Gender, Educational, and Occupational Digital Gaps

1983-2002

SUSAN CAROL LOSH
Florida State University

Using representative national surveys, this study tracks education, occupation, and gender access and use of digital technology among adults between 1983 and 2002. Although greater parity has occurred, substantial divisions remain. For individuals who owned a home computer, gender, education, and labor force gaps in home Internet access had largely disappeared by 2002, although better educated males still most often used home e-mail. Male college graduates most often had work web access or e-mail. Gender gaps in online time rose from 1995 to 2002; men and very well educated adults increased their hours the most. Occupational variables were critical: many gender differences in information technology (IT) access and use lessened when labor force participation or occupational type were controlled. Although disparities have diminished, digital gaps across gender and educational level and among those with different labor force experiences continue.

Keywords: digital divide; gender IT gaps; education; occupation; IT

Information technology (IT) is often described as potentially facilitating social equality, and IT appreciation and adoption in American society is high (The National Public Radio, Kaiser Family Foundation, and Kennedy School of Government, 2000). Using several national surveys of adults, this study tracks gender, occupational, and educational gaps in computer and Internet access and use from 1983 to 2000. Because gender, occupation, and education are such critical stratification variables, it is important to understand how they affect information technology developments.

The relationship between IT access or use and economic well-being is plausibly reciprocal: policy makers and scholars worry that societal inequities in information technology reinforce preexisting gender, wealth, and ethnic differences (Carvin, 2000). Conversely, wealthier or better educated individuals have easier access to IT, can afford it more readily, and may have cognitive frameworks that facilitate IT adoption.

AUTHOR'S NOTE: This research was supported in part by grant no. 03-212-SRS-0086139 from the Association for Institutional Research and an American Statistical Association–National Science Foundation Research Fellowship (ASA/SRS-NSF no. 0209274). Analyses through 1999 use the NSF Science Resources Statistics Surveys of Public Understanding of Science and Technology, collected under the direction of Jon D. Miller from 1983 to 1999. I want to thank Jon Miller and Linda Kimmel for providing information about the data, Raymond Eve, Mary Frank Fox, Erich B. Goode, Robert Hashway, Melissa Pollak, Terry Russell, Alice Robbin, and John P. Robinson for their continuing insights, and Christopher M. Tavani, Rose Njoroge, Ryan Wilke, and Taner Yigit for research assistance. The analyses and interpretations presented here are the author's and do not necessarily reflect those of the National Science Foundation.

Social Science Computer Review, Vol. 22 No. 2, Summer 2004 152-166
DOI: 10.1177/0894439303262557

Although information technology may potentially create more equality, its access and use varies by strata. Most studies indicate that men and the better educated use IT more than women and the less educated for diverse tasks and entertainment. Because occupational effects have received far less research attention, they are a focus in this report. *Digital divides* describe these gaps in IT access and use across individuals who occupy different situses. Considerable research and debate have centered on the size of these gaps and how they have changed. Thus, multivariate analyses over time to assess IT access and use in the general public are valuable.

ISSUES IN THE DIGITAL "GENDER GAP"

Gender differences in education and occupation generate at least some expected disparities in digital technology access and use. In the late 20th century, American women made significant educational and occupational gains, now earning most baccalaureate and master's degrees and more than 40% of M.D., doctorate, or law degrees. Most research on the general public has found that better educated individuals more often buy, access, and use IT (see citations under Selected Research section below). Education, of course, is a primary determinant of occupational attainment.

Most American adult women across age, marital, or parental statuses now hold paid employment, and the overall distribution of professional and managerial jobs by gender is increasingly similar. In 2000, women composed more than half of professionals, nearly half of biological or medical scientists, and about one third of mathematicians, computer scientists, or chemists (all, U.S. Bureau of the Census, 2001).

Nevertheless, continuing discrepancies may influence IT access and use. Men elect more high school physical science and advanced math and more college science than women. Women major less often in engineering, architecture, or physical science, fields in which sophisticated IT use is common, and women are more often teachers than researchers. In 2000, 10% of engineers and 20% of engineering technicians were female, fractions only slightly higher than those in 1983 when this data series begins. One third of all employed women held clerical or retail sales jobs, a rate 4 times that of employed men (all, U.S. Bureau of the Census, 2001).

These differences affect what has been called the "second" digital divide (Attewell, 2001; Hargittai, 2002; Natriello, 2001): use as opposed to access to IT. For example, clerical workers (virtually all female) have accessed IT for data entry or word processing for decades, tasks that do not require Internet use. Clerical or retail sales workers typically use computers far less for analyses, syntheses, or information searches than professionals and managers do.

Educational gender differences steer women and men toward different job specialties. Occupational type, in turn, should directly link to IT use. Research, science, or technology workers (more often male) routinely employ digital searches, diagnostics, analyses, simulations, or syntheses. So-called Other Professionals may want IT but have limited job access or use. Many Other Professionals are female pink-collar workers in schools, medical offices, or service agencies. Medical assistants use IT to test or diagnose, but their employers may not see web access or e-mail as enhancing their job performance. Teachers often work on budgets so stretched that they buy student supplies with personal dollars. Despite emphases on digital resources, many schools have obsolete hardware or software and lack Internet connections (Harrell, 1998; Revenaugh, 2000).

Managerial workers find e-mail useful and Internet access may enhance their job performance. On the other hand, clerical workers often have computers, but not e-mail or Internet

access. Clerical worker e-mail may only function on the employer's server rather than on the entire web.

Digital needs of sales or blue-collar workers vary. Mostly female retail clerks have little time or opportunity to consult the Internet, although they may use so-called smart cash registers for transactions. Although digital access may enhance largely male wholesale sales jobs, the travel often required creates IT needs differing from those of more stationary professionals or managers. Finally, bosses may believe that blue-collar workers lack the training to use digital resources. Largely male skilled workers or operatives may use IT for diagnostics, but employers may view e-mail or web access as tangential for their jobs. Mostly female service workers have little time or occasion for digital work beyond data lookup. These jobs also have higher turnover, so employers also may see little incentive to train job incumbents in IT.

Individuals often transfer skills learned in one situation to others. Verba, Schoolman, and Brady (1995) found that middle-class Whites or Blacks, and Blacks active in church, transferred organizational skills to political volunteerism. Losh, Wasserman, and Wasserman (2000) found well-educated summoned jurors, more often than those less educated, filed written requests to excuse or postpone service. Educational differences in these requests narrowed when the presiding judge initiated a set of tear-off sheets in the jury summons.

Thus, skills gained from using IT at school or work can transfer to home use. For example, if a nurse practitioner culls web data on medication interactions, he or she will more easily employ web searches at home. Nie and Erbring (2000) found that the Internet enables—sometimes even requires—individuals to bring work home, blurring job and home distinctions. All these factors imply that sex differences in work computer use can transfer to sex differences in home use.

SELECTED RESEARCH ON THE DIGITAL DIVIDE

Most gender digital-divide studies are one-shot reports of preschool to college students (Lievrouw & Farb, 2003; Reinen & Plomp, 1997; Whitley, 1997; for an exception, see Vernon-Gerstenfeld, 1989). They provide little insight about how one's education or occupation affect adult IT access or use. Yet learning extends throughout life: Many adults elect vocational or continuing education classes, and instructional systems are designed for all ages. This is especially true for IT, with its constant software and hardware upgrades. Furthermore, uses and gratifications that children derive from IT may not generalize to adults. For example, some research (Mitra et al., 2000; Mumtaz, 2001) found girls are less interested in computers or have less access. However, among adults, most word processors or data-entry personnel are women. Although girls initially may be more resistant to IT than boys, this may not be true for adult women and men (American Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education, 2000; Vernon-Gerstenfeld, 1989).

Online questionnaires typically survey self-selected adults who already have web access (e.g., the *National Geographic*'s 2000 study), who do not represent any known population. Because this study focuses in part on how gender, education, and occupation affect online use, data from representative samples, rather than volunteer web surfers, are needed to ascertain changes over time in access to and use of IT.

Current national surveys on general public adults present mixed results on gender, although all find home or work IT access and use rise with degree level. Because women are about 52% of adults, studies reporting that females are 50% of information technology users

fall slightly short of gender parity. Some 54% of nonusers were female in the Pew Internet and American Life Project (Lenhart et al., 2003).

The widely cited U.S. Department of Commerce "Falling Through the Net" series found gender web parity by 2000 and its results have been optimistically interpreted; however, virtually all other studies find small persistent sex differences. Methodology may be at issue: Interviewers spoke with a person at least 15 years of age "considered knowledgeable about everyone in the household," who provided proxy responses for all other residents (Victory & Cooper, 2002). Data were then weighted up to represent all household members. Thus, anyone at least 15 could offer data about others without verification, unlike other research cited here which uses self-reported information.

Most nationally representative research reports greater Internet access for the college-educated and less for women, Blacks, or Hispanics. Nie and Erbring (2000) found that men and the well-educated used the web more and for more varied activities, as did The National Public Radio, Kaiser Family Foundation, and Kennedy School of Government (2000) survey. Pertinent to this study, Nie and Erbring (2000) attributed gaps they found to labor force status (although they did not address type of job). The *UCLA Internet Report* (Cole et al. 2003; Cole, Suman, Schramm, Lunn, & Lebo, 2002; Cole et al., 2000) found greater Internet usage among men than women in 2000 (71% vs. 64%), 2001 (74% vs. 71%) and 2002 (73% vs. 69%).

Most national research on IT access and use is recent. For example, the UCLA, General Social Survey, and Pew Project studies began in 2000. Most also focus on the web, yet individuals with limited access to computers or other IT also may be uncomfortable with the Internet. Furthermore, some gender-occupation combinations (e.g., clerical women), have used computers, yet may not have e-mail or Internet access.

The present study fills many gaps: It uses national surveys of adults to track computer access from 1983 to 2002, and Internet access from 1995 to 2002. It examines educational level, and also labor force status and occupational type. Thus, we can better identify educational and employment dimensions of the gender digital divide.

DATA USED IN THIS REPORT

Data sources. The longest repeated module about basic U.S. adult use of information technology is the National Science Foundation (NSF) surveys of public understanding of science and technology (Miller & Kimmel, 1999).[1] Computer items were asked from 1983 to 1999. Internet items began in 1995. The NSF surveys used here comprise seven random-digit-dial national telephone surveys (1983, 1985, 1988, 1990, 1995, 1997, and 1999) of 13,568 adults at least 18 years of age. Samples ranged from 1,631 (1983) to 2,041 (1988); completion rates in contacted households exceeded 65%. Actual analytic case bases vary (e.g., only labor force respondents who reported access to a work computer were asked about job web or e-mail access). The surveys span 16 years in a critical era for technological diffusion.

The NSF IT modules ended in 1999, so data were added from the 2000 and 2002 in-person probability samples of the General Social Survey (GSS) (Davis & Smith, 2002). Only respondents with telephone access were used here (n = 5,245) for 18,813 total respondents. The use of several GSS questionnaire filters in 2000 often created small samples. For example, the 2000 estimates of web work access had samples fewer than 300, and, because of

skips and filters, some questions (e.g., home computer ownership or work computer access) cannot be directly used as general population estimates.

Variables. Both surveys contained items about computer access, e-mail, and Internet access at home and work, and estimated annual hours of home and work use. For total estimated annual online hours, this study examined access from any location. These variables are the most basic and have the longest time series. Background and demographic items found on both the GSS and NSF surveys were as follows: gender, marital status, age, number of minor children, and urban residence. Degree level used common codes: high school or less, 2-year college degree, baccalaureate, or advanced college degree.

Occupational variables included labor force participation and occupational type. The NSF surveys coded occupation several different ways. Therefore, a general measure was used for job type: engineering, technology, or science professions; Other professions; managerial jobs; clerical jobs; and combined sales or blue-collar jobs. White- or pink-collar workers use IT more than blue-collar workers. Science or technology professionals were also expected to use computers more. Income was unavailable for the NSF surveys.

The primary analyses employ three-way analyses of variance. First, gender, education, and year of study were used as factors. The second set used gender, labor force status, and time, and the third examined gender, time, and job type effects. Mean scores or percentages for outcome or dependent variables are shown throughout. Covariates were also often added as controls (e.g., age, urban residence, marital status).

RESULTS

Gender, Degree Level, and Home Computer and Internet Access

Figure 1 presents home computer ownership by gender and education from 1983 to 2002. Men, the better educated, and recent respondents more often owned a home computer. A two-way time-education interaction ($F_{21,16112} = 8.93$, $p < .001$) indicated that the ownership gap across degree levels increased over time. The time-gender interaction ($F_{7,16112} = 2.04$, $p = .047$) reflected that women and men had similar computer ownership in 1983 (8% vs. 9%). However, by 1990, 29% of men but only 20% of women owned a home computer. Thereafter, the difference narrowed, reaching an insignificant 59% versus 58% comparison in 2002.

Figure 2 shows home Internet access among computer owners. Contrary to Blau (2002), access may "be enough." By 2002, more than 90% of home computer owners in all educational groups were online, compared with 33% overall in 1995. Web access among computer owners converged across education by 2002 ($F_{9,2912} = 3.63$, $p < .001$). A 26% difference between advanced degree holders and the high school educated dropped to 4% by 2002. The gender home web gap converged from an 11% difference (1995) to 1% (2002) ($F_{3,2912} = 8.14$, $p < .001$).

Changes also occurred for having home e-mail among home computer owners. Home e-mail use was higher in 2002 than in 1997 (75% vs. 40%) and among graduate school adults than among the high school educated (68% vs. 60%). A gender-time interaction ($F_{2,3495} = 4.00$, $p = .018$) showed that the sex difference flipped from favoring men by 9 percentage points in 1997 (45% vs. 34%) to a 1-point difference favoring women in 2002 (76% vs. 75%).[2]

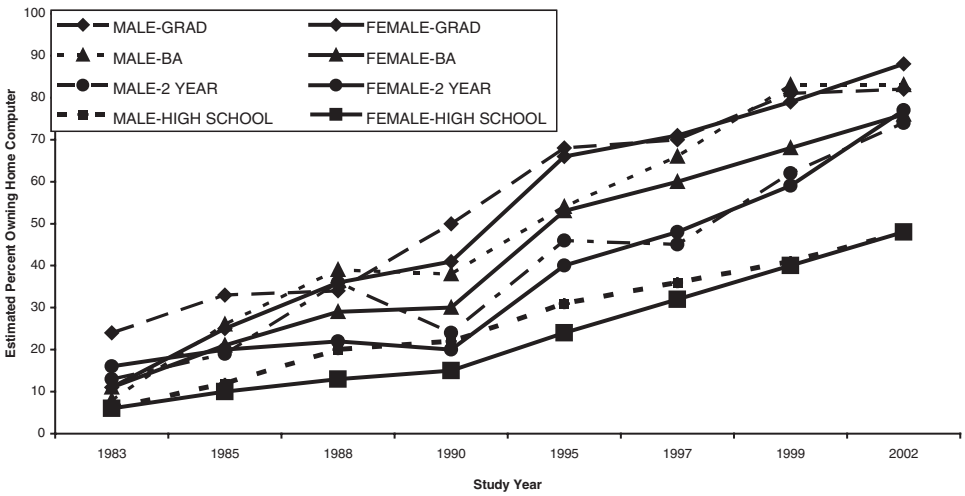

Figure 1: Home Computer Ownership by Gender, Education, and Time
NOTE: $n = 16{,}176$, $\eta = .45$.

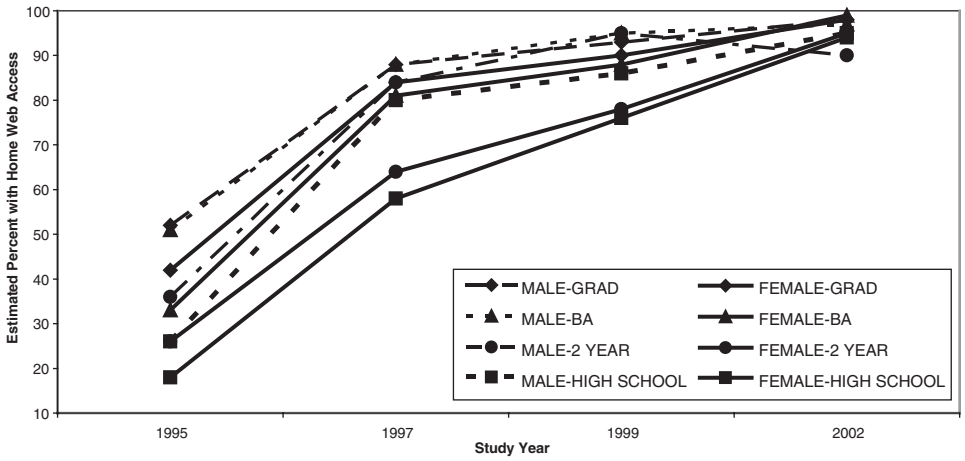

Figure 2: Percentage With Home Web Access by Gender, Education, and Time for Those With Home Computers
NOTE: $n = 2{,}944$, $\eta = .58$.

Gender, Degree Level, and Work Computer and Internet Access

Nie and Erbring (2000) felt the largest cleavage in Internet use was because of labor force participation. Work environments can introduce workers to new technology, including the

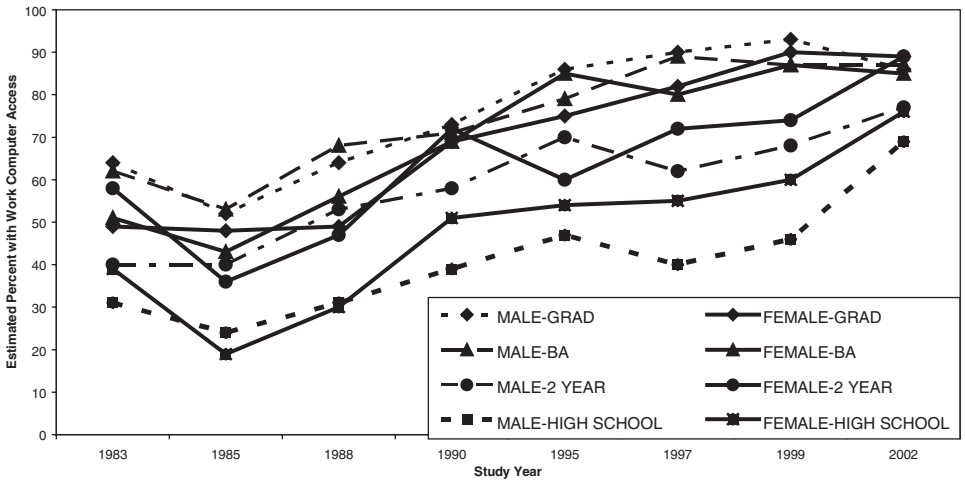

Figure 3: Worker Computer Access by Gender, Education, and Time
NOTE: $n = 10{,}589$, $\eta = .38$.

Internet. Workers may then generalize interest and comfort levels to home use. The job environment also highlights the disproportionate female use of IT in clerical tasks. As Nie and Erbring also suggested, work IT use may lead employers to assign homework, or, for other reasons (e.g., employee ambition), people may take work home. (Of course, many individuals now encounter IT as children at home, as students, or in libraries or community centers; analyses here do not address such experiences.)

Figure 3 shows work computer access by gender and degree from 1983 to 2002. All education and gender groups increased their work computer access. Although women and men overall had equal work computer access (54%), a gender-degree interaction ($F_{3,11499} = 14.24$, $p < .001$) showed that women with high school or junior college degrees more often used work computers than comparable men (47% vs. 44%). On the other hand, men with BA or advanced degrees were 6% more likely than women to have a work computer (75% vs. 69%). These results are consistent with the clerical jobs often held by less-educated women and the science and technology jobs more often held by men with at least 4-year college degrees.

Less-educated workers increased their work computer access more between 1983 and 2002 (by 37%) than did those with at least a baccalaureate (by 27%, $F_{21,11499} = 2.89$, $p < .001$). Thus, there was a trickle-down effect for workers with high school or junior college degrees. The education IT gap closed by more than one quarter over time because less-educated workers received more job computer access.

Workers increasingly access the web to locate information or perform analyses. Overall, graduate-degree workers had greater web access than the high school educated (80% vs. 46%). Internet access for those with work computers rose from 41% to 72% between 1997 and 2002 and overall was higher for men than for women (62% vs. 54%).

However, gender and educational gaps shrank. Workers with BA, junior college, or high school degrees increased job web access more between 1997 and 2002 (by 35%, 48%, and 34%, respectively) than did workers with graduate degrees (only 25%) ($F_{6,2900} = 3.76$, $p = .001$). A gender-time interaction ($F_{2,2900} = 2.99$, $p = .05$) showed that women increased work web access over time more than men (38% vs. 23% increase). Comparable to home use, once

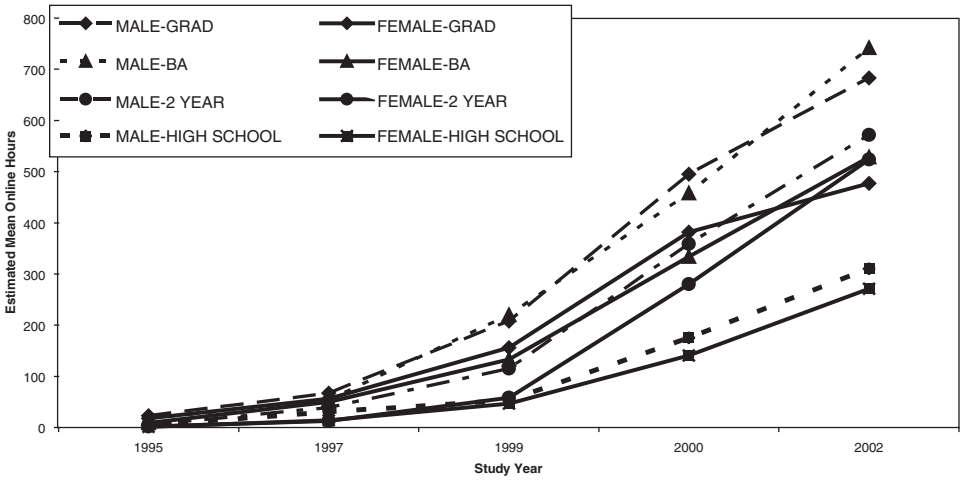

Figure 4: Average Annual Total Online Hours by Gender, Education, and Time
NOTE: $n = 10{,}628$, $\eta = .39$.

individuals gained access to a work computer, gender and educational divides in Internet work access decreased over time.

Work e-mail can conveniently relay instructions, schedule appointments, send documents, or foster collegial networking. Of those with office computers, men had work e-mail more often than women (59% vs. 53%). Work e-mail rose from 41% to 77% across degree levels, and from 46% to 66% between 1997 and 2002. E-mail use was especially pronounced for men with at least a BA degree. Of those with advanced degrees and office computers, more men than women had work e-mail (81% vs. 71%, $F_{3,2900} = 6.96$, $p < .001$). Again, some differences may stem from occupational sex-segregation. Many largely female primary and secondary teachers, social workers, or lower level bank managers still lack work web or e-mail access. When e-mail is available, workers may be able to only communicate with others on the same server (this difference could not be tested with either data set).

Education and Online Time

Figure 4 estimates annual online hours from 1995 to 2002 from any source (home use was the major measure in 1995).[3] Online hours literally exploded over time, although men spent more hours online than women (436 vs. 347 mean annual online hours in 2002). The best-educated averaged 580 annual hours in 2002, compared with 288 for high school graduates. Online hours rose more over time for the best-educated, widening the educational gap to a chasm ($F_{12,10588} = 17.07$, $p < .001$). Although both sexes increased their online time, men's hours increased more ($F_{3,10588} = 3.93$, $p = .003$), by 427 hours between 1997 and 2002, compared with 343 hours for women. Increased education led to longer online time for men than for comparable women (a 135- vs. 98-hour increase across degree levels, $F_{3,10588} = 4.50$, $p = .004$).

Because degree level relates to age, labor force status, and urban residence, all of which may affect online time, these variables became covariate controls in the ANOVA equation.

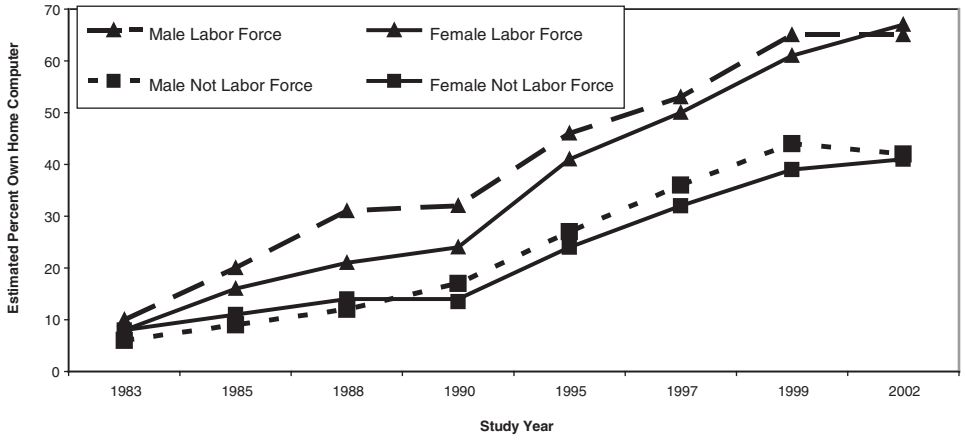

Figure 5: Home Computer by Gender, Labor Force Status, and Time
NOTE: n = 12,857, η = .48.

Marital status (married) and the number of children under 18 were also controlled. Although the summary eta correlation rose from .39 to .42, gender, degree level, and time remained major determinants of online hours. Labor force status was particularly likely to raise online use (partial correlation = .11) and is explored below.

Labor Force Participation and Home Computer Use

Clearly, financial factors can affect owning a home computer. Married couples, men, or the well-educated more often do so (Losh, 2003). Labor force participants also should have more financial resources than those at home full time. However, cognitive factors in skill transfer are also pertinent: Workers take home technical skills and comfort at working with IT—and perhaps homework from the boss, too.

Among labor force participants over the entire 20-year period, 55% who used a work computer owned a home computer, but among those not in the labor force, only 24% did. Even by 2002, when this gap had narrowed substantially, 88% of those with work computer access had a home computer compared with 69% of workers who lacked computer access (corrected $\chi^2_{(1)} = 64.44$, $p < .001$).

Figure 5 illustrates how the ownership gap dramatically grew between those in and those out of the labor force between 1983 and 2002. Although men owned a home computer slightly more often, labor force status was the major determinant: 9% of labor force participants owned a home computer in 1983 compared with 7% of those at home. But by 2002, 66% of labor force participants but only 41% of those at home owned a computer ($F_{7,1612} = 11.99$, $p < .001$).

Those out of the labor force are typically younger or older than the employed, and women at home more often have young children. Both employment opportunities and Internet access are often greater in cities (e.g., Katsinas & Moeck, 2002). A second ANOVA model

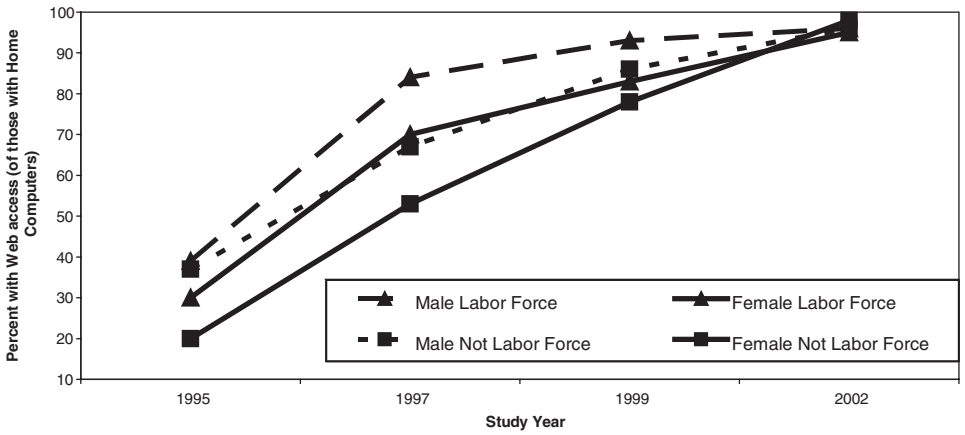

Figure 6: Home Web Access by Gender, Labor Force Status, and Time
NOTE: n = 2,944, η = .56.

TABLE 1
Estimated Percentage of Workers With Computer Access by Gender, Occupation, and Time

	Year							
Gender-Occupation	*1983*	*1985*	*1988*	*1990*	*1995*	*1997*	*1999*	*2002*
Male-science/tech	89	74	88	83	94	93	94	84
Female-science/tech	76	88	80	90	100	95	100	88
Male-manager	54	80	57	60	77	84	87	86
Female-manager	72	50	95	71	77	76	86	86
Male-other professional	46	36	52	59	73	79	84	92
Female-other professional	41	39	46	63	68	74	81	87
Male-clerical	40	50	52	50	64	56	57	76
Female-clerical	56	73	71	73	84	80	82	93
Male-other occupation	33	35	33	39	50	46	49	66
Female-other occupation	32	33	27	28	35	47	50	66
n	1,124	1,323	1,376	1,320	1,351	1,392	1,285	1,420

included age, marital status, number of children under age 18, degree level, and urban residence as covariates. Although the model eta including covariates increased from .41 to .48, even with controls, the labor force status by time interaction on computer ownership was still statistically significant ($F_{6, 12824} = 7.59$, $p < .001$).

Once someone owned a home computer, similar to educational effects, convergence in home web access had occurred across labor force participation groups by 2002. Trend lines are shown in Figure 6. Initially, in the mid-1990s, men more often adopted home online use. Sex differences in web access among home computer owners vanished by 2002 ($F_{3,2928} = 7.35$, $p < .001$). In related analyses, women at home used home e-mail the most by 2002. However, men still logged more home online hours than women, largely because of an increase by retired males after 1995.[4]

TABLE 2
Analysis of Variance Statistics (η = .47)

Effect	df	F *Ratio*	p
Gender	1, 10511	17.04	< .001
Occupation	4, 10511	354.81	< .001
Time	7, 10511	88.55	< .001
Gender by occupation	4, 10511	13.26	001
Gender by time	7, 10511	.88	.518
Occupation by time	28, 10511	4.63	< .001
Gender by occupation by time	28, 10511	1.21	.209
Explained	79, 10511	31.52	< .001
Residual	10,511		
Total	10,590		

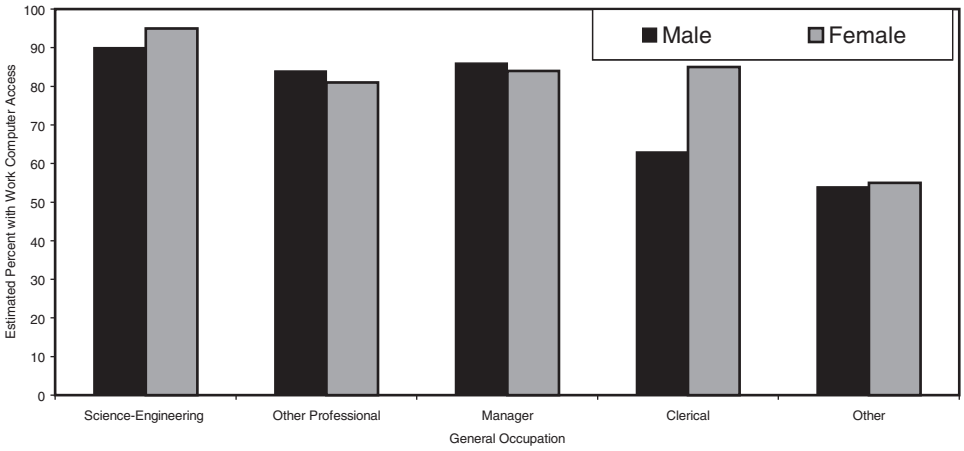

Figure 7: Work Computer Access by Gender and Occupation, 1997, 1999, and 2002 Combined
NOTE: *n* = 4,097, η = .34

Type of Occupation

As noted earlier, gendered occupational differences should directly affect work IT use because women are overrepresented in clerical work but are underrepresented in many science or technology occupations. Table 1 (and accompanying ANOVA statistics in Table 2) shows work computer access by gender, general occupation, and time. Overall, women had more work computer access than men (60% vs. 56%). Exempting clerical women, professionals or managers used computers more than clerical or Other workers. Work computer access significantly rose from 1983 (43%) to 2002 (78%).

Because of the many time, occupation, and gender combinations, it is difficult to read figures based on all data years. For presentational ease, Figure 7 presents work computer access, Figure 8 presents work Internet access, and Figure 9 presents work e-mail access by gender and occupation, collapsing the millennial years 1997, 1999, and 2002.[5] Figures 8 and 9 only include those who had access to a work computer.

Figure 8: Work Web Access by Gender and Occupational Type, 1997, 1999, and 2002 Combined
NOTE: Minimum $n = 3{,}629$, $\eta = .35$.

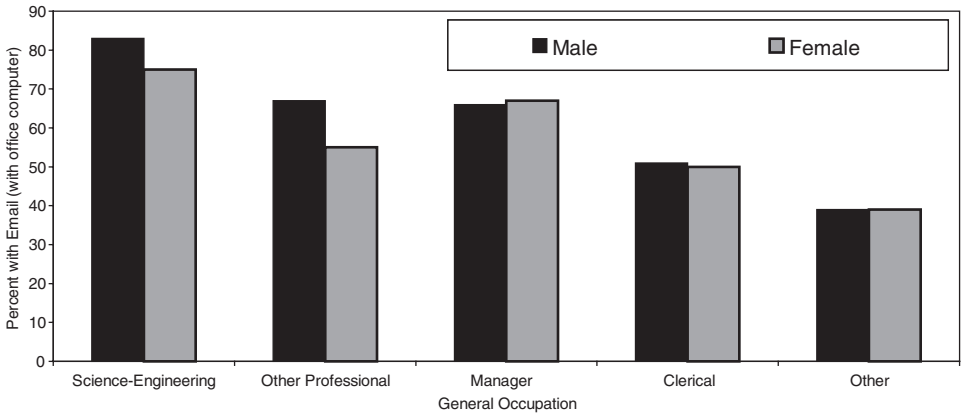

Figure 9: Work E-Mail by Gender and Occupational Type, 1997, 1999, and 2002 Combined
NOTE: $n = 2{,}937$, $\eta = .28$.

During these years, employed women more often had work computer access than men (74% vs. 69%, $F_{1,4087} = 12.82$, $p < .001$). Managers and professionals also had increased access ($F_{4,4087} = 123.49$, $p < .001$). Science or technology workers most often had both web and e-mail work access, whereas clerical and Other workers least often had either. There were no interaction effects on work e-mail, although women Other Professionals lagged behind male professionals or managers. Gender-occupation interactions for Internet access ($F_{4,3575} = 3.68$, $p = .005$) indicated that compared with men, fewer women scientists, other professionals, or managers had web access, whereas women clerical workers had slightly more access than comparable men.

The key factors influencing work online time for those with work computers were time (estimated online annual work hours tripled from 122 in 1997 to 359 hours in 2002, $F_{2,1978} = 62.99, p < .001$) and occupation ($F_{4,1978} = 14.39, p < .001$). Gender was not statistically significant in this ANOVA.

Other workers with computers logged relatively few annual work online hours (about 207 in 2002) and female Other Professionals lagged behind in general (242 hours in 2002, compared with 448 hours for male Other Professionals). In 2002, science or technology professionals (607 annual online work hours), managers (522 hours), or even clerical workers (377 hours) all spent more work online time than women Other Professionals. Perhaps because these job incumbents spend so much time working firsthand with students, patients, or clients, comparatively less time remains for online exploration, analyses, or communication. On the other hand, women scientists or technology workers logged the most annual online hours (826) in 2002 of any gender-occupation combination.

DISCUSSION

How do we interpret these digital divides over time by gender, education, and occupation? Answers from these national surveys are mixed. Degree level digital gaps in computer ownership rose over time, leaving the high school educated behind. Because educational disparities in home web access converged by 2002 among computer owners, this gap is critical. Despite the proliferation of alternative locations for Internet access, such as cyber cafes, the computer at home fosters web use. Although men in the early 1990s more often owned computers than women, that gap was gone by 2002, as was the gender gap in home web or e-mail use among computer owners.

Home gender gaps contrasted with those at work. At work, well-educated men but less-educated women more often had computer access, results reflecting sex segregation in clerical, science, and technology occupations. Because work computer access creates greater work e-mail or web use, this gap is important. A trickle-down effect for less-educated workers in both computer and Internet access was apparent by 2002.

The most striking findings involved labor force status. Labor force participants more often owned a home computer. Gaps in ownership grew between those in and out of the labor force. By 2002, having the home computer almost invariably meant home e-mail and Internet access too (regardless of labor force status), so the ownership gap is critical.

Although the type of use varied, women and men showed more comparable work computer access over time. By the millennium, within general occupations, the only substantial gender gap remaining was in clerical work, where women more than men had computer access. Women science or technology professionals or managers had far greater digital parity in 2002, although men overall more often had work e-mail or web access. Science and technology professionals more often had work computers, e-mail, and the Internet and spent the most time online, especially women scientists in 2002. Clerical women had high work computer access but relatively low web or e-mail access.

Other professional women, often employed in fields such as primary or secondary education or medical support, lagged behind other well-educated workers in web or e-mail access and online work time. Although these workers might have used web or e-mail access more, apparently employers provided such resources for them less. Because of the impact work IT use has on home use, and the influence these professionals have on students, patients, and clients, this gap is particularly significant.

One vision of IT is that of the so-called great leveler, bringing updated information, opportunities, and life enhancements to the public and bridging gaps across status levels.

Women or the poorly educated have increased their computer and Internet access. However, in many cases, men, the well-educated, or labor force participants have increased access and use even more; thus, many digital gaps remain or grow. Even in the workforce, women in more traditionally female professions seem to lag in digital resources. These findings are sobering for those who look to IT to promote greater societal equality. The historical stratification analyses in this study afford a clearer understanding of the seriousness of IT disparities across American social groups and, it is hoped, provide a basis for steps to eliminate them.

NOTES

1. The NSF surveys are now public-access files. The data used in this report can be accessed and/or analyzed via the SDA statistical online program on the University of Maryland's Scientific Research on the web site http://webuse.umd.edu through the archival link Computer and Internet Access & Use: 1983-2002; The NSF Surveys of Public Understanding of Science and Technology (1983-1999 and the 2002 GSS). Further information about file access is available from the author.

2. Home e-mail use and Internet access overlap, but the correlation is moderate (tau-beta = 0.30, $\chi^2_{(1)}$ corrected = 227.68, $p < .001$) rather than strong, indicating considerable independence in use. Individuals can access e-mail several ways, and many respondents did not have a separate home e-mail address.

3. Because of skip and filter patterns, online time can be estimated for the 2000 General Social Survey.

4. An analysis of age, gender, and labor force status indicated that in 2002, 53% of men at home were at least age 65 and only 12% were under 24; 46% of women at home were 65 or over, and only 9% were under 24. The data indicate the increase in online hours came more from older retirees as opposed to younger students. Complete tables are available by request from the author.

5. Complete tables disaggregating the data by gender, occupation, and separate year are available on request from the author.

REFERENCES

American Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education. (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, DC: Author.

Attewell, P. (2001). The first and second digital divides. *Sociology of Education*, *74*(3), 252-259.

Blau, A. (2002). Access isn't enough: Merely connecting people and computers won't close the digital divide. *American Libraries*, *33*(6), 50-52.

Carvin, A. (2000). Mind the gap: The digital divide as the civil rights issue of the new millennium. *MultiMedia Schools*, *7*(1), 56-58.

Cole, J. I., Suman, M., Schramm, P., Lunn, R., Aquino, J. –S., & Lebo, H. (2003). *The UCLA Internet report: Surveying the digital future year three*. Los Angeles: UCLA Center for Communication Policy.

Cole, J. I., Suman, M., Schramm, P., Lunn, R., & Lebo, H. (2002). *The UCLA Internet report 2001: Surveying the digital future year two*. Los Angeles: UCLA Center for Communication Policy.

Cole, J. I., Suman, M., Schramm, P., van Bel, D., Lunn, P. R., Maguire, P., et al. (2000). *The UCLA Internet report: Surveying the digital future*. Los Angeles: UCLA Center for Communication Policy.

Davis, J. A., & Smith, T. W. (2002). *General social surveys, 1972-2002: Cumulative codebook* (NORC ed.). Chicago: National Opinion Research Center.

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday*, *7*(4).

Harrell, W. (1998). Gender and equity issues affecting educational computer use. *Equity and Excellence in Education*, *31*(3), 46-53.

Katsinas, S. G., & Moeck, P. (2002). The digital divide and rural community colleges: Problems and prospects. *Community College Journal of Research and Practice*, *26*(3), 207-224.

Lenhart, A., Horrigan, J., Rainie, L., Allen, K., Boyce, A., Madden, M., et al. (2003). *The ever-shifting Internet population: A new look at Internet access and the digital divide*. Washington, DC: Pew Internet and American Life Project.

Lievrouw, L. A., & Farb, S. E. (2003). Information and equity. *Annual Review of Information Science and Technology*, *37*, 499-540.

Losh, S. C. (2003). Gender and educational digital gaps: 1983-2000. *IT & Society*, *1*(5), 56-71. Retrieved from www.stanford.edu/group/siqss/itandsociety/v01i05/v01i05a04.pdf

Losh, S. C., Wasserman, A. W., & Wasserman, M. A. (2000). "Reluctant jurors": What summons responses reveal about jury duty attitudes. *Judicature*, *83*(6), 304-310.

Miller, J. D., & Kimmel, L. (1999). *The United States science and engineering indicators studies CD-ROM: Users manual*. Chicago: Chicago Academy of Sciences.

Mitra, A., Lenzmeier, S., Steffensmeier, T., Avon, R., Qu, N., & Hazen, M. (2000). Gender and computer use in an academic institution: Report from a longitudinal study. *Journal of Educational Computing Research*, *23*(1), 67-84.

Mumtaz, S. (2001). Children's enjoyment and perception of computer use in the home and the school. *Computers and Education*, *36*(4), 347-362.

National Geographic. (2000). *The National Geographic survey, 2000*. Retrieved from http://survey2000.nationalgeographic.com/

The National Public Radio, Kaiser Family Foundation, and Kennedy School of Government. (2000). *National survey of American adults on technology and national survey of American kids on technology*. Cambridge, MA: Harvard Kennedy School of Government.

Natriello, G. (2001). Bridging the second digital divide: What can sociologists of education contribute? *Sociology of Education*, *74*(3), 260-265.

Nie, N., & Erbring, L. (2000). *The InterSurvey study*. Menlo Park, CA: Stanford University.

Reinen, I. J., & Plomp, T. (1997). Information technology and gender equality: A contradiction in Terminis? *Computers and Education*, *28*(2), 65-78.

Revenaugh, M. (2000). Beyond the digital divide: Pathways to equity. *Technology and Learning*, *20*(10), pp. 38-40, 44, 46, 48, 50.

U.S. Bureau of the Census. (2001). *Statistical abstract of the United States* (121st ed.). Washington, DC: Government Printing Office.

Verba, S., Schoolman, K. L., & Brady, H. E. (1995). *Voice and equality: Civic volunteerism in American politics*. Cambridge, MA: Harvard University Press.

Vernon-Gerstenfeld, S. (1989). Serendipity? Are there gender differences in the adoption of computers? *Sex Roles: A Journal of Research*, *21*(3-4), 161-173.

Victory, N. J., & Cooper, K. B. (2002). *A nation online: How Americans are expanding their use of the Internet*. Washington, DC: U.S. Department of Commerce, Economics and Statistics Administration.

Whitley, B. E., Jr. (1997). Gender differences in computer-related attitudes and behavior: A meta-analysis. *Computers in Human Behavior*, *13*(1), 1-22.

Susan Carol Losh is an associate professor of educational psychology and learning systems at Florida State University, program leader of the Learning and Cognition Program, and the 2003-2004 American Statistical Association-NSF/SRS Research Fellow. She may be reached by e-mail at slosh@garnet.acns.fsu.edu.