ARE WE ASSUMING TOO MUCH?

EXPLORING STUDENTS' PERCEPTIONS OF THEIR COMPUTER COMPETENCE

Melinda Messineo and Ione Y. DeOllos

Abstract. The reported experience, comfort level, and perceived skill of 233 students in a medium-size midwestern university were measured to determine how best to approach the use of information technology within departmental curricula. Results show that students view their computer competence differently depending on whether they are using the technology for personal or course-related tasks. Additionally, while the expressed levels of experience and comfort are high for some forms of technology, exposure and confidence with more advanced applications are lacking. Such findings suggest that faculty members may make false assumptions about student preparedness and, in turn, may jeopardize student success. Differences by gender and race/ethnicity also were observed, suggesting that departments need to be aware of the varied experiences of their students.

The ownership of personal computers dramatically increased in the United States over the past ten years, from 22.8 percent of the population in 1993 to 51 percent in 2000 (U.S. Census Bureau 2001). Of the 51 percent of the population with computers, 41.5 percent had access to the Internet, twice the number with access just three years earlier (U.S. Census Bureau 2001). This increase has expanded access and opportunities for children and young adults, with 65 percent of all children between three and seventeen years old living in a household with a computer. Similar trends have been identified in schools (Coley, Cradler, and Engel 1997). Although there is some debate over the educational value of computers at home and in schools beyond skill acquisition (Di, Dunn, and Lee 2000; Orleans and Laney 2000; Skinner 1997; Subrahmanyam, Kraut, Greenfield, and Gross 2000), this early preparation is important, as colleges and universities promote information technology use in the classroom and increase their expectations of student skills with and access to personal computers (Kuenzi 1999–2000; O'Donnell 1993; Wazienski 1998). Often, the assumption is that on entering college, students are prepared to use computers and information technology in the classroom (Facer and Furlong 2001). Faculty members who are in the process of learning how to integrate technology into their classrooms may feel, perhaps incorrectly, that their students are more competent with the technology. The assumption that students are comfortable and prepared may lead faculty members to present material in ways that disadvantage those students who are less comfortable and prepared. In response to these concerns, this study (1) assesses the perceived competence of students in terms of their self-reported level of experience, degree of skill, and comfort of use with information technology; (2) investigates gender and race differences in reported competence; and (3) explores the possible implications that such findings have for college curriculum.

Computers and Information Technology in the Classroom

Efforts by faculty to integrate computer

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use and information technology (IT) into the classroom increasingly are being encouraged, rewarded, and, in some cases, required (Noble 2002). The incorporation of computers and IT into a course may be as simple as using an opaque projector to display photos or as complex as interactive virtual courses administered entirely online. Within this range are the Web pages, online databases, e-books, discussion boards, online testing, virtual tutoring, courseware programs, and numerous other options that make up information technology. Despite the increasing breadth, adoption of IT in the classroom hardly is new. Educational institutions have continually worked to integrate new technology into the classroom. There are perhaps instances when applications have been adopted merely for "technology's sake," but there are benefits to adoption as well. Research indicates that there is pedagogical value to the integration of computers and IT into the classroom, including improved performance and attitude, increased student engagement, enhanced skill mastery, and advanced inferential thinking (Johnston and Joscelyn 1989; Reed-Sanders and Liebowitz 1991). Concerns about expense, reliability, diminished creativity, and reduction in face-to-face interaction indicate that the benefits are not without their costs (Domozatov 1989; Karger and Kreuger 1988; Persell 1992).

Anxiety and Academic Performance

The increased use of computers and IT also has the potential to disadvantage students who simply lack technical skills. The lack of skills can increase anxiety among students, perhaps reducing their sense of self-efficacy and, as a result, their academic success (Bowers and Bowers 1996; Di, Dunn, and Lee 2000; Kinzie 1994). Researchers have investigated this link between technophobia and academic success and have determined that experience and skill mastery are important precursors to comfort and academic achievement (Bowers and Bowers 1996; Kinzie and Delcourt 1993). Without comfortable and frequent interactions with familiar technology, student anxiety increases as new applications are introduced. As a result, students who are uncomfortable with computers potentially could do less well on assignments that require IT use.

Digital Divide

If experience is the key to comfort and, ultimately, success, then the risk of not having access becomes even more pressing. Research shows that there is indeed disparity in access to computers and information technology, specifically disadvantaging lower-income, racial and ethnic minority, and female students. This lack of equity calls into question the assumptions that all students are "cyberkids," highly skilled youth infinitely comfortable with new technology (Facer and Furlong 2001). Research suggests that female college students are less likely to have home computers and that they spend fewer hours using them. In contrast, females with home computers were more likely to have e-mail and Internet access compared to their male counterparts (Office of Institutional Research 2000). Studies also have found that freshmen at black colleges are less likely to use a personal computer and have less IT experience than freshmen at other colleges ("Freshmen" 2002). There is some concern that this difference may actually increase in college for some students (Hawkins and Paris 1997). Attewell (2001) points out that simply having access to computers does not guarantee success. In fact, research in elementary and secondary schools illustrates how usage between higher- and lower-income districts varies, with more sophisticated and intellectually challenging applications being employed in the more prosperous districts (Becker 2000). These findings illustrate that bridging the digital divide requires more than increasing access. The types of technologies that are adopted, how they are used, and how disadvantaged students acquire access also must be addressed (Natriello 2001).

Sample and Instrument

The 29-item survey instrument was distributed to students in lower- and upper-division courses in a medium-size midwestern university with semi-selective admissions criteria. Participation was voluntary with informed consent. There was an 83-percent response rate, with 233 students participating. The majority of respondents (66.5 percent) were female (reflecting course enrollment), with 29.6 percent male and 3.9 percent not responding. A majority of the respondents (82.8 percent) identified as white/Caucasian, with 6 percent identifying as black/African American; 2.6 percent, Hispanic/Latino; 1.3 percent, Asian/Pacific Islander; 0.9 percent, multiracial; 0.4 percent, other; and 6 percent not responding (again reflecting course enrollments). Most students (91.4 percent) were age 18–23, with 12 percent seniors, 16.3 percent juniors, 18.5 percent sophomores, 47.6 percent freshman, and 0.9 percent graduate, with 4.7 percent not responding. Student-reported grade point averages (GPA) on a four-point scale were as follows: 21 percent reported a GPA of 3.5–4.0, 30.9 percent reported a GPA in the range of 3.0–3.4, 29.6 percent in the range of 2.5–2.9, 12 percent in the 2.0–2.4 range, 1.7 percent reported less than 2.0, and 4.7 percent did not respond.

Results

Preparedness

Exposure and experience. Students clearly were familiar with computers, with 99.6 percent having IT experience. When asked to name all of the reasons they use a computer, 93.1 percent of respondents felt that they were "a tool to help them get things done." About 74 percent reported that the enjoyment of computers encouraged their use, while 76.4 acknowledged that courses that require the use of technology also serve as a motivation. Maintaining social ties and networks also was mentioned frequently. About 72 percent of the respondents used computers by the time they were ten years old, an additional 24 percent used them by age fifteen, and a full 97 percent had computer experience before entering college. The majority of these first experiences occurred at school (69.5 percent), and only 23 percent occurred at home. The remainder of first contacts occurred in combined or alternative settings, such as at the home of a friend or grandparent. Although the majority of first experiences occurred at school, many respondents eventually had access to a computer at home.

College attendance had a leveling effect, with almost 97 percent of students

owning or having access to a computer where they currently lived. When comparing themselves to their friends, most students felt they were "equally experienced" (55.4 percent), while about 30 percent felt "more experienced" and only 12 percent felt "less experienced."

General comfort level. When asked how comfortable they would feel if the instructor made required material available only on a course Web site, 80 percent of respondents stated they would feel "very or somewhat comfortable." About 9 percent reported feeling "uncomfortable." About 5 percent of the sample explained that their discomfort was linked to their preference for personal contact or because of their view that increased use of information technology was a sign of faculty laziness. Another 2 percent felt they lacked the skills to deal with such course requirements, in part because they felt the university did not provide enough IT instruction.

Specific application experience. Students reported considerable experience with the Internet, e-mail, and word processing (98.7 percent; see table 1). Experience also was high for the top nine categories on the table, through the category "presentation software" (84.5 percent). Exposure, however, dropped off with applications requiring more advanced skills, with "data processing" at 76 percent, "online testing" at 50.2 percent, and "online courses" at 22.3 percent (table 1).

Specific application comfort level. To explore the relationship between comfort level and experience, we asked students to report their ease with the various IT applications. Not surprisingly, the applications with which they were more experienced garnered the greatest comfort. These levels dropped dramatically as the applications became more complex with "data processing," "online homework submission," and "online courses" at or below 50 percent. Interestingly, experience was not always linked to comfort, as illustrated in the finding that a number of students who had experience with data processing were not comfortable with the application (76 percent "experienced" compared to 51 percent "comfortable"). Students had little experience with online courses (22.3 percent) and were not especially comfortable with the prospect of enrolling in such a course (only 35.2 percent reported that they felt comfortable), which suggests a lack of information about the application or a lack of comfort with their own skills (see table 1).

Specific application self-reported skill level. With an understanding of student experience and comfort with computers and IT, we explored students' ratings of their skill levels. Students' perceptions of their competence inform their overall comfort level with technology regardless of their actual skill levels. Students saw themselves as being quite skilled at using e-mail, word processing programs, the Internet, and course-management products such as a Web-based gradebook. It is interesting to note that students made a distinction between personal and class use, with many rating their skill at using e-mail and the Internet for class purposes lower than for their own personal correspondence (for example, personal e-mail 87.9 percent "skilled," compared to class e-mail at 78.1 percent). We do not know how these reported skill levels reflect actual ability, but perception is an important part of confidence, and the students in this study rate their confidence levels rather high in these lower skill areas. There was, however, a shift in reported skill level as the tasks became more intricate. The percentage of students reporting themselves as "skilled" dropped to about 60 percent for "Web-based course support" technology, 43.9 percent for using "online library resources," 30 percent for "online testing," and only 24.3 percent for "data processing" (table 1). These findings may be counterintuitive to some faculty members who ascribe greater confidence to students in terms of IT skills.

We then created scales from the comfort and skill items (Relative Comfort with IT Scale, $\alpha = .88$, and Relative IT Skill Scale, $\alpha = .84$). We used these scales to look at how GPA and class standing were related to overall IT comfort and skill levels. There was no relationship between these variables. The class level comparison revealed that sophomores expressed the greatest confidence in their skills, while juniors expressed the least. These findings are counterintuitive given the fact that students should have gained greater exposure in the more advanced courses and potentially greater comfort with these applications. It may be that students adjust their perceptions of their own skill levels as their degree of experience increases.

The digital divide. A number of differences by race and gender were observed. Minority respondents were significantly less likely to have computers when growing up (32 percent did not have a computer, compared to only 7.3 percent of the white respondents, $p < .001$; see table 2). White respondents were significantly more likely to self-identify as skilled at e-mail for class purposes (81.8 percent, compared to 56.5 percent minority respondents, $p < .005$; see table 3), while minorities had less online library experience (84.6 percent, compared to 97.4 per-

TABLE 1. Self-Reported Experience, Comfort, and Skill with Information Technology

IT application	Experienced %	Comfortable %	Rank	Skilled %	Rank
Internet-Web (own use)	98.7	95.7	4	76.2	4
E-mail (own use)	98.7	98.3	1	87.9	1
Word processing	98.7	97.8	2	84.8	2
Internet-Web (for course)	97.9	92.1	6	63.6	6
E-mail (for course)	96.1	95.1	5	78.1	3
Web-based course support	96.1	88.9	7	60.3	7
Web-based gradebook	96.6	96.9	3	76.1	5
Online library resources	94.4	74.9	8	43.9	9
Presentation software	84.5	74.8	9	48.6	8
Data processing	76.0	51.0	11	24.3	11
Online testing	50.2	59.0	10	30.4	10
Online homework submission	27.0	41.8	12	14.6	13
Online courses	22.3	35.2	13	18.1	12

cent for white respondents, $p < .002$; see table 3). Minority respondents were significantly less likely to report using their university e-mail account regularly (52 percent minority, compared to 78.3 percent for majority, $p < .016$). Interestingly, on the overall skill scale, minorities were significantly more likely to identify as skilled as compared to white respondents (19.2 percent compared to 5.2 percent).

Gender differences also were observed. Female respondents had less total exposure to computers in the home (48.7 percent, compared to 67.2 percent males; see table 2). Female respondents reported less skill (19 percent females, compared to 36.2 percent males) and comfort (42.1 percent females, compared to 58 percent males) with data processing and had less experience with online courses (18.7 percent females, compared to 30.4 percent males; see table 4).

Discussion

Overall, students reported having considerable experience with the Internet, e-mail, word processing, and online course support applications. However, the reduction in reported comfort and experience as tasks become more challenging indicates that students may lack depth in their skill repertoire. Students, who in some ways are quite comfortable and confident with their computer skills, are less secure and confident about more advanced, and perhaps more marketable, techniques such as data processing and analysis. The lack of comfort and confidence could translate into students' being less willing to take risks with technology and perhaps succumbing to a self-fulfilling prophecy of inability. Interestingly, upper-level students expressed reduced confidence in their skills precisely as they faced the more challenging applications in class. Given that students expressed confidence in their skills, they may have internalized a cultural view of their computer literacy that is beyond their actual abilities. As a result, they may have unrealistic expectations about the potential speed of acquiring new competencies.

These concerns become even more pronounced when considering the experiences of women and minorities in the educational system. The lack of exposure to computers for women and minorities puts

them at a disadvantage in courses early in their academic careers. For women, their lack of comfort and confidence with data processing and online courses may be exacerbated in college if instructional opportunities are not provided by faculty, the institution, or both. Students who lack confidence in their IT competence may be receptive to supplemental instruction, yet they also may become discouraged and less willing to take risks. An unwillingness to take risks may cause students to avoid enrolling in important courses simply because of IT requirements. It is interesting to note that minority students were less likely to use their university e-mail and that they felt less skilled at using e-mail for class. These findings show that the potential for interaction with minority students via e-mail may be less effective. In contrast, minorities reported higher

overall skill than white respondents. This could possibly be the result of how minorities perceive the abilities of those in their comparison group. For example, because black students are less likely to report having computer experience prior to college, any level of skill would be greater than their peer group in the community, which has low exposure and experience. The potential for a digital divide is real but not inevitable.

Of particular interest is the fact that students identify the academic use of IT as more challenging than personal applications. If our assumptions about the preparedness of "cyberkids" are based on our understanding of their personal use of computers, we are missing the reality that they view the uses as dissimilar and feel they are less competent at using IT in courses. It is accurate and encouraging that

TABLE 2. Differences by Race/Ethnicity in Access to Computers while Growing Up

	n	Yes, most of the time (%)	Yes, some of the time (%)	No, not at all (%)
White	192	56.5	36.1	7.3
Minority	23	36.0	32.0	32.0
$p < .001$				
Female	153	48.7	40.9	10.4
Male	69	67.2	20.9	11.9
$p < .015$				

TABLE 3. Differences by Race/Ethnicity on Various Measures

	n	Skilled e-mail for class (%)	Experienced online library (%)	Regularly use university e-mail (%)	Skilled overall IT scale (%)
White	192	81.8	97.4	78.3	5.2
Minority	23	56.5	84.6	52.0	19.2
		$p < .005$	$p < .002$	$p < .016$	$p < .008$

TABLE 4. Differences by Gender on Various Measures

	n	Skilled data processing (%)	Comfortable data processing (%)	Experienced online course (%)
Male	153	36.2	58.0	30.4
Female	69	19.0	42.1	18.7
		$p < .005$	$p < .029$	$p < .052$

students recognize that searching the Internet for a course assignment most likely requires more rigor than nonacademic searches, but are the fundamental skills not similar? Likewise, why do students rate themselves as less skilled in using e-mail for class purposes? Perhaps communication of any form is more challenging when it is with a faculty member, but it is interesting to note that they report that they actually felt less skilled.

The degree and significance of this incongruence will not be understood until further research is undertaken; however, this distinction between personal and course-related use illustrates the need for instructors to create bridges between personal and academic applications of information technology. How often do we assume that students actually know more about technology than we do, therefore leaving them to their own devices to wade through materials? This scenario brings to mind yet another perhaps painful possibility: In full awareness of our own shortcomings, we rush through IT instruction in the hope that students will know more than we do and thus will not challenge us to develop our own IT skills. It would be comforting to know that our weaknesses do not affect our students, but perhaps we are assuming too much.

Application to Academic Disciplines

Because the specific information and content of any job is rapidly outdated, much of what a bachelor's degree has to offer students are transferable skills such as critical thinking and problem solving through advanced data processing. As a result, we are faced with the question of whether or not we are providing sufficient guidance for the successful application of these skills. As previous research indicates, much of the IT exposure that young adults have comes from the classroom setting, so as we increase our expectations of students' IT competencies it is important to keep in mind that we may be the only source for skills instruction. We are at risk of treating computer skills much as we do language and writing skills, often assuming that students are comfortable and skilled upon entering the university, and although desirable, such mastery may not be the case. Universities increasingly will need to provide opportunities to develop IT literacy if students are going to be able to participate and succeed both in classes and in the workforce. If these opportunities are not available at the university level, individual departments may need to take up the slack to best meet their students' needs. Specifically, departments may find that they can offer unique IT experiences for students that go above and beyond skill acquisition. For example, a service-learning course that gathers, analyzes, and presents community-needs data could be enhanced through the use of information technology. For such assignments to be possible, a strong foundation of resources, competencies, and support needs to be in place.

This need for IT competence is relevant beyond the classroom walls as well. As departments work toward more online courses, they also should keep in mind that students recognize that they lack experience in this area and are less comfortable with this application than with other information technologies. Again, the assumption that young adults are ready and able to take online courses may be misguided. How will students get the most from these offerings without the requisite experience and skills?

Although the need is apparent, few departments have the time and resources to provide more IT instruction for their faculty and students. Faculty members struggle to keep up-to-date with the latest IT changes and upgrades themselves, let alone have enough time to keep their students current. Perhaps departments need to consider creating courses that focus on the use of computers and technology within the discipline. These IT-intensive courses need to be offered early enough in the curriculum to give students the skills, experience, and confidence to succeed. In fact, the advanced application of information technology may be a way for departments to appeal to students seeking transferable skills. If offering IT instruction directly to students is not feasible, offering a departmental colloquium on technology could complement existing professional development series to help faculty members develop their skills and integrate the resources into their research as well as their teaching (Proulx and Campbell 1997). Individual faculty members may find that they need to provide more explicit instruction on various assignments to cover the range of skills and comfort levels in the course. Helping students identify their attitudes about technology as well as their personal skills and deficiencies could help focus exercises and activities. Some colleges and universities may already have units that can assist in these efforts, while others may need to develop these resources.

Conclusion

The results of this study illustrate that although students have some computer skills, their confidence does not extend far into advanced IT applications. Students were less secure as they found their skills base challenged and made distinctions between using IT for personal versus academic purposes. The findings call into question faculty assumptions about student computer competency and challenge the way IT is integrated into the curriculum. Because skills acquisition often occurs in the classroom, departments will need to assume some of the instruction of more complicated instructional technology applications if their university does not provide targeted opportunities. Instructors could better target their efforts by conducting skills surveys early in the term. This information also could be used to help students identify their feelings toward computers and help increase comfort levels through guided practice exercises. Special attention needs to be paid to the experience of women and minority students to ensure that they are not disadvantaged by a department's use of instructional technology.

What this study does not tell us is how reported comfort, experience, and skill compare with actual ability and the potential to learn new tasks. Future research should explore the relationship between reported and actual skills among the targeted populations, as well as develop and test ways to help instructors build the skills levels of all of their students within the course context. Departments may embrace the idea of providing IT instruction to students only to find that they do not have the necessary resources. University-wide efforts may be needed at some institutions to ensure that equity in access is maintained. Ultimately, the increased use of constantly evolving

information technology in the classroom could represent an opportunity for departments to provide additional transferable skills within their curriculum, as long as it exists in an environment that provides skills training and consciously addresses the issue of equity of access.

Key words: technology, computer skills, student confidence

NOTE

The experience of Asian and Pacific Islanders over age 18, however, does not fit this trend. At 66 percent, these groups have the highest computer access of any race or ethnic group, followed by white non-Hispanic at 61 percent, black at 37 percent, and Hispanic at 35 percent (U.S. Census Bureau 2001).

REFERENCES

Attewell, P. 2001. The first and second digital divides. *Sociology of Education* 74:252–59.

Becker, H. J. 2000. Who's wired and who's not? Children's access to and use of computer technology. *Future of Children* 10 (2): 44–75.

Bowers, D. A., and V. M. Bowers. 1996. Assessing and coping with computer anxiety in the social science classroom. *Social Science Computer Review* 14:439–43.

Coley, R., J. Cradler, and P. K. Engel. 1997. Computers and classrooms: The status of technology in U.S. schools. Policy information report. Princeton, NJ: Educational Testing Service Policy Information Center.

Di, X., D. Dunn, and S. J. Lee. 2000. An integrated approach to instructional technology. *Action in Teacher Education* 22:1–13.

Domozatov, C. 1989. Some consequences of computerization: The scientists' opinion. *Bulletin of Science, Technology, and Society* 9:102–9.

Facer, K., and R. Furlong. 2001. Beyond the myth of the "cyberkid": Young people at the margins of the information revolution. *Journal of Youth Studies* 4:451–69.

Freshmen at black colleges are becoming more liberal but not by much. *Journal of Blacks in Higher Education* 35 (Spring 2002): 25–28.

Hawkins, R., and A. E. Paris. 1997. Computer literacy and computer use among college students: Differences in black and white. *Journal of Negro Education* 66:147–58.

Johnston, J., and M. Joscelyn. 1989. The computer revolution in teaching. Accent on improving college teaching and learning, no. 5. Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching and Learning, ED 329151.

Karger, H. J., and L. W. Kreuger. 1988. Technology and the "not always so human" services. *Computers in Human Services* 3:111–26.

Kinzie, M. B. 1994. Computer technologies: Attitudes and self-efficacy across undergraduate disciplines. *Research in Higher Education* 35:745–68.

Kinzie, M. B., and M. A. Delcourt. 1993. Computer technologies in teacher education: The measurement of attitudes and self-efficacy. *Journal of Research and Development in Education* 27:35–41.

Kuenzi, J. 1999–2000. Trends in college students' computer use and ownership. *Journal of Educational Technology Systems* 28:21–31.

Natriello, G. 2001. Bridging the second digital divide: What can sociologists of education contribute? *Sociology of Education* 74:260–65.

Noble, D. F. 2002. *Digital diploma mills: The automation of higher education*. New York: Monthly Review Press.

O'Donnell, K. 1993. Computer laboratory assistant interactions with communications students. Paper presented at the annual meeting of the Speech Communication Association, Miami Beach, FL.

Office of Institutional Research. 2000. Digital divide: Gender and race variations of computer use by NVCC students. OIR report. Annandale: Northern Virginia Community College.

Orleans, M., and M. C. Laney. 2000. Children's computer use in the home: Isolation or sociation? *Social Science Computer Review* 18:56–72.

Persell, C. H. 1992. Bringing PCs into introductory sociology courses: First steps, missteps, and future prospects. *Teaching Sociology* 20:91–103.

Proulx, M., and B. Campbell. 1997. The professional practices of faculty and the diffusion of computer technologies in university teaching. *Electronic Journal of Sociology* 2 (3), http://www.sociology.org/content/vol 002.003/proulx.html.

Reed-Sanders, D., and S. Liebowitz. 1991. An empirical test of integration of computers in introductory sociology. *Teaching Sociology* 19:223–30.

Skinner, D. 1997. Computers: Good for education? *Public Interest* 128:98–109.

Subrahmanyam, K., R. E. Kraut, P. M. Greenfield, and E. F. Gross. 2000. The impact of home computer use on children's activities and development. *Future of Children* 10:123–44.

U.S. Census Bureau. 2001. Current population reports, September: Home computers and Internet use in the United States: August 2000.

Wazienski, R. 1998. The status of instructional technology use and development in sociology departments. *Social Science Computer Review* 16:96–101.