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# Diversity and Technology: Classroom Implications of the Digital Divide

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# Diversity and Technology: Classroom Implications of the Digital Divide

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This paper analyzes the intersection of technology and diversity in classrooms with reference to the implications of the inequity of access and usage for under-represented groups including low-income, minority students, students from culturally diverse backgrounds, students with disabilities, and female students. Strategies at national and individual levels to facilitate a process of digital inclusion for all children are identified.

While the advent of technology into our everyday lives has had indisputable benefits, it has also led to some unfortunate, even unexpected, consequences. The most insidious of these consequences is the inequitable access to information and communication technologies (ICT) between privileged and underprivileged groups, often referred to as the digital divide (Blau, 2002; Carvin, 2000; Pearson, 2001). This disparity of access affects specific populations primarily based on geography, income and race. Generally, children who are already disadvantaged are the least likely to have access to the new technology. Statistics show that rural, young, minority and single-parent households lag behind the national average in both computer ownership and Internet access (Carvin, 2000; Hinson & Daniel, 2001; Katsinas & Moeck, 2002; Wilhelm, Carmen, & Reynolds, 2002).

Closely associated with lack of access is the issue of digital literacy (Carvin, 2000; Cullen, 2001; Menard-Warwick & Dabach, 2002), defined as "a set of habits through which individuals use computer technology for learning, work, socializing, and fun" (Hargittai, 2002, p. 3). This article analyzes the intersection of technology and diversity in classrooms with reference to the implications of the inequity of access and usage for under-represented groups including low-income, minority students, students from culturally diverse backgrounds, students with disabilities, and female students.

## What is the Digital Divide

In 1995, the U.S. Commerce Department's National Telecommunications and Information Administration (NTIA) released the first report in its *Falling Through the Net* series analyzing telephone, computer, and online access penetration rates throughout the United States, identifying several categories of information have-nots (NTIA, 1999; Singleton & Mast, 2000). Statistics showed that households earning incomes over $75,000 were over 20 times more likely to have home Internet access than those at the lowest income levels, and, in rural areas, those with college degrees were 11 times more likely to have a home computer and 26 times more likely to have home Internet access than those with just an elementary school education (Carvin, 2000). Generally, minority children living in poor families, and particularly those living in high poverty neighborhoods were the least likely to have a computer or access to the Internet (Wilhelm, Carmen, & Reynolds, 2002).

In its latest report in 2002, however, the NTIA announced that the Digital Divide was rapidly closing, based on statistics that indicated significant gains in computer ownership and Internet access in all demographic groups and geographic locations (Cooper & Victory, 2002). For instance, between 1993 and 2001, the share of all children, ages 3 to 17, living in households with computers increased from 32% to 71% (Wilhelm et al., 2002). By 2000, 98% of all classrooms had computers (Swain & Pearson, 2003), and 25% of school-age children who did not have computers at home were able to access them at school, reducing the number of children who had no access to ICT (Wilhelm et al.). Similarly, while only 11% of children were connected to the Internet from home in 1997, in 2001, this figure had increased to 41% (Wilhelm et al.), and Internet access for rural households approximated those of households across the country (Malecki, 2003).

Yet, the gap not only still persists, it has actually widened for many groups. For one, what constitutes access is hard to define, suggesting that there may be different levels of access. For instance, Blau (2002) notes that while some may own home computers, others may only have access at work, school, or at libraries. Malecki (2003) states that, although

access to the Internet through digital subscriber line (DSL) technology in rural areas has improved, the higher subscription rates for rural individual homeowners has resulted in the rural-urban gap becoming larger in 2002 than it was in 2000. Hargittai (2002) points to differences in technical access or the physical availability of the technology, and in social access or the professional knowledge and technical skills necessary to benefit from information technologies.

For another, mere access or a simple transferring of resources to those without computers is insufficient to solve the problem. The distinction between technical and social access indicates the presence of a second-level digital divide, or digital literacy, which includes patterns of use, availability of technical support and ability to use the Internet or application packages effectively (Carvin, 2000; Hargittai, 2002; Menard-Warwick & Dabach, 2002; Swain & Pearson, 2003). For instance, although many senior citizens may be able to afford personal computers and, therefore, have access to them, few actually use them. In 2000, just 15% of people over age 65, most of whom were White, male, wealthy, and very well-educated, used the Internet (Shin, 2005). Similarly, schools in White suburban neighborhoods were more likely than schools with low-income minority students to utilize application packages and software programs that allow students to develop higher order thinking skills, such as communication, research, problem-solving and decision-making skills (Swain & Pearson, 2003). Indeed, as Blau (2002) suggested, "the digital divide actually becomes more crucial as an issue as overall access grows, because that's when lack of access will be not just an inconvenience but a true barrier" (p. 51). In the following sections of the paper, we analyze the implications of both digital divide (relating to access) and digital literacy (relating to use) for specific groups of students.

### Low-Income Minority Students

Because the digital divide is related primarily to inequity of resources, the largest group it affects is students from low-income, minority families. The impact is experienced both in terms of demographics (i.e., income, race, and family structure) and in terms of geography or region (i.e., urban or inner city and rural areas as compared to suburban areas). This section presents statistics that illustrate these differences, and analyzes the implications for low-income, minority students who experienced a lack of access at both the home and in school, and the lack of usage for the acquisition of information and communication technology (ICT) skills.

*Impact by demographics and geography.* Low-income minority students experience the digital divide in terms of both access and usage. These disparities are primarily based on income, race, and family type. For instance, in 2001, among households earning $15,000 or less a year, only 33% of children had a computer at home and 14% had Internet connections, compared to 95% and 63% respectively of children in households earning $75,000 or more a year (Wilhelm et al., 2002). Similarly, studies have found that Whites are twice more likely to own a home computer than African Americans or Hispanics (Pearson, 2001; Wilhelm et al.), and even though all three groups increased their technology acquisition between 1998 and 2000, this difference in access rates was unchanged (Swain & Pearson, 2003). More significantly, the most socio-economically disadvantaged White and Asian American households are much more likely to own computers and have home Internet access than similarly disadvantaged Hispanic and African American households (Gorski, 2005). Further, the lack of data on computer and Internet use among Native Americans after 1999, as Gorski puts it, "illustrates the larger complexity of the racial digital divide as a symptom of systemic racism" (p. 26). Finally, 49% of children who lived with a single mother had access to a home computer and 27% had connections to the Internet, compared to 79% and 47% respectively of children who lived with married parents in 2001 (Wilhelm et al.).

Low-income students may be doubly disadvantaged by a lack of access both in schools and at home as governmental economic policies and practices have impeded electronic and telephone service provision in remote, rural areas and inner cities (Carvin, 2000; Katsinas & Moeck, 2002; Malecki, 2003; Wilhelm et al., 2002). As a result, homes may lack the hardware resources needed to be Internet-ready or wired. Additionally, limited resources at home may mean that parents cannot afford to subscribe to online services, particularly at the higher rates that currently prevail in rural areas (Malecki). In 2000, only 53% of children who lived in inner cities had access to a computer and 24% used the Internet, compared to 61% and 29% of rural children, and 73% and 35% of suburban children respectively (Wilhelm et al.). Further, the 10 states that had 45% or fewer households with children able to access the Internet from home also had low overall rankings for child well-being, and were all located in the South or Southwest (Katsinas & Moeck; Wilhelm et al.).

*Lack of access.* Schools in inner city and rural areas are often battling a shortage of resources in which computers become a scarce commodity (Guice & McCoy, 2001; Malecki, 2003; Swain & Pearson, 2003). For instance, schools with a minority population greater than 50% have computers in only 37% of the classrooms, compared to 57% in schools with a minority population of less than 6% (Pearson, 2001). Indeed, Pearson notes, the more students a school has from a minority or low socioeconomic group, the higher the ratio of students to computers, peaking at 32 to 1. In such cases, students end up having to share a computer with a peer or peers in a once-a-week session in a computer lab. Often,

students may have no access to computers at school at all as the only one in the classroom is for the teacher's sole use.

Limited resources also indicates that schools will be unlikely to afford to purchase or have the latest, cutting edge software programs or access to the Internet (Gorski, 2005; Pearson, 2001; Swain & Pearson, 2003). The technology available in schools with a majority of students from low-income families is usually 1 to 2 years behind schools with students from middle-income families and 3 to 4 years behind schools with students from high-income families (Swain & Pearson). Similarly, the disparity between Whites and minority groups regarding access to Internet has widened: Over 20% of White students have Internet access in schools as compared to 15% of African American students and 12% of Hispanic students (Gorski; Pearson). Schools where 71% or more of the students received free or reduced lunches have a ratio of 16 to 1 of students to computers with Internet access as compared to a ratio of 7 to 1 in schools where 11% or less of the students received free or reduced lunches (Gorski; Swain & Pearson).

*Lack of usage.* Even if schools and households have computers, digital literacy continues to be a barrier (Blau, 2002; Hargittai, 2002). Limited access affects the acquisition of skills needed to operate various application packages, impacting, in turn, students' academic performance in a myriad ways. Without Internet access, students are unable to research sources online for a school project, and students who miss a day of school are unable to access online programs that provide the day's homework and other important school-related information (Carvin, 2000). Research indicates that low-income students are less likely than affluent students to use their home computers for word processing, school assignments, and other standard software applications and more likely to use them for games (Becker & Ravitz, 1999; Wilhelm et al., 2002).

Further, scholars (e.g., Becker, 2000; Gorski, 2005; Swain & Pearson, 2003; Wilhelm et al., 2002) assert that differences in teachers' levels of comfort, familiarity and expertise related to educational technology are a crucial contributing factor to the digital literacy divide. Inner city and rural schools are less likely to have teachers who are been trained in technology over the past 5 years than suburban schools (Litton, 2002; Pearson & Swain, 2001).

Teachers need training not only on how to use technology but also on how to integrate it into the daily learning environment. For instance, Swain and Pearson (2003) found that teachers working in low socio-economic status schools used computers more than any other socioeconomic group. Yet, this frequency of use did not lead to gains in achievement because the computer was used primarily for lower-level thinking activities, such as drill and practice. In fact, minority, poor and urban students were more likely to use computers for lower-order thinking skills than their White, non-poor, and suburban counterparts (Gorski, 2005).

Later, students find their lack of skills in using application packages a serious impediment towards entering the competitive world of college or towards acquiring a service-based job (Blau, 2002). This situation is further compounded by the dearth of online resources for low-income users, including job listings for entry-level positions, local housing listings for low-rent apartments and homes in foreclosure, and general community information about schools and healthcare services (Gorski, 2005).

On the other hand, evidence is available to suggest benefits subsequent to computer usage by individuals from minority, poor and urban backgrounds. For example, Hinson and Daniel (2001) reported that when fourth grade teachers in seven inner city schools received basic training in using the Internet (e.g., email and posting homework assignments), and in conjunction with their students being given free computers and Internet access at home, the students (a) used the Internet to complete assignments, (b) search for information, (c) email each other, and (d) complete practice exercises for standardized tests, as well as play games. This also resulted in students receiving higher grades in school, while the parents became more involved in their children's schoolwork and increased their communication with the school (Hinson & Daniel).

### Students from Culturally Diverse Backgrounds

Although statistics indicate differential rates of access for different ethnic and racial groups, such as between African-American and Hispanic populations, these figures typically represent students who are economically disadvantaged and for whom lack of access is primarily a consequence of disparities in income rather than of culture. In this section, we consider access and usage for students who do not belong to the Western or mainstream culture that predominates in the United States, for whom lack of access may not be an economic barrier or is less of an obstacle than usage. This includes students belonging to cultural and ethnic groups outside the dominant, mainstream Western culture, students for whom English is not their primary or native language, and students who are recent immigrants to the United States. Factors that can affect the usage of technology for students from culturally diverse backgrounds include differences in cultural values (Cullen, 2001; Guice & McCoy, 2001) and in communication styles (Janey Wang, 2001), language barriers (National Education Association, 1997) and unfamiliarity with navigating services and basic hardware (Nel & Wilkinson, 2001).

*Differences in cultural values.* Differences in cultural values also impact access. Attitudes towards technology, such as the beliefs that computers are for brainy people or belong

to a middle-class White culture (Cullen, 2001; Hughes & Coyne, 1996), or concern that the Internet is unsafe for families because of unsuitable material are often barriers to access (Cullen). Similarly, studies indicate that Whites and People of Color use computers and the Internet for different reasons, differences that Gorski (2005) asserts "must be understood in the context of racist education, socialization, and expectations of (People of Color) in the United States and the connected maintenance of power and privilege among White people" (p. 31). For instance, while Whites tended to seek financial, product or health information online, African Americans were more likely to use the Internet to chat, play games or listen to music, and Hispanic Americans were more likely to own a DVD player and home theater than a home computer (Gorski).

Similarly, cultural or ethnic groups outside the predominantly Western culture of the Internet may choose not to access the Internet because its content is not relevant or interesting to them (Gorski, 2005; Litton, 2002; Martin & Litton, 2001). For instance, many software programs and online Web sites either use graphics that feature caricatures of ethnic children dressed in native costumes or do not represent people from diverse cultural backgrounds (Meadows, 2001), so that students, particularly young children, may find it difficult to connect with the characters or enjoy playing on and using these programs. As a result of government funding to help prepare Native Americans for careers in ICT, however, members of some tribal communities are building on their newly acquired skills to develop culturally-relevant content to include information, for instance, on their ancestry and heritage, herbal medicines, and traditional practices (Cullen, 2001). Similarly, Meadows suggested the use of digital cameras and scanners to take actual pictures of family members, community helpers, and community points of interest to create real-life or graphic representations of young children's cultural heritage.

Because of the inequitable availability of high-speed digital infrastructure in rural areas, combined with a lack of financial resources, many Native American communities that live on reservations lack access to computers and the Internet (Cullen, 2001; Guice & McCoy, 2001). However, these effects are further compounded by the values espoused by local tribal leaders whose decision it is whether or not to integrate computers and the Internet into the education system of tribal schools. Guice and McCoy's study of the digital divide in Native American tribal schools found that the most important issue affecting technology use in the schools was the tribes' attitudes towards education. The community that did not value education as highly had chosen not to invest in improving and bringing more resources, including technology, into the schools. Other communities, such as the Maori of New Zealand, have resisted displaying sacred information and icons on the Internet because the uncontrolled access it allows others has the potential for desecration or inappropriate use (Cullen). Families from culturally diverse backgrounds may have differing responses to using assistive technology (AT) for their children with disabilities consistent with their values, including declining AT services to maintain normalcy or reduce stigma or preferring a device that encourages cooperation over competition (Parette & Brotherson, 2004).

Closely associated with the idea that differing cultural responses to computers, based upon differences in values and beliefs, may affect patterns of use is the concept of *affect*, or the emotional response to computers, often based on differences in class (Menard-Warwick & Dabach, 2002). Many middle-class, White computer owners experience a sense of entitlement that facilitates their usage, that makes them feel quite comfortable playing games or sending email, while often, individuals from low-income or non-White backgrounds experience a sense of fear, particularly in the initial stages of learning to use a computer, and may be reluctant to even turn it on or touch the mouse (Hughes & Coyne, 1996; Menard-Warwick & Dabach; Nel & Wilkinson, 2001).

*Differences in communication styles.* Differences in communication styles may also affect students' usage of technology. In strongly networked cultural groups, which place high value on oral, personal communication and strong family and kinship networks, the use of computers for communication will not be a high priority (Cullen, 2001). Similarly, some students may belong to cultures where nonverbal cues, such as facial expression, gestures and tone of voice, are an integral part of the communication process, or face-to-face communication, such as a direct conversation or a phone call, is valued over the impersonal, more formal approach of print or written communication (Janey Wang, 2001). These students may, therefore, hesitate to use email to correspond with peers or teachers or sophisticated software presentation packages when preparing a report for class. This reluctance to use written communication also has implications for home-school connections, where parents may prefer to speak to teachers directly in a face-to-face meeting or over the phone, even if this is infrequent, rather than communicate via email or a notebook on a daily basis, both because they may prefer a direct interaction that affords opportunities for immediate feedback and because they may lack the literacy skills to write a message and the computer literacy skills to manipulate an email account (Rao & Kalyanpur, 2001).

*Language barriers.* As Cullen (2001) pointed out, "the use of English as the lingua franca of the Internet is far more inhibiting than English speakers realize" (p. 9). Less than 32% of all Web pages are in languages other than English (Gorski, 2005). For instance, a study of two Mexican families' usage of

the Internet (Menard-Warwick & Dabach, 2002) found that because the bilingual family that had advanced literacy skills in both English and Spanish had a much wider choice of Web sites than the family that spoke only Spanish, they accessed the Internet more often and for their professional, health, and children's educational purposes. Further, those websites that are in languages other than English often offer content that is based on stereotypical assumptions of interests. For instance, the links to business, industry, and health resources on the most popular Hispanic-focused Web portal, LatinoWeb, are in English, and those to shopping sites are in Spanish (Gorski).

There is also a dearth of high-quality software and Web sites designed for English-language learners (Gorski, 2005; Zehr, 2001). Students for whom English is a second language (ESL) or recently immigrated students with limited English proficiency (LEP) will find little courseware available in languages other than English (Zehr), or rarely find sites that incorporate graphics and other non-textbook tools for improving reading skills and English language tutorial programs (Gorski). As a result, students may have difficulty comprehending the content of Web sites they may need to access and research for school, and may, therefore, be reluctant to do so. Further, bilingual education programs tend to be poorly funded and often lack basic computer equipment, further restricting ESL students' access to computers to when they are mainstreamed into regular academic classrooms. However, as Zehr points out, since "the teachers of those classes are not trained in overcoming language and cultural barriers, this access is not meaningful" (p. 28).

Since directions in drop-down menus also are often in English, older LEP students may also be unable to acquire the skills to manipulate software programs. Web sites and software designed for English-language learners that are available often require considerable adaptation, as the vocabulary may be beyond the students' skill levels (Zehr, 2001). African students with English as their second language had greater problems acquiring computer literacy because the instructors taught through the medium of English and the practical guides and manuals were all in English (Nel & Wilkinson, 2001).

On the other hand, studies show that when ESL students, who are often marginalized in schools because of their lack of English language skills, are introduced to technology towards creating multimedia presentations of their homelands and cultural heritage, they feel empowered because they are given an opportunity to share information about their homelands, and feel less isolated from the rest of the student body because they are now perceived as the technology experts (National Education Association, 1997; Thornthwaite, 2001).

*Unfamiliarity with services and hardware.* Often, recently immigrated students with little or no exposure to computers in their native country, find the initial transition into a computer-rich environment difficult. Nel and Wilkinson (2001) described how a student who had never touched a computer and was required to take a course in computer literacy became a source of great amusement to instructor and peers alike when, on the first day of class, he could not find the any key. An otherwise bright student, he ended up failing the course because "the pace was just too fast for him" and he "became completely lost somewhere between *double click* and *pull down* menus" (Nel & Wilkinson, p. 57).

### Students with Disabilities

The inclusion of students with disabilities in general education has generated a plethora of software and hardware programs designed to provide the necessary accommodations and modifications that these students might need. However, access and usage continues to be limited for many students with disabilities (Jackson, 2003; Kaye, 2000). In this section, we analyze three factors that create a digital divide for students with disabilities: (a) lack of access, (b) funding, and (c) teacher training.

*Lack of access.* Individuals with disabilities are less likely to own a computer or use the Internet (Cullen, 2001; Gorski, 2005; Katsinas & Moeck, 2002; Kaye, 2000). In 2000, the NTIA revealed that nearly 60% of Americans with disabilities had never used a computer and were only half as likely to live in homes with Internet access than those without disabilities (Shapiro & Rohde, 2000). Further, the type of disabilities also affects access and use. While 40% of individuals with learning disabilities had Internet access from home or elsewhere, only 20% of individuals with visual impairments did. People with disabilities were less likely to have access to the Internet or use a computer than people without disabilities at all income levels, although this disparity did decline as income rose. At income levels of less than $25,000, the difference was over 50% and dropped to less than 20% at income levels of over $75,000. Disparities were also evident by gender and race. While the difference in rates of access for men with and without disabilities was 4% , it was 55% for women. Similarly, White and Asian Americans with disabilities were half as likely, and African Americans less than half as likely (41%), as their comparative group without disabilities to have Internet access. Hispanic Americans with or without disabilities were equally unlikely to have access. Finally, African Americans and Asian Americans had the greatest disparity between people with and without disabilities on a percentage basis with regard to access to computers.

In many cases, the disability itself is a barrier to access. When computers are located in buildings or classrooms that are not handicap-accessible, a person in a wheelchair cannot access the technology (Bergstahler, 2002; Gorski, 2005). Students with visual impairments will have difficulty

accessing a computer program that is text-based (Bergstahler; Jackson, 2003). Students who are blind will not be able to interpret graphics (e.g., such as pictures, drawings, image maps), or access print and videotape. Students with low vision who may see only a small portion of the screen at a time may become confused when Web pages are cluttered or when page layouts change from page to page (Bergstahler). Students who are color blind may have difficulty navigating pages or understanding content if pages are designed in such a way that they must distinguish between colors (Bergstahler). Students with motor or physical impairments that include limited fine motor ability may have problems manipulating a mouse or a regular keyboard, or selecting small buttons on a screen (Bergstahler, 2002). If their movements and input methods are slow paced, they may not be able to participate effectively in fast-paced chat communication (Bergstahler; Meyer & Rose, 2000). Students with hearing impairments cannot access audio output (Meyer & Rose), while students with some types of learning disabilities may have difficulty understanding Web sites when the information is cluttered, when confusing vocabulary or grammatical structure is used, or when the screen layout changes from one page to the next (Bergstahler).

The mandates for access to public programs and services for individuals with disabilities and AT for students with disabilities (e.g., Americans with Disabilities Act of 1990; Assistive Technology Act of 2004; Individuals with Disabilities Education Act of 1997) have provided the legal imperative for reducing some of these barriers of access. However, AT that provides these modifications is often expensive and therefore unavailable to students on a consistent and individual basis. Researchers have identified the two biggest barriers to AT access to be (a) lack of funding and (b) lack of knowledge about appropriate technology (Bergstahler, 2002; Jackson, 2003).

*Lack of funding.* Despite the mandate for AT devices and services to be made available to students with disabilities, school administrators with an eye to the needs of the larger population of regular education students, often hesitate before investing large sums of money to procure computers, particularly modified units, for this minority population. As a result of this lack of funding, in some cases, while regular education classrooms may be well equipped with computers, special education classrooms in the same school might not be (Bergstahler, 2001; Gorski, 2005; Jackson, 2003)

Administrators may hesitate for another reason, the fact that technology for students with special needs must be individualized and/or modified for students to accrue optimal benefits which often means incurring additional expenses (Jackson, 2003). A software program with a high degree of novelty and surprise that might engage a student with attention deficit hyperactivity disorder (ADHD) may be quite terrifying and therefore ineffective for a student with autism (Rose & Meyer, 2000). For students and their families, the bureaucracy of public programs and insurance companies becomes yet another barrier towards individualization or customizing of AT devices (Bergstahler, 2001).

*Lack of teacher training.* Teachers are often untrained in the use of AT devices, which, in turn, affects students' usage. As a result, teachers may not know about or have the skills to integrate technology into their instruction (Jackson, 2003). In some cases, teachers may be more likely to recommend low-tech devices that require little or no training and are inexpensive and readily available, such as switch-activated toys and communication boards, than high-tech devices that are more complex to use, such as sophisticated electronic communication devices and computer applications (Parette & Brotherson, 2004).

### Female Students

Research indicates that the digital divide impacts female students, too. Although women use computers and the Internet at roughly the same rate as men in the US, females continue to experience limited access to technology-related fields, to ICT software and a safe cyber culture (Gorski, 2005). In this section, we describe how societal attitudes and gender bias have affected girls' access to and usage of computers and the Internet.

*Societal attitudes as a barrier to access.* Historically, societal attitudes have disadvantaged female students, restricting them both from entering the field of computer technology and from spending extended time on computers (Cullen, 2001; Gorski, 2005; Groendal-Cobb & Patterson, 2002; Kirmani, 1992, 1995; Litton, 2002). The under-representation of women in software design and in the hard sciences fields, including mathematics, physics, and computer sciences, is attributed to the perpetuation of gender stereotypes that computers are a male activity or that women are academically less capable than men (Bennett, Brunner, & Honey, 1999; Gorski; Groendal-Cobb & Patterson; Litton). For instance, a large percentage of gender-identifiable characters in computer software programs are males who are assigned to high status positions and active roles while the females are represented in traditional roles (Kirova-Petrova, Bhargava, & McNair, 1999). When games do display a strong, heroic female lead character, she is usually portrayed in a highly sexualized way as "a fantasy object for heterosexual male consumers" (Gorski, p. 37). Similarly, only 4.5% of the total clipart images in different Windows-based programs depict women, and they are typically represented in stereotypical roles, like secretaries, nurses, and teachers (Groendal-Cobb & Patterson). As a result, Gorski asserts, girls are excluded from "the mainstream computer culture" by the "hostile, sexist content" they find (p. 37).

On the other hand, the technological advent of online courses in distance learning programs has facilitated access for larger numbers of women who may be constrained by lack of mobility and flexibility of time to pursue more traditional options for further education (Kirmani, 1995; Kramarae, 2001). Kramarae's study showed that many women are attracted to distance education because they find various advantages over traditional classrooms, including minimized commuting and childcare costs, and the flexibility to control the pace of learning and the time constraints of personal and professional responsibilities.

*Gender bias in usage.* Given equal access to computers, particularly in middle-class households, however, girls and boys continue to differ in terms of usage. Boys are twice as likely than girls to use computers at home and, even at the preschool level, use them for longer periods of time (Kirova-Petrova et al., 1999). Gender continues to play a significant role regarding interests and practices. For instance, studies on gender differences in computer usage have found that while boys chose programs and online games related to cars, sports, war and similar aggressive activities, girls tended to choose programs that revolved around artistic or nurturing activities — the younger girls opting for dolls and crafts (Kirmani & Hardisky, 2003), and the older girls preferring programs on how to handle problems with boyfriends, or how to dress and what kind of make-up to wear (Bennett et al., 1999), and using the Internet primarily to communicate with their peers through email or instant messaging (Groendal-Cobb & Patterson, 2002). Similarly, Menard-Warwick & Dabach (2002) found that while middle-class males' Internet and computer use tended to be intimately connected with their professional identity, women and non-professional males used the Internet to gain information on topics of interest, such as women's health and sexuality, parenting and literature for the women, and sports and sex for the men.

Secondly, and more unfortunately, many girls choose not to use the Internet or software programs because their content is not interesting to them (Cullen, 2001; Groendal-Cobb & Patterson, 2002; Kirmani, 1992; Litton, 2002). Groendal-Cobb and Patterson assert that a primary reason why females account for only 30%of video game players is because video games are not being created to interest girls while educational software is often presented in formats that suggest violence, war, and other male-oriented interests. Bennett et al. (1999) argued that the online gaming and software design industry needed to move beyond an either/or paradigm of conventional understandings of masculinity and femininity to "a technology that is neither over-determined nor exclusive… that can incorporate multiple perspectives and varying themes" (p. 3), and suggested the need for programs that appeal to both boys and girls, such as open-ended problem-solving games and software.

**Towards Digital Inclusion**

Achieving the goal of digital inclusion in access and literacy for all children requires both political leadership and public effort. This section highlights some strategies to facilitate this process that can be implemented at the national and individual level.

Providing technical infrastructure is crucial toward ensuring access. Policy decision-makers at both national and state levels need to support economic policies that increase access to up-to-date technological and quality software programs in schools (Gorski, 2005; Litton, 2002; Wilhelm et al., 2002). These policies need to go beyond supporting high-speed Internet access in schools and libraries by extending discounts to community-based organizations and low-income families in urban or inner city (Blau, 2002; Wilhelm et al.) and rural areas (Katsinas & Moeck, 2002; Malecki, 2003). More comprehensive legislation for greater accessibility in public buildings, such as libraries (Blau, 2002; Gorski), and funding to ensure affordable accommodations in hardware will benefit students with disabilities (Gorski). Statistics indicate that positive outcomes accrue when there is political will. For instance, although Florida has the 10th highest poverty rate, it is ranked 16th in home Internet penetration, as a result of innovative statewide technology programs, including putting computers in community centers and providing extra technology investments to low-performing and low-income schools (Wilhelm et al.).

Public effort is also needed to make computers and the Internet more accessible. Public places, such as schools (Carvin, 2000), libraries (Blau, 2002) and community centers (Menard-Warwick & Dabach, 2002) can make innovative use of their space by providing increased access to computers through extended hours and creating a learning environment with low-cost training programs (Gorski, 2005). The corporate computer industry needs to recognize the importance of developing open-ended problem solving games and software that appeal to both girls and boys alike (Bennett et al., 1999), as well as culturally-sensitive and culturally - relevant software that facilitates cultural connections for ESL and LEP students (Martin & Litton, 2001; Zehr, 2001). The use of the principles of universal design with in-built accessibility features when developing Web sites will allow greater access to individuals with disabilities as well (Bergstahler, 2002).

An equally important priority is teaching students to be effective users of technology. As Blau (2002) puts it, "only when individuals see the people around them using computers to do the tasks they want to perform do they start to see that technology is a useful and a routine part of life" (p. 52). Studies have shown that students do move beyond accessing programs or the Internet for playing games or listening to music to more sophisticated uses, such as

research and problem solving, as they acquire greater proficiency (Becker, 2000; Pearson & Swain, 2001). In order to achieve this goal, it is crucial that teachers, both pre-service and in-service, acquire training in technology (Gorski, 2005; Hinson & Daniel, 2001; Hughes & Coyne, 1996; Litton, 2002; Parette & Brotherson, 2004; Pearson & Swain, 2001). Teacher preparation programs must offer courses in instructional technology (Pearson & Swain) and assistive technology (Parette & Brotherson), while inservice teachers can benefit from training that responds to various levels of expertise, from basic training on using the Internet and posting homework assignments (Hinson & Daniel; Wilhelm et al., 2002) to more sophisticated applications toward integrating technology into the learning environment (Pearson & Swain) and promoting higher-level critical thinking in students (Gorski).

Training parents and teachers together has several advantages. As parents increase their communication with the school through email and become better informed about their child's homework (Hinson & Daniel, 2001) or the choices for AT for their child with disabilities (Parette & Brotherson, 2004), they become more involved in their child's education. As parents learn about and become more proficient in the many uses of computer and the Internet, they are more likely to invest in a home computer and provide the immersion experience students need (Blau, 2002; Hinson & Daniel; Kirova-Petrova et al., 1999).

Creating supportive environments for new users, particularly parents, to learn about computers is a crucial part of this training process (Hughes & Coyne, 1996; Menard–Warwick & Dabach, 2002; Nel & Wilkinson, 2001). This includes responding to participants' affect, which may include a fear of computers (Menard–Warwick & Dabach), pacing lessons appropriately to meet participants' needs and levels of comfort (Hughes & Coyne), explaining all technical terms without presuming any prior knowledge (Nel & Wilkinson), and responding to cultural differences in values (Janey Wang, 2001; Parette & Brotherson, 2004). Further, teachers are more likely to continue and maintain their technological use when on-going technical support and training are provided (Blau, 2002). Gorski (2005) recommends placing technology specialists in every school to provide support and computer and network maintenance.

Teachers can promote digital inclusion for all students by integrating technology into their instruction effectively and in ways that promote higher order, critical thinking skills, and selecting courseware and websites that are responsive to female and male students' interests. This will expose students to a variety of electronic resources and engage them in activities that use technology for communication, research, problem solving and decision-making (Swain & Pearson, 2003). Teachers also need to be cognizant of cultural differences and the need to be sensitive to diverse intercultural communication styles of learners during the process of instruction (Janey Wang, 2001). This can include using a blend of computer-facilitated communication and face-to-face interaction (Gorski, 2005).

Teachers can also ensure appropriate accommodations for students with disabilities through the use of assistive technology. Access to the Internet is considerably enhanced for students with disabilities if websites are based on principles of universal design, which means that "the wide range of characteristics of potential product users is anticipated ahead of time and accessibility features are built into the product's design" (Bergstahler, 2001, p. 2). Universal design features for Web pages can include text alternatives that can be read by speech and Braille output systems and audio descriptions for video output for students who are blind, or multimedia resources that are captioned for students with hearing impairments (Hughes & Coyne, 1996; Jackson, 2003). Universal Design for Learning (Meyer & Rose, 2000) extends these principles of universal design into the classroom, using AT and specially designed software packages, towards developing curriculum materials that respond to a wide range of learning styles. These can include modified keyboards with enlarged keys or overlays, text readers, computer-based speech synthesizers, screen magnification programs, and computer training modules (Hughes & Coyne; Jackson; Meyer & Rose).

## Conclusion

As information and communication technologies become more ubiquitous and an integral part of our everyday lives in the 21st century, the issue of inequity of access and usage of computers and the Internet becomes increasingly problematic. It is particularly troubling that children who are already disadvantaged, students from poor, rural and minority households, are the least likely to have access to the new technologies. Additionally, female students and students with disabilities also experience disparities in access and usage. The implications are enormous and the costs to society great, as these students are impeded by their lack of technological skills from entering the competitive world of college, including computer-related fields, or work, including service-based jobs. Achieving the goal of digital inclusion in access and literacy for all children will require both political leadership and public effort.

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