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The College Role in Diminishing the Digital Divide Gender Gap: Assessment of Male vs. Female Computer Access and Use

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ABSTRACT

Higher education has been allied with the computer industry since the advent of the personal computer. In the past, an anomalous gap has been found to generally exist between males and females in the United States regarding the access and use of computers. The purpose of this study is to review research regarding college student computer access for males and females. The report will also examine computer ownership based on examination of the results of a college-based survey, as well as by comparisons to past and present technology ownership trends. While a number of colleges have published reports on the progress of their technological initiatives, few publish gender data in regard to the state of computer ownership or college supported access today in order to continue to monitor important digital divide trends. The findings of this study suggest that colleges and universities offering low-cost options for computer use, purchase, or lease, and Internet access, are critical in suppressing the gender gap.

INTRODUCTION

Digital Technology Emergence

The unprecedented technological boom of the 1980s invited businesses and consumers to consider owning individual computers for "desktop" or personal use. The personal computer introduced a specific "need" for consumer ability to access, process, store, and share information with ease. Conjunctively, digital communication networks came into existence to compliment these new consumer needs. In 1992, one of the first graphical web browsers, Mosaic, offered new versatility to the personal computer (mainly used in variations for office, business,

and education) by allowing social groups and market activities to take place between users regionally, or internationally, day or night, via the Internet. As web browser capabilities expanded, this net-like world of connectivity manipulated by visually-based user screens was coined the "World Wide Web."

Experts at the United States Census Bureau agreed that the personal computer alone was the single most important technological tool to touch a universal audience in America within the last half of the 20th century (Kominski & Newberger, 1999). Within a short time of the Internet going "online," access to computer equipment and networking services became world-wide keys of economic status, power, and political representation. In terms of democratic power, Wilhelm (2000) proclaimed active involvement in this technological revolution as central to the ability of free citizens to speak to the world. According to Wilhelm, in order for democracy to flourish, universal Internet access would have to play a central part in promoting means of access for all citizens to use online applications for information and group interaction. Active participation in World Wide Web activities was seen as a political power governed by economics and affordability (Wilhelm, 2000).

Digital Equity and Research Predictions

Noting rapid and unparalleled technological developments, United States Vice President Al Gore headed the "Information Summit" in 1995 (also called the Telecommunication Conference). Soon after, President William Clinton hosted "NetDay." At that time, Clinton outlined goals of providing all youth with computer access through educational institutions by 2007 (Clinton, 1996). Clinton, and many others, predicted the infusion of technology into the lives of all citizens within a decade. Responding to raucous discussions regarding assurance that all U.S. citizens be allowed fair access to the Internet, the Clinton Administration also influenced the passing of the 1996 Telecommunications Act. The act was aimed at eliminating entry-barriers into the communications network market. This type of barrier elimination was expected to stimulate competition and increase options for consumers to low cost online services. While waiting for the telecommunications industry to catch up, the government specified that universal access should be a target in schools and public libraries if in no other places (Compaine, 2001). This is reasonable since organizations typically have the economic means to purchase computers and applications before independent users do (Thomas & Wyatt, 2000).

The Digital Divide and the Gender Gap

New computer and communication networks emerged at the same time as the majority of predictive studies exploded over access or usage barriers. From critics, social interest groups, and researchers, this boom of computer use and online service offerings simultaneously brought about caution-cries of the probability and expectation of "white male privilege" dominating the number of those able to access, use, design, and otherwise manipulate this emerging technology. Any measured population gap in the privileged use of computers and online services was put under a conceptual umbrella coined "the digital divide." A 1995–1999 government research project ensured the establishment of telephone and Internet modem access for all citizens (U.S. National Telecommunications and Information Administration, 1995 & 1999). According to the statistical analysis, women, racial groups, and low-income population sets were expected to lag far behind that of typically privileged computer users initially identified as white males in the majority. Within the "access divide," low-income challenges, gender issues, consideration for the disabled, and racial disparities in computer ownership were frequently measured by early Internet researchers. General World Wide Web usage was also measured by destination and preferences across populations. Disparities in technological ownership, or other potential access opportunities for women, in comparison to men of similar age, professions, or situations was dubbed by researchers and social theorists as the digital divide "gender gap" (Thomas & Wyatt, 2000; Compaine, 2001; Norris, 2001).

The width of the gender gap has been revisited by researchers in general throughout this decade. Malcolm Brynin reviewed the gender-related impact on economics, as determined by technological proficiency (as cited in Kraut, Brynin, & Kiesler, 2006, p. 84–93). Brynin's data showed a measurement of women utilizing computers as much as men at work, but still showed a higher number of working men (55%) using computers at home than women (46%). The mean of salaries showed the same gap for male computer users with an average of $5,501 monthly in take-home pay, while female computer users averaged $4,741 a month. Brynin's conclusion was that as technology significantly contributes to productivity in the work arena, if men have greater technological skills, they have the greater economic advantage over women (Kraut, Brynin, & Kiesler, 2006). Closing the gender gap is not a male verses female issue, but part and parcel of the need to continue to equip women and other minorities in our nation in an area of skills currently being internation-

ally outsourced at an alarming rate.

Higher Education, Ubiquity, and Technological Standardization

Within the educational sphere, divides exert their presence in particular forms recognizable to educators and researchers. According to Warschauer (as cited in Smolin & Lawless, 2007), the digital differences that impact teaching and learning specifically includes those of school access, school use, gender gap, and generation gap. He explained that unequal access to digital technology in school impacts many students considered, "at-risk" or disadvantaged in society as a whole. Warschauer asserted that employing the appropriate and meaningful technological strategies will enhance the education of all students and work to eradicate significant "digital differences." On a similar vein, a longitudinal study of 13 United States, Canadian, and United Kingdom programs (Brown, 2003) followed colleges that made significant commitments to standard computer requirements and issues for all students from the mid-1990s to 2003. For all the schools in the study, similar laptop computers were distributed among faculty and students. In this way the "playing field" of technology equipment, platforms, and applications were leveled. In making the case for standardized computing and answering the question, "Why should all students have computers?" one of Brown's (2003) top factors of consideration was "equity" (p. 5). An important point he stresses is that "students who don't have them are at an unfair disadvantage. Computers for all is the only way to level the playing field" (p. 5). Other factors in support of computer standardization in Brown's research (2003) include "communication…recruitment…access to scholarly materials…interactive and collaborative learning…visualization and advancement through computer literacy…" (p. 5). Brown attributes his university's great success in part to adding to student success by making computers affordable. He discusses the digital divide viewed as a two-class society separated by affordability for quality computer equipment. The commitment at Wake Forest was summed up in his book (Brown, 1999). Regarding the economic gap for students in the digital divide, Brown (1999) stated, "we could not afford to support this disparity. Universal ownership of computers seemed to be the only solution" (p. 113).

Digital Technology and Higher Education

The cultural and societal implications and benefits of imple-

menting policies and strategies to ensure the accessibility and familiarity of use (and whenever possible, ownership) of technological tools by college students in order to maximize societal benefits are overwhelming to the United States. According to Rosser (2005), each sector of the United States government and industry should be proactive in ensuring the inclusion of women in digital technology on all fronts. Rosser (2005) was convinced that this is especially true for higher education where many technological initiatives or programs, which are funded by grants from the United States government, help students gain and retain computer access.

Assessing the many aspects of the college role in suppressing the gender gap, Castells (1999) indicated that the most important factors in the "logic" of digital technology are the issues of inclusion vs. exclusion. He recognized that people who are technologically marginalized have dissipating advantages and potentials in their society, or wasted potential. To counteract a downward spiral of exclusion of all types of technological marginalization would take, "a dramatic investment in overhauling the educational system everywhere" (p. 4). For higher education this means a focus on universities and a willingness to "share knowledge and expertise for the common good" (p. 6).

LITERATURE REVIEW

Higher Education's Responsiveness to Technological Change

Early reports of Internet usage showed that students and faculty at colleges were among the first "Internet consumers" (Jones, 2002). In the 1990s, the cost of computer ownership in the United States was beyond the reach of many consumers. Colleges with early personal computer use, connectivity, and access to graphical user environments such as the World Wide Web, achieved access from institutional budgets (Thomas & Wyatt, 2000) or government assistance. Since that time, the educational arena has remained one of the largest contributing populations to Internet access (Jones, 2002). Hoffman and Novak (1999) indicate college students were more likely to have "access" to computers and online services than others their age who were not enrolled in college. They also report higher levels of education correlated to increased computer access at school, work, and home. Thus, higher education institutions continued to play a significant role in providing citizens across the digital divides of socio-economics, gender, race, and disabilities the means to take part in the digital revolution.

Hanna and Associates (2000) addressed digital technology is-

sues confronting colleges and universities. In one chapter, Poley (2000) addressed gender. She observed that the "World Wide Web isn't really worldwide yet—in content or reach" (p. 252). Gaps in opportunities for women to access are clear. As a result, Poley suggested using digital technologies to develop innovations and solutions more suited to women's lives (Hanna & Associates, 2000). Poley (2000) also suggested that even if global markets improved in technology access and use gaps, further imbalances of power worldwide could result in "more of the same." Thus, higher education has been marked as a strong contributor to equitable access of the right learning tools (Poley, 2000).

Duderstadt (2002) advocated the need to actively and positively provide students with access to digital technologies in order to enhance their fundamental activities of education, scholarship, and public service. Duderstadt (2002) also addressed the need to ensure the full participation of marginalized or currently underrepresented minorities and women, emphasizing these needs to be crucial to our commitment to equity. The future effect of neglecting equity in access and use of digital technologies is associated in the discourse with deficits in social justice, as well as negative repercussions on our nation's potential strength (Duderstadt, Atkins, & Houweling, 2002).

The high utility of easily navigable operating systems and web browsers caused higher education institutions to face the fact that Internet access for academic use was inevitable and crucial. Erhmann (1995) challenged higher education to begin asking the right questions related to institutional and student needs in a push forward in utilizing digital technologies. LeBlanc and Teal (1998) emphasized answering the complex question of: "What is the vision of how the computers will be used?" By asking these questions, colleges and universities would better direct their students regarding computer use and ownership.

Fouts (2000) significantly expounded on "classroom transformations" and new learning options for educators on all levels. However, he expressed concern about the marginalized receiving equal access and gaining critical skills. Fouts (2000) raised further "continuous assessment" questions for higher education institutions. Primarily, he posed the question of whether adequate time and access to technology for marginalized groups would be sufficiently addressed by each college or university. Once we address this concern, LeBlanc and Teal (1998) suggest that universities would need to know how to directly affect student groups regarding computer use and ownership and how to promote technology skills necessary for competition in the new millennium. Others (North

Central Regional Educational Laboratory & Metiri Group, 2003) both emphasized and illustrated the interrelatedness of digital-age literacy to other skills gained in K–16 institutions (See Figure 1).

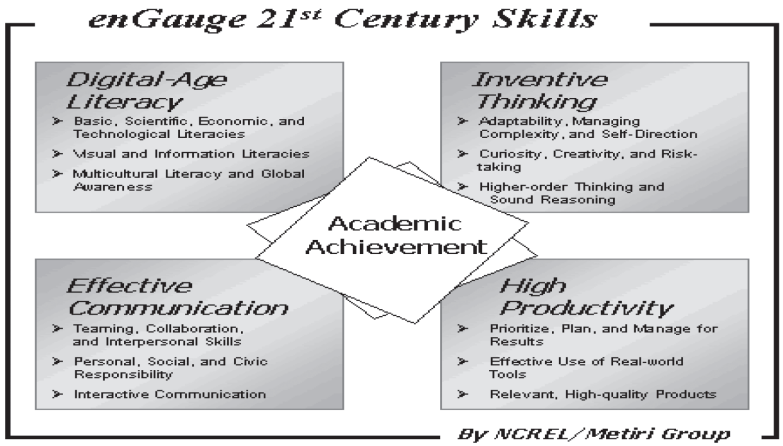

Figure 1. Technology in 21st century skills assessment

Roles of Independent Higher Education Institutions

Educational theorists have promoted conscious understanding of the impact of technology on gender and other digital divide sectors. There is also a need to encourage higher educational institutions to influence technological processes impacting student experiences (Smolin & Lawless, 2007). Early higher education theory projections expect that structural and economic initiatives supporting equal access to technological equipment and services would indeed diminish much of the access gap, including the disparities of computer access and use by women (Van Dusen, 2000). Thus, initiatives in higher education promote skills and career preparedness equity across gender, racial, and economic lines. As subsequent cohorts of college-aged men and women exit the educational environment, similar skills sets and computer experience should be evident across gender lines.

Positive effects of the utilization of digital technologies on student learning and professionalism are noted by case studies (Kuh & Vesper, 2001; Tan & Morris, 2005). Initially educational theorists placed great emphasis on the success of student learning on faculty use of tech-

nology to support learning outcomes (Chickering & Ehrmann, 1996). However, less focus has been directed to the influence of personal investment in encouraging women to independently utilize technology. Female students' ability to access technology has a tremendous impact on their college experiences, skills development, and career preparedness.

Access to computers and online courses increases the ability of women to "take courses around the demand of their lives" (Koch & Irby, 2002). Online versions of campus-based courses (Card, 2000; Kramerae, 2001) respond to student's needs related to accessing computers. Online courses have also been found to be well-suited for the needs and learning styles of many women (Kramerae, 2001). A more recent study by Palm, Brallier, and Gilbert (2006) notes the enrollment of females for online courses to be higher (68% women verses 32% for males). Women achieve higher performance in these online courses than men (Brown & Liedholm, 2002). Anderson and Haddad (2005) similarly found that women in both online and face-to-face courses demonstrated a greater depth of perception and greater controls over their learning processes. More quantitative study comparisons would be helpful as the rate of diversity in students taking advantage of online courses and degree programs offered across the United States continues to increase (Yu, Digangi, Jannasch-Pennell, & Kaprolet, 2008).

On college campuses, competition for on-site computer access has been cited as an institutional barrier for many students who require computers for completion of homework assignments (Maldonado, 1997). Gardner and Eng's study (2005) of undergraduate student use of a college library reported 51% of respondents cited the need for more computers. In order to negate disparaging trends affecting women (as one group of "minorities"), Gardner and Eng (2005) proposed the following: 1) increasing the range and abilities of campus networks; 2) encouraging purchase/ownership opportunities; 3) extending technology laboratory access for extended software and other technology applications unaffordable to students, as well as adequate support for online course instruction or direction; 4) providing online course opportunities to support individual needs for timing of access to course materials (lectures, etc.); and 5) adding provisions of onsite instructional personnel (i.e., help desk personnel, on-site consultants, etc.). Independently, colleges and universities have responded to government publications and concern over gaps in physical access to computers for women, racial minorities, and low-income groups by supporting endowed, grant supported, or university funded projects that update their technology infrastructures (Indiana State University, 1998–2005; Wayne State Univer-

sity, 2008; Northern Michigan University, 2008) or offer assistance with the purchase of (or the ability to borrow) computer equipment. Mutually beneficial relationships with Microsoft, Apple, and other major computer companies have resulted in the provision of low cost software packages (Kimmel, 1998).

As of 2003, when computer technology evolved to include smaller, more portable, and more affordable computers, over 150 colleges in the United States created "Laptop Universities," instituted universal notebook requirements and programs, or took on specific "laptop initiatives," encouraging ownership or personal possession of a laptop computer for every student (Brown, 2003). Following this government push and collegiate response, many higher education institutions have amalgamated wireless and other computer technology services to specific financial aid allowances for students, giving them access to funds for computer purchases. Other schools have laptop purchase or lending plans. Thus, the past ten years witnessed exciting technological drives to provide lower cost computer access alternatives for all students at colleges and universities (Brown, 1999 & 2003). All of these measures have been admirable responses to national expectations for world-wide growth in technology use and direct preparation of the future workforce. These measures have secondarily served to minimize gaps in access by access-marginalized groups, including women.

Collegiate Economic Considerations for Closing the Gender Gap

Schools and colleges are "natural environments" for information access, processing and dissemination. Colleges, through government and private funding, are associated with the economic ability to afford technology for all post-graduates (Norris, 2001). Researchers rallied for U.S. government-supported financial initiatives to integrate technology further into public schools, based on an economic certainty that the financially disadvantaged in poorer regions could not be expected to create their own technological opportunities for access and use (Coley, Cradler, & Engel, 1997). These authors argue that financial considerations for economically disadvantaged students should continue to play a part in the consciousness of higher education institutions when implementing technology plans and considering universal access and the ability of all students to meet educational objectives. In terms of gender and ownership (ownership equating higher levels or greater frequency of access and use), Sacrowitz and Parelius (1996) found that female students

in computer technology courses were significantly less likely to own a computer in comparison to their male cohorts. The authors dubbed this finding "an unlevel playing field."

Research studies from the 1990s to 2005 continued to find a gender gap in access to computers, connectivity to networks, and Internet participation. Koch and colleagues (2002) emphasized the importance of gender, which should receive continuous assessment. Their epilogue reiterates the need to re-examine technology gender gap issues periodically, as would any industry seeing the need for continuous improvement. Sanders (2005), pinpoints a substantial amount of literature supporting the conclusion that women's level of comfort in using computers is strongly related to the ability to continually access and use the equipment and applications. Morahan-Martin and Schumacher (2007) conducted a series of studies from 2000–2007 regarding differences in access and use of digital technologies by men and women. They found that males who owned computers tended to have more technological expertise than women, lending them significant advantages in learning and professional opportunities. Clearly, women need more opportunities to own and access computers in order to be on a level playing field with male counterparts.

Results of Academic Initiatives on the Gender Gap

In 1999 the United States Census Bureau reported on the integration of the personal computer into daily life (Kominski & Newburger, 1999). According to Kominiski and Newburger (1999), transitions from organizationally based access to personal access are an expected social phenomenon worth watching. The Internet, a critical element in higher education, is also integral to successful immersion in the job market (Shaw & Gant, 2002). Theorists surveying male and female use of the Internet indicated educational and professional deficits projected for the future if women do not consistently gain computer skills (Shaw & Gant, 2002). Over the past 20 years of computer use on the academic level in higher education, scholars suggested many options colleges could undertake to ensure that students would consistently have universal, open doors of access and meaningful use of Information and Communications Technology (ICT) and Computer-Mediated Communication (CMC) applications in their favor to bolster their quality of life and contributions to their communities (Card & Horton, 2000). These same scholars predicted that initiatives taken by colleges and universities to ensure equal access to technology would eliminate a gender gap among college-age students

or college enrollees. Indeed, by 2003–2005 studies emerged suggesting that the gap in access and use of computers by women in the mainstream population and at colleges had "virtually disappeared" (Mossberger, Tolbert, & Stansbury, 2003; Kalyanpur & Kirmani, 2005).

Implications for Laptop Ownership Rate Increase for College Men and Women

According to research by Chickering and Ehrmann (1996), possession of computers increased opportunities for engaging in the learning process, as well as increasing familiarity with interdisciplinary tools such as digital libraries, reference web sites, help-desk resources, and other aspects of life-long learning (Indiana State University, 2005a & b). Tan and Morris (2005) showed that technology integration into the college student's life can enhance life-long skills development with computer applications such as spreadsheets and advanced e-mail capabilities. Tan and Morris (2005) also found that students put their laptops to use in multiple ways, resulting in retention of life-long skills associated with professional and social development and careers. Even though women have the intelligence and learning skills for higher levels of technological application, academic studies, and submergence into technical careers, many barriers still restrain them, such as lack of acceptance in classroom environments (American Association of University Women, 1991; Hall & Sandler, 1982), low interest in certain fields, lack of support systems (educational and familial), and financial concerns (Siann & Callaghan, 2001).

The ability to take advantage of online courses also has a positive impact on women who may need post-secondary educational opportunities in their late 20s or older. This ability is also weighty for women needing to access college-level classes on alternative schedules to meet family or work obligations. Computer ownership is a necessity in these cases, as access to college labs after certain hours is not practical for all women. Depending on the college community, campus, or environment, attempting to gain access to computers or wireless services on college campuses in the evening may also vary in the safety aspects. Opportunities for technology access in these situations may both be perceived and acted on differently by men and women. Since the year 2001, universities have reported higher numbers of female enrollees in online courses and degree programs than men (Picciano, 2002; Sullivan, 2001; Halsne & Gatta, 2002). For women in particular, the educational

environment, virtually accessed, has become a community of learners who otherwise might be excluded from higher learning because of time restrictions or other obligations such as family or work (Kramarae, 2001; Sullivan, 2001). Reports indicate that since offerings for online courses and degrees began to rise in the 1990s, female students have taken online courses and completed online degrees in greater numbers than men (Sullivan, 2001). Review of any known recent data or by the report of new research studies would be helpful to determine the current status for women taking online courses.

Ownership or consistent access to personal computers and online applications for professional development is especially critical for women who often need this technological edge in order to find competitive positions in the workforce. More studies are needed to determine which institutional initiatives have successfully closed gender gaps in technology access and use and how these positive programs and initiatives may be adapted to support women in the educational arena. Case studies suggest that students who emerge from colleges with computer skills and experience are highly desired employees (University of Minnesota-Crookston, 2003–2005; McVay, Snyder, & Graetz, 2005).

Surveys by the Pew Internet and American Life Project (Horrigan, 2008) confirmed that economic factors play significant roles in the consistency and quality of access to online services by citizens relying on home computer services alone. Horrigan further emphasized that economics may prove by far to be the greatest access barrier—one that persists today, regardless of, or in conjunction, with gender, or ethnic co-elements of disparity classes. However, it would be remiss not to stress that the greater the number of co-elements of disparity facing an individual (such as, gender, race, disability, economic class, etc.), the greater the task to gain access to and retain use of computer privileges.

In a recessive economy, the true realities of privilege come into focus. The 1990s were a decade of high consumer credit use as well as high consumer debt. According to economist Michael Hodges, household debt reached historic highs during this period, citing that the economy was driven more by this than anything else (Hodges, 2008). In the decade following, the true affordability factor of owning a computer and the ability to take self-driven, or educationally based, opportunities for access to some computer users are once again "at risk" for many in the United States and around the world. At risk of loss of computer access are those who cannot afford a computer or consistent access to sophisticated software, computer consultation services, or Internet provider services. Today, the economic positivity that once allowed consum-

ers access to electronic purchases in the 1990s and early 2000s continues to decline. Therefore, new difficulties confronting women in computer ownership may emerge in many forms. An example set includes the economic competition of all other familial needs that may not allow for computer equipment purchases (Korgen, Odell, & Schumacher, 2001; Kramarae, 2001).

Shifts in the Digital Divide and the Need for Continued Assessment

Since the 1990s advent of the Internet, the relationship between computer ownership and computer equipment access to digital technologies has been shuffled to the background. It is presumptuous to believe that all Americans have a computer with hardware, software, and services sufficient for consistent use. In the 1980s to early 1990s, the typical desktop computer averaged $2000 (Computer Hope, 1998–2008), and the average laptop (used more often by academics and government personnel) cost $1000 for contracted bulk sales. A decade would be a fair amount of time in which to assess if many of the economic, gender, and racial minority gaps in access and subsequent use of digital technologies—including online services—have leveled as the prices of computers and Internet services have come down.

Issues surrounding computer access and the digital gender gap have shifted in many regards. Hu and Kuh (2001) were concerned with trends related to college students' needs to attend "wired" schools where access of desktop computers and online services was a major consideration. According to an Intel (2005) press release and DiGangi et al. (2007), higher education institutions today vie to be the most "unwired" campuses in the United States. Current research shows that over 90% of students own a home computer, with less than one-third of computers being specified as laptops and 41% specified as desktop models (DiGangi et al., 2007).

Having access to computers and online services are more necessities for students than options, considering the intertwining of e-mail, online college course work requirements, the need for specific current hardware, software applications, and increased connectedness of online social networks to the student lifestyle. Further, DiGangi et al. (2007) found that even students themselves desired greater digital resources in classrooms and on campus. They also discovered that 81% of students considered a laptop computer to be critical to their college success (DiGangi, et. al., 2007). However, only 60% of students in this study cited willingness to pay for their computers if financial assistance was not

available. This is an important example of the conflict of students falling within the economic digital divide marginalization. The study also highlighted important access opportunities United States students are able to take advantage of, specifically by ownership of computers, when funding is available.

National Computer Access Trends

When higher-education institutions perform self-assessments on the state of computer technology use by students, they contribute to a society's ability to meet the computer needs of the nation. Self-assessments by higher education institutions can also serve to suppress the gender gap by meeting the digital technology needs of all students for academic purposes, as well as encouraging computer purchase, borrowing, or other supplemental funding programs that make affording digital technologies, software, and Internet service more affordable for the entire population.

Technology access and use reports at four-year colleges around the country suggest a high rate of access, ownership, and use of computers for males and females. High instances were found in which students owned or used equipment with the latest operating systems and software, suitable to the demands of their educational disciplines. In his study, Wolff (2006a &b) reported that of 100 students surveyed, 100% of students owned either a laptop or desktop computer, and at least 75% of students reported wireless Internet access by several means (school, work, or home). Specifically, 71% reported high-speed home Internet access (37% for females, and 34% for males). Wireless home access by independent means (not subsidized by schools) was found to be similar for females (28%) and for males (25%). Laptop ownership was reported at 90% overall, with a 92% rate for females and 87% rate for males, while females (50%) owned desktops at a slightly lower rate than males (56%). Students who owned both laptops and desktop computers rated closely for females (43%) and for males (44%) (See Table 1; Wolff, 2006).

GENDER	OWNS A LAPTOP	OWNS A DESKTOP	OWNS A LAPTOP & DESKTOP	LAPTOP OWNERS USING LAPTOP
Female	93%	50%	43%	75%
Male	87%	56%	44%	91%

Table 1. University of Texas-Austin (Wolff, 2006)

A 2007 public access network (PNA) report at the same uni-

versity showed similar trends of Internet use for males and female users (University of Texas-Austin, 2007). In this report the ratio of access to campus networks for females (combined student, faculty, and staff) stood at 50% for both males and females. On-campus Internet use was also measured on a base of an even number of males to females in the university campus population (50:50 ratio). The rate of computer access, in ownership and rate of use at the university level, was found to be significant (Wolff, 2006; University of Texas at Austin, 2005 & 2007).

Similarly, a 2007 national sampling of college students from 40 two-year institutions (associates degree level) and four-year colleges initiated by the Education Center for Applied Research (ECAR) reported a 58% increase in laptop ownership since 2005. Of the 97.7% of all students owning a computer in 2005, 48% owned a laptop, 18% owned a desktop, and 32% owned both. In 2007, results showed that 98.4% of all students owned a computer. In particular, from 2005 to 2007 laptop ownership increased from 53% to 76%, with 61% of all respondents now owning this type of computer. Males (73%) and females (74%) owned similar numbers of laptop computers in a similar study (Caruso & Salaway, 2007). ECAR results reported that males owned desktop computers at a higher rate than females (males 66%, vs. females 57%) (Educause, 2007).

The study also reported the 91% of all students utilize high-speed Internet service, with wireless service steadily increasing. Dial-up access was still utilized (8%) by some students. With these assessments as periodic examples, patterns indicate that the college environment is highly supportive of continuous computer access, and mitigating digital divides.

RESEARCH PROBLEM

Research Questions

Consistent with these research studies, this study addresses a number of questions regarding college-level attainments towards gender equity in the digital divide. Specifically:

1) Is ownership of computers proportionate by gender for this campus?
2) Do males and females take similar advantage of computer programs and wired or wireless services?
3) Do males and females take similar advantage of computer labs available on campus?
4) Do males and females take advantage of online courses at

similar rates?

5) Do males and females access online course material at similar rates?

METHODS

Setting/Sample

Eastern Michigan University (EMU) is a mid-western institution with 22,848 students enrolled as of fall 2007. The university is an 84% commuter campus, with only 16% of undergraduate students currently living in university housing. A 2007 internal statistical analysis reports the student body as 60% female (N=13,637) and 40% males (N=9,190) (with an unknown/undeclared gender variable of .09%) (EMU, 2007) (See Figure 2).

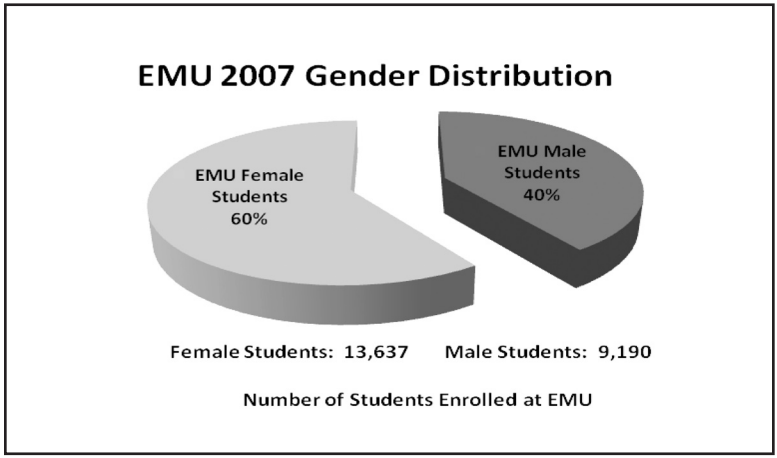

Figure 2. EMU gender distribution for returning students, 2007.

Information regarding EMU provided by Collegeboard.com (2008) reports 1% of courses taught as independent learning (correspondence) courses, 4% of courses taught online, 2% of courses taught as a hybrid type course with technological elements involved and 93% of courses taught face-to-face.

The EMU Office of Financial Aid offers a one-time increase in loan-based aid specifically for a computer purchase listed on its webpage. The university does not have a compulsory laptop program nor are specific initiatives in place to encourage or provide students with computer purchases or leases. However, discounts on computer equipment through the campus computer store are suggested on the campus IT webpage, which

highlights the necessity of student-owned computers.

According to Aric Kirkland, an information technology administrator for the university, the campus has wireless networks in specific locations, and has 70 college-specific (e.g., College of Education, College of Technology) computer labs for general and specified-purpose access. This total includes one Adaptive Technologies Lab designed to provide digital technology access to students with disabilities. The Adaptive Technologies laboratory is currently equipped with 20 Windows-based computers compatible for network and Internet access, and zero Macintosh computers. Other EMU labs host a total of 1,320 Windows based PCs, and 392 Macintosh computers. The campus library with two major computer commons is a major hub of student computer access. All labs remain as wired networks and utilize wired Internet services in addition to wireless capabilities. Students also continue to have the option of using dial-up access to the Internet from outside the university through a contracted service provider.

Data Sources and Analysis

To determine student ownership and use of technology a survey was administered at the end of the 2007–2008 school year. Recruitment for the survey was accomplished via e-mail. No paper surveys were given. The email survey considers the ownership, use and access of computer technology by college students and analyzes the rate of use of campus-based computer technology for female students in comparison to male students. Data were analyzed with SPSS using frequency distributions.

RESEARCH RESULTS

E-mail survey participation resulted in 4% of the student population (N= 851) responding to an off-campus survey system (Zoomerang). Of the survey respondents, 67% (N=568) were female and 33% (N=283) were male. Ages of student participants ranged from 17 to 56 years or more.

EMU Computer Ownership and Use Findings by Gender

Ownership of computer equipment for participants in this study was found to be overwhelmingly positive, with 98% of both males and females owning a home computer. Two percent each of males and females reported lack of computer ownership (See Figure 3).

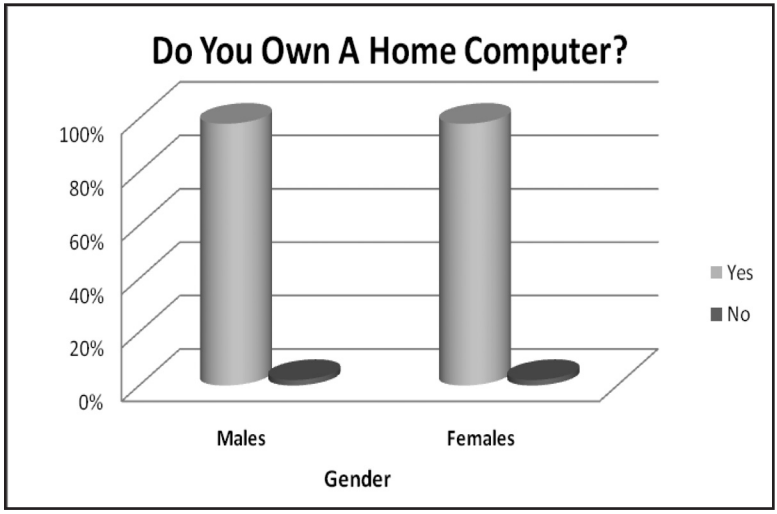

Figure 3. Home computer ownership by gender.

In a basic analysis of computer type by respondents who claimed home computer ownership, female students reported a 34% ownership rate of laptops, and a 26% rate of desktop ownership. Male students reported 28% laptop and 26% desktop ownership rates. Forty-one percent of all students report owning both laptop and desktop (See Figure 4).

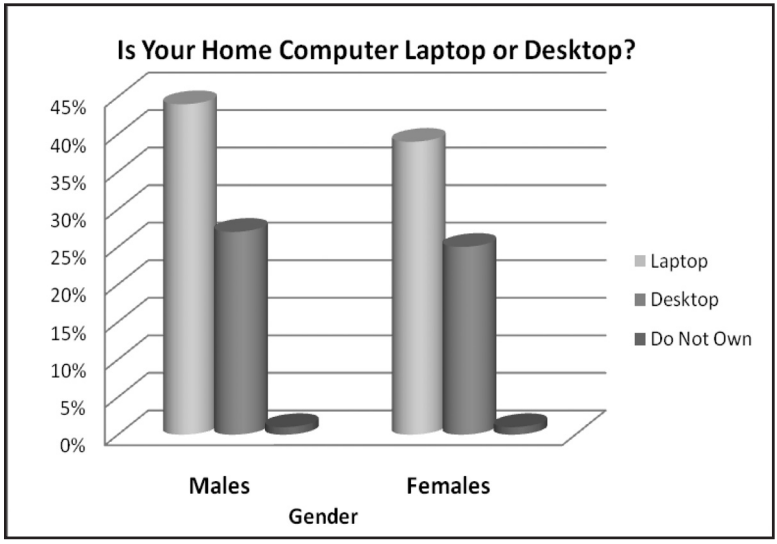

Figure 4. Differential laptop or desktop ownership by gender.

The age of computer equipment varied for the population. The number of students in the overall population who owned computers that were more than one year to two years old was the largest reported, with a combined rate of 54%. The percentage of male and female college students who owned newer (one to two years old) computers was 57% (N=160), and 53% (N=301), respectively. The percentage of students who owned computers more than 3 years old was 43%. The number of females who owned older equipment (3–5 years old) was 44%, while the percentage of males who owned equipment 3–5 years old was 42%. The percentage of students who do not have a home computer was 1% for both males (N=4) and females (N=8).

Use of Programs and Services by Gender

In terms of operating system status, 61% (N=851) students reported having Windows XP as their platform, while 58% of females and 67% of males ran XP on their home computers. Windows Vista was newly available at the time of this survey. Similar numbers of students for each gender reported using it on home computers: 31% for males and 28% for females (see Figure 5).

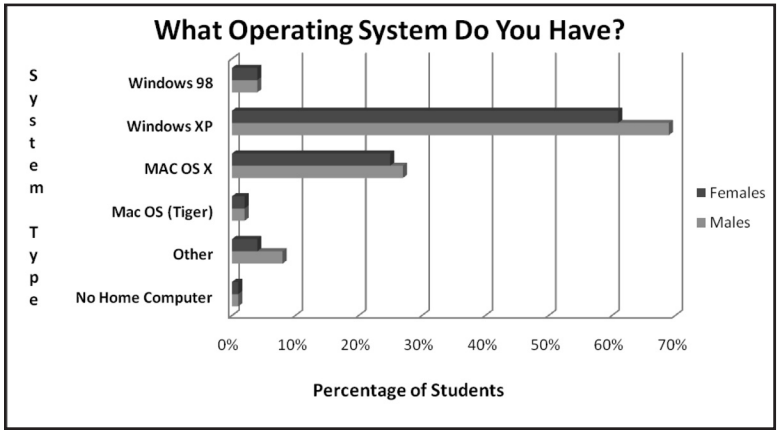

Figure 5. Home computer operating systems by gender.

Students reported high Internet access. High speed Internet access (cable and DSL combined) continued to play an important role in student Internet connectivity (88% for females and 87% for males). Only 3% of males reported not having an Internet connection at home; 64% favored cable provider services, and 24% favored DSL. Similarly, 4% of women reported not currently having Internet service at home, with 52% using cable services, and 35% utilizing DSL (broadband). Four percent of both

males and females reported use of dial-up Internet services (See Figure 6). It is unknown whether the dial-up services is university or independently supported.

Given multiple options, 96% of students indicated that they used home access to complete class assignments, while 40% took advantage of workplace computers. In gender comparisons, 96% of females used their home equipment for course assignments; similarly, 95% of males used home-based computers for course assignments. Of campus-based computer networks, students overall reported a 52% utilization of the campus library for course assignments, with 55% of females and 45% of male reporting campus library use.

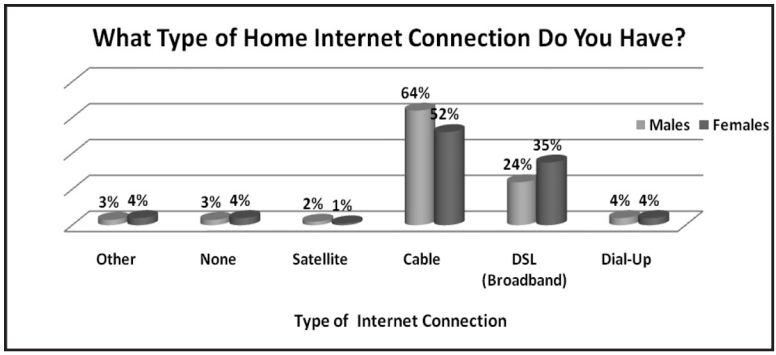

Figure 6. Home Internet connection types by gender.

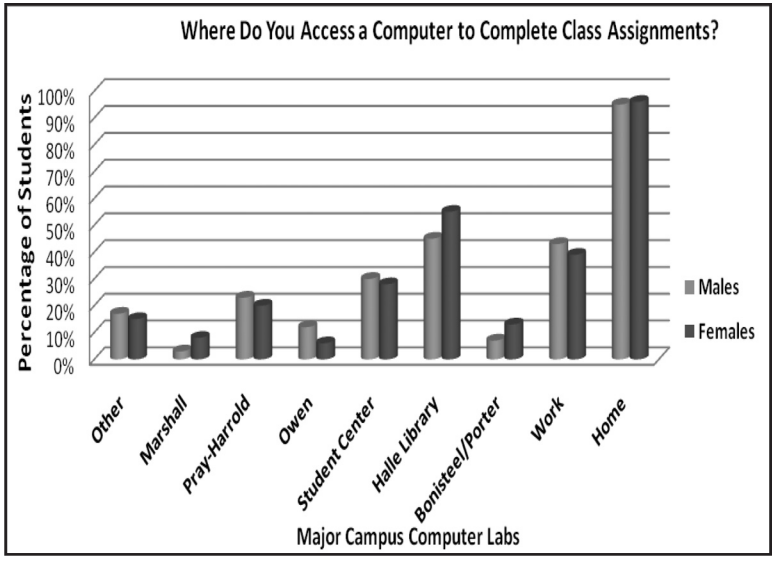

Figure 7. Access of computers for class assignments by gender.

According to the findings, 28% of the population used the campus Student Center computer lab for course work. Access to this major hub of computing was 28% for females and 30% for males. Other labs specified as an option included the Marshall, Pray-Harrold, Owen Building, and Bonisteel computer rooms. Other lab usage ranged from a minimum of 6% to a maximum of 22% (See Figure 7).

Online Course Participation by Gender

In regards to online courses, 71% of females reported having taken an online course, while only 58% of males reported ever having taken one (See Figure 8). Women (89%) also reported accessing online course materials on a weekly basis at a slightly higher rate than men (81%) (See Figure 9). Overall, the

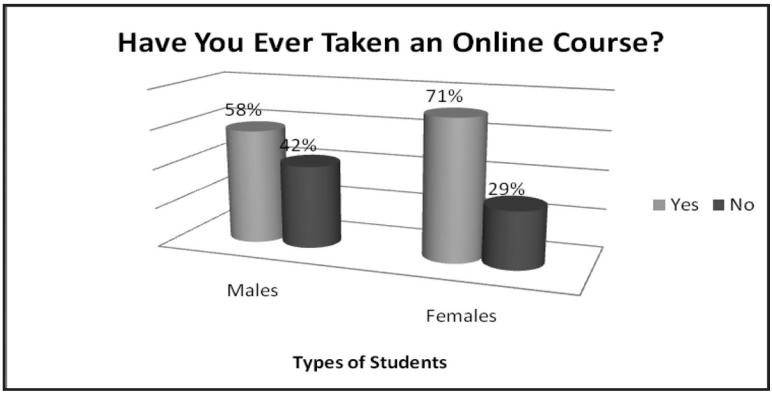

Figure 8. Online course participation by gender.

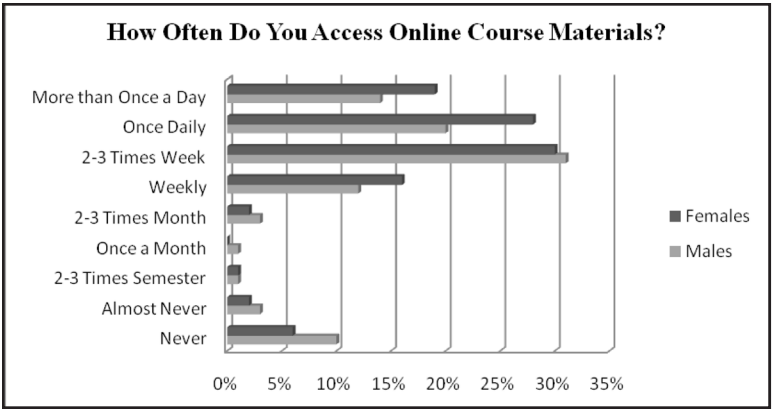

Figure 9. Online course materials access by gender.

findings suggest that more women utilize computers for course-work.

DISCUSSION

Computer Ownership by Gender

Data from the study at EMU was consistent with trends that indicate women enroll in higher education programs at a higher rate than men (Eastern Michigan University, 2007; Indiana State, 2008a). Rates of male-to-female laptop and desktop ownership also showed similar trends, as well as home Internet access among male and female computer users.

The findings show that there were similar patterns in how males and females utilized on-campus facilities and home computers for assignments. Home computer usage was the most popular means of Internet access. This may be due to the fact that the university predominantly hosts a commuter student population.

Compared to national reports over the past ten years, data trends in EMU technology access and use were also suggestive of a rise in the numbers of students owning computers in general (Pew Research Center for the People and the Press, 1999 & 2000). Results of this survey further suggested a minimal gap in physical access and use of home and campus-based computers between men and women.

Use of Programs and Wired or Wireless Services by Gender

While this survey and data collection showed a great number of college males and females accessing computers and online services independently, a large number of respondents continued to utilize computer equipment and services provided by the university. By providing computer, Internet, software, and online course access in a variety of locations, as well as in various formats (wireless, wired, or dial-up), colleges and universities continue to play an active role in diminishing the digital divide. This study suggested that increased access options stimulate usage. To determine where differences still exist in the types of Internet access male and female students choose, affordability questions may need to be a focus for future studies.

Online Course Participation

Results of the survey showed evidence that female students are technologically prepared and willing to take equal advantage of courses that require consistent access to computers, and strong online application skills required for online courses. The findings also indicated that wom-

en choose online course options more than men. This trend was similar to other reports cited in the literature review of this research study (Kramarae, 2001; Anderson & Haddad, 2005).

Implications for Issues Addressing the Gender Gap

Greater closure of digital divides in regards to access and use of technology by women, when compared to that of men, occurred in this study, which gathered data ten years after the publication of pioneer case studies related to technology access. The gender gaps in access to technological equipment and services seem to be shifting in that not only are rates and incidences of women's access and ownership of computers increasing amongst college students, but also the rate of female enrollment is gradually outpacing that of males. This suggests that the rates of access and ownership of computers for female students could soon overtake that of male students. When universities provide access, encourage computer equipment and software purchases, and incorporate digital learning opportunities into the curricula, women appear to take advantage of computer access. As a result, they might develop skills they can immediately use within the learning environment and later in their career fields, whereas in the past they may have been lacking these skills in comparison to males.

As the numbers of women currently enrolled in colleges outweighs that of men, the gender divide may continue to diminish. Higher education environments may encourage women to explore access and ownership of computers in their course work, research or communication within the university framework. Through greater access, women may also be encouraged to participate in electronic communications or in research.

As universities develop computer initiatives, the concerns related to universal access and benefits to all students should not be ignored. Enhancing and refining universal access will address student's needs related to computer access. The benefits of ownership of modern equipment, software, and applications, as well as swift access to campus-based equipment and services, may also diminish the gender gap in the digital divide.

Implications for Further Studies

This research project at Eastern Michigan University supported the need for quantitative case study assessments evaluating the successes of university support related to technology access. Issues such as male

verses female campus use of specific computer labs may lie within reasons of degree specialization or designated labs associated with particular colleges, as well as other unknown reasons for their access at the various sites. Qualitative studies investigating Internet access by gender would be beneficial and possibly answer these questions, as well as others. More qualitative studies would also be helpful in determining reasons for male or female student preferences.

Since this study was limited to quantitative data, qualitative questions may adequately clarify the needs of students, for example, in the times of day males and females choose or need to use equipment and online services, or other insights. This information would be beneficial to the universities as they construct technology programs reflecting students' needs or input. A more in-depth data analysis may further reveal specific patterns of use. Additional qualitative, open-ended surveys may help assess the effectiveness of campus-based equipment and services for male and female students in relation to academics and personal development.

Finally, the means for disseminating the survey for this study was via e-mail. To gain a greater picture of the overall population for access, a paper survey might demonstrate which students have or utilize computer technology. Other studies may also consider surveying the campus population outside lecture halls in addition to using an e-mail survey.

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