Holderness’s statement above makes a strong claim about access to technology, implying that females are somehow excluded from all the benefits of information technology. The question needs to be asked: “Is Holderness correct, and if so, what can be done to address the situation he describes?”. In this paper we concur with Bradley (1993), that although the situation for women using technology has improved, women still do not have equal access to the rewards of education and employment. We offer some ideas about the causes of this situation. We conclude by giving some suggestions for how teachers might make the classroom environment more conducive to equitable participation by girls and boys in information technology based activities.

Gender equity in information technology

The word ‘equity’ has become an important part of the vocabulary of teachers in recent years. After decades of inequitable treatment of females in education systems, teachers and others in the education system have been forced to take note of previously ignored hindrances to full and equal access to education by females and members of minority groups. Hansen (1996) defined equity as “a system of rules and principles based on fairness and justice”, and listed a number of topics that it encompassed, including:

- under-representation,
- stereotyping,
- disenfranchisement,
- misunderstanding,
- bias,
- discrimination, and
- prejudice (Hansen, 1996, p. 2).

In terms of information technology, equity has much to do with access, defined by Collins Australian Dictionary (1985) as “the right to enter or use”. As Balka (in Shade, 1993) argued, the major issue facing women today is their right to equal access to information technology. Since gaining the benefits of information technology requires the use of information technology machinery (hardware), if a person is denied access to that machinery then the person is simultaneously denied access to the benefits that flow from it.

Workplace equity

It is relevant here to look at the question of whether or not females have equal access to technology in the workplace. Issues of equity confronted by women globally are reflected in the levels of work participation and educational attainment (Rees, 1992). Though Behan (in Goldsworthy & Meredith, 1993) stated that there are now many successful women in computing, Rasmussen (in Grundy, Kohler, Oechtering & Petersen, 1997) stated that the level of women among computer professionals has always been low and has been declining steadily over the last ten years. The fact that women are outnumbered in the information technology industry has been noted by Monk and Chester (1997) and Liggins (in Goldsworthy & Meredith, 1993), who has worked in the computer industry for the past 25 years. Liggins observed that “there has not been much improvement in the proportion of women employed in the field during this time” (p. 12).

Equity in higher education

While Adams, Emms, Green, and Owen (1994) stated that in the last twenty
years there has been an increase in female students studying computer and technology subjects, Teague and Clarke (1994) argued that women’s enrolments in technology classes are still below 50 percent and need to be improved. This view is supported by Underwood and Maddern (1999), who showed that the percentage of female students enrolled in Queensland University of Technology’s undergraduate science courses had fallen each year between 1993 to 1998 from 23.7% to 17.8%. A number of authors (e.g., Chaika, 1995; Granstam, 1988; Teague & Clarke, 1994; Underwood & Maddern, 1999) have pointed out that, by avoiding computers, women are cutting off career options that are well paid and have good employment prospects.

Equity in society

Women also face other issues besides those in work and education, regarding equitable access to information technology (Shade, 1993). Other areas of concern for women’s access include:

• harassment of females on the Internet (Shade, 1993, Spertus, 1996);
• software programs that are targeted mainly at a male audience (Chaika, 1995; Lovegrove & Hall, 1996);
• attitudes towards women, and attitudes held by women themselves, in relation to new technologies (Silverman & Pritchard, 1993);
• the perception that females are not as competent with computers as males (Lovegrove & Hall, 1996);
• the fact that “over 90% of identifiable names on the Internet are male” (Holderness, 1993, p. 39); and
• the image of the gender appropriateness of computers portrayed by the media and other sections of society (Nelson & Cooper, 1989).

Given the prevalence of the above factors, it is no surprise that they are influencing girls’ attitudes regarding accessing information technologies.

Reasons for gender inequality.

Fabricant and Adner (1989) suggested that the small number of women in technical fields is not a result of differences in ability but caused by the decision made by women not to study technical subjects. Girls observe the association between males and computers and decide they don’t belong (Sanders & Stone, 1986). While no significant gender differences are being shown in marks obtained for computing courses (Scott, 1996), the factors which discourage some high school students from taking technology subjects have a particularly strong impact on girls (Silverman & Pritchard, 1993). Factors that can discourage girls from following these options include:

• lack of knowledge of technical occupations (Ayersman & Reed, 1996),
• the failure to connect class work with technical careers (Wilcox, 1996), combined with
• the traditional gender stereotypes about subjects, courses and occupations (Silverman & Pritchard, 1993).

There are indications that girls’ attitudes towards technology are established at an early age (Granstam, 1988). Children by the age of seven are already associating boys with computers (Lovegrove & Hall, 1996), apparently due largely to differing experiences with computers (Granstam, 1988).

The influence of computer games

Gunter (in Teague and Clarke, 1994) drew attention to the fact that boys’ interest in computer games and how games are produced motivates a number of them to study computing. Computer interest is often associated with an interest in "video games" (Nelson & Cooper, 1989, p. 203) as these are generally the first contact children have with computers (Wilcox, 1996). Jacob (in Wilcox, 1996) pointed out that many children do not enjoy these video games and a large proportion of those turned off by them are girls. The aggressive action and language used in the majority of the games has been shown as not appealing to girls (Wilburg, 1995, McInerney & Park, 1986) and leads girls to feel that computing is not for them and is “neither interesting nor meaningful” (Bransgrove, 1994, p. 23).

Influence of friends, family and teachers

Sexism among peers (Silverman & Pritchard, 1993), traditional stereotyping of occupations (Scott, 1996) and a limited number of accessible role models (Silverman & Pritchard, 1993) all contribute to the inequality in access to technology for females in industrialised countries. Silverman and Pritchard (1993) stated that more girls than boys report being discouraged from technology education classes; Teague and Clarke (1994) noted that girls who do take computer courses have often been encouraged by relatives, friends and teachers. This encouragement is important to girls, as it is likely that:

• girls have less experience than boys with the technology (Scott, 1996),
• they have a less positive attitude towards computers than boys (Ayersman & Reed, 1996, Sacks, Bellisimo & Mergendoller, 1994) and
• therefore fewer girls will use computers or take further computing studies (Scott, 1996).

Encouraging greater access for girls to information technology society attitudes

In order to increase the interest of girls in technology certain measures are seen as helpful:

• making the Internet more friendly to female users (Shade, 1993),
• developing gender-neutral software (Litterton, Light, Barnes, & Messer, 1993),
• producing computer games that appeal to girls (Chaika, 1995) and
• providing role models of women involved in the information technology industry (Granstam, 1988).

By addressing these issues the stereotypical view of computers being a “male domain” should diminish (Fabricant & Adner, 1989), though once the stereotypes are overcome girls still have to contend with their own attitude towards technology (Granstam, 1988).

Females’ exposure to and experience with technology

Fabricant and Adner (1989) stated
that girls often have a more negative attitude towards computer use; this may be attributed to lack of experience with computers (Silverman & Pritchard, 1993; Russell, 1995). Gender differences in attitude towards use of information technology was found to diminish with computer experience (Sacks, Bellisimo & Mergendoller, 1994). This highlights the point that gender is not the important variable in attitude, but rather the opportunity to gain experience and knowledge (Scott, 1996).

Kirk (1992, p. 30) pointed out that the inequity problem "may not be as serious as we are led to believe" and proposed that inequalities be overcome by exposure to computers. The exposure to computers should begin at an early age (Alloway, 1995), perhaps as early as at age five (Granstam, 1988) as the perception of computers being a male domain has been shown to be present in children as early as age seven (Lovegrove & Hall, 1996).

Career information

Information should be made available to young girls concerning various technical occupations and the educational prerequisites needed to attain these occupations (Granstam, 1988) and attitudes towards the possibilities of girls gaining a technology-based occupation should be addressed (Fabricant & Adner, 1989). Shade (1993) discussed the fact that attention must also be paid to the metaphors used and images portrayed, so they don't exclude women, or include them in undesirable ways. This would assist in making the Internet and various forms of computer networks a desirable tool for women to use.

Implications for education

It should be realised that the introduction of computers into schools has not caused the inequalities described in this article; gender inequalities already existed in schools before computers were introduced (Kirk, 1992). However, as noted by Wiburg (1995), the way information technology is taught in schools has the capacity to change or reinforce these inequalities.

Improving teacher awareness

One strategy for improving the situation for girls using information technology is to improve the teachers' awareness of the issues involved. Teachers need to be aware of the gender implications in order to provide the best learning environment for all students (Lovegrove & Hall, 1996). Therefore equity issues are an important component to include in future teachers' curriculum (Hansen, 1996). A study by Thurston (1990) showed that after teachers undertook an equity training programme there was a more equitable attitude regarding use of computers in their classrooms and reported increases in their female students' attitudes to and use of computers. Granstam (1988) stated that it is also important for teachers to be trained in the use of technology, since teachers' negative attitudes, due to ignorance, may be passed on to their pupils.

Teaching strategies

Strategies that may be taken by teachers to reduce gender inequalities include:
- introduce information technology to students at an early age,
- change curricula to integrate technology,
- provide accurate information about careers in information technology,
- challenge stereotypes about gender and technology,
- invite female technology users to speak to students, and
- take courses to improve their own confidence and experience with computers.

The need to introduce information technology to children at an early age has been discussed previously (Alloway, 1995). Fabricant and Adner (1989) also suggested that technology should be incorporated throughout the curriculum and children should be encouraged to use computers for completing projects in a range of subjects. This would assist children to develop an appreciation of the diverse use of computers (Scott, 1996) and make the connection between school subjects and use of technology in workplaces clearer (Silverman & Pritchard, 1993). It is also necessary for teachers to provide students with encouragement and detailed information about what careers are available and what educational qualifications are needed to attain them (Teague & Clarke, 1994). Stereotypes of differing gender occupations should be challenged with the provision of this information (Silverman & Pritchard, 1993) and can be emphasised by female technologists talking to young students about their education and occupation (Granstam, 1988). Silverman and Pritchard (1993) argued that although participation rates are low, once girls enter specific technology courses the teaching methods and classroom atmosphere provided by an equity-trained teacher can change the current trend of girls feeling that computers are not for them (Bransgrove, 1994).

Conclusion

As we mentioned at the beginning of this article, women still do not have equal access to information technology and this is one of the major issues facing women today. We discussed a number of aspects to the inequities faced by women with regards to information technology, including inequities in employment, higher education, schools and society generally. A number of reasons have been proposed for this situation, including traditional gender stereotypes, lack of information about careers for women, lack of experience with computers and the types of computer games offered to children.

It is important for teachers at all school levels to be aware of actions they can take to reduce inequities for girls with regards to information technology. Teachers of young children need to ensure that their students (female and male) have experience with information technology, which should help assist the students to develop confidence with technology. This should also help them accept computers as devices to be used by both genders, and for many varied purposes. Teachers in secondary schools need to make sure that students are well informed of career choices, including those in information technology. Secondary teachers should
ensure that students’ prejudices regarding gender stereotypes and technology are challenged; use can be made of female users of information technology to act as suitable role models in this regard.

To summarise, we believe that teachers can do much to improve the access that females have to information technology. Once students have been exposed to equitable computer classes, the gender component in Holderness’s (1993) statement that “to make the most of the information age, you need to be male, speak English and live in an industrialised country” (p. 36) should be extinguished. Well-designed and -implemented school equity programmes will assist in improving girls’ access to information technology, and change attitudes not only of the girls themselves but within society generally (Silverman & Pritchard, 1993).

**REFERENCES**


