The ECAR Study of Undergraduate Students and Information Technology, 2006

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EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology.

The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

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Today’s undergraduate college and university students are referred to by many as digital natives. When they were in elementary school, Tapscott (1998) labeled theirs the Net Generation. These names are apt, as they describe a segment of the West’s population that grew up with one or more computers in their homes and with (often) a broadband connection to the Internet. These 18- to 24-year-olds have enjoyed access to the world’s digital resources via the World Wide Web since elementary school. Indeed, the evidence is that U.S. teenagers, not simply college and university prospects, use the Internet (87 percent), use it daily (51 percent), play games online (81 percent), get news online (76 percent), and use the Internet to communicate with one another. Today’s teens use instant messaging (IM) extensively, and not just to send text messages. Teens who use IM use it to link to Web sites (50 percent), send photos or documents (45 percent), and exchange music or video files (31 percent) (Lenhart, Madden, & Hitlin, 2005).

It is reasonable to speculate that college-bound teens enjoy even better access to computers, the Internet, broadband, cell phones, and other accoutrements of wired life. We take it to be self-evident that college-bound digital natives are in fact digital cognoscenti, sophisticates, and perhaps even digital connoisseurs who will arrive at our nations’ institutions of higher learning with digital gadgets of every imaginable shape and function, with insatiable appetites for all things digital, and with (limited) patience for the charming but antiquated artifacts of the analog academic world. Such artifacts might include our clock towers and ivy-covered gates, but also our lecture halls, textbooks, whiteboards, and even our professors!

A great unspoken fear in the halls of higher education is that these digital sophisticates will come to our institutions to find aging technologies, legacy systems, congested (or bandwidth-shaped) networks, and decidedly unsophisticated purveyors of institutional information technology (IT) services—or, even worse, a technologically unsophisticated faculty who will curb their enthusiasm for all things digital. It is, to borrow someone else’s great epithet (Levine & Cureton, 1998), another opportunity for hope and fear to collide, only in this instance it could be student hopes colliding with institutional fears!

The 2004 ECAR study of students and technology was a giant first step in fulfilling ECAR’s earliest and most ambitious vision. Robert Albrecht, Mary Beth Baker, Diana Oblinger, and I had the audacity to imagine
that ECAR, our modest start-up, might someday institute an ongoing survey of the IT practices, preferences, preparedness, and performance of collegiate students. It took ECAR Fellows Robert Kvavik and Judy Caruso, working with many others, to bring this dream to fruition. The ECAR study is a simple one. In an era of spam e-mail, dwindling attention spans, and excessive market research, ECAR investigators knew that we would at best have a limited opportunity to engage—electronically or otherwise—with freshman and senior-year students. We would have to navigate institutional review board (IRB) scrutiny and approval processes not once, but repeatedly. We would have to depend on the generosity and shared vision of our colleagues throughout higher education to broker the necessary cooperation of CIOs, registrars, provosts, and many others. In 2004, 13 courageous universities took a plunge and important ground was broken. In 2005, this number swelled to 63 colleges and universities.

By 2006, a solid foundation had been laid. In all, 96 colleges and universities participated in the 2006 ECAR study, and invitations to participate went to more than 277,000. In all, 28,724 students accepted our invitation to participate. Their responses provide a rich source of data and insight into the behaviors and expectations of a critical cohort—our future leaders. Lest our excitement outrun the limits of our methods, we hasten to add that our findings are conclusive only as regards students at the 96 participating colleges and universities. These colleges and universities do not per se reflect the diversity of U.S. colleges and universities, and in particular underrepresent two-year institutions.

Notwithstanding limitations of sampling and nonresponder bias, ECAR findings in 2006 closely resemble those found in 2004 and those in other studies. If and as participation in the ECAR study grows, we hope to make broader inferences. In ECAR tradition, we tortured the data and the data tortured us. In the end, what emerges is an increasingly robust understanding of how students engage with information and communications technologies.

The 2006 ECAR study findings to a great extent corroborate the findings uncovered in 2005. Key among those findings:

♦ Respondents own a variety of information and communication technologies and use them regularly to communicate, find and exchange information on the Internet, do class work, and to recreate.

♦ While many respondents fit the enthusiastic Net Gen characterization of undergraduates, many do not. There is an “underclass” of students who do not have access to great IT, who do not claim to be proficient in many purposeful uses of IT, and who in fact don’t even like IT.

♦ Overall, responding undergraduates prefer a “moderate” amount of technology in their courses.

♦ Responding freshmen and seniors report different skill levels and different preferences for technology in support of course activities.

♦ There are differences by gender in the patterns of ownership and use of, preference for, and skill with IT. Many of these differences can be accounted for by differences in how males and females are distributed, by academic major.

♦ The choice of a respondent’s academic major is closely associated with the student’s perceived skills in certain IT applications and with the student’s reported preference for technology in courses.

♦ Respondents are overwhelmingly positive about course management systems.

♦ Respondents overall believe that IT is enhancing their communication, collaboration, research, feedback from faculty, control of course activity, and learning. Respondents with higher IT skills and who think of themselves as early adopters of IT are significantly more bullish about these outcomes.
ECAR has many people to thank. First, it is always a privilege and an honor to work with members of the ECAR fellowship. Coauthors Judith B. Caruso and Gail Salaway are simply extraordinary. Judy has, among many other things, managed the many-headed hydra of campus IRB approvals, making this study possible. Gail is simultaneously the spark plug and one of the finest analysts I have ever known. Mark Nelson retains our link to the academic literature and to current research methods. His leadership on the qualitative analysis of hundreds of pages of respondent commentary yielded a treasury of richly textured findings. If the data are ECAR’s precious stones and our analysts the stonecutters, Mark’s qualitative analysis and Judy’s work with focus groups and other qualitative sources are the polish that adds fire and brilliance to the story.

The ECAR Study of Undergraduate Students and Information Technology, 2006 can only be dedicated to one person. In fact, no ECAR study has ever been thus dedicated. I am honored to dedicate this study to our colleague and friend Robert B. Kvavik, author or coauthor of numerous important ECAR studies, including the 2004 and 2005 ECAR studies of students. Bob, a career-long faculty member and senior administrator at the University of Minnesota, once again answered the call of duty and left ECAR in mid-2006 to become vice president for planning for that great institution. Everyone in the ECAR community knows that Bob is a giant. Bob joined ECAR as a senior fellow in 2002, making it possible for ECAR to undertake heavyweight research. Before then, we were on a tenuous track of trying to spark the interest of commercial research firms in matters related to higher education. Bob said then and always, “We can do better.” Bob is my evil twin, or perhaps I am his. Together, we are nearly fanatical about quality and always, always push for more. This shared and stubborn commitment to excellence has forged a bond of friendship that was formed in the crucible of sharp give-and-take over findings of fact and interpretations of data. I believe that ECAR studies are as good as they are in part due to this true collegiality. Bob is loved and admired by the fellows. He is our mentor and friend. The community of ECAR-subscribing institutions—now 425 strong—owes Bob a lot.

As I write this, I imagine Bob saying only one thing: “Make it 500 subscribers, Richard.” I could never say enough for or to Bob to express my thanks. Thankfully, I’ll have a lifetime of opportunities ahead to do this.

Bob, of course, reviewed every chapter in this study, worked with us on survey design, and helped us through complex analyses, when we were unsure of what the data were telling us. This work is not only difficult in the usual analytical and logistical ways; it also poses a big administrative challenge. Quite rightly, the study of students demands and receives the full measure of protections under a variety of state and federal regulations. In particular, research on students often falls under the purview of college and university institutional review boards. IRB approval is never a foregone conclusion and is rarely easily obtained. For this study, approval was received from every institution that participated. At each institution, one individual handled the necessary and often complex coordination associated with obtaining the necessary approvals to move forward. These people are named—with our considerable thanks—in Appendix B.

In addition, a variety of campus operating leaders shepherded the process of developing randomized samplings of their freshman and senior populations and deploying the survey to resulting sample members. We owe this large cadre of active supporters a lot.

Finally, though not remotely comprehensively, I’d like to thank those individuals who coordinated and/or participated in our on-site focus groups. In addition, James Jonas, infor-
mation services/electronic resources librarian at the University of Wisconsin–Madison, and analyst Ronald L. Huesman Jr., of the University of Minnesota, were exceptionally helpful. The opportunity for us to speak directly to instructional technologists and to students enlarged our understanding of the student experience of IT tremendously. And it was fun.

ECAR Fellow Toby Sitko continues to manage the interface between temperamental researchers and a complex production process with great grace and skill. She, Greg Dobbin, and Nancy Hays coordinate with an outstanding cast of editors, typographers, and printers. Complex work demands and deserves the rigor they apply, and ECAR subscribers deserve texts that are as beautiful as they are clear. Thank you to all of my colleagues at EDUCAUSE and to all of you subscribers. I am unimaginably lucky to work with you and to serve you.

Richard N. Katz
Boulder, Colorado
Executive Summary

A man’s intellect is stored powder; it cannot touch itself off; the fire must come from the outside.
—Mark Twain

Undergraduate students. Our future. They are at once our youthful intelligentsia and our future knowledge workers. In the fall of 2004, nearly 15 million undergraduates enrolled in U.S. two-year and four-year institutions. Undergraduates represent 38 percent of all U.S. 18- to 24-year-olds. During 2003–2004, these undergraduates earned 665,301 associate's degrees and nearly 1.4 million bachelor’s degrees. Nearly one-third (32.4 percent) of them enrolled in colleges and universities in California, Florida, New York, and Texas (Chronicle of Higher Education, 2006). According to Student Monitor, in fall 2003 undergraduates rated using cell phones, drinking beer, e-mailing, the Internet, and going to clubs as their five most “in” activities (Student Monitor, 2006). They scored an average of 1028 on their SATs, and although students of color have made significant gains in college enrollment, African American and Hispanic students still lag behind their white peers in college enrollment rates (American Council on Education, 2006). Nearly half (46.4 percent) of today’s undergraduates receive either grants or loans to finance their education. During 2003–2004, nearly one-third of U.S. undergraduates (32.9 percent) worked full time, and 21.4 percent of them were already married. Just over half (54.3 percent) of the freshmen who entered college during 1997–1998 had graduated six years later (Chronicle of Higher Education, 2006).

The ECAR Study in Context

There is a substantial and growing literature about undergraduate students in the United States. Much of this literature focuses on the lifestyle of this important demographic group; some focuses on generational issues, and several important surveys exist to help us understand their engagement in their education and their overall attitudes toward politics and the world around them. A new but growing literature focuses on undergraduate students and information technology (IT). Organizations like the Pew Foundation, NetDay, and the Student Monitor try to help companies understand the consumer preferences of this population, while nonprofits like the National Postsecondary Education Cooperative (NPEC) try to ascertain why some students succeed in college and others do not.

In 2003, the EDUCAUSE Center for Applied Research (ECAR) placed its stake in this growing domain and developed a survey of undergraduates and IT. The ECAR niche is unique insofar as our overarching goal is to provide information on the technology behav-
tors, preferences, and satisfaction of higher education’s most essential and arguably most mercurial population. Even more, the ECAR study was designed to be read—and acted on—by college and university administrators and in particular by those administrators charged with implementing the technology environments these students will consume. As well, we hope that ECAR research will inform the practices of teaching faculty who are working to incorporate information technologies in rich and meaningful ways into their curricula and pedagogies. The ECAR Study of Undergraduate Students and Information Technology, 2006 was designed to test hypotheses about generational behaviors and propensities and to leverage our growing understanding of students’ Internet (and related) behaviors of other important population segments.  

Since our first study in 2004, the ECAR study of undergraduates and IT has become mature. In 2004, 13 universities participated in this study of freshman and senior students. In 2005, this number swelled to 63 colleges and universities, and in 2006, 96 two-year and four-year institutions participated. Fully 28,724 students responded to the 2006 ECAR survey. Most respondents were freshmen and seniors in four-year colleges and universities in the spring of 2006. Some 3,380 participants in this survey were enrolled in one of eight participating two-year institutions. Most responding students (83.8 percent) attended public institutions, and nearly two in five (37.8 percent) attended institutions with enrollments greater than 15,000 students.  

Female undergraduates represent 63.2 percent of the participants in the ECAR study, despite oversampling of males. Participants in the ECAR study reflect considerable diversity in their choices of academic major, with 19.3 percent declaring majors in social sciences, 22.2 percent declaring as life or physical science majors, 10.2 percent as humanities majors, 19.5 percent as business majors, and 9.7 percent as engineers.  

Findings  
ECAR learned much about undergraduates’ experiences with IT, and several themes emerged as we reviewed our results. These themes cover student technology ownership, use and skill with IT, student preferences for IT in courses, and how students feel IT is contributing to their academic experience.  

Ownership and Use of IT and Skill with IT  
Undergraduate students are most certainly wired with technology. Nearly all (97.8 percent) of our respondents own a PC. In fact, nearly two-fifths (38.3 percent) of the 18- and 19-year-old respondents begin their undergraduate experience with both a laptop computer and a desktop computer. The 2006 ECAR data suggest that owning a computer has become a prerequisite to attending college or university for most respondents. Three-quarters of responding freshmen from four-year institutions own laptop computers. The vast majority (72.8 percent) of these laptops are less than one year old. This is good news overall for campus technologists who must struggle to ensure the currency of the installed base of computers they need to support. Overall, ECAR survey respondents are showing a clear preference for laptop computers.  

Mobility is important to the students participating in this study. Almost one student in five (19.8 percent) of responding undergraduates owns either a personal digital assistant (PDA) or a smart phone. More than one-third (36.1 percent) own a wireless hub! These undergraduates overwhelmingly prefer broadband network connections, and fewer than 10 percent depend on dial-up access to the Internet. Importantly, 15 percent of two-year-college respondents depend on dial-up access.
Today’s students spend a lot of time using a raft of gadgets and a lot of time online. While the average respondent reports spending 23 hours per week using various technologies, more than one-quarter of male respondents report using electronics more than 30 hours per week. Engineering majors and business majors use IT more often than others, a finding that echoes other ECAR findings in 2004 and 2005.

Undergraduates are communicators. Nearly all (99.9 percent) create, read, and send e-mail, and more than 80 percent use instant messaging, most using it daily. They use their arsenals of electronics to write documents for coursework (98.8 percent), access an official university or college library Web site (94 percent), and create presentations (90.8 percent). Three-quarters of these undergraduates use course management systems, most using them several times per week or more. Recreationally, 70.6 percent of responding students download music or video files and/or use social networks such as Facebook.com. Most of them (73.4 percent) play computer/video games. A smaller number of students appear to be engaged in new media. More than a quarter of respondents (27.7 percent) report using software to create or edit video and audio files, and 28.6 percent of them create Web pages.

While some of the literature, particularly journalistic, suggests that students may be shifting from e-mail to more immediate data communication modes such as instant messaging, our respondents seem comfortable with both. For college and university administrators, the good news is that respondents overwhelmingly (84.9 percent) prefer e-mail to instant messaging, Web reporting, or other modes of communication for official communication with their institutions. The bad news is that only 11.8 percent of these respondents maintain only one e-mail account, and respondents are evenly split between those who prefer their college or university e-mail provider and those who prefer a provider who is not their academic institution. We think that consideration of abandoning e-mail for official campus communications is premature. Complex, yes, but premature nonetheless.

ECAR survey respondents are generally confident in their skills using information technologies. Seniors report higher skills than freshmen in technologies that are instrumentally useful to their academic majors. Freshmen report similar confidence as seniors in their skills of new media skills such as creating and editing audio and video. More than one-third of respondents (34.3 percent) report few or no skills with course management systems.

When we asked survey participants how they would spend new institutional IT money on their behalf, 18- and 19-year-olds said, “Give us more network speed and access to music!” Respondents ages 20 to 29 said, “Give us more computer labs and IT training for students!” One student commented, “I believe that basic IT courses should be included in every undergraduate major on campus. Programs such as Excel and Word are so important and most students hardly even know how to input data. We need to push for this if we want a strong workforce.”

Importantly, the value of student IT training expressed seems to rise with a student’s age, reminding us perhaps that “the less I know about a subject the more confidence I have” (Johnson, 1935).

Information Technology in Courses

While most students surveyed are enthusiastic users of IT and use it to support many aspects of their academic lives, they are moderates when it comes to the amount of IT they want in their courses. More than half (56.2 percent) of responding students indicate that they’d prefer only a “moderate” amount of IT in their courses. On the whole,
younger respondents and female respondents to the ECAR survey prefer less technology in their courses. This finding suggests that while younger students arrive on campus with many IT tools and self-described skills in IT-mediated communication and recreation, they are comparatively unskilled in IT to support academic purposes. Engineering and business majors prefer somewhat more IT in their courses than others. Not surprisingly, respondents who claim knowledge of the advanced features of many software applications prefer technology in their courses. We do not know whether this reflects the power users’ opportunities to shine, the real opportunity for IT to deepen understanding of course content, or a sentiment by less skilled IT users that their lack of IT skill may pose an additional barrier to learning. Likely all three forces are at work.

While respondents appear to resoundingly prefer laptop computers and some are loading up on PDAs and smart phones, they are largely not bringing computers to class. Most respondents (70.3 percent) never bring their laptop computers to class, and only 14.5 percent do so weekly or more often. Even 16.2 percent of responding students who are enrolled in courses that require a laptop fail to bring these devices to class. The weight of laptop computers and the risk of their theft are cited frequently as reasons students do not bring laptops to class.

Nearly three of every four survey respondents (72.7 percent) have used a course management system (CMS). This percentage has not changed since 2004. This finding masks the evidence that among community college respondents to the ECAR survey, only 54.6 percent have used these systems. Much of the nonuse of a CMS in AA institutions, however, is among those who are not enrolled in a degree program, so this finding merits closer scrutiny. In four-year institutions, there is little difference in the proportion of freshman and senior-year students having used these systems.

Survey respondents like these systems. Three-quarters (75.6 percent) of those who use them are, overall, positive or very positive about them. In fact, 18.3 percent of those who use a CMS are very positive about it. Only 4.5 percent of those who use a CMS report having an overall negative or very negative experience with it. Familiarity with these systems breeds contentment. Students who report using these systems daily are overwhelmingly positive about them. Responding students who use these systems less frequently are less bullish, but they remain consistently positive. Respondents rate the asynchronous aspects of these systems more positively than the synchronous elements. In particular, they value the ability to keep track of assignments and grades through these systems and to gain access to sample exams and quizzes online.

Making a Difference

The ECAR Study of Undergraduate Students and Information Technology, 2006 helps us understand how students feel IT is contributing to their academic experience and success. Responding students in 2006 continue to be positive in their views about IT’s contribution. ECAR asked students whether they agreed with the following statements:

◆ IT in courses improved my learning.
◆ I am more engaged in courses that use technology.
◆ IT in courses results in more prompt feedback from my instructor.
◆ IT helps me do better research for my courses.
◆ IT helps me better communicate and collaborate with my classmates.
◆ IT allows me to take greater control of course activities.

Respondents were positive or very positive in their answers to all of these questions. Very importantly, 64.4 percent agreed or strongly agreed that IT in their courses has improved their learning. Only 7.6 percent of respon-
Students disagreed with that statement. Older respondents and business and engineering majors agreed more often with these statements about the academic outcomes of their experience. Respondents who prefer more IT in courses are positive about their use of course management systems and describe themselves as either early adopters of or innovators with IT. These respondents agreed more strongly with positive statements about their experiences and outcomes.

Respondents continue to rank convenience as the single most important benefit of IT in their academic experience. Nearly one respondent in five (19.3 percent) from two-year institutions indicated that improved learning was the paramount benefit of IT. This is higher than the responses from participating four-year-institution students. This is a powerful finding, given that these students, on average, own fewer gadgets, depend more often on dial-up access, and have less access to course management systems than their counterparts in four-year institutions.

Fewer respondents in 2006 rated enhanced peer communication as the top IT benefit than did in 2005, while more of the 2006 respondents gave top marks to IT’s facilitation of greater control over course activities. It seems likely that the multiplicity of communication options enjoyed by these respondents may diminish their importance as distinct and identifiable technologies. That is not to suggest that communication is not essential. Said one student, “IT has helped with my undergraduate experiences because it helps me communicate with my professors and my peers about class and class assignments.”

IT seems to exert less of a pull on respondents with respect to its value as a tool of engagement. While respondents agreed that they are more engaged in courses that incorporate IT, they do so mildly. This may in part reflect respondent opinion about their instructors’ IT capabilities. While most respondents (56.8 percent) agreed or strongly agreed that their instructors use IT well in class, 13.6 percent disagreed or strongly disagreed on this point. There is passion among some respondents on this subject. The need for additional training for instructors was a frequent theme in the qualitative data. While this year saw the usual number of comments regarding faculty overuse or misuse of applications like PowerPoint, the underlying theme of faculty capability with technology was still highly prevalent, with several hundred comments in this area. The theme of particular interest as it relates to training is the set of comments by students citing the need for additional training for faculty. This theme is frequently conveyed as faculty use being nonproficient, so that training faculty would benefit both faculty and students. In an increasingly technology-related learning environment, this may suggest a link between faculty development in the use of technology and the effectiveness of technology for learning in the classroom—a linkage that students are aware of as impacting the learning experience. Said one respondent, “To move forward in information technology requires training the professors. More than half of the technology that is currently available for use is not even touched. Most professors have no idea how to work things on a simple level.”

Not only are some respondents vocal about the mixed IT skills of some of their instructors, but they can also be frustrated with instructors’ expectations of student IT skills. One student, among many, commented, “Profs never teach us to use IT; they usually just assume we know how and require us to use it, which results in self-teaching, and only enough to get by. I wish they would teach us to use the programs they require us to use (such as Excel and PowerPoint).”

**Bottom Lines?**

*The ECAR Study of Undergraduate Students and Information Technology, 2006*
Students and Information Technology, 2006

ECAR Research Study 7, 2006

unearths literally hundreds of interesting findings large and small. For college and university administrators who need to make consequential investment, service, and other priority decisions, some findings are more pressing than others. We therefore summarize some of the most important findings below.

◆ Overall, undergraduates like IT and use it in their social, recreational, working, and academic lives. Mobility is perhaps an enabler of this social, recreational, and instrumental integration of IT.

◆ The Net Gen characterization of technophile students born in the Internet era applies to a substantial minority of undergraduates, but not to the whole group. In fact, an important minority of undergraduates do not appear enamored of IT, and some appear even to avoid it. Understanding the needs of leading-edge and trailing-edge undergraduate IT users is important for higher education administrators.

◆ College or university is a place where people mature as IT users as well as in other ways. While younger students can boast an arsenal of IT skills to underpin their social lives (such as e-mail, instant messaging, and social networking) and their recreational lives (such as computer gaming), they are less skilled or confident users of instrumentally useful technologies. The undergraduate’s choice of and progress toward an academic major are closely associated with his or her preferences for, use and ownership of, and outcomes with IT.

◆ Respondents—across the spectrum of demographic or user profile—agree with a series of positive outcome statements about IT. These responses suggest that IT is helping students communicate, collaborate, learn, engage, conduct research, gain academic feedback, and control their course activities.

For Many, Wired and Wonderful

It is clear that the Net Gen appellation is insightful and true regarding those undergraduates who label themselves IT innovators or early adopters. These young people are indeed wired and wonderful and seem to have integrated IT comfortably into the fabric of their social, recreation, work, and academic lives. They own many gadgets, but it seems reasonable to speculate that over time these early adopters will “go convergence,” and we expect to see them (or their successors) arriving on campus with handheld devices that integrate computation, network access, and telephone while also serving as video and music devices. This segment of the undergraduate population really likes technology, uses it many hours a week, and appreciates its presence in the classroom. They feel that IT serves important purposes in their academic lives and strongly agree with statements about IT’s contributions to learning, research, control over course requirements, and other outcomes. This techno-proficient group represents about a third of our respondents and is more often than not male and inclined to major in engineering or business.

For Some, Wired and Tired

It is equally clear that this Net Generation within a generation does not speak for everyone. Not all undergraduates are coming to campus with a new laptop computer (and an old desktop device!). Some, in fact, seem to struggle with one computer four or more years old, and too many accomplish their academic purposes over narrowband connections. This is not a value judgment. In fact, respondents who use narrowband connections in general express lower levels of comfort and satisfaction with IT and ascribe less potency to IT’s impact on important outcomes in their academic lives. Said one respondent, “I feel that the integration of technology in the class-
room is useful, as it is important to be familiar with (considering we are a technology-driven society). However, I feel that a lot of professors assume that everyone has easy access to a computer.” Another made the point even more poignantly: “The use of new technology is great in class; however, the income of college students prevents many from purchasing expensive items. I would like new systems to be used but not made a requirement.”

In short, there is a technology underclass on campus. More often, members of this underclass are female, too often they are found at two-year institutions, and most often they are found majoring in the humanities. These undergraduates, like others, use information technologies for communicating with their peers, but they are far less likely to admit to possessing advanced skills in academically instrumental uses of IT such as presentation software, spreadsheets, and the like. One IT-phobic respondent summed it up: “I hate computers and use them as little as possible. Computers today are supposed to be easy to use. I think they are very difficult to use. I also think people today rely way too much on computers for everyday tasks and need to get outside too.”

University administrators and faculty must come to grips with the two faces of the undergraduate student body and reconcile the differences in student segments with one-size-fits-all technology strategies for teaching and learning at the institution. Administrators must decide how much they can invest at the leading edge to keep the early adopters engaged and motivated, and how much they can invest in raising the comfort and skills of those late adopters on campus.

Maturing Digitally

Much of the concept of a Net Generation emerges from Don Tapscott’s notion of growing up digitally (Tapscott, 1998). This ECAR study of undergraduates and IT suggests too that higher education is a place for students’ technology usage to mature. First, it remains clear after three years of study that a student’s choice of academic major is closely associated with a set of IT skills, choices, and preferences. This is not surprising. Business majors need to use spreadsheets and presentation software; engineers spend considerable time with technology; and so forth. Second, the data suggest that undergraduate skill and use of technology is tiered. On one tier, information technologies serve students’ social needs. Undergraduates are great communicators, and skills in and use of communication technologies such as e-mail and instant messaging are widespread. Communication is increasingly mobile, and students are investing in laptop computers, PDAs, and smart phones. Most of these students are engaged with social networking applications like MySpace and Facebook; in fact, the qualitative evidence suggests that many of our undergraduates spend a great deal of time in these environments.

The second tier is recreational. Undergraduates are engaged in computer-based gaming, though this province continues to be dominated by male respondents. Our respondents also download music and videos regularly.

The third tier is what we describe as academically instrumental and consists of information technologies and software applications used in the service of a student’s coursework or employment. The ECAR data suggest that students arrive on campus ready and eager to communicate and socialize. Data from other sources such as Pew’s study of teens and the Internet and NetDay confirm this. It is also clear from the ECAR data and from studies of IT and teens that today’s undergraduates often arrive on campus with well-established recreational skills and habits with IT. Video game play is widespread among K–12 students, as is participation in social networks. The ECAR data suggest that undergraduate skill with and use of academically instrumental
IT comes with age. Or, more appropriately, this skill and use comes with specific academic experience. Freshman respondents more often admit to lower skill levels in these technologies than do seniors, a finding that reinforces the notion that skill acquisition in this tier is tied to one’s choice of academic discipline. In essence, undergraduates appear to arrive somewhat insecure and unskilled in producing presentations, creating spreadsheets, or using specialized software, while students with higher class standing in technology-intensive disciplines report higher skills.

**The e’s Have It**

The question of ultimate consequence for every senior higher education administrator as well as for most parents is, of course, whether all of this IT is an educationally good thing. The question of outcomes in higher education is extraordinarily complex and rich, and is subject to ongoing debate. As a result, linking IT investments, preferences, and behaviors is problematic. Of course, so is linking of study habits or beer drinking to the achievement (or underachievement) of educational outcomes. Notwithstanding this complexity and those reservations, we believe that students are reasonably reliable evaluators of the educational contribution of IT. We caution the reader that this is only one data point, and we also applaud efforts like the National Study of Student Engagement (NSSE) and the Collegiate Learning Assessment Project that together can triangulate toward a deep understanding of this complex issue.

Respondents to the ECAR survey are generally bullish about IT’s contributions. Most (64.4 percent) of them agree or strongly agree that IT in courses is improving their learning. Two-fifths (40.3 percent) agree or strongly agree that they are more engaged in courses that incorporate IT, and more than two-thirds (68.7 percent) believe that IT facilitates prompt feedback from their instructors. More than half of respondents (55.3 percent) believe IT helps them communicate and collaborate more effectively with their fellow students. It is important to note that learning theory generally suggests that instructor feedback and peer collaboration contribute significantly and positively to learning.

*The ECAR Study of Undergraduate Students and Information Technology, 2006* finds once again that students understand and appreciate IT largely for its capacity to make student life more convenient. We invite the reader to take the plunge into this study with two thoughts in mind. First, while convenience is overwhelmingly the outcome most often ascribed to IT, we honor this fact here. As one begins to think about undergraduate students who are under unprecedented pressures to achieve academically, who are often their family’s first-generation collegians, who are often older and married, encumbered by increasing debt, and simultaneously working (many of them full time), the value of “convenience” cannot be minimized. One could speculate, in fact, that IT may make balancing these complex lives doable and enjoyable. As one respondent put it, “Having the ability to do courses online is WONDERFUL! It’s a great way to balance schooling with a sometimes unpredictable work schedule. The convenience is unbeatable, and not having to be in a set place at a set time each week really works for me.”

Second, and finally, many of our respondents really do believe that IT is contributing to their learning. Among those students who prefer IT in general and who think of themselves as early adopters of IT, the positive attitude toward IT in the learning experience is impressive. It seems to us that the interesting question is no longer can IT contribute to learning, but how do we activate interest and skill in IT in more of our students and their instructors?
Endnotes

1. ECAR is particularly grateful for the work being undertaken under the aegis of the Pew Internet & American Life Project. This project, among other things, has studied the IT behaviors, expectations, habits, and preferences of U.S. adults, teens, and preteens, making possible rich comparisons with data developed by ECAR about undergraduates. NetDay’s Project Tomorrow, as well, provides much insight into the technology habits and preferences of K–12 students.

2. ECAR totals including all majors declared exceed 100 percent due to students who are seeking double majors.

3. This wonderful characterization comes from Jeanette Cureton, who delivered a speech of the same title at the ECAR Symposium, November 2002.
Today’s Undergraduate Student—Wired and Wonderful

Back to School, circa 2006:
uwguy_19: hey sis
uwguy_19: yes, I’d be more than happy to help you move into your new apartment
uwguy_19: but, you know its kinda small, how’s everything going to fit?
Sugar_sugar_320: well i’m not bringing that much
Sugar_sugar_320: all i really need is a twin bed, desk, table, pop up chair and my computer
Sugar_sugar_320: oh and of course my clothes
uwguy_19: what about an alarm clock
Sugar_sugar_320: my phone does that
uwguy_19: what about a tv, do you have room for a tv?
Sugar_sugar_320: don’t need one, i have utube and dvds for my computer
uwguy_19: what are you going to do with your sweet stereo from last year
Sugar_sugar_320: bringing it back to the parent’s house, just itunes from now on
uwguy_19: ah, so i guess you’ll break down and finally get an mp3 player
Sugar_sugar_320: maybe, i don’t really need one
Sugar_sugar_320: i mean i can get all my class podcasts on my computer
Sugar_sugar_320: plus i can’t afford a real nice one, and if i was going to get one it would have to be a video l-pod nano
Sugar_sugar_320: i’ll probably just ask mom and dad for one
uwguy_19: lol
uwguy_19: so what are you going to do for internet
Sugar_sugar_320: i have to go get a wireless hub for my desktop and then i’ll just steal internet from the coffee shop below my apartment
uwguy_19: sneaky
Sugar_sugar_320: yeah i know
Sugar_sugar_320: g2g bye
uwguy_19: l8r

This dialogue and variations on it are being repeated across the country as students settle in at their respective colleges and universities. These students differ from those of just a few years ago, for whom televisions and stereos were the “must-haves” in residence hall rooms, and their pattern of use and expectations regarding information technology are a far cry from those of preceding generations of students.

Who are the undergraduates at our colleges and universities? What makes them unique? How can we understand what they want and provide the educational environ-
ment they need to be successful? What role does technology play in their lives? Finding answers to these and other questions requires that we explore what is known and ask questions of the students themselves.

The ECAR Study of Undergraduate Students and Information Technology, 2006 takes a short voyage through students’ experiences with, attitudes and preferences toward, uses of, and reactions to IT, and it can help us appreciate, we hope, what makes today’s undergraduates tick. We take this voyage mindful of the diversity of our student population—in age, learning styles, gender, economic background, K–12 experience, and class, race, or ethnicity. All these factors shape students’ interactions with IT and likely influence their expectations about IT throughout their college or university careers.

The ECAR study was designed to validate, deepen, modify, or refute the many characterizations of today’s undergraduate students with real data from these students. Are students, as suggested by Twenge (2006), self-focused, even narcissistic? Do today’s undergraduates behave as a cohesive Net Gen, as characterized by Oblinger and Oblinger (2005) or others? What are the advantages and limitations of generational characterizations of these students? While social networking activities like MySpace attract many undergraduates, allegedly suspicious and distrustful of adult interloping in these youthful environments, external data show that as of August 2006, more than half (51.6 percent) of the unique visitors to MySpace were over 34 years old (eMarketer, 2006a). Why are some students suspicious? To what extent do our students respond as a collective whole in regard to technology use and skill?

Today’s undergraduate student body is diverse. It is safe to say that the nontraditional undergraduate has become a traditional fixture of the modern college or university. There are currently 17.6 million students enrolled in U.S. colleges and universities (Gaylord, 2006). According to National Center for Education Statistics (2005), the undergraduate student population is changing fast. More than 30 percent of undergraduates are racial or ethnic minorities, and 50 percent of full-time college students work. In 1994, women accounted for 55.4 percent of postsecondary enrollments; by fall 2004, for 57.2 percent of enrollments. And today more than ever, undergraduate student bodies include older returning adults as well as the traditional 18–24-year-old students. Thirty-eight percent of today’s undergraduates are 25 or older, and the period from September 2000 to September 2004 saw a 20 percent increase in the enrollments of students aged 35 and older (from 559,000 to 729,000). The increasing number of returning adult learners places new demands on our teaching methods and challenges our IT services to be increasingly mindful of their needs, which may differ significantly from those of traditional students.

Notwithstanding this increasing undergraduate student diversity, the ECAR study focuses to a great extent on traditional undergraduate students, as these students constitute a majority of our survey respondents. We begin by reviewing what some researchers and experts think about today’s traditional undergraduate students, who are sometimes called the Net Generation, Millennials, or Generation Y. This chapter discusses the attributes of today’s traditional undergraduate students as described in some of the literature, presenting a small window into their experiences and perspectives. Through this review, we hope to better contextualize, understand, and analyze the results of our 2006 study of students and IT.

**Today’s Traditional Undergraduates**

The traditional undergraduate freshman in the spring of 2006 was likely born in 1987 or 1988. For such a student, canned tuna has
always been dolphin safe, the Soviet Union is an artifact of history, and carbon copies are oddities found in their grandparents’ attics (Gaylord, 2006). When these students were five years old and entering elementary school, Microsoft released Windows 3.1, Euro Disney opened in France, and unrestricted commercial use of the Internet was one year old. When they were 10, the World Wide Web was five years old, the DVD was three years old, eBay was two years old, and Google was founded. When today’s traditional freshmen entered high school, Wikipedia went online, Apple released the iPod, Microsoft released Windows XP, and the 9/11 hijacking attacks occurred. Throughout their lives, today’s traditional undergraduates have had access to the Internet, including online shopping and Web searching. Some have likely never used video or audio cassette-tape technologies.

Information technology has been an integral part of today’s students’ lives. As they aged, many of these young people readily adapted to technologies already in existence and adopted new technologies. Oblinger and Oblinger (2005) suggest that IT from one generation is taken for granted by the next. Today’s undergraduates simply use and expect that computers, the Internet, online resources, and instantaneous access are the way things are done. According to researchers at the University of Central Florida (Oblinger & Oblinger, 2005, p. 6.3), Behaviors of the Net Generation are expressed through technologies to an extent not observed in previous generations. At one level, Net Geners are the beneficiaries of decades of technological development that preceded them; at another level, as students they use these technologies in new ways, and in so doing are redefining the landscape in higher education and perhaps beyond.

Today’s undergraduates are also described as digitally literate, connected, immediate, experiential, and social (Oblinger & Oblinger, 2005). These students are thought to be comfortable with technology and in many cases to prefer the Internet to asynchronous media like television. They are believed by many to be always connected with others via technology and can often be seen talking on their cell phones while navigating Web sites online. During breaks between classes, today’s undergraduates use their cell phones while walking to their next class location. They are said to increasingly expect immediate responses; they move quickly from one task to another and are often doing more than one thing at a time. For many, IT is simply a part of their everyday life (Oblinger & Oblinger, 2005). Just as baby boomers cannot visualize a world without telephones, today’s undergraduates cannot imagine life without cell phones, Internet access, and instant messaging. James Wagner notes, “Technology is invisible and intuitive; students don’t ‘learn technology,’ nor do they think of it as separate from the activities it enables” (Oblinger & Oblinger, 2005, p. 10.1).

Some experts also believe that connecting with others and communicating is very important to many students. They enjoy interacting in both face-to-face and online situations (Oblinger & Oblinger, 2005). Many of them are described as ready adopters of technologies that enable these interactions, such as instant messaging and social networking.

While traditional undergraduate students are less likely to play online games than their younger teen counterparts (Fox & Madden, 2005), they still play more than adults aged 29–40 (54 percent for current traditional undergraduates and 37 percent for the older group). They also are more likely to do school research online (73 percent), instant message (66 percent), and text message (60 percent) than older adults.

Research on undergraduates suggests that many college and university students trust the Internet as a preferred source of
information. Many undergraduates commonly get their news and information from Internet sources found through searches, rather than by reading newspapers or using library materials (Oblinger & Oblinger, 2005). They are also said to trust other people online and expect that trust to be returned. Using social networking sites such as MySpace and Facebook, many students connect with others openly and reveal personal information (Schweitzer, 2005).

Many traditional undergraduates are also characterized as civic-minded consumers and employees by some researchers. Using the Internet to base their organizations, such students are creating Web sites, Facebook groups, and blogs to further their political ideals and interests. The Internet is an important channel for expressing their social activism. According to the CEO of YouthNoise (Kornblum, 2006a), an online site created to help teens find and act on social issues, people as young as 16 or 17 can create a social movement. Facebook <http://www.facebook.com>, with its 4.5 million groups organized around hobbies, musical groups, heritage, political causes, and other interests, is one site where students can find others interested in the same social issues. These groups can become a catalyst for nationwide youth movements. A Facebook feature called “Election Pulse” measures users’ affiliations with candidates for political office.

Not all experts agree that traditional students are civic minded. Twenge, in her online blog (2006), notes that while increasing numbers of high school and college students report volunteering their time in the community in the past year, the trend for those who volunteer once a week or more is completely flat. While these young people volunteer, they do so only one or two times. And because colleges and high schools sometimes require community service, these volunteering efforts may only reflect meeting those requirements.

According to Weiler (2004), the generation of students born between 1980 and 1994 are visual learners. These students may benefit from learning environments that incorporate hands-on activities that can increase interest and retention. Oblinger and Oblinger (2005) suggest that many faculty members may expect students to be like they were in college and, as a result, may not be presenting information in ways that are best for these students. This possible generational gap presents a challenge to higher education in our efforts to provide the academic experience that undergraduates need and desire.

Meeting your roommate has for some taken on new meaning with these traditional undergraduates. With the ability to create a profile in Facebook, potential residence hall roommates can now “meet” online before they come to campus (Lewin, 2006). Someone who doesn’t like the profile of a potential roommate may request a different roommate. In fall 2006, several institutions’ housing offices received Facebook calls. Reasons for asking for a change of roommate included disagreement or discomfort with the Facebook entries regarding sexual behavior, religion, drinking, drugs, and tattoos.

While some experts and researchers depict today’s traditional undergraduates as always connected with IT, questions remain about their information literacy. In the 2005 ECAR student study, we concluded from the survey data and from our talks with university administrators that students tend to overstate their skills with technology. In response to the question about technology skill and information literacy, the Educational Testing Service developed an information and communication technology literacy assessment (Educational Testing Service, 2006). In the spring semester of 2006, more than 6,400 students participated in the first assessments using this tool. The purpose of the assessment was to identify students’ strengths and weaknesses with re-
Students and Information Technology, 2006

ECAR Research Study 7, 2006

Regarding information literacy. The results were mixed. For one of the information research problems, only 40 percent of the test takers were able to identify the correct research statement for the stated research assignment, but 74 percent were able to select the best question to clarify the assignment. Also, because our student populations include students of varying ages and K–12 experiences, further exploration is required to understand what students' real IT and information skills are and how best to improve them.

Trying to understand this generation is a complex issue and is the focus of several film documentaries. Students Ray Hafner and Derek Franzese produced a 90-minute documentary (Jayson, 2006b), interviewing students to illustrate how technology has changed dramatically during their lifetime. Notes Franzese, “We’re the first generation in American history that has grown up in an environment [technological] that is so different than anybody has ever seen before.” In addition, Judy Woodruff and a team from MacNeil/Lehrer Productions are shooting a documentary for PBS, expected to air in early 2007, with more than 100 hours of interviews of young people.

What Do Today’s Undergraduates Bring to College?

Throughout their lower school education, many of today’s undergraduates have been exposed to and worked with computers. Therefore, they expect IT to be an integral part of their college lives. Each fall, NetDay, a national nonprofit organization, sponsors a survey (Project Tomorrow, 2006) that provides K–12 students and teachers the opportunity to report on technology use in K–12 education. At the Our Voices, Our Future Speak Up Event held in fall 2005, 82 percent of grade 6 through 12 students reported using a desktop computer on a weekly basis, 75 percent a cell phone, and 61 percent a video game player. Thirty percent indicated that they used a desktop computer, cell phone, DVD or CD burner, and video game player on a weekly basis. These 2005 results indicated a 10 percent increase in use of digital cameras, video cameras, laptop computers, and MP3 players over 2004.

The Internet and online communication tools are very popular with teenagers. The cell phone is their favorite communication tool (Project Tomorrow, 2006), followed by instant messaging (IM). More than 75 percent of high school seniors at the NetDay event noted daily use of IM or e-mail, and high school students who used both IM and e-mail daily overwhelmingly indicated a preference for IM for general communication and e-mail to keep track of messages and documents.

In April 2006, the firm MindShare asked teens which media technologies they would miss the most if they became unavailable (eMarketer.com, 2006b). These young people indicated that they would miss television (41 percent), the Internet (31 percent), and video games (20 percent) the most. Only seven percent or fewer of MindShare’s respondents would miss radio, newspapers, or magazines. These students “always” or “often” use a search engine (76 percent), look up information for school and homework (69 percent), read or send e-mail (62 percent), and use instant messaging (60 percent). Less often these students go to social network Web sites (such as MySpace) (33 percent), read blogs (30.7 percent), or write blogs (22 percent).

In high school, many students are exposed to technologies that support classroom instruction. Schools have long been providing teachers with technologies and tools. More than 28 percent of the K–12 teachers who participated in the NetDay 2005 event indicated that they use course management software (Project Tomorrow, 2006). In addition, 47 percent of the surveyed teachers reported that
their school provides them with tools to create Web sites. Having used technologies in their high school courses, many college freshmen are likely to expect the same or more use of these tools in college.

High school students also reported using technology for schoolwork. According to Project Tomorrow (2006), the top three benefits of using technology for schoolwork were: “I can get assignments done more efficiently” (69 percent), “I can get the most accurate and up-to-date information online” (68 percent), and “It’s more fun” (66 percent). More than 45 percent of high school seniors noted that either they or someone they knew had taken an online class. When these students were asked their opinion about online classes, 65 percent reported a positive experience.

Most students in grades 6–12 view technology skills as important. At the fall 2005 NetDay event, 70 percent of students this age indicated that they thought technology skills are necessary for doing well in school. Another 63 percent believed these skills are necessary for success in college. We wonder a bit about the large percentage of respondents who do not share this view.

**New Technologies and Technology Adoption**

In August 2006, the “must-have” purchases for many incoming freshmen included not only the usual extra-long sheets, school T-shirt, and textbooks but also a plethora of electronic devices including smart cell phones, video iPods, laptops, and gaming devices. According to the National Retail Federation (Shropshire, 2006), college students were expected to spend more than $10.5 billion on back-to-school items.

Each year as new technologies emerge and old technologies become passé, undergraduate students’ use patterns change, according to some experts. Among some students, e-mail is believed to be old school and is associated with the older generation (Irvine, 2006). One 25-year-old declared, “In this world of instant gratification, e-mail has become the new snail mail.” This student began instant messaging in college and has used it ever since. E-mail has become associated with school and work.

**Socializing and Communicating Through IT**

Communicating and socializing are important to many students. High school students, for example, are using e-mail, IM, and social networking software to interact with their friends. These online communications provide an opportunity for students to supplement their everyday face-to-face interactions with additional online friends. This is not without its difficulties, however. In a recent study of high schoolers (Ybarra, Alexander, & Mitchell, 2003), those who expressed depressive behaviors were more likely than other students to reveal personal information about themselves online, making them vulnerable to stalking or other misuse. These high school students often retain these habits when they attend colleges or universities.

Every generation has its habits that are considered “cool.” According to a 2006 survey of 1,200 college students undertaken by the Student Monitor (Carney, 2006), listening to iPods was considered more “in” (73 percent) on college campuses than beer drinking (71 percent) or getting on the Facebook Web site (71 percent). The survey showed that iPod listening climbed from 22 percent in spring 2004 to 59 percent in 2005 to 73 percent in 2006. These results indicate the importance of interactive and social technology to many students.

In the past few years, Facebook has played an important role in many undergraduate students’ virtual world. In our conversations with students, their enthusiasm for its features and ability to connect with other like-minded
students was very evident. Facebook has grown in use and popularity. One common student goal is to “collect friends” (Kornblum, 2006b). Both Facebook and MySpace let users establish a friends list, typically filled with all sorts of friends, from best friends to virtual strangers. Users sometimes collect friends just to see how many they can get. It can be seen as a proxy for popularity.

One of the newest technologies—radio frequency identification (RFID)—is now being integrated into student social life. The University of Westminster student union uses RFID tables in the bar to deliver drinks remotely (Best, 2006). Using pop-up screens, students can select the beverages they want and place an order, paying with their RFID cards. Orders show up in the bartenders’ windows, and an employee delivers the drinks. The screens also enable students to chat with students at other tables. They also come with preprogrammed chat lines such as, “I’m not actually this tall. I’m sitting on my wallet.”

How Are Colleges and Universities Adapting to Today’s Undergraduates?

To meet students’ changing expectations, higher education institutions have also supplied technologies of their own. Some institutions have provided laptop computers to incoming freshmen for the past five years. In 2004, Duke initiated the Duke Digital Initiative, aimed at using portable, personal multimedia technologies and digital course materials to promote innovative and effective teaching (Duke Digital Initiative, 2006). A key component of this program is student and faculty use of iPod technology to enhance teaching and learning. At Coppin State University in Baltimore, students can watch digital recordings of lectures using a system that merges video recordings of class lectures with a digital version of a student’s own notes (Kiernan, 2006).

In fall 2006, some institutions began distributing special cell phone/personal digital assistant devices to their students (Jaschik, 2006). For example, at Allen University in South Carolina, students and faculty members alike received cell phones to enable communication and access to university resources. At the University of Cincinnati, where institutionally offered cell phones are available to all students, students aren’t required to purchase the phones; instead, program managers expect them to be attracted to these phones’ full coverage everywhere on campus. At Wake Forest University, the MobileU program provides a cell phone/personal digital assistant designed to emphasize academics, including special quiz programs and library guides and search tools. Integrated with course management systems and institution-specific Web sites, these devices are providing faculty and students with a common communication and interaction environment.

One of the hottest new technologies has been the MP3 player. The ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning (Kvavik & Caruso, 2005) reported students’ overall ownership level for MP3 players at 28.4 percent. In 2006 the number grew to 58.6 percent. In response to this increase, several institutions have initiated podcast services for faculty lectures. At the University of California, Berkeley, and Stanford University, MP3 technology has been integrated into the curriculum, and students can either download individual files or subscribe to podcasts that automatically put new files in their electronic devices (Bear, 2005). Several universities have also joined Apple’s iTunes U initiative (University of Wisconsin–Madison, 2006). This service enables colleges to use part of the iTunes Music Store to distribute course content and other audiovisual materials. The collaboration with Apple has enabled institutions such as the University of Wisconsin–Madison to
experiment with podcasting for instruction without having to build a separate podcasting capability for the campus.

One area of technology whose instruction potential is due for additional exploration is electronic gaming. Since many students have been playing electronic games since they were very young, they are familiar with and comfortable using these technologies. Some institutions are using an online digital world, Second Life, to create virtual classrooms of students (Lamb, 2006). In Second Life, students can set up businesses, buy land, build structures, and meet other students. They can build things that would be too expensive or physically impossible in the real world.

**Diversity Extends to Information Technology**

The generational conceptualizations of the experts go far in describing a tidal wave of changed expectations and behaviors that will likely change the higher education landscape in profound ways. At the same time, while every generation has its innovators and early adopters of change, so do they have skeptics, late adopters, and those whose economic circumstances leave them on the sidelines of the information revolution. The ECAR study that follows attempts to chronicle the spectrum of undergraduates as reflected in survey responses. Some of our respondents behave like one would expect of the Net Gen and adopt new technologies as soon as they become available. Others respond to IT with greater hesitancy, skepticism, and reserve. College and university technology providers and faculty must account for this spectrum; therefore, these differences are reflected in our study results.

**The ECAR Study**

In this chapter we focused primarily on traditional undergraduate students. Our study results, though, include both traditional and nontraditional students. The respondents to our survey are largely female (63.2 percent) and are a mix of ages (35.2 percent 18–19 years old, 43.2 percent 20–24 years old, and 21.6 percent 25 years old or older). Full-time students make up 85.9 percent of the respondents. Considering the demographic mix is important to us as we analyze and present our study results.

As we undertook this third annual study of students and IT, we sought to expand upon the findings of 2004 and 2005. We wanted a snapshot of the 2006 students’ IT experiences and, to the extent possible, to look for trends in students’ experiences with IT. We focused on student technology ownership, technology use and skills, experiences with technology in their courses, and perceptions of the value of IT in their academic experiences. Through our analysis of demographic variables such age, year in school, gender, and academic major, we have sought to discover how student differences impact their perspectives and experiences with IT.

In the following chapters, we present the results from more than 28,000 student responses to a quantitative survey, some excerpts from student comments in the survey and in focus group interviews, and a comparison of results from 2005 and 2006.

**Endnote**

1. For context and additional historical data concerning today’s undergraduates, see The People History at <http://www.thepeoplehistory.com/>. 
Methodology

The annual research studies on student use of information technology (IT) represent one of ECAR’s most ambitious undertakings. In 2001, ECAR fellows discussed the paucity of data and analysis of undergraduate students and their uses, preferences, expectations, and experiences with IT. With the help of knowledgeable leaders, the audacious idea of creating a new survey of students focusing on technology was hatched and given flight.1 In 2004, the first ECAR study was launched with a baseline of 13 institutions, and in 2005 the number of participating institutions jumped to 63. In this study, 96 institutions participated.

The 2006 study builds on and extends previous successes and consists of six data collection and analytical initiatives:

- We undertook a literature review (extending the 2005 literature review) and reviewed other surveys, both U.S.-based and international. The references appear in Appendix A.
- We used the results of our previous ECAR studies on student and faculty use of IT to provide insight for the current 2006 study. These include the ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control (Kvavik, Caruso, & Morgan, 2004); The ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning (Kvavik & Caruso, 2005); and the Faculty Use of Course Management Systems (Morgan, 2003).
- A Web-based survey of undergraduate freshmen and seniors from 88 four-year institutions and general community college students from eight associate’s institutions supplied student quantitative data based on their experiences with IT in higher education. A sample of 277,137 students at these 96 higher education institutions in 32 states received the e-mail invitation to participate in the study.2 Fully 28,724 students responded.3 A few questions were deleted because we found they did not work well in 2005. We improved other questions with better wording or clearer definitions. We also added some questions in 2006 to address issues we learned were important in 2005. The online survey appears in Appendix C.
- We supplemented the quantitative data with interviews of 71 students in focus groups, to provide diverse perceptions of IT’s impact in higher education.4 We recognize, of course, that as consumers of higher education, few students can offer expert opinions about either instructional

Respondent Characteristics

I did not realize how much technology we use on campus until I took this survey.
—An undergraduate student
methods or IT. Their opinions and perceptions nevertheless have meaning.

◆ Almost 5,000 students (17 percent) responded to the open-ended survey questions. They expressed opinions on their use of and skill with IT, the state of their institutions’ IT support services, and their perceptions of technology use in their courses. They also offered advice on how to improve IT at their institutions. These comments were analyzed and give additional perspectives on the undergraduate IT experience.

◆ The 2005 and 2006 data were compared where possible to identify similarities and dissimilarities. While it is important to note that this study does not attempt to follow the same students over time, we were able to use comparative data from the 49 institutions that participated in both the 2005 and 2006 studies.

We asked institutions to construct a sample of their students to achieve a 95 percent level of confidence with a +/- 5 percent margin of error. However, a number of them chose to include their entire freshman and senior classes. In the absence of our weighting of institutional responses, this means that we can generalize to the sampled students but not to the 96 institutions. For the sampled students, we achieved a 99 percent level of confidence with a +/- 2 percent margin of error, which means that one can say with 99 percent confidence that the error attributable to sampling and other random effects is +/- 2 percent.5

We use means and standard deviations in this study. Means are arithmetic averages and measures of central tendency. Standard deviations are measures of dispersion or variability. This means that the larger the standard deviation, the more disagreement exists among the respondents. We also did some further modeling and regression analyses to determine levels of correlation among the variables, but for reasons of simplicity we do not present the figures.6

Research Team

Gail Salaway, Richard N. Katz, and Judith Borreson Caruso are the principal investigators. Robert B. Kvavik substantially contributed by providing guidance and review throughout the study process. Mark R. Nelson’s contribution to the study is a content analysis of more than 400 pages of commentary provided by students in two open-ended survey questions.

Gail Salaway

Gail Salaway earned her PhD in management of information systems from UCLA (1984). She is a former director of administrative computing and communications at UCLA, where she was responsible for campus-wide administrative information systems and telecommunications services, and management of academic and general computing initiatives. As an ECAR fellow, she has been principal investigator of research studies on IT networking, IT alignment, and IT leadership in higher education and author of several research bulletins and case studies.

Richard N. Katz

Richard N. Katz is an EDUCAUSE vice president and is the founding and current director of ECAR. In this capacity he has served as principal investigator and contributing author to numerous ECAR studies and publications. He has served EDUCAUSE (and its predecessors) since 1996, where he has been responsible for educational programs as well as member and corporate relations. Formerly, Katz was an executive director of business planning and practices at the University of California, where he was responsible for design and implementation of many of the UC System’s strategic management initiatives.
Judith Borreson Caruso
Judith Borreson Caruso is director of policy and planning at the University of Wisconsin–Madison and has been an ECAR fellow since July 2002. She previously served for many years as the University of Wisconsin–Madison’s director of applications technology. Caruso is active in several IT professional organizations, including EDUCAUSE. She has served on the EDUCAUSE Current Issues Committee and the EDUCAUSE Quarterly Editorial Committee. Currently she serves as chair of the University of Wisconsin System IT Management Council. While with ECAR, she participated in the enterprise resource planning (ERP), IT security, and student studies.

Robert B. Kvavik
Robert B. Kvavik earned his PhD from Stanford University (1971). He is currently professor of political science and vice president at the University of Minnesota. He directed the University of Minnesota’s implementation of the PeopleSoft student and human resources modules. He has published extensively in his academic discipline and increasingly on the impact and organization of information technologies on institutional services. Kvavik is a nationally known speaker on e-business and IT-enabled services in higher education. He has been a principal author of ECAR’s ERP, IT security, IT leadership, business process performance, and student use of technology studies.

Mark R. Nelson
Mark R. Nelson earned his PhD in information science from the University at Albany, SUNY (1998). He is the digital content specialist at the National Association of College Stores. Formerly, Nelson was assistant professor in management information systems and IT at the Lally School of Management and Technology at Rensselaer Polytechnic Institute. Nelson has served as an ECAR fellow since summer 2003. In this capacity, he has contributed to major research studies, including IT leadership, and he authored several research bulletins. He is a specialist in qualitative research.

Participating Institutions
Participation in the study was voluntary, and each institution obtained approvals from their institutional executives and their institutional review board (IRB). Therefore, the institutions participating in the study do not represent a statistical representation of U.S. higher educational diversity as a whole (see Table 3-1). Specifically, they are overwhelmingly four-year institutions whose undergraduates are generally traditional in age (78 percent are 24 years old or younger). The freshman and senior responses are further biased toward doctoral institutions (42.6 percent), larger institutions (70.8 percent enroll more than 8,000 students), and public institutions (83.8 percent). We therefore consider our findings to be instructive or indicative rather than conclusive of student experiences at different types of institutions. Even considering these biases, the 96 institutions that participated in this study do reflect a mix of the different U.S. higher education institution types in terms of Carnegie class, size of institution, private versus public status, sources of funding, and levels of technology emphasis. We had participating institutions from 32 states (up from 24 states in the 2005 study). Further, in this 2006 study, we had much higher participation from AA institutions—eight institutions accounting for 11.8 percent of student respondents (up from only two AA institutions participating in the 2005 study).
Sample and Response Size and Characteristics

Invitations to participate in the survey were sent by e-mail to 277,137 students at 96 institutions (see Appendix E). Of those we invited to participate, 10,057 freshmen, 15,287 seniors, and 3,380 community college students responded. Freshmen make up 35.0 percent of the respondents, seniors make up 53.2 percent of the respondents, and community college students make up 11.8 percent. Each university used a different sampling model.

The overall student response rate in the 2006 study is 10.8 percent, compared with a 12.6 percent response rate in 2005 and a 23.7 percent response rate in 2004. There is significant variation by institution, but no significant difference between seniors, freshmen, and community college students. The slightly reduced response rate from 2005 may be caused by several factors. First, there continues to be a proliferation of spam, and since many spam e-mails can contain computer viruses and other forms of malware, it is not unlikely that students are increasingly cautious about responding to the e-mail invitation. Second, students receive numerous e-mails throughout the year asking them to take a survey and win a prize. Finally, this year, for the first time, we accepted 15 institutions that did not offer the prize and therefore had significantly lower response rates.

A profile of student respondents appears in Table 3-2. Female students made up 63.2 percent of the respondents, despite our strategy of oversampling male students in the population. We emphasize again that our student respondents are weighted with so-called traditional students. The majority are under 25 years old (78.4 percent) and go to school full time. Freshmen most often live on campus (73.9 percent), while seniors most often live off campus (80.0 percent). However,
the sizable population of community college respondents in this 2006 study has resulted in an increased representation of older students, students residing off campus, and students attending school part time. The grade point averages for our respondents appear to follow a fairly normal distribution. More than 74 percent of the students have a B or better grade point average.

We asked the students to identify their major (see Table 3-3). Note that the number of respondents is larger than the sample size (N = 28,724) due to students’ reporting double majors. Because so many students are freshmen, it is not surprising to find that 24.9 percent are undecided or do not know. social sciences (19.3 percent) and business (19.5 percent) are the largest major areas of declared interest.

**Qualitative Data**

ECAR collected qualitative data by means of student focus groups at Coppin State University, Gettysburg College, North Dakota State University, the University of St. Thomas, and the University of Wisconsin–Whitewater. We strove to interview as diverse a group of students as possible. A total of 71 students participated in the focus groups, and each focus group meeting lasted for an hour. The focus group questions appear in Appendix D.

In addition, almost 5,000 students responding to the quantitative survey took the opportunity to provide additional insights by...
responding to two open-ended questions. Mark Nelson analyzed their comments using the content analysis tool SPSS Text Analysis, thereby providing us with additional insight into the substance of the qualitative data.11

The students articulated several themes, which we have incorporated into the main text of this study. These students’ comments can form the basis for a set of recommendations to administrators for improving IT use. We characterize such comments as the wisdom of students, and policymakers can take them as one important input to the complex set of choices and options they face. Content analysis allowed the comments (both positive and negative) provided by students to be categorized into the following themes:

- student and faculty IT training and user assistance,
- faculty use of technology,
- desire for more and better technology on campus,
- the social implications of technology in classrooms,
- the impact of IT on communication,
- the convenience provided by IT,
- the importance of IT for students’ careers,
- the usefulness of and problems with various applications (such as Excel or PowerPoint),
- access to IT as facilitating learning,
- how money is spent on IT at institutions,
- the impact of IT on learning (mostly positive), and
- problems with the use of IT in general and course management systems in particular.

### Endnotes

1. ECAR is indebted to Robert Albrecht (ECAR), Carole Barone (then with EDUCAUSE), Darwin Handel (University of Minnesota), Diana Oblinger (then with ECAR), and many others who consulted on this research and survey design.

2. To encourage a larger response from the students, ECAR offered 30 $50 gift certificates and 50 $100 gift certificates for Amazon.com, using a lottery. We had learned from other institutions’ experiences that the absence of an incentive would greatly reduce the response rate. Such awards are prohibited in some states; as a result, some institutions did not participate in the lottery.

3. The information collected from the student respondents is confidential, and no personally identifiable data is available from the quantitative survey. The required institutional review board (IRB) approval was received from every participating institution.

4. Interviews were conducted at Coppin State Uni-
5. The confidence interval (margin of error) refers only to the statistical error associated with the size of a sample, assuming a representative and random sample. This is the only type of error that can be readily quantified. Note, however, that there are other potential sources of error that are non-sample-related, such as the wording of the survey questions (may not be clear) and most notably nonrepresentative responses (a large percentage of the students declined to take this survey). Since the response rates in this study were lower than hoped for at a number of schools, one cannot be certain of how representative the respondents are of their respective campuses or of this population in general. Therefore, caution should be exercised in assuming that the findings generalize beyond the sampled students.

6. Note also that percentages in some of the tables do not add up to 100 percent because of rounding. Rounding occurs in the figures as well.

7. Each institution required approvals from institutional executives and their institutional review board (IRB) in order to participate in the study. The approval processes, while navigated by an institutional contact, varied considerably in difficulty from institution to institution. Often, the information required for approval was different from one institution to the next. While the investigators made every attempt to provide all information required at the start of the study solicitation, additional details were added throughout the approval process to provide what each institution required. The information collected is confidential. No data from the quantitative survey are presented that would make it possible to identify a particular respondent. The data files we used for analysis have been purged of any information that would have similar consequences. The IRB applications, application dates, and approval dates are available from ECAR.

8. Nationally, one source from 2002 assessed the average student grade point average at 21 four-year public and private postsecondary institutions as 3.09. See Rojstaczer (2003).

9. Nationally, 21.4 percent of undergraduate degrees are issued in business and marketing, 10.3 percent in social science and history, and 4.8 percent in biological/life sciences (U.S. Dept. of Education, 2003).

10. To recruit students, staff from participating institutions posted advertisements in various campus locations, made announcements in large-enrollment classes, and e-mailed students. Food and beverages were provided as incentives to attend. Students who work in general-access undergraduate student computing laboratories or for student technology help desks were also included in the focus groups. Students were advised of IRB regulations that govern the research and their rights, and the responsibility of the investigators to protect their rights. Notes were taken. None of the comments made by students and cited in this study identify any individual student. In some instances, we corrected their English but made no change in meaning.

11. The qualitative analysis for this study used a simple, iterative codification analysis process. SPSS Text Analysis for Surveys (v. 2.0) software was used as follows: (1) terms and concepts were identified by frequency; (2) the terms were evaluated by “type,” such as whether a term or a combination of terms had a positive or negative tone; (3) terms and term pairings were reviewed for accuracy and greater contextual understanding than provided by the software; (4) as needed, responses were force coded into additional categories, reclassified as synonyms, and/or new study-specific terms were added to the software dictionary. In addition, all responses were reviewed manually for additional concepts, topics, or patterns needing to be codified within the data. This process required multiple reviews of the data, as is common in grounded theory and similar approaches to qualitative data analysis.
4
Student Ownership of, Use of, and Skill with Information Technology

I love learning about new technologies, but at the same time, I feel our culture is becoming more fast-paced than necessary because of it. We need a balance in order to have a healthy society for now and in the future.
—An undergraduate student

Key Findings

♦ Fully 97.8 percent of respondents own a PC. Nearly two-thirds (66.4 percent) own a laptop computer.
♦ Laptops are emerging as the platform of choice: 76.7 percent of freshman respondents own a laptop computer. Ownership of laptops rose by 26.7 percent since 2005.
♦ Some respondents own only a desktop computer that is four years old or more. Such PCs may pose performance or reliability issues.
♦ Mobility is important: 19.8 percent of respondents own either a PDA (15.7 percent) or a smart phone (8.3 percent). Ownership of these devices rose significantly from 2005.
♦ Respondents spend 23 hours per week using an electronic device. Males spend more time (25.9 hours) than females (21.1 hours). More than one-quarter of male respondents use electronic devices more than 30 hours per week.
♦ The choice of academic major is associated with the number of hours spent using technologies. Engineering majors report far greater hours of use.
♦ More than 80 percent of respondents exchange instant messages, and of these 57.3 percent do so every day. More than 70 percent use social networking sites such as MySpace and Facebook, and of these 65.9 percent do so several times per week or more.
♦ E-mail is used by virtually all respondents, and only 11.8 percent maintain only one e-mail account. There is an almost even split between those who prefer their institutional e-mail account (50.3 percent) and those who prefer another account (49.7 percent). Students with a greater number of e-mail accounts generally prefer a provider that is not their academic institution.
♦ Respondents overwhelmingly (84.9 percent) prefer e-mail (over Web reporting, IM, or paper) for official institutional communications.
There is no question that information technology (IT) is transforming every aspect of our society and economy. Today, more than a billion men, women, and children connect to the Internet (eMarketer Daily, 2006). Among active Web users in the United States, the average computer time spent per person is now over 30 hours per month, and nearly 95 million U.S. Web users connect to the Internet via broadband. The impact of IT on learning and student life, too, is dramatic if incompletely understood.

This chapter addresses technology adoption and diffusion among college and university freshmen, seniors, and, to a lesser extent, community college students. Within this context and the literature of this field, diffusion is defined as the process by which an innovation is adopted and gains acceptance by members of a certain community. Several factors interact to influence the diffusion of an innovation. The four major factors that are thought to influence the diffusion process are the innovation itself, how information about the innovation is communicated, time, and the nature of the social system into which the innovation is being introduced (Rogers, 2005). In 2005, Kristina Woolsey suggested, "[A]sking [students] about technology is a bit like asking a fish about water" (Woolsey, Woolsey, & Woolsey, 2005, p. 5). When an innovation becomes like the air we breathe, it is safe to say that the innovation has been fully diffused!

The transformational power of IT knows no bounds and is sparing no institution or process, least of all education. NetDay’s survey of 562,000 students reveals that 63 percent of the K–3 students in the United States use desktop computers on a weekly basis. Twenty-one percent of this cohort uses a laptop computer at least weekly. By grades 6–12, the weekly use of desktops has risen to 82 percent of NetDay survey respondents and the use of laptops to 35 percent! Even more amazingly, 16 percent of students from grade 6 to grade 12 report using a personal digital assistant (PDA) on a weekly basis (Project Tomorrow, 2006).

This chapter focuses on what technologies college and university students own, what they use both inside and outside the classroom, how they describe their own skills with IT, and what motivated them to learn to use technologies.
Student Ownership of Technology

So what electronic devices do college and university undergraduates own?

The easy answer to this question is that they own a lot (Table 4-1). Not surprisingly, the generation of teenagers who were raised in households with PCs, VCRs, DVRs, and broadband connectivity has come to our universities and colleges owning a lot of electronics. Male student respondents own more electronic devices. While female respondents own proportionately more digital cameras and a similar number of laptop computers, the proportion of males claiming to own electronic devices was higher in every other device category—significantly in some. In particular, male respondents own PDAs, wireless hubs, and electronic game devices at rates nearly 50 percent higher than female respondents. In fact, more than 61 percent of males report owning four or more of the eight devices listed in the ECAR survey. Correspondingly, male respondents report far greater ownership of software in categories often used in postsecondary education and in the workplace.

While few female respondents are gadgetless, many navigate their higher education in “gadget-light” condition. More than one-half report owning three or fewer devices, and three-quarters own four or fewer.

Table 4-1. What Electronic Devices Students Own

<table>
<thead>
<tr>
<th>Type of electronic devices owned</th>
<th>N</th>
<th>Males</th>
<th>Females</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital camera</td>
<td>28,234</td>
<td>65.9%</td>
<td>76.0%</td>
<td>72.3%</td>
</tr>
<tr>
<td>Personal computer—desktop</td>
<td>27,553</td>
<td>76.6%</td>
<td>68.0%</td>
<td>71.2%</td>
</tr>
<tr>
<td>Personal computer—laptop</td>
<td>27,436</td>
<td>65.7%</td>
<td>66.9%</td>
<td>66.4%</td>
</tr>
<tr>
<td>Electronic music/video device</td>
<td>28,129</td>
<td>62.1%</td>
<td>56.6%</td>
<td>58.6%</td>
</tr>
<tr>
<td>Electronic game device</td>
<td>28,013</td>
<td>65.9%</td>
<td>43.0%</td>
<td>51.5%</td>
</tr>
<tr>
<td>Wireless hub</td>
<td>27,847</td>
<td>45.3%</td>
<td>30.7%</td>
<td>36.1%</td>
</tr>
<tr>
<td>Personal digital assistant (PDA)</td>
<td>27,705</td>
<td>20.6%</td>
<td>12.9%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Smart phone (combo cell phone/PDA)</td>
<td>27,638</td>
<td>10.7%</td>
<td>7.0%</td>
<td>8.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of different types of electronic devices owned</th>
<th>N</th>
<th>Males</th>
<th>Females</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>213</td>
<td>0.6%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>One device</td>
<td>1,844</td>
<td>4.8%</td>
<td>7.4%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Two devices</td>
<td>4,421</td>
<td>12.4%</td>
<td>17.2%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Three devices</td>
<td>6,921</td>
<td>20.5%</td>
<td>26.3%</td>
<td>24.2%</td>
</tr>
<tr>
<td>Four devices</td>
<td>6,702</td>
<td>23.5%</td>
<td>23.4%</td>
<td>23.4%</td>
</tr>
<tr>
<td>Five devices or more</td>
<td>8,522</td>
<td>38.1%</td>
<td>24.9%</td>
<td>29.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of software purchased</th>
<th>N</th>
<th>Males</th>
<th>Females</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation software</td>
<td>28,241</td>
<td>52.7%</td>
<td>43.8%</td>
<td>47.1%</td>
</tr>
<tr>
<td>Spreadsheet software</td>
<td>28,295</td>
<td>54.3%</td>
<td>42.6%</td>
<td>46.9%</td>
</tr>
<tr>
<td>Video/audio software</td>
<td>28,078</td>
<td>46.8%</td>
<td>31.8%</td>
<td>37.4%</td>
</tr>
<tr>
<td>Graphics software</td>
<td>28,044</td>
<td>39.9%</td>
<td>27.8%</td>
<td>32.3%</td>
</tr>
<tr>
<td>Web page software</td>
<td>27,765</td>
<td>23.0%</td>
<td>12.1%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>
Personal Computers

Nearly all ECAR survey respondents (97.8 percent) report owning a personal computer. Fully 71.2 percent of all respondents own a desktop device, and nearly two-thirds (66.4 percent) report owning a laptop device. One senior engineering student interviewed by ECAR confessed to owning two laptops and four desktops. He also noted that, conveniently, he had not changed residences in four years.

Age also appears to have an association with consumer choice among survey respondents (Table 4-2). Unsurprisingly, older students—with presumably more disposable income—have accrued more electronic equipment, but this pattern does not hold across all categories of devices. A greater share of 18- to 19-year-old respondents own laptop computers. More than three-quarters (76.7 percent) of freshman respondents own laptop computers, compared with only 61.2 percent of responding seniors. Perhaps more importantly, only 58 percent of responding community college students report owning a laptop computer, suggesting a new and more subtle digital divide.

Many of the youngest respondents (38.3 percent) begin their college careers with both a laptop computer and a desktop computer. Overall, 37.2 percent of respondents own both platforms. Of those who own a desktop and a laptop computer, laptops appear to be in the ascendant. In fact, 63 percent of those who report owning both platforms report that their laptop computer is newer than their desktop device, while 23 percent of those who own both platforms report that their desktop device is newer than their laptop. Somewhat surprisingly, 14 percent of respondents report owning both a desktop and a laptop computer of about the same age!

While male and female respondents show similar ownership patterns of laptops versus desktops, male respondents are far more likely to own both platforms. While 42 percent of male respondents own both a desktop and a laptop computer, only slightly more than 34 percent of female respondents make this claim. It is possible that some of these differing behaviors can be accounted for by computer gaming, as (chiefly) male respondents optimize one platform for speed and audio effects associated with video games.

Patterns of respondent personal computer ownership seem to reflect more than taste. They may in fact reflect student circumstance, particularly economic circumstance. The age

Table 4-2. What Electronic Devices Students Own, by Respondent Age

<table>
<thead>
<tr>
<th></th>
<th>18–19 (N = 10,084)</th>
<th>20–24 (N = 12,369)</th>
<th>25–29 (N = 2,387)</th>
<th>30–39 (N = 1,975)</th>
<th>40 and Older (N = 1,840)</th>
<th>All (N = 28,655)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital camera</td>
<td>69.0%</td>
<td>72.5%</td>
<td>73.8%</td>
<td>82.1%</td>
<td>76.6%</td>
<td>72.3%</td>
</tr>
<tr>
<td>Personal computer—desktop</td>
<td>62.3%</td>
<td>70.1%</td>
<td>82.0%</td>
<td>88.5%</td>
<td>91.8%</td>
<td>71.2%</td>
</tr>
<tr>
<td>Personal computer—laptop</td>
<td>76.4%</td>
<td>61.4%</td>
<td>60.3%</td>
<td>61.8%</td>
<td>57.1%</td>
<td>66.4%</td>
</tr>
<tr>
<td>Electronic music/video device</td>
<td>66.3%</td>
<td>58.5%</td>
<td>51.7%</td>
<td>48.7%</td>
<td>35.7%</td>
<td>58.6%</td>
</tr>
<tr>
<td>Electronic game device</td>
<td>56.7%</td>
<td>47.6%</td>
<td>54.9%</td>
<td>56.2%</td>
<td>39.0%</td>
<td>51.5%</td>
</tr>
<tr>
<td>Wireless hub</td>
<td>29.0%</td>
<td>38.6%</td>
<td>40.4%</td>
<td>44.7%</td>
<td>43.2%</td>
<td>36.1%</td>
</tr>
<tr>
<td>Personal digital assistant (PDA)</td>
<td>10.6%</td>
<td>15.8%</td>
<td>20.2%</td>
<td>26.4%</td>
<td>27.2%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Smart phone (combo cell phone/PDA)</td>
<td>8.8%</td>
<td>7.2%</td>
<td>10.2%</td>
<td>10.1%</td>
<td>9.2%</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
of respondents’ equipment varies noticeably by the type of platform owned. Among those who report owning a laptop computer, nearly three-fifths (58.7 percent) report that these devices are one year old or newer (Figure 4-1). Conversely, of those who report owning a desktop computer, 35.6 percent report owning a computer that is four years old or older. While this evidence is not conclusive, it suggests a number of possible things:

◆ Respondents, especially younger ones, are switching from desktop computers to laptops.
◆ Respondents with laptop computers are likely to have a newer platform than those with desktop computers.
◆ Respondents are accruing computers, with many reporting ownership of more than one computer.
◆ Some respondents who own only a desktop computer are using a computer that is old enough to pose reliability and/or performance issues. The more nuanced questions about a digital divide in the twenty-first century are surely ones about the age of students’ computing platform, their training, and their access to high-speed networking, rather than ones surrounding the ownership of a computer.

The 2006 ECAR student data suggest that owning a computer has become a prerequisite to attending college or university for many respondents. Figure 4-2 shows that 85.7 percent of four-year-college or university freshman respondents who own laptop computers report owning a laptop computer that is one year old or less. Clearly they are not bringing to college the old family laptop or a laptop they may have used in high school. Fewer than eight percent of those freshmen who report owning a laptop own one that is three years old or more. From a support perspective, respondents from four-year institutions are often arriving with current computing technology. The findings for two-year-college respondents with laptops are less bullish. Only 52.1 percent of these students report owning a laptop computer that is one year old or less, and 28.9 percent of these respondents report owning a laptop that is three years old or more. The laptop computers of four-year college seniors responding to the ECAR survey are spread more evenly across the age spectrum.

Figure 4-3 shows the age of students’ computers, looking only at the most recently acquired computer. More than half (52.8 percent) of these students own a computer that is one year old or less, and more than two-thirds (67.9 percent) own a computer that is two years old or less. It is also noteworthy.
that one-fifth of the students report that their newest computer is four years old or more. According to one student, “The one thing I find frustrating is having a significant amount of IT requirements for courses but not having a quality computer at home. I have one, but it’s slow and sometimes it acts up to where I can’t accomplish something. I wish there was more support for that, especially for students who have less money than I do, or no computer at all at home.”

One unanswered question posed by the shift of students toward laptop computers is whether this shift results from the emergence of widespread wireless connectivity on campus (and elsewhere), the rapid reduction in the prices of laptops, the better integration of technology into campus instruction, added convenience, or simply, as one student put it, “to look cool.” In the University of Wisconsin–Madison 2006 Student Survey, students who brought their laptops to class 50 percent...
or less of the time reported that their primary reason for not bringing their laptops was “it’s too heavy” (University of Wisconsin–Madison, 2006). In support of the argument that mobility is gaining importance, it is interesting to note that PDAs and smart phones are increasingly performing some of the functionality of the personal computer. The rates of ownership of these devices among respondents are worth calling attention to. After adjusting for students who own both devices, we find that 15.5 percent of ECAR respondents ages 18 or 19 own either a PDA or a smart phone, and 19.2 percent of respondents ages 20–24 own one of these devices. Clearly, for some, the handheld computing and communication device is perceived to be of new value within the college or university experience. As convergence of voice and data functionality proceeds, we expect to find more and more students owning and using intelligent handheld devices over time. To test this hypothesis, we compared key patterns of ownership among respondents to our 2005 and 2006 surveys (Table 4-3).

While this table does not compare identical student populations, the findings strongly suggest that

- ownership of laptops among students is rising at more than twice the rate of desktop computers;
- PDAs have a secure toehold among undergraduates, and smart phone ownership is rising very rapidly—assuming roughly comparable functionality in these devices—with now 19.8 percent of respondents owning a smart handheld device;
- electronic music and video devices continue to penetrate the postsecondary student market rapidly; and
- mobile communication is a deeply socialized student behavior, and mobile computing is an important emerging behavior.

### Networking: From a Port for Every Pillow to a Router for Every Room

Much more will be said about responding students’ use of network information resources. In the context of IT devices owned, it is interesting and likely important to highlight the finding that more than one in three (36.1 percent) survey respondents report owning a wireless hub (Table 4-1). Once again, male respondents’ rate of ownership (45.3 percent) significantly outpaces that of female respondents (30.7 percent). These ownership rates suggest (confirmed later) that respondents

<table>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal desktop computer</td>
<td>67.3%</td>
<td>60.6%</td>
<td>6.7%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Personal laptop computer</td>
<td>69.8%</td>
<td>55.1%</td>
<td>14.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Personal digital assistant (PDA)</td>
<td>14.7%</td>
<td>12.2%</td>
<td>2.5%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Smart phone (combination cell phone/PDA)</td>
<td>7.5%</td>
<td>1.1%</td>
<td>6.4%</td>
<td>581.8%</td>
</tr>
<tr>
<td>Electronic music/video device</td>
<td>61.3%</td>
<td>38.6%</td>
<td>22.7%</td>
<td>58.8%</td>
</tr>
</tbody>
</table>

Note: Comparisons of changes between 2005 and 2006 are based on student responses from the 49 institutions that participated in both studies.
have—and value—very high rates of access to the Internet and more specifically to broadband connectivity. Additionally, anecdotal evidence of widespread sharing of broadband capacity among several student roommates suggests that a very high proportion of respondents are enjoying residential access to high-speed networking. The 1990s battle cry of a “port per pillow” may be getting supplemented this century with “a router for every room, or at least a hub for every home!”

**Student Use of Technology**

The doors opened by these electronic devices are seductive to our respondents. ECAR survey respondents report spending an average of 23 hours per week using the wide array of electronic devices that includes computers, video games, MP3 players, PDAs, and smart phones. Other studies report student online engagement of more than 20 hours per week (Jayson, 2006a). Engagement with these electronic devices varies by gender among respondents. Females responding to the ECAR survey report a mean use of 21.1 hours per week, while responding males report using these devices 25.9 hours per week. One female senior majoring in computer and user technology noted, “I’m on my computer 70 percent of my awake time.” Engagement, as reflected in hours of use, is shown in Figure 4-4. Note that while the majority of respondents report spending fewer than 20 hours per week using these electronic devices, more than one-quarter of the males responding report using them in excess of 30 hours per week.

The use of these devices varies as well by the respondent’s academic major; engineering and business majors spend more time than others using them (Table 4-4). Indeed, for engineering majors, the likely curricular incentives or requirements to use these technologies trump gender differences. Differences in patterns of engagement between male and female engineering students are negligible. As earlier ECAR studies found, there is a wide variance in hours of use of these devices by academic major. Engineering majors on average report spending 50 percent more time per week using these electronic devices.

![Figure 4-4. Hours per Week Using an Electronic Device, by Gender](image-url)
devices than do life science, education, and social science majors.

More important, of course, than what technologies students own and how many hours they use them are questions that seek to objectify what activities engage students while they are using information technologies. Table 4-5 confirms that nearly all respondents are using technologies to create, read, or send e-mail, to produce documents for their coursework, to use the institutional library and other Web resources, and to create presentations. More than two-thirds of the respondents use spreadsheets and course management systems, and create graphics using Photoshop, as well as play video games, engage in social networking and online commerce, and exchange instant messages. A smaller but substantial number of respondents (more than 25 percent) create and edit audio and video files and Web pages, and engage in blogging and online gaming. These cohorts resemble their collegiate predecessors of the 1960s and their relationship with cars: most owned cars, many used them extensively, and a smaller cadre spent time under the hood.

Clearly, the computer is a major communication lifeline for college and university students. Not only do nearly all students use e-mail, but they also e-mail on a daily basis. Similarly, more than 80 percent of respondents exchange instant messages; of these, more than half (57.3 percent) do so on a daily basis. These communication activities are, in Woolsey's parlance, like water for fish (Woolsey, Woolsey, & Woolsey, 2005). Strikingly, relatively new social networking activities like Facebook and MySpace are used by more than 70 percent of the survey respondents, and of these, nearly two-thirds (65.9 percent) do so several times a week. As reported in our student focus groups, some of this use can be extraordinary. “I check facebook.com several times a day. You get an e-mail saying that someone wants to join your group or something else changed, and so you have to go to facebook.com to check out what request you got. The time adds up quickly—at least 2 hours a day,” acknowledged one sophomore we interviewed. Another sophomore confirmed this: “I check facebook.com several times a day. The facebook.com should have mediators.” Instant messaging and social networking activities are more prevalent among younger respondents. The importance of the computer as a communication device was emphasized by one student: “I do not have a ton of time to use technology because

<table>
<thead>
<tr>
<th>Major</th>
<th>N</th>
<th>Mean Hours per Week</th>
<th>Median Hours per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>2,773</td>
<td>30.3</td>
<td>24</td>
</tr>
<tr>
<td>Business</td>
<td>5,608</td>
<td>24.7</td>
<td>20</td>
</tr>
<tr>
<td>Other</td>
<td>5,057</td>
<td>24.7</td>
<td>20</td>
</tr>
<tr>
<td>Humanities</td>
<td>2,915</td>
<td>22.9</td>
<td>20</td>
</tr>
<tr>
<td>Fine arts</td>
<td>2,159</td>
<td>22.6</td>
<td>16</td>
</tr>
<tr>
<td>Physical sciences</td>
<td>1,965</td>
<td>22.1</td>
<td>16</td>
</tr>
<tr>
<td>Social sciences</td>
<td>5,525</td>
<td>21.8</td>
<td>17</td>
</tr>
<tr>
<td>Undecided</td>
<td>2,099</td>
<td>21.0</td>
<td>15</td>
</tr>
<tr>
<td>Life sciences</td>
<td>4,392</td>
<td>19.3</td>
<td>15</td>
</tr>
<tr>
<td>Education</td>
<td>3,688</td>
<td>18.8</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4-4. Hours per Week Using an Electronic Device, by Major
Table 4-5. Student Use of Electronic Devices for Activities

<table>
<thead>
<tr>
<th>IT-Related Activities</th>
<th>N</th>
<th>Students Engaged</th>
<th>Median Frequency of Use*</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Almost all Students Engaged</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create, read, send e-mail</td>
<td>28,612</td>
<td>99.9%</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write documents for coursework</td>
<td>28,664</td>
<td>98.8%</td>
<td>Several times/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use for course activities</td>
<td>28,607</td>
<td>98.5%</td>
<td>Several times/week</td>
<td>Senior</td>
<td>Engineering</td>
</tr>
<tr>
<td>Use library on university/college Web site</td>
<td>28,676</td>
<td>94.0%</td>
<td>Monthly</td>
<td>4-year institution</td>
<td>Social sciences</td>
</tr>
<tr>
<td>Create presentations (PowerPoint)</td>
<td>28,569</td>
<td>90.8%</td>
<td>Monthly</td>
<td>Senior</td>
<td>Business</td>
</tr>
<tr>
<td><strong>Most Students Engaged</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create spreadsheets or charts (Excel)</td>
<td>28,624</td>
<td>85.1%</td>
<td>Monthly</td>
<td>Senior</td>
<td>Business</td>
</tr>
<tr>
<td>Shop online</td>
<td>28,596</td>
<td>84.1%</td>
<td>Monthly</td>
<td>Senior</td>
<td>Male</td>
</tr>
<tr>
<td>As an in-class requirement</td>
<td>28,528</td>
<td>83.6%</td>
<td>Weekly</td>
<td>Senior</td>
<td>Engineering</td>
</tr>
<tr>
<td>Create, read, send instant messages</td>
<td>28,622</td>
<td>81.5%</td>
<td>Daily</td>
<td>Age (younger)</td>
<td>Reside on campus</td>
</tr>
<tr>
<td>Use course management system</td>
<td>28,663</td>
<td>75.0%</td>
<td>Several times/week</td>
<td>4-year institution</td>
<td>Senior</td>
</tr>
<tr>
<td>Play computer games</td>
<td>28,632</td>
<td>73.4%</td>
<td>Monthly</td>
<td>Male</td>
<td>Age (younger)</td>
</tr>
<tr>
<td>Online social network (facebook.com, etc.)</td>
<td>28,619</td>
<td>70.6%</td>
<td>Several times/week</td>
<td>Age (younger)</td>
<td>Reside on campus</td>
</tr>
<tr>
<td>Download Web-based music or videos</td>
<td>28,623</td>
<td>70.6%</td>
<td>Weekly</td>
<td>Age (younger)</td>
<td>Male</td>
</tr>
<tr>
<td>Create graphics (Photoshop, etc.)</td>
<td>28,634</td>
<td>68.0%</td>
<td>Monthly</td>
<td>Fine arts</td>
<td>Engineering</td>
</tr>
<tr>
<td><strong>Few Students Engaged</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online gaming (partypoker.com, etc.)</td>
<td>28,660</td>
<td>34.2%</td>
<td>Monthly</td>
<td>Male</td>
<td>Age (younger)</td>
</tr>
<tr>
<td>Blogging</td>
<td>28,510</td>
<td>28.6%</td>
<td>Monthly</td>
<td>Age (younger)</td>
<td>Fine arts</td>
</tr>
<tr>
<td>Create Web pages (Dreamweaver, etc.)</td>
<td>28,614</td>
<td>28.6%</td>
<td>Once per quarter/semester</td>
<td>Engineering</td>
<td>Male</td>
</tr>
<tr>
<td>Create audio/video (Director, iMovie, etc.)</td>
<td>28,588</td>
<td>27.7%</td>
<td>Once per quarter/semester</td>
<td>Male</td>
<td>Fine arts</td>
</tr>
</tbody>
</table>

*The median is the midpoint in a series of numbers; half the data values are above the median, and half are below.*

(1 = never, 2 = once a year, 3 = once per quarter/semester, 4 = monthly, 5 = weekly, 6 = several times per week, 7 = daily)
of other activities on campus, but basically my AIM, my cell phone, and my e-mail are the focal point of all my organization, and I would be lost without them.”

A great deal of respondent usage is highly purposeful, with respondents reporting frequent use of technologies such as course management systems for course activities (most use several times per week or more) and regular use of tools such as library resources, spreadsheets, or presentation software (most use monthly or more often).

And of course technology supplies both the tools and the environments for a considerable amount of student entertainment. Survey respondents are actively engaged in playing computer games (online and offline) and in downloading Web-based music and videos.

Age, gender, class standing, and academic major are influential factors in association with a set of technology-mediated activities. Younger students are more likely to be exploiting the social potential of technologies, particularly through blogging, instant messaging, and social networking environments such as Facebook. Male students are more likely to be gamers, reporting higher usage of computer and online games. One student even suggested, “My institution needs to learn more about the Xbox Live and online console gaming systems and how to help students set them up.” Seniors and business and engineering majors are more likely to report using course management systems and spreadsheets as well as to produce presentations and graphics, and to make Web pages. It is not yet clear whether these predilections reflect a tendency of students to move through technology preferences (a maturation process) or simply the crowding out of recreational and social activities based on the greater demands posed by a higher standing within the academic experience.

In August 2006, Google announced a set of enterprise service offerings particularly focused on messaging services for the small business and college and university markets. Google executive Matt Glotzbach stated that Google is “bringing the ease of use of consumer apps to a business setting, eliminating the cost of buying, installing, and maintaining servers. Our goal is to develop an application suite that leverages our infrastructure, that will serve as a platform to give businesses a significantly lower-cost (or free) solution, and also be a platform for the future” (Needleman, 2006). This offering was widely discussed over the EDUCAUSE CIO listserv in October 2006 as college and university technology leaders debated the future of a host of campus-supplied services.

To inform this discussion, ECAR asked students about their preferences and behaviors regarding e-mail in particular. In 2006, there was an almost even split between students who prefer their university e-mail account (50.3 percent) and those who prefer another account (49.7 percent). The data most associated with e-mail preference are residential status and age. Of students who reside on campus, 68.2 percent prefer their institution e-mail account, while only 39.8 percent of students who reside off campus prefer the institution’s e-mail account. Older students are more likely to prefer their noninstitutional e-mail account, especially those 25 and older; 58.1 percent of students under age 25 prefer their institution e-mail account, whereas only 21.9 percent of students 25 or older do.

Almost half (46.6 percent) of students reported that they maintain two e-mail accounts, and slightly more than one-fourth (26.4 percent) maintain three accounts. Only 11.8 percent of respondents maintain only one e-mail account. There is a strong association between number of e-mail accounts and e-mail account preference; students with a greater number of e-mail accounts generally prefer an e-mail provider that is not their academic provider (Figure 4-5).
Another major topic of debate among college and university IT service providers is the extent to which e-mail might be starting to become passé among undergraduates. A commonly quoted but perhaps apocryphal student rejoinder is “e-mail, that’s for old people.” Student preferences for basic communication services are a matter of grave importance for colleges and universities. For example, it appears that many colleges and universities are rethinking and in many cases uninstalling their telephone landlines in the residence halls owing to the overwhelming student preference for cell phones. Such decisions have economic implications, but even more important are the implications for overall campus communications, including emergency communications. Notwithstanding either urban legends or trends among precollegiate students who may be college or university bound, the communication medium preferred by respondents for institutional communications is clear. Overwhelmingly, these students prefer e-mail (Figure 4-6). In the open-ended comments, one student noted, “E-mail notices to students are a great way to keep us informed, providing that the system can handle it.” Another echoed, “E-mail is an essential tool. For the convenience and ease of use and correspondence with classmates, professor, etc., e-mail is essential.”

So who among our respondents seems to prefer instant messaging? They appear to be, first, students who use IM daily and, second, younger respondents. Of students who use IM daily (46.7 percent of all respondents), almost 6 percent (5.8 percent) selected IM as their first-choice medium for institutional communications. In contrast, only 1.1 percent of those students who do not use IM daily selected IM as their first choice for communication from the institution. This pattern does not hold for text messaging.

Regarding age, 5 percent of 18- and 19-year-old respondents chose IM as their preferred means of communication. The preference for IM among respondents, by age, follows a classic stair-step pattern. Among respondents ages 20 to 24, 2.7 percent chose IM; among respondents ages 25 to 29, 2 percent chose IM; and among respondents age 30 and up, 1.6 percent preferred IM. Again, it is premature to speculate whether young IMers will come to dominate the undergraduate landscape. This could be a technology preference that young people will moderate or rebalance as they age.

Campus IT service providers are also concerned about student needs and preferences
for network bandwidth, and they work hard to strike a fine balance between providing high-capacity networks that are free of congestion and the optimal investment of campus dollars. The ECAR survey data regarding student network preferences is clear:

- responding students strongly prefer broadband to narrowband and overwhelmingly have access to broadband;
- the move to laptop ownership is also a move toward wireless networking; and
- student preference for ISP is an artifact of where they live, with residential students preferring the campus as an ISP, while off-campus students are making extensive use of commercial ISPs.

Independent of a wide array of factors such as residential status, class standing, and other demographic factors, female respondents use dial-up access more often than do male respondents (Table 4-6). Interestingly, female respondents report a greater use of wireless networks than their male counterparts. As well, community college students depend to a far greater extent on narrowband network connections (15 percent) than do respondents from four-year institutions (9 percent). These community college students do not demonstrate greater use of or access to wireless networks. Again, this data combined with data concerning the age of computers within different subpopulations in this sample suggest the existence of subtle but potentially important digital divides.

Importantly and not surprisingly, a relationship exists between the method of Internet access and the hours of Internet use per week. The mean hours of Internet use per week for students who depend on dial-up Internet access most frequently is 17.8 hours per week; for students most frequently using broadband, it’s 23.1 hours per week; and for students most frequently using wireless Internet, it’s 22.5 hours per week. Even controlling for the fact that more females than males use dial-up access most frequently, Internet access remains a significant variable. One student noted, “I had numerous problems with the course I took via the course management system because I am on dial-up. Where I am located, high-speed access is not available.” But, overall, it is not yet clear whether

Figure 4-6. First Choice for Institutional Communication (N = 28,648)
Students also commented on the importance of the wireless network. One suggested, “I would appreciate an expansion of the wireless network on campus because it is so convenient.” Another complained, “The wireless signal within many buildings is weak or unreachable. Frequently I am unable to connect at all from within my classrooms. When I do manage to connect, the signal drops out frequently, often staying connected for only a minute or two, making it difficult to download any lecture notes the instructor has posted, or to participate in any online contact such as the course management system discussion boards.” A wireless-supporting student noted, “The most important aspect of IT on my campus is the campus-wide wireless Internet connection.”

Finally, over the past year, we find an increase at the high end in the percentage of students who “normally use an electronic device (excluding cell phones) for school, work, or recreation” more than 20 hours a week. In this 2006 ECAR study, 38.2 percent of respondents used their devices more than 20 hours per week, while in the 2005 ECAR study we found that only 30.9 percent did so.

### Student Skills

Of course, it is one thing to own information technologies, another to use them, and yet another to use them as instruments of academic achievement.

In many ways, students’ responses affirm our expectations. They rate themselves as being generally accomplished in key areas of activity such as using online library resources and software productivity tools (Table 4-7). Nearly two-thirds of respondents (65.8 percent) report having at least basic skill with course management systems—a remarkable fact, considering the relatively recent introduction of this technology. Respondents’ self-reported skill levels drop in association with more expensive, complex, or specialized tools like those for producing complex graphics, Web pages, or audio/video. Even these tools, however, are widely in use by more than one-quarter of the responding students. Gender again is an influential factor in explaining perceived differences in skill levels: being male is associated with higher reported levels of skills.

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**Table 4-6. Most Frequently Used Internet Access Method**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Broadband, Wired</th>
<th>Wireless</th>
<th>Dial-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10,505</td>
<td>81.6%</td>
<td>12.2%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Female</td>
<td>18,020</td>
<td>68.3%</td>
<td>19.9%</td>
<td>11.8%</td>
</tr>
<tr>
<td><strong>Institution Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four-year institution</td>
<td>25,259</td>
<td>73.6%</td>
<td>17.4%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Community college</td>
<td>3,363</td>
<td>70.4%</td>
<td>14.6%</td>
<td>15.0%</td>
</tr>
<tr>
<td><strong>Laptop Ownership</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own laptop</td>
<td>18,212</td>
<td>70.4%</td>
<td>21.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Don’t own laptop</td>
<td>9,223</td>
<td>78.3%</td>
<td>9.3%</td>
<td>12.4%</td>
</tr>
</tbody>
</table>
Academic discipline, as in past ECAR surveys, is strongly associated with one’s perceived levels of skill. Not surprisingly, social science majors report more advanced skills with using online library resources, while business majors report more advanced skills in using presentation software. Majoring in engineering is closely associated with high skill levels in activities related to maintaining and securing computers, as well as to using spreadsheets and developing Web pages. Findings with regard to engineering majors are likely influenced as well by the frequent colocation of computer science within the engineering curriculum.

One question uppermost in the minds of educators and policymakers is the role of the higher education experience itself in the acquisition of skills, including computer skills. The ECAR data, of course, are inconclusive in this regard but nevertheless provide useful data points for triangulating on this complex topic. And, of course, relying on self-reported skill levels limits the reliability of this data. Notwithstanding these caveats, it is interesting to note that of those students who report knowing either basic or advanced features of a set of relevant technologies, seniors report using advanced features significantly more often than do freshmen (Table 4-8) in the key areas of:

- online library resources,
- presentation software,
- spreadsheet software, and
- course management systems.

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**Table 4-7. Student Technology Skill Levels***

<table>
<thead>
<tr>
<th>Technology</th>
<th>N</th>
<th>Minimal or No Use</th>
<th>Use Basic Features</th>
<th>Use Advanced Features</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online library resources</td>
<td>27,978</td>
<td>9.4%</td>
<td>46.9%</td>
<td>43.7%</td>
<td>Senior</td>
<td>Social sciences</td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
<td>27,433</td>
<td>14.0%</td>
<td>42.2%</td>
<td>43.7%</td>
<td>Business</td>
<td>Senior</td>
</tr>
<tr>
<td>Spreadsheets (Excel, etc.)</td>
<td>27,267</td>
<td>19.6%</td>
<td>41.9%</td>
<td>38.5%</td>
<td>Engineering</td>
<td>Business</td>
</tr>
<tr>
<td>Computer maintenance</td>
<td>27,405</td>
<td>20.1%</td>
<td>50.4%</td>
<td>29.5%</td>
<td>Male</td>
<td>Engineering</td>
</tr>
<tr>
<td>Computer security</td>
<td>27,563</td>
<td>20.1%</td>
<td>54.0%</td>
<td>25.9%</td>
<td>Male</td>
<td>Engineering</td>
</tr>
<tr>
<td>Course management system</td>
<td>26,023</td>
<td>34.3%</td>
<td>35.9%</td>
<td>29.9%</td>
<td>Male</td>
<td>Senior</td>
</tr>
<tr>
<td>Graphics (Photoshop, Flash, etc.)</td>
<td>25,373</td>
<td>41.5%</td>
<td>37.3%</td>
<td>21.2%</td>
<td>Engineering</td>
<td>Fine arts</td>
</tr>
<tr>
<td>Web pages (Dreamweaver, etc.)</td>
<td>24,740</td>
<td>73.6%</td>
<td>14.4%</td>
<td>12.0%</td>
<td>Male</td>
<td>Engineering</td>
</tr>
<tr>
<td>Video/audio (Director, iMovie, etc.)</td>
<td>24,740</td>
<td>74.0%</td>
<td>13.6%</td>
<td>12.4%</td>
<td>Male</td>
<td>Fine arts</td>
</tr>
</tbody>
</table>

*Categories of skill: Minimal or No Use (very little or no use of basic features); Basic Features (use of some or all of the basic features, but not the advanced features); Advanced Features (full use of basic features and many or all of the advanced features).*
Interestingly, and perhaps importantly, slightly more freshmen respondents report having knowledge of advanced features in audio and video production than do seniors. Clearly, these new-media skills are interesting to many freshmen and are either self-taught or learned in high school. Not surprisingly, a reported major in fine arts is associated with higher reported skills in film and audio software tools.

Several older students commented on their skills. One said, “As an older student, I have often felt at a disadvantage in regard to my competency with new technologies. Your more typical college student, in terms of age, has had opportunities to learn new technologies in high school at a sensible pace, over a period of time. I have had to come in and do a crash course, as it were, on PowerPoint, for instance, without the leisure of taking my time with it.” Another commented, “This technology is hard to learn and understand for older-than-average students, especially those of us over 50, because we did not grow up with computers. I think instructors need to take this into consideration with us and be patient with us.”

We looked at each academic major to see which skills were strong relative to the full respondent population and which were weak. The results of this analysis closely reflected our expectations (Table 4-9).

The association between reported skill levels and academic major is likely accounted for in part because of students’ motivations for learning information technologies. We asked students why they learned certain technologies (Table 4-10). College or university requirements or expectations dominated skilled respondents’ motivations for learning spreadsheet software (54.8 percent) and presentation software (71.5 percent). Interestingly, reported skills in producing or editing

---

**Table 4-8. Student Skills with Technology, by Class Standing**

<table>
<thead>
<tr>
<th></th>
<th>Seniors</th>
<th></th>
<th>Freshmen</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Use Basic Features</td>
<td>Use Advanced Features</td>
<td>Use Basic Features</td>
</tr>
<tr>
<td>Seniors report more advanced skill than freshmen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online library resources</td>
<td>25,031</td>
<td>43.9%</td>
<td>50.0%</td>
<td>52.8%</td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
<td>24,810</td>
<td>41.4%</td>
<td>49.4%</td>
<td>44.7%</td>
</tr>
<tr>
<td>Spreadsheet software (Excel, etc.)</td>
<td>24,912</td>
<td>40.1%</td>
<td>45.6%</td>
<td>45.3%</td>
</tr>
<tr>
<td>Course management system</td>
<td>24,243</td>
<td>35.7%</td>
<td>34.9%</td>
<td>38.3%</td>
</tr>
<tr>
<td>Web pages (Dreamweaver, etc.)</td>
<td>25,183</td>
<td>17.4%</td>
<td>13.7%</td>
<td>10.6%</td>
</tr>
</tbody>
</table>

*Categories of skill: Basic Features (use of some or all of the basic features, but not the advanced features); Advanced Features (full use of basic features and many or all of the advanced features).
Table 4-9. Majors Showing Strong and Weak Skills

<table>
<thead>
<tr>
<th>Strong Skills</th>
<th>Weak Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online library access</td>
<td>Social sciences, humanities</td>
</tr>
<tr>
<td>Course management system</td>
<td>Engineering, business</td>
</tr>
<tr>
<td>Education, fine arts</td>
<td></td>
</tr>
<tr>
<td>Spreadsheet software (Excel, etc.)</td>
<td>Engineering, business</td>
</tr>
<tr>
<td>Education, fine arts</td>
<td></td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
<td>Engineering, business</td>
</tr>
<tr>
<td>Education, fine arts</td>
<td></td>
</tr>
<tr>
<td>Graphics (Photoshop, Flash, etc.)</td>
<td>Engineering, fine arts</td>
</tr>
<tr>
<td>Video/audio (Director, iMovie, etc.)</td>
<td>Engineering, fine arts</td>
</tr>
<tr>
<td>Computer maintenance</td>
<td>Engineering</td>
</tr>
<tr>
<td>Computer security</td>
<td>Education</td>
</tr>
</tbody>
</table>

Table 4-10. Why Students Learn Technologies

<table>
<thead>
<tr>
<th>School course or activity reasons</th>
<th>Spreadsheet Software (N = 23,728)</th>
<th>Presentation Software (N = 25,276)</th>
<th>Graphics Software (N = 16,316)</th>
<th>Video/Audio Software (N = 6,935)</th>
<th>Web Page Software (N = 7,417)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course or major requirement</td>
<td>37.1%</td>
<td>43.0%</td>
<td>13.0%</td>
<td>15.9%</td>
<td>33.6%</td>
</tr>
<tr>
<td>Improve my course performance</td>
<td>13.2%</td>
<td>24.0%</td>
<td>5.9%</td>
<td>4.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Campus requirement</td>
<td>2.3%</td>
<td>2.3%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Required for student organization/activities</td>
<td>2.2%</td>
<td>2.2%</td>
<td>1.4%</td>
<td>1.0%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Total</td>
<td>54.8%</td>
<td>71.5%</td>
<td>21.0%</td>
<td>22.0%</td>
<td>41.3%</td>
</tr>
<tr>
<td>Employment reasons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job requirement</td>
<td>15.5%</td>
<td>6.7%</td>
<td>5.0%</td>
<td>3.3%</td>
<td>9.5%</td>
</tr>
<tr>
<td>To enhance future job opportunities</td>
<td>8.2%</td>
<td>5.8%</td>
<td>4.0%</td>
<td>3.5%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Total</td>
<td>23.7%</td>
<td>12.5%</td>
<td>9.0%</td>
<td>6.8%</td>
<td>16.3%</td>
</tr>
<tr>
<td>Personal interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal interest</td>
<td>12.4%</td>
<td>9.5%</td>
<td>63.2%</td>
<td>64.4%</td>
<td>38.0%</td>
</tr>
<tr>
<td>Total</td>
<td>12.4%</td>
<td>9.5%</td>
<td>63.2%</td>
<td>64.4%</td>
<td>38.0%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>9.0%</td>
<td>6.4%</td>
<td>6.7%</td>
<td>6.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Total</td>
<td>9.0%</td>
<td>6.4%</td>
<td>6.7%</td>
<td>6.7%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Note: Students who report that they “do not use” a technology are excluded.
audio and video or in composing or editing complex graphics was motivated far less often by institutional requirements than by personal interest. This finding reinforces our suspicion that incoming students are either self-taught in these technologies or have acquired reported skills in high schools. It is interesting to speculate about how these self-taught new-media-literate undergraduates might press both our campus IT infrastructures and their faculty.

When we asked students in the qualitative interviews why they learned technologies, they offered a variety of answers. One male management science major stated, “Your major has a big impact on what technologies you use and have to learn. If you’re an English major, you mostly use Word, but I’m a business major and I have to learn PowerPoint and Excel. They are used in all my classes.” A history major commented, “I know how to use Dreamweaver, MS Access, and FrontPage. I work for Big Brothers/Big Sisters, where I learned these things. There are lots of students who don’t have experience with MS Access.” One student affirmed that you only learn what you have to: “The only reason I have little knowledge is that I have not actively been seeking to learn more. I would do so if I had a more immediate incentive.”

This last comment reinforces a fascinating finding of an observed association between student skill levels and motivations for acquiring skills. Students who report learning a skill for employment or personal interest also report higher levels of skill. Although this finding does not imply a causal link between these two factors, it is an interesting association and one worthy of deeper research.

While the vast majority of our respondents report having knowledge of basic skills in using productivity tools and online library resources, are they in fact technology literate? This question is complex and beyond the scope of this study. Again, however, ECAR tries to provide data points that may be indicative and also can be used with other data to triangulate on answers. To that end we asked participating students whether they needed more training in technology skill areas studied (Figure 4-7). More than one-quarter (27 percent) of respondents agreed or strongly agreed with the statement “My school needs to give me more training on the IT that I am required to use in my courses.”

There is a mild association between the perceived need for more training by the institution and student age. Interestingly, younger students indicate slightly less need for more training, and older students indicate slightly more need for additional training. This may be an instance of Mark Twain’s insight when he observed that his father was an amazing man. Apparently, the older Twain got, the
students commented on their need for training. One noted, "It would be great if we received more IT education. I have a tough time teaching myself, and so when I have to run statistics on data, and have never been taught how to, it actually hinders my productivity." Another felt underprepared for graduate school: "I need more PowerPoint and Excel instruction. I am planning on entering grad school and have been doing research, which required me to use the spreadsheet for data. I was clueless and had to figure it out by myself. This was horrible for someone who is planning on possibly extending my education to include a doctoral program."

**Leading Edges, Trailing Edges, and the Mainstream**

The findings from the 2006 ECAR study of students and IT are largely heartening. Students have computers and they use them in educationally instrumental ways, as well as for communications, social enrichment, work, and entertainment. Seniors at four-year institutions use advanced features of key education-related software in greater proportions than do freshmen, suggesting a potential (and intuitive) interplay between the increasing rigors of upper-division undergraduate coursework and the need to demand more functionality from supporting software. The digital divide of the 1970s with regard to ownership and access to computers and networks and to their acquisition is not in great evidence within this base of respondents.

Notwithstanding this overall good news, important gaps remain in student IT ownership, access to broadband networks, participation in coursework via course management systems, and skills in core software to support the educational experience. While the ECAR study of students and IT presents the most comprehensive look ever undertaken at postsecondary students and their behaviors and preferences for IT, it is important to note that college and university students do not represent a monolithic demographic. We have learned, for example, that key differences exist among students of different ages, gender, class standing, and academic discipline. Certain differences also appear between the behaviors and expectations of students at four-year institutions and those of students at two-year institutions.

From the perspective of the faculty who face students daily in the classroom and administrators who need to provide both infrastructure and services that support many facets of student learning and student life, it is essential to recognize other possible nuances within the student population. Who, for example, are the power users, and how do their behaviors and preferences compare with those of the majority of students? What about students who may be late adopters of technology? To better understand the dynamics of these subpopulations, we asked respondents to describe themselves as technology adopters using the standard scale developed by Everett Rogers (2005) (Table 4-11). ECAR uncovered important differences between self-described mainstream technology adopters and those who either lead or lag in this aspect of student experience. One student who self-reports as a "close follower" in adopting technology said, "I love new technologies and use them as soon as all the guinea pigs (oops, I mean ‘early adopters’) have worked out all the bugs." Another is poetic in describing the range of student technology adoption: "For most students the magic is close to the surface. They don’t know what clicking here does so they don’t
know how to fix it when something doesn’t work. There is a lot of ‘chicken dancing’ with people who look tech savvy but they are not. They don’t know.”

As Table 4-12 shows, important differences exist among these groups. Students who describe themselves as early adopters or innovators (36.1 percent of the total respondent population) are indeed wired or, more appropriately, wireless. These students clearly value mobility, with more than half (50.8 percent) reporting ownership of a wireless hub and nearly one-third (30.3 percent) owning either a PDA or a smart phone. More than two of every five (40.8 percent) of these “power users” spend 25 hours or more per week using an electronic device. They are more than 50 percent more likely than the mainstream users to own software to produce or edit complex graphics, photos, Web pages, and audio/video files, and nearly three times more likely to claim advanced skills in using these tools. These students are more than five times more likely than late adopter respondents to be skilled in these areas.

More than one respondent in seven (14.8 percent) describes himself or herself as a late adopter of IT. Only 17.5 percent of these respondents spend 25 hours or more per week using an electronic device, and fewer than one in 10 (9.7 percent) report advanced skills in producing or editing complex graphics, Web pages, and audio/video files. It is worrisome that overall nearly one respondent in 10 reports either not using or having few or no skills in acquiring online library resources. Similarly, 14 percent of respondents report either not using or having few or no skills in using presentation software. These skills seem basic to an undergraduate education today.

One can infer, in fact, that important gaps in ownership, use, and skill continue to exist among our students. These gaps are perhaps more subtle than in the past. They relate to access to broadband and to course management systems, as well as to the age of the student’s computer. While a surprising number of students own more than one device and a significant number of freshmen enter college or university with a nearly new computer, some students are using computers that are four years old or older. Nearly one student in 10 continues to rely on a narrowband connection either institutionally or commercially provided.

Looking at student subpopulations, we hope, raises issues of institutional policy and priority. If ownership of mobile devices is closely associated with early adopters, is it likely that within five years most students will have and use these devices? We suspect so. If so, what are the implications
The question on many people's minds, of course, is how technology behaviors—specifically literacy—relate to academic outcomes. Grade performance is one reflection of these outcomes. Popular literature is filled with suppositions about this relationship; some observers believe that higher IT literacy must be associated with high grades, while others assert that IT (gaming, surfing, and the like) can be a serious distraction from academic purposes and therefore is likely for some to be associated with poor grades. These debates are largely ideological in nature, and the analysis of grade performance is mired in complexity. In the main, ECAR analysis suggests that most of the factors that ECAR analyzes are not strongly associated with self-reported grade performance.

It does turn out that GPA is somewhat associated with only one nondemographic variable—frequency of use of technologies—in the study. Those respondents who reported frequent creation and exchange of instant messages, playing of computer games, or downloading of Web-based music or videos also reported achieving lower grade point av-

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**Table 4-12. Self-Description Regarding Technology Profile**

<table>
<thead>
<tr>
<th></th>
<th>Innovator/ Early Adopter (N = 10,328)</th>
<th>Mainstream Adopter (N = 14,082)</th>
<th>Late Adopter/ Laggard (N = 4,243)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own PDA or smart phone</td>
<td>30.3%</td>
<td>15.2%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Own wireless hub</td>
<td>50.8%</td>
<td>30.2%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Purchased graphics, video/audio, and/or Web page software</td>
<td>64.4%</td>
<td>42.2%</td>
<td>29.7%</td>
</tr>
<tr>
<td>Skills with advanced features of graphics, video/audio, and/or Web page software</td>
<td>51.3%</td>
<td>19.0%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Skills with advanced features of computer maintenance</td>
<td>56.2%</td>
<td>16.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Spend 25 hours or more per week using an electronic device</td>
<td>40.8%</td>
<td>24.5%</td>
<td>17.5%</td>
</tr>
</tbody>
</table>

---

**IT Ownership, Use, Skill, and Grade Performance**

Perhaps most important, we hope that each institution uses this data to ascertain the nature of its own student population and to engage other important institutional policies and priorities. Do we, for example, invest in an academic and support infrastructure that is designed for the mainstream user or the early adopter? Clearly there are economic and student satisfaction trade-offs that must be engaged in such a discussion. What is the nature and size of the population of late adopters at our institution? Does this group suggest the need for remediation and a different set of institutional investments, or do the patterns of ownership, use, and skill of students in this cohort represent an acceptable baseline?
eras. ECAR controlled for gender and age, which are variables widely understood to be associated with GPA. This association is not strong and is likely not surprising. It suggests that beyond certain thresholds, student socializing and recreational activities are implicated in academic underperformance. In fact, it is the relative mildness of this association that is interesting and surprising, as there is an anecdotal and somewhat sensationalistic literature that decries the corrosive effects of video gaming in particular on student academic success.

**Endnotes**

1. The 2005 survey questions were in the format “Check all that apply.” Therefore, all items not checked (which would include both “No” or “Missing” responses) were coded as “No” during the data preparation process. This can result in the number of “No” answers being somewhat overstated. The 2006 survey questions were in a format allowing the respondent to specify explicitly either “Yes” or “No,” so we can distinguish “Missing” from “No” answers. The end result is that the change in percentages may be somewhat overstated. Also, the 2005 survey question “Which of the following electronic devices do you own? Electronic music device (iPod, etc.)” was slightly changed in the 2006 survey to be “Which of the following electronic devices do you own? Electronic music/video device (iPod, etc.).”

2. This difference likely reflects a possible overstatement of skills by male respondents.

3. It is important to remind the reader that there is likely an overall bias in the data that favors the technology literate. The ECAR survey is, after all, a network-based survey. Students with no or limited network access or connectivity are less likely to participate in this study.
5
Information Technology in Courses

PowerPoint is the single worst thing that has ever happened to lecture halls in the history of the world.
—An undergraduate student

Key Findings
- Fully 56.2 percent of respondents prefer a moderate amount of technology in their courses.
- Younger respondents and female respondents prefer less technology in their courses.
- Engineering and business majors prefer more technology in their courses.
- Respondents who describe themselves as early technology adopters also prefer more IT in their courses.
- Those who prefer IT in their courses also claim greater skills with IT.
- Two-year college students report lower IT use in courses than four-year students.
- Nearly three respondents in four (72.7 percent) have used a course management system (CMS) at some time:
  - During the academic quarter of the survey, similar proportions of seniors (67.4 percent) and freshmen (65.6 percent) at four-year institutions report taking a course that used a CMS.
  - Course management systems are used less among respondents from two-year institutions. Only 54.6 percent of community college students have taken a course that used a CMS.
  - The more a student uses a CMS, the more she or he appears to like it.
  - Respondents actively use most CMS features and report that they are useful.
- Most respondents (70.3 percent) never bring their laptops to class, including 16.2 percent of those students who said they are required to do so.
- Except for 18- and 19-year-olds, survey respondents said that if asked how to spend additional campus IT money, they would spend it on computer labs.

This chapter attempts to deepen our understanding of how undergraduates experience IT in their course work. Here, we try to illuminate respondents’ preferences for IT in courses;
- uses of IT in the semester, quarter, or trimester when they were surveyed;
- classroom use or nonuse of laptops;
- interactions with and sentiments about course management systems; and
- stated preferences for hypothetically allocating campus resources.
ECAR looked closely at responses to questions that were asked in 2005 as well as in
2006 and found no significant changes since 2005 that relate to respondents’
◆ perceived needs for more IT training,
◆ experience in taking courses that use a
CMS, or
◆ overall experience (positive or negative) with a CMS.

**Preference for Technology in Courses**

We asked students how much technology they prefer in courses (Figure 5-1). Answer choices offered ranged from “no IT” to “exclusive IT.” The survey results are clear: the overwhelming majority (56.2 percent) prefer that a “moderate” amount of technology be used in their courses.1

This finding, of course, begs a host of interesting questions. Why do students who spend so much of their social, academic, professional, and recreational time in technology-mediated activities prefer only moderate technology in their courses? Or, do these preferences instead suggest that course-related uses of technology do not yet measure up in student thinking? Do respondent preferences reflect students’ underlying insecurities with technology, their uncertainty or negativity about the IT skills of their instructors, or other things entirely? These subjects will be probed more deeply in future ECAR studies.

Consistent with findings in 2005, younger students, which includes most freshmen, have a lower preference for technology in their courses than do their older peers (Figure 5-2). One older student commented in the survey, “IT in courses is a fabulous idea!! I have 3 children and work full time. This has allowed me to go back to school to finish my degree.”

A respondent’s academic major and preference for IT in courses are associated (Table 5-1). Consistent with other findings, engineering and business majors more strongly prefer technology in their courses than others. In the survey’s open-ended comments, one engineering student noted, “In engineering, it is vital that an understanding of technology be reached. This may be why I am so open to the idea of using technology in education.”

---

1. One older student commented, “IT in courses is a fabulous idea!! I have 3 children and work full time. This has allowed me to go back to school to finish my degree.”
Gender, in general, also appears to be important. Female respondents overall prefer less technology in courses. While 34.1 percent of male respondents prefer “extensive” or “exclusive” use of technology in courses, only 18.4 percent of females do so. This finding is consistent with findings from Chapter 4 that show gender-based differences in technology ownership, hours of use, and other factors.

ECAR also sought to test the hypothesis that students who consider themselves early IT adopters are also more likely to prefer IT in their courses. Again, using Rogers’s five-point adoption scale, we find a close, if unsurprising, association between these factors (Figure 5-3).

We think this finding is important. It appears, first of all, that students are highly reliable reporters of their relative propensities to adopt IT. Second, it appears that students’
self-identification is closely associated with a host of preferences and behaviors. Perhaps most importantly, students who claim to be early adopters of IT in general also prefer IT in their courses. This insight, while perhaps self-evident, is potentially important in matching prospective students and institutions, and in counseling students through the variety of academic alternatives they face in an undergraduate experience. This finding suggests that institutions like Olin College of Engineering, MIT, and others that pride themselves on attracting a technology-literate and technology-loving student body must invest in course-related technologies and in complementary pedagogies to a greater extent than others if they wish to align their instructional resources with student preferences. Similarly, institutions that attract students who prefer less IT in courses may need to consider with great care how, where, and how quickly to integrate IT into their instructional practices.

Not surprisingly, there is also a strong association between respondents’ self-reported levels of skill with specific technologies and their stated preferences for IT in courses (Table 5-2). While this may again seem intuitive—and no case can be made for a causal relationship—it may be important. It is tempting to speculate that a student’s lack of IT skill may in fact pose a barrier to his or her acceptance of, or preference for, technology in courses. This, of course, is the premise of those who promote IT literacy as an enabler of greater integration of IT into instruction. Survey respondents who report advanced skill in nearly any academically instrumental technology also strongly prefer IT in their courses. Perhaps this is only because IT-laden courses provide these cognoscenti with the opportunity to shine, or perhaps their technical expertise is facilitating deeper analyses and promoting greater insights and understanding of the subject.

Interesting too is that students with a greater preference for technology in courses also
- report that they use electronic devices more often;
- bring a laptop to class more often;

![Figure 5-3. Self-Description Regarding Technology, by Preference for Technology in Courses](image-url)
are more likely to use an electronic device as an in-class requirement, and/or for a course activity;
◆ are more likely to own a wireless hub, PDA, and/or smart phone; and
◆ report that they spend more hours per week using an electronic device.

**Technologies Used This Academic Period**

We asked students to indicate which technologies they were using in courses being taken at the time of the ECAR survey (March/April 2006). Answers in Table 5-3 reinforce the idea that the academically instrumental uses of IT change and typically grow as a student progresses through the undergraduate curriculum. In coursework for the current academic period, virtually all students reported using core technologies such as e-mail. Interestingly, freshman respondents report higher use of other IT-enabled communication activities such as social networks and instant messaging in courses. We do not know if these activities are course related or are merely occurring in class. Not surprisingly, freshman respondents report higher use of clickers, online gradebooks, quizzes, and tests, while seniors are creating more spreadsheets and presentations, and using specialized software applica-
tions that likely reflect the changed nature of academic requirements in the upper-division curriculum. Community college respondents generally report less use of technologies in courses than four-year-college freshman respondents across much of the spectrum of choices offered. Notable exceptions to this general pattern include higher reported levels of Webcasts and online discussions by respondents from community colleges.

In summary, ECAR survey respondents report uses of technology in courses this academic period that align closely with a vision of the higher education experience wherein lower-division courses are often larger and more dependent on quizzes and tests. The pedagogy demanded for lectures is well suited for clickers, online quizzes and tests, electronic gradebooks, and related technologies that help manage the scale of teaching and learning in larger classes. One student commented about clickers in the large lecture classroom, “I am pleased with the immediate response system (clicker system). Quizzes are quicker. I am more attentive during the large lecture.” Another disagreed: “Clickers distract from the learning experience because students are supposed to be learning at their own pace. Get rid of them.” In upper-division work where classes are smaller and where a greater mastery of the academic subject matter is expected, students might be expected

<table>
<thead>
<tr>
<th>Table 5-3. Technologies Used in Courses This Academic Period, by Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seniors (N = 15,248)</td>
</tr>
<tr>
<td>Almost all students use this semester/quarter</td>
</tr>
<tr>
<td>E-mail</td>
</tr>
<tr>
<td>Most students use this semester/quarter</td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
</tr>
<tr>
<td>Course management system</td>
</tr>
<tr>
<td>Course Web site</td>
</tr>
<tr>
<td>Online gradebook</td>
</tr>
<tr>
<td>Spreadsheets (Excel, etc.)</td>
</tr>
<tr>
<td>Some students use this semester/quarter</td>
</tr>
<tr>
<td>Online discussions</td>
</tr>
<tr>
<td>Online quizzes/tests</td>
</tr>
<tr>
<td>Few students use this semester/quarter</td>
</tr>
<tr>
<td>Discipline-specific IT (Matlab, Stella, etc.)</td>
</tr>
<tr>
<td>Simulations</td>
</tr>
<tr>
<td>Online social network (facebook.com, etc.)</td>
</tr>
<tr>
<td>Clickers (student response systems)</td>
</tr>
<tr>
<td>Instant messaging</td>
</tr>
<tr>
<td>E-portfolios</td>
</tr>
<tr>
<td>Blogs</td>
</tr>
<tr>
<td>Webcast</td>
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<tr>
<td>Podcast</td>
</tr>
</tbody>
</table>
to more often produce higher-level analyses using spreadsheets or specialized software tools and to be assessed on papers, complex projects, and presentations. In essence, the lecture gives way to the seminar, tutorial, and laboratory, inviting the opportunity to incorporate different technologies in different intensities, at different stages of the student experience. Interestingly, freshman and senior respondents reported very similar current use of course management systems.

Consistent with earlier ECAR findings, a student’s reported academic major is closely associated with his or her reported frequency of technology use in the current academic period (Table 5-4). Engineering and business majors dominate the uses of many of the technologies identified, while scholarship in a physical science discipline is closely associated with use of discipline-specific software.

The use of e-portfolios is associated with respondents who are education majors. This likely reflects the fact that e-portfolios were often pioneered in schools and departments of education. Over time, students in majors linked to professions that demand professional certifications will likely adopt and use e-portfolio software more often than others. Not surprisingly, the use of presentation software is more strongly associated with business majors (72.5 percent) than others (61.6 percent), as is the use of spreadsheets (67.3 percent versus 43 percent).

Among engineering majors currently, a remarkable 65.4 percent of respondents report using discipline-specific information technologies in their courses. This compares with only 11.9 percent of others in the ECAR sample. Engineering majors report using spreadsheets in their coursework even more often (74.0 percent) than business majors do (67.3 percent). While the numbers are small, blogging has a significant association with fine arts majors. Nearly one in 10 (9.1 percent) of responding

Table 5-4. Technologies Used in Courses This Academic Period, Associated with Majors

<table>
<thead>
<tr>
<th>Technology</th>
<th>Associated Majors</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td></td>
</tr>
<tr>
<td>Instant messaging</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets (Excel, etc.)</td>
<td>Engineering, business</td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
<td>Business, engineering</td>
</tr>
<tr>
<td>Course management system</td>
<td>Business</td>
</tr>
<tr>
<td>Online social network (facebook.com, etc.)</td>
<td></td>
</tr>
<tr>
<td>Clickers (student response systems)</td>
<td></td>
</tr>
<tr>
<td>Online discussions</td>
<td></td>
</tr>
<tr>
<td>Online quizzes/tests</td>
<td></td>
</tr>
<tr>
<td>Online gradebook</td>
<td></td>
</tr>
<tr>
<td>Course Web site</td>
<td>Engineering</td>
</tr>
<tr>
<td>Simulations</td>
<td>Engineering</td>
</tr>
<tr>
<td>Discipline-specific IT (Matlab, Stella, etc.)</td>
<td>Engineering, physical sciences</td>
</tr>
<tr>
<td>E-portfolios</td>
<td>Education</td>
</tr>
<tr>
<td>Podcast</td>
<td></td>
</tr>
<tr>
<td>Webcast</td>
<td></td>
</tr>
<tr>
<td>Blogs</td>
<td>Fine arts</td>
</tr>
</tbody>
</table>
fine arts majors report using blogs in their courses in the current academic period, compared with 6.8 percent of others.

ECAR also calculated how many of the 17 technologies listed in Table 5-3 were used by each student this academic period (Figure 5-4).

We find that while senior and freshman respondents from four-year colleges report using nearly the same number of technologies in the current academic period, they use different technologies. Community college student respondents use fewer technologies in coursework than their four-year college counterparts during the period investigated. Nearly one-third (31.7 percent) of community college respondents used three or fewer technologies in their current courses, while only 18.2 percent of four-year students used three or fewer technologies in their current courses.

We are somewhat surprised to report that mobile computing does not yet appear to play an important role in the classroom. We asked students how often they bring their laptop computers to class (Figure 5-5). Most respondents (70.3 percent) never do, and only one respondent in seven (14.5 percent) reports bringing a laptop to class weekly, several times a week, or daily. Only 752 responding students (2.6 percent) are required to bring a laptop to class for any of their courses. Despite this requirement, only 520 of these respondents actually do bring their laptops to class weekly, several times a week, or daily. Also, 16.2 percent of those respondents who say they have a course-based laptop requirement indicate that they never bring a laptop to class. One student in the open-ended comments shared his opinion: “I think that having it more common to bring laptops to class would be wonderful. It would be much more convenient and I believe it would help better learning.”

Of the 14.5 percent of respondents who do bring their laptops to class weekly or more often, males (20.9 percent) outnumber females (10.9 percent). Fully 8.5 percent of male respondents who bring laptops to class bring them daily, while only 3.4 percent of female respondents do so. Again, engineering and business majors are more likely than others to bring laptops to class, and students
at doctoral universities are more likely (18.3 percent) than others (14.5 percent) to do so. This latter finding likely reflects in part the larger number of engineering and business majors at these institutions.

Students who more frequently bring their laptop to class often identify themselves as early technology adopters and are more likely to

◆ prefer technology in their courses;
◆ own a wireless hub;
◆ own a PDA and/or a smart phone;
◆ own software to create Web pages, graphics, and/or presentations;
◆ claim more skill at computer maintenance, graphics software, and/or presentation software; and
◆ make more frequent use of presentation software, audio/video software, and/or downloading Web-based music or videos.

It is important to note that many of these variables are closely associated with each other. The bottom line seems to be that relatively few students who own laptops bring them to class regularly. Self-identified early technology adopters are most likely to bring them. One student said, in the open-ended comments, “I love taking my laptop to class. It has helped improve my grade because I can take notes faster.” In focus sessions, we asked students why they don’t bring their laptops to class. Many report that laptops continue to be too heavy to carry around campus, and others report fearing that laptops might be stolen or lost.

**Students and Course Management Systems**

The CMS has a remarkable history in higher education. While educators have been experimenting with such systems for many years, it is only in the last decade that these systems have emerged as commercial offerings with institution-wide potential. In that time frame, they have been adopted widely in postsecondary education and now touch the educational experience of millions of students.

We asked students if they have ever taken a course that used a CMS. Nearly three respondents in four (72.7 percent) report that they have taken a course that used a CMS such as ANGEL, EEE, WebCT, Blackboard, Desire-
2Learn, Moodle, Sakai, Oncourse, or FirstClass. Interestingly, from 2005 to 2006, this percentage has not increased meaningfully.

Seniors, of course, have had the greatest (81.8 percent) exposure to course management systems. Freshman respondents report a remarkable exposure (72.1 percent) to course management systems—remarkable because of the relative brevity of their collegiate experiences. Only 54.6 percent of community college respondents report having taken a course that incorporated a CMS.

We probed more deeply to understand the community college use of course management systems and observe that:
- of those not enrolled in a degree program, only 37.5 percent have taken a course using a CMS;
- of those who have completed less than 25 percent of a degree program, 53.7 percent have taken a course using a CMS; and
- of those who have completed more than 25 percent of a degree program, 63.4 percent have taken a course using a CMS.

Figure 5-6 illustrates that the diffusion of CMS adoption and use appears to cascade through higher education as a function of institutional mission (for example, Carnegie class), though mission may in some cases be masking money as a primary driving diffusion factor.

Note also that engineering students report higher CMS use in their coursework. Again, some differences in use by institutional mission may in fact reflect the existence, nonexistence, or relative size of engineering programs.

How thoroughly do students use typical CMS features? We find that students who report using a CMS use most of its features (Figure 5-7). Nearly half of the responding students (47.3 percent) report using all nine CMS features listed in the ECAR survey. The median number of CMS features used by respondents who use a CMS is eight. The reported use of CMS features did not change significantly among respondents in 2006 when compared with those who responded to the 2005 ECAR survey.

We also asked students to identify the CMS features they find most useful (Table 5-5). We find that students deem those features that directly impact grade performance—such as...
keeping track of grades and gaining access to sample exams—to be most useful. One student in the open-ended comments said, “Grades online motivates you. It’s an automatic organizer.” As in past years, respondents find CMS features that support online peer interactions to be least useful among the answer choices provided. Another student noted, “The online discussion board is not very personal. I think in-class discussion is better.” CMS users report that all of the features listed are useful and that many of these features are very useful.

In Chapter 4, we noted that senior-class respondents from four-year colleges report using course management systems more often than either four-year college freshmen or community college respondents. In this analysis, we see that survey respondents age 25 and older rate the usefulness of listed CMS features more highly than do their younger peers. There is little difference in perceived...
usefulness of these systems between 18- and 19-year-old respondents and those aged 20 to 24 years, or between freshman respondents and seniors. Regarding usefulness, then, age rather than class standing is the stronger explanatory factor. Female respondents generally rate the usefulness of CMS features slightly higher than males, and off-campus students generally rate their usefulness slightly higher than on-campus students. Engineering students find CMS features somewhat less useful than other majors, especially “taking exams and quizzes online.” This may simply reflect the added challenge math and engineering students face because they use so many specialized symbols.

Familiarity with course management systems appears to breed comfort. Students who report using a CMS often and who indicate a stronger preference for technology in courses also rate the usefulness of CMS features more highly. This result tracks closely with that found in 2005. Further, those who identify themselves as early adopters of technology do not rate the usefulness of course management systems more highly than others do.

Respondents across all demographic criteria are overwhelmingly (75.6 percent) positive about their experiences with course management systems (Figure 5-8). In fact, only 4.5 percent of respondents are negative or very negative about these systems, and almost one-fifth of respondents (18.3 percent) are very positive.

Not surprisingly, those reporting different overall CMS experiences rate the usefulness of CMS features differently (Figure 5-9). What is interesting is the magnitude of the difference. Those students who report a negative experience with course management systems do not generally rate any CMS features as useful and are very negative regarding the usefulness of these systems’ collaborative components (sharing course materials, participating in online conversations). One student reported, “My CMS experience was awful. It was difficult to upload and download assignments. You had to constantly try things.” Respondents who report positive experiences with course management systems still generally rate CMS features as very useful. Importantly, respondents whose experiences are neutral are generally positive about CMS features. The significant differences in attitudes toward course management systems expressed by those with negative experiences deserve fur-
ther study. Have these students merely hit a bump along their technology learning curves, or have bad experiences “poisoned the well” for a longer term? Do they as a result of early bad experiences with course management systems avoid future coursework that incorporates these systems?

Interestingly, whether they have a positive or negative CMS experience, responding students rate the relative usefulness of CMS features about the same (for example, keeping track of grades or assignments is rated most useful and online discussion boards are rated least useful). The exception is that students who report a negative CMS experience rank “turning in assignments online” and “taking exams and quizzes online for grading purposes” as relatively less useful than students who report a positive CMS experience. These are the two CMS features listed that require students to actually use a CMS to enter materials that affect their grading.

While responding students on average are positive about course management systems, the more often a student uses a CMS, the more he or she appears to like it (Table 5-6). One student noted, “I really wish all my classes did everything on CMS. It is immensely useful.” Students who report using a CMS several times a week or daily, on average, are more positive about these systems than students who use a CMS less often.

**Where Students Would Invest Institutional Resources**

To sharpen our understanding of student IT priorities, we asked them to indicate where they would invest additional institutional resources in technology if funds were available (Table 5-7). Respondents were limited to three answers among 10 answer choices. Interestingly and importantly for IT service providers, student IT priorities for the institution vary by age. Younger students would spend more of their institution’s resources on network music services and on the network itself, while older students would spend resources on computer labs and student IT training. This investment preference seems to be another reflection of the finding that younger students are more focused on the communication and recreational aspects of IT, while older students are focused more on the academically instrumental uses of IT.
Perhaps surprisingly, respondents of all ages would invest little new money in help desk services. Future research might ask whether this suggests that help desks are generally performing to student satisfaction or if students do not place high value on help desk services. Older students more often indicate that they would invest in help desk services than do younger students.

All responding students, except those ages 18 and 19, would deploy new institutional resources into computer labs. One student commented, “Computer labs are insufficient. The labs provided by the university are always at capacity.” The oldest group of respondents would supplement the funding for both computer labs and student IT training. This finding is important in light of a trend among many campus IT service providers to cut funding for these labs and to reduce the number of labs overall. More research is needed in this arena. It is clear that despite high levels of student

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>3,787</td>
<td>4.16</td>
<td>0.728</td>
</tr>
<tr>
<td>Several times per week</td>
<td>4,745</td>
<td>3.99</td>
<td>0.726</td>
</tr>
<tr>
<td>Weekly</td>
<td>4,330</td>
<td>3.79</td>
<td>0.716</td>
</tr>
<tr>
<td>Monthly</td>
<td>1,448</td>
<td>3.59</td>
<td>0.794</td>
</tr>
<tr>
<td>Once per semester/quarter</td>
<td>849</td>
<td>3.58</td>
<td>0.816</td>
</tr>
<tr>
<td>Once per year</td>
<td>324</td>
<td>3.52</td>
<td>0.823</td>
</tr>
</tbody>
</table>

(1 = very negative, 2 = negative, 3 = neutral, 4 = positive, 5 = very positive)
ownership of computers in general and laptop computers in particular, and despite the continued proliferation of wireless networking on campus, computer labs serve a useful purpose for many. What students value in these labs is worthy of additional study. Is this a social space? Is it a place to hang out between classes? Is it a source of printers, or of expert help? It would also be useful to study whether student interest in computer labs will decline as today’s freshmen mature, or whether students’ needs in this area evolve through their undergraduate experience. Interestingly, a respondent’s academic major does not play a significant role in explaining differences in the funding priorities expressed. However, students who reside on campus would increase the amount of campus IT money spent on IT security in greater numbers than students who live off campus.

Only 30.7 percent of respondents chose student IT training as one of their top three institutional spending choices. Chapter 4 reported that only 27 percent of respondents agreed that their institution “needs to provide more training on IT required for my courses.” Why are there slightly more students willing to spend more institutional monies on student IT training than there are students who think more IT training is required at their institution? Is it possible that these apparently conflicting data reflect a capacity issue—that is, respondents’ belief that the necessary IT training is available, just unused?

Endnote
1. The shape of the response curve in 2006 is a near-perfect bell, as it was in 2004 and 2005. In 2006, the percentage of students choosing “moderate use of IT” was higher, possibly because the wording in the 2004 and 2005 survey questions was different in that the 2006 survey did not provide examples of what constituted limited, moderate, extensive, and exclusive IT in courses.
Information Technology
and the Student Academic Experience

I no longer have to go to the library for research and carry many books home. Now, I have the world of knowledge at my fingertips.
—An undergraduate student

Key Findings

♦ Respondents to the 2006 survey continue to be positive in their views about IT’s contribution to their academic experience:
  ♦ Respondents were positive about all seven outcome statements presented.
  ♦ Nearly two-thirds (64.4 percent) of respondents agree or strongly agree that IT has improved their learning, while just under 8 percent disagree or strongly disagree.
  ♦ Older students, business majors, and engineering majors are more positive than others about IT’s impact on their academic experience.
♦ Respondents, especially at BA institutions, continue to overwhelmingly view IT’s most valuable benefit to be the convenience it brings to the academic experience:
  ♦ Fewer respondents in 2006 rated improved communication as IT’s chief benefit than in 2005.
  ♦ More respondents in 2006 rated facilitating management of course activities as IT’s chief benefit than in 2005.
  ♦ Nearly one in five respondents (19.3 percent) from two-year institutions rated improved learning as IT’s chief benefit, and 19.3 percent of engineering majors also rated improved learning as IT’s chief benefit.
♦ Students who report having a positive experience with course management systems agree more with positive statements about academic outcomes than those who report a negative experience with course management systems.
♦ Students who prefer more IT in courses agree more with positive statements about academic outcomes than those who prefer less IT in courses.
♦ Students who describe themselves as IT early adopters or innovators agree more with positive statements about academic outcomes than those who describe themselves as IT late adopters or laggards.
♦ While proportionally fewer respondents used podcasts, e-portfolios, instant messaging, Webcasts, and simulations in their current courses, those who did use them agreed more strongly that IT improved their learning.
**Background**

One major, if unstated, goal of every higher education leader, public policymaker, and campus technologist is to demonstrate the impact of institutional IT investments on student success. This goal is in fact the *sine qua non* of IT. As with most essential conditions, illuminating the complex relationship between institutional IT investments and the student academic experience is complex. Indeed, there is a wide, deep, and largely inconclusive literature on the etiology of student success and a very small and conjectural literature on the relationship of student ownership and uses of IT, technology preferences, and IT influence on academic endeavors with student engagement, academic performance, persistence, and degree completion.

Even the very topic of student success—absent the IT piece—is problematic. Tinto and Pusser, for example, in noting that the rates of college completion in the United States have not changed materially in the past 20 years, conclude that “it is clear that gains in our understanding of the process of student persistence have not been translated into gains in student persistence” (Tinto & Pusser, 2006, p. 2). For these authors, not only is the connection between institutional IT and student success an ongoing mystery, but even the relationship between broad dimensions of institutional practice and student outcomes is also up for grabs!

Recognizing the very real complexity of this topic, the authors of the ECAR study of undergraduates and IT venture into this discussion with great caution. Readers need to understand that collectively we face

- questions about the interplay at the broadest levels between institutional action and student impact,
- real and obvious limits to the application of survey research and self-reported outcomes to the topics of learning and engagement, and
- an unmeasured nonrespondent bias to the ECAR Web-based survey coupled with a near certainty that Web-based surveys are likely to result in somewhat inflated responses (Carini et al., 2003).

Notwithstanding these caveats, we conclude that even tentative and fragmentary information in this critical arena—properly qualified—is important. We believe that the analysis that follows is indicative of a partial reality, at least, and as such is important. In this chapter, we assess students’ self-described impacts of IT on learning, engagement, and support for course activities. We define support for course activities to include

- peer communication and collaboration,
- instructor feedback,
- student control over the learning experience, and
- student ability to conduct course-related research.

This chapter also analyzes and summarizes student responses and commentary related to their perceptions of instructor facility with IT in the context of coursework. We caution the reader more strongly about the limits of this data, particularly in light of emerging evidence that students not only overestimate their own prowess with IT but also in fact struggle over certain fundamental issues of information literacy (Educational Testing Service, 2006). This external finding leaves us with a bit of counsel to students to “judge not, lest ye be judged.”

That said, it is at least interesting and perhaps important that while respondents overall rated their instructors positively in this arena, many students judge their instructors’ IT skills harshly. This assessment shows up not so much in response to scaled questions, but prominently in answers to open-ended questions that were not always designed to focus on matters of instructor classroom practice. This is a problematic area of study, but one that clearly deserves closer review. In the
open-ended comments, one student noted, “Professors who try to use IT but are unable to or do not know how to end up having IT do more harm than good.” This may very well be less a story of instructor skill than one of rising student expectations. As more and more freshmen arrive, as it seems, with Web page authoring and new-media skills, judgments of instructor IT skills may become more harsh, independent of whether those judgments are harnessed to any student understanding of an instructor’s pedagogy.

Finally, before proceeding, in this study we take engagement to mean student participation in programs and activities that institutions provide for their learning and personal development. Engagement, in this context, reflects behaviors by undergraduate students that are associated with desired outcomes of college. Methodologically, the analysis that underlies this chapter depends to a great extent on a series of Likert-scaled opinion questions about students’ experience with IT in their courses. The scale used was 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

**Overview of IT and the Student Academic Experience**

In 2004 and 2005, ECAR looked closely at how students answered the question “What was the most valuable benefit of IT (in your courses)?” and concluded that students believe that IT
- makes their academic experiences far more convenient;
- helps them communicate more effectively with other students and faculty; and
- gives them a measure of control of the academic experience through access to grades, test examples, syllabi, and so forth.

Responding students in 2004 and 2005 were generally positive about the roles and impacts of IT on their academic experiences and overall learning. Students in 2006 continue to be positive (Table 6-1).

Overall, respondents in 2006 are positive across the range of experiences examined, including their assessment of instructors’ use of IT. Respondents were most positive about IT’s proclivity to help them do better research and to facilitate course-related

<table>
<thead>
<tr>
<th>Table 6-1. Student Experience with IT in Courses</th>
</tr>
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<tbody>
<tr>
<td>Helps me do better research for my courses</td>
</tr>
<tr>
<td>Results in more prompt feedback from my instructor</td>
</tr>
<tr>
<td>The use of IT in my courses has improved my learning</td>
</tr>
<tr>
<td>Allows me to take greater control of my course activities</td>
</tr>
<tr>
<td>Helps me better communicate and collaborate with my classmates</td>
</tr>
<tr>
<td>Overall, my instructors use IT well in my courses</td>
</tr>
<tr>
<td>I am more engaged in courses that require me to use IT</td>
</tr>
</tbody>
</table>

*(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*
feedback from their instructors. Nearly two respondents in three (64.4 percent) agree or strongly agree that IT in their courses improved their learning. Not quite 8 percent of the survey respondents who answered the question disagreed or strongly disagreed with the statement that IT improved their learning. While again it is essential to remind the reader of the limits of this finding, it is certainly a gratifying and reassuring indicator—or, perhaps more aptly said, the reverse finding would surely have been cause for considerable concern. Respondent sentiment about the role of IT in learning was slightly more positive than their still-positive beliefs about the role of IT in helping them gain control of their learning experience and to communicate and collaborate.

Older students are generally more positive about the impacts of IT on their academic experiences than younger students. As well, business and engineering majors, not surprisingly, are disproportionately bullish about the positive impacts of IT on academic outcomes.

Looking at the frequency distribution of responses to these questions about student experience with IT in courses provides a somewhat different view of the data (Figure 6-1). Here we see that the responses are almost always skewed strongly to the positive; that is, the number of positive responses outweighs both negative and neutral responses. This is not the case with responses to the statement “I am more engaged in courses that use technology.” Answers to this question are more normally distributed around a lower (but still positive) mean of 3.24.

**Information Technology and Learning**

As discussed above, we asked students to respond to the statement “The use of IT in my courses has improved my learning.” The impact of IT on learning, while problematic, is likely the most interesting and important outcome statement in this study. Table 6-2 describes how the other outcome statements discussed above relate to the learning outcome statements. We remind the reader that these statements are all highly correlated and are therefore bound to have strong associations with the statement “IT in courses improved my learning.”
This analysis uncovers several findings. First, it confirms the generally positive tilt of this set of student respondents. Even students who disagree with statements that could materially factor into IT’s role in learning are overall positively inclined toward IT as a learning tool. Despite this finding, differences in self-reported levels of technology-facilitated engagement, communication, control, and feedback conspire substantially with reported students’ beliefs that IT is facilitating learning. While those reporting lower agreement with IT-related enablers are in the minority, they remain a big enough minority to deserve attention. We cannot infer from this data whether these respondents are simply more negative across the board, or whether institutional investments to enhance IT-facilitated communication, control, and so forth would elevate students’ confidence that IT is making a difference in their learning. One student noted, “Don’t let technology overshadow the learning process. Temper the use. Make the technology part of the learning.”
Course Management Systems and Outcomes

We asked students, “Have you ever taken a course using a course management system?” Responding students who have taken a course that used a CMS report somewhat stronger agreement with all of the outcome statements discussed in this chapter. However, even though the association is statistically significant, the absolute numbers are not strikingly different. Instead, we’ll focus on respondents’ actual rating—from negative to positive—of their CMS experience (Figure 6-2).

The differences in responses to this battery of outcome-related statements among respondents with varying CMS experiences are significant. Respondents who report having very positive experiences with course management systems are overwhelmingly positive about the role IT has played in learning, course-related research, control of their course experience, and faculty feedback. One student commented, “The course management system has improved my education level and helped me achieve a higher grade. I’m learning so much more because my instructor puts his expectations on what the student should know prior to taking the test.” They are less buoyant (though still quite positive) about IT in the process of peer communication and in their engagement in IT-enabled courses, and about their instructors’ uses of IT. This is not surprising, as these factors emphasize interactive or synchronous uses of IT, and we have seen earlier that these features or functions of the CMS are less frequently brought to bear in instruction.

Respondents who report having bad experiences with course management systems, while a minority, are in general disagreement with positive statements about outcomes across the board.

Figure 6-2. Student Experience with IT in Courses, by Student Experience Using CMS
Students who rate CMS features as more useful agree much more with the set of positive outcome statements about learning, course-related research, control of course activities, communication with classmates, student engagement, and instructor use of IT than do students who rate CMS features as not useful. The association is especially strong for the outcome statement “I am more engaged in courses that require me to use IT,” as Figure 6-3 shows. A positive relationship between the usefulness of IT, here in the form of course management systems, and more active student engagement in courses that use IT is what we would expect and hope to find. It suggests that the enormous amount of work done by campus IT units and their vendors to create high-quality, easy-to-use student systems and processes may be well worth the effort.

Preference for Technology in Courses and Outcomes

We also examined the relationship of respondents’ preferences for IT in courses with their general experiences with IT in courses, vis-à-vis learning, engagement, and so forth (Figure 6-4). We remind the reader that 2006 survey respondents overwhelmingly state a preference for moderate IT in their courses, so discussion of those who prefer more limited or more extensive IT should be taken with a grain of salt. That said, the gap in ratings of outcome statements between those with preference for no IT and those with preference for exclusive IT in courses is striking; some have mean differences of 1.0 or more (on a five-point scale). It is reasonable to say that those who do not prefer IT in their courses generally disagree with the set of positive outcome statements they were offered, while those who prefer IT in their courses generally strongly agree with positive outcome statements. Again, these findings suggest that it may be a matter of effective campus practice to note, as does the University of Central Florida, which courses blend IT and which do not. While such measures will not swell the ranks of IT aficionados, they allow self-aware students to enroll or not enroll in courses that fit their current learning preferences (or biases).

![Figure 6-3. Usefulness of CMS Features, by Student Engagement in Courses with IT](image-url)
Self-Description Regarding Technology and Outcomes

We also wanted to examine the interplay between perceived outcomes about students’ experiences with IT in courses and respondents’ self-image as defined in their self-identification along the classic IT user characterizations ranging from “technology laggard” to “innovator.” Again, these characterizations prove meaningful, and responding students appear to be honest and consistent with their answers (Figure 6-5).

Once again the patterns of response are striking. Respondents who see themselves as late adopters of technology are considerably less strong in their agreement with our series of positive outcome statements about IT and course outcomes. Again, this analysis reveals clear “stair steps,” as we see that the more highly a student rates his or her quickness of IT adoption, the more strongly he or she resonates with positive statements about technology in the teaching and learning process. While we cannot infer causality or other potentially valuable linkages in these associations, it is tempting to speculate that institutional knowledge of a student’s self-assessment as a technophile or technophobe may be an accurate predictor of the student’s satisfaction with courses that use technologies. Real and important patterns begin to emerge from this data: students who see themselves as early technology adopters prefer IT in their classes and ascribe a host of good outcomes to these classes. Conversely, students who are late adopters prefer less technology in their instruction and do not agree that IT adds instructional value. It is tempting to surmise that these students—owing to their lack of IT facility—experience IT as an impediment, an
extra thing to learn while working to learn the meat of a course topic. The technophile, on the other hand, is likely able to extend his or her understanding of course content through and via the technology.

Interestingly, students across the spectrum of self-described technology capability rate their instructors’ capabilities very similarly. On average, they are positive, though lukewarm. Looking past these averages, we see that many students—across the spectrum of IT interest—do not characterize their instructors as skilled with IT. This finding is interesting as it challenges some widely held arguments that precocious IT-literate students are pressing hard on their instructors to use more IT in class work. Instead, we see a majority of students expressing a preference for moderate IT in classes and across-the-skill-spectrum satisfaction with the IT skill levels demonstrated by instructors.

### The Most Valuable Benefit of Information Technology

We asked students which of the following benefits from using IT in their courses was most valuable to them. Was it convenience? Communication? Or was IT most useful in helping students manage their course activities? We defined “managing course activities” as planning, apportioning time, noting success and failure, and so forth.

As was found in 2004 and 2005, students overwhelmingly value IT’s capacity to make their lives as students more convenient. One undergraduate student said, “I feel IT is very convenient. With my courses that incorporate a CMS, I can access information 24 x 7 and I can also reach students or my professor with questions at any time.” Small but interesting differences in relative perceived benefits exist
by gender (Figure 6-6). Only 7.9 percent of male respondents considered IT’s ability to facilitate communication as its chief benefit, while 12.6 percent of females chose communication. Gender is the strongest demographic factor related to the choice of most valuable IT benefit.

Overall, 51.4 percent of respondents rated convenience as the dominant benefit of IT. Nearly one respondent in seven (14.5 percent) rated improved learning as IT’s paramount benefit.

Interesting differences do exist among respondents based on the kind of institution they are attending (Figure 6-7). Students at baccalaureate institutions place the most value on convenience, while nearly one-fifth (19.3 percent) of the students at two-year institutions say the most important value is the use of IT as a tool to foster learning. This difference may reflect differing student backgrounds (relative number of older students), curricular emphases, or differing pedagogies in use. Whatever the explanation, this is an observation worthy of additional study.

We found differing responses among students with differing declared majors (Table 6-3). Engineering majors, who also rated their instructors’ skills (and their own) with IT most highly among all majors, also rated IT highly as an enabler of learning. These same respondents did not assign great benefit to IT’s contribution to helping students communicate more effectively. Interestingly, humanities majors—who generally eschew IT—assign high relative importance to IT’s benefits in facilitating communication. Education and fine arts majors also shared this view of IT’s value to communication.

The Most Valuable Benefit of Technologies Used This Academic Period

We asked students to think about the technologies and applications they were using in the time frame of the ECAR survey and to help us understand the value imparted vis-à-vis learning, convenience, the management of course activities, and communication. Interestingly, newer technologies or applications such as podcasting, Webcasting, instant messaging, and e-portfolios—while used by relatively few—were valued highly by their users for their impacts on learning (Table 6-4). It is not clear whether this is because of these capabilities’ newness or novelty, or if more du-
rable benefits will be found. In any case, these are technologies and activities worth tracking in years to come. One student commented, “Using a clicker in class was extremely helpful in a large class. It also allowed teachers to give pop quizzes when in other situations classes are too large to allow this.”

Insightfully though somewhat ironically, responding students rated the learning benefits of course management systems lowest, instead characterizing the benefits of these systems as resting chiefly in the domain of convenience. Likely the makers of these systems would agree, particularly in light of

Table 6-3. Most Valuable Benefit, by Major

<table>
<thead>
<tr>
<th>Major</th>
<th>N</th>
<th>Improved My Learning</th>
<th>Convenience</th>
<th>Helped Manage Course Activities</th>
<th>Helped Me Communicate</th>
<th>No Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>2,723</td>
<td>19.3%</td>
<td>53.5%</td>
<td>17.3%</td>
<td>7.7%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Business</td>
<td>5,540</td>
<td>16.9%</td>
<td>51.0%</td>
<td>21.2%</td>
<td>8.8%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Other</td>
<td>4,949</td>
<td>16.0%</td>
<td>49.9%</td>
<td>19.2%</td>
<td>11.6%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Education</td>
<td>3,637</td>
<td>15.4%</td>
<td>47.8%</td>
<td>18.9%</td>
<td>14.2%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Fine arts</td>
<td>2,123</td>
<td>14.6%</td>
<td>49.1%</td>
<td>17.5%</td>
<td>13.6%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Physical sciences</td>
<td>1,938</td>
<td>14.4%</td>
<td>54.6%</td>
<td>17.3%</td>
<td>10.3%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Undecided</td>
<td>2,065</td>
<td>14.1%</td>
<td>52.0%</td>
<td>17.4%</td>
<td>11.6%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Life sciences</td>
<td>4,347</td>
<td>12.7%</td>
<td>53.6%</td>
<td>21.3%</td>
<td>9.9%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Social sciences</td>
<td>5,459</td>
<td>12.1%</td>
<td>53.6%</td>
<td>19.2%</td>
<td>11.6%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Humanities</td>
<td>2,872</td>
<td>11.2%</td>
<td>54.3%</td>
<td>17.0%</td>
<td>13.4%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>
respondents’ disproportionate reliance on the asynchronous features of course management systems. As the e-collaboration features of course management systems find greater currency in use, we expect to see these tools gain more recognition for their contribution to learning, communication, and collaboration.

### IT and the Student Academic Experience: Changes from 2005

We investigated whether the interplay between ownership, use, preference, and other input or demographic factors and self-described outcomes changed in the sample populations of respondents between 2005 and 2006. We found no statistically significant differences in participants’ agreement with statements about IT’s impact in courses on convenience, engagement, learning, or support. Nor did we see a change in participants’ perceptions about instructors’ use of IT in courses.

However, we did find two areas with a meaningful change between 2005 and 2006, and they are related. Table 6-5 shows a sig-

<table>
<thead>
<tr>
<th>Technologies Used in Courses this Academic Period</th>
<th>N</th>
<th>Improved My Learning</th>
<th>Convenience</th>
<th>Helped Manage Course Activities</th>
<th>Helped Me Communicate</th>
<th>No Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podcast</td>
<td>912</td>
<td>23.0%</td>
<td>45.9%</td>
<td>17.9%</td>
<td>10.7%</td>
<td>2.4%</td>
</tr>
<tr>
<td>E-portfolios</td>
<td>2,029</td>
<td>21.6%</td>
<td>45.7%</td>
<td>18.9%</td>
<td>11.6%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Instant messaging</td>
<td>3,967</td>
<td>21.6%</td>
<td>45.7%</td>
<td>19.2%</td>
<td>11.1%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Webcast</td>
<td>1,141</td>
<td>21.5%</td>
<td>47.9%</td>
<td>20.9%</td>
<td>7.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Simulations</td>
<td>4,497</td>
<td>20.4%</td>
<td>49.4%</td>
<td>19.3%</td>
<td>9.2%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Blogs</td>
<td>1,955</td>
<td>19.1%</td>
<td>47.8%</td>
<td>19.4%</td>
<td>11.2%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Clickers (student response systems)</td>
<td>5,156</td>
<td>18.2%</td>
<td>47.7%</td>
<td>21.8%</td>
<td>10.4%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Discipline-specific IT (Mathematica, etc.)</td>
<td>4,751</td>
<td>18.1%</td>
<td>52.0%</td>
<td>18.4%</td>
<td>9.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Social networking software (thefacebook.com, etc.)</td>
<td>5,780</td>
<td>17.9%</td>
<td>47.9%</td>
<td>20.7%</td>
<td>11.1%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Spreadsheets (Excel, etc.)</td>
<td>13,375</td>
<td>17.0%</td>
<td>51.5%</td>
<td>20.0%</td>
<td>9.6%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Presentation software (PowerPoint, etc.)</td>
<td>17,775</td>
<td>15.8%</td>
<td>51.7%</td>
<td>19.5%</td>
<td>10.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Course Web site</td>
<td>18,188</td>
<td>15.6%</td>
<td>51.5%</td>
<td>19.7%</td>
<td>10.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Online quizzes or tests</td>
<td>11,564</td>
<td>15.2%</td>
<td>51.3%</td>
<td>22.0%</td>
<td>9.1%</td>
<td>2.4%</td>
</tr>
<tr>
<td>E-mail</td>
<td>26,544</td>
<td>14.6%</td>
<td>52.2%</td>
<td>19.1%</td>
<td>11.2%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Online discussions</td>
<td>10,556</td>
<td>14.3%</td>
<td>51.7%</td>
<td>20.8%</td>
<td>11.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Online gradebook</td>
<td>17,392</td>
<td>14.2%</td>
<td>52.7%</td>
<td>21.6%</td>
<td>9.2%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Course management system</td>
<td>18,204</td>
<td>12.4%</td>
<td>55.0%</td>
<td>20.9%</td>
<td>9.3%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Table 6-4. Most Valuable Benefit, by Technologies Used in Courses This Academic Period
significant increase in the proportion of 2006 respondents who identified IT’s role in helping them manage their course activities (control) as the chief benefit. Even more interesting is the significant decrease in those who identified communication as the chief benefit.

This finding is corroborated by data shown in Table 6-6, where ECAR survey respondents in 2006 again conveyed a significantly changed perception of the contribution of IT to communication and collaboration with classmates. We speculate that communicating—socially, recreationally, professionally, and academically—via a wide variety of information technologies may be so interlaced with the student experience as to be increasingly inseparable by respondents as an educational outcome. Last year, Kristina Woolsey compared asking a college student about e-mail to asking a fish about water (Woolsey, Woolsey, & Woolsey, 2005). If communicating and collaborating via IT is truly second nature to students, we expect to continue to find it difficult for respondents to separate improved communication as an independent benefit of technology.

Table 6-5. Change in Most Valuable Benefit, 2005 to 2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>52.6%</td>
<td>50.7%</td>
<td>1.9%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Helped me manage course activities</td>
<td>18.0%</td>
<td>13.2%</td>
<td>4.8%</td>
<td>36.4%</td>
</tr>
<tr>
<td>Improved my learning</td>
<td>13.8%</td>
<td>12.4%</td>
<td>1.4%</td>
<td>11.3%</td>
</tr>
<tr>
<td>Helped me communicate with classmates and instructors</td>
<td>11.7%</td>
<td>20.0%</td>
<td>-8.3%</td>
<td>-41.5%</td>
</tr>
<tr>
<td>No benefits</td>
<td>2.9%</td>
<td>2.6%</td>
<td>0.3%</td>
<td>11.5%</td>
</tr>
<tr>
<td>Other</td>
<td>1.1%</td>
<td>1.1%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Note: Comparisons of changes between 2005 and 2006 are based on student responses from the 49 institutions that participated in both studies.

Table 6-6. Change in Student Experience: “IT in Courses Helps Me Better Communicate and Collaborate with Classmates,” 2005 to 2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>2.5%</td>
<td>1.9%</td>
<td>0.6%</td>
<td>31.6%</td>
</tr>
<tr>
<td>Disagree</td>
<td>11.9%</td>
<td>8.4%</td>
<td>3.5%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Neutral</td>
<td>29.9%</td>
<td>24.3%</td>
<td>5.6%</td>
<td>23.0%</td>
</tr>
<tr>
<td>Agree</td>
<td>44.1%</td>
<td>48.1%</td>
<td>-4.0%</td>
<td>-8.3%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>11.7%</td>
<td>17.3%</td>
<td>-5.6%</td>
<td>-32.4%</td>
</tr>
</tbody>
</table>

Note: Comparisons of changes between 2005 and 2006 are based on student responses from the 49 institutions that participated in both studies.
Endnotes

1. The “No Benefits” category is 3.3 percent of the whole population. The percentages in this table are lower because they are only for the group of respondents using each technology this academic period. The group of respondents not using each technology this academic period has a proportionally larger percentage of “No Benefits” responses, but they are not shown here. Also, technologies such as e-mail (N = 26,544), with Ns approaching the full population (N = 28,724), have percentage distributions close to the distribution of the full population of respondents using a technology this academic period.

2. The wording in the 2005 and 2006 surveys was not identical. The 2006 survey added the words “than in courses that do not use technology” to all the statements regarding outcomes. The 2006 survey statement was “The use of information technology in my courses helps me better communicate and collaborate with my classmates than in courses that do not use technology.” The 2005 survey statement was “The use of information technology in courses has helped me better communicate and collaborate with my classmates.”
Appendix A

References


Appendix B

Acknowledgments

Used throughout this ECAR research study are product names that are trademarked by their respective owners. Photoshop is a trademark of Adobe Systems, Inc.; ANGEL is a trademark of ANGEL Learning; iMove and OS X are trademarks of Apple Computer, Inc.; WebCT and Blackboard are trademarks of Blackboard, Inc.; Desire2Learn is a trademark of Desire2Learn, Inc.; Director, Dreamweaver, and Flash are trademarks of Macromedia, Inc.; Excel, FrontPage, PowerPoint, Windows, Xbox, and Word are trademarks of Microsoft Corporation; PlayStation is a trademark of Sony Computer Entertainment, Inc.; Mathematica is a trademark of Wolfram Research, Inc. Other trademarked products mentioned in the study include First Class, Moodle, Oncourse, and Sakai.

We wish to express our appreciation to the following individuals who helped make this study possible. Their contributions include securing institutional approval to do the study at their institution, completing the requisite institutional review board application, inviting students to participate in the study, constructing a sample of students to contact, helping to recruit students for focus groups, and a variety of other tasks.

Adelaine, Michael – South Dakota State University
Anderson, Mark – University of Wisconsin–Superior
Anderson, Tammy – Community College of Rhode Island
Antons, Chris – Willamette University
Arazan, Christy – Northern Arizona University
Aurillo, Suzanne – San Diego State University
Backscheider, Nicholas – Auburn University
Benson, Marisa – Emory University
Bergeron, Corrie – Lakeland Community College
Bianchi, Julius – California Lutheran University
Bielec, John – Drexel University
Biros, Jan – Drexel University
Bohlmann, Nathan – Purdue University
Brinthaupt, Tom – Middle Tennessee State University
Bruce, Rose – Sonoma State University
Brum, Debra – California State Polytechnic University, Pomona
Burrell, Steven – Saint Leo University
Cahill, Rosann – University of St. Thomas
Camp, John – Wayne State University
Campbell, John – Purdue University
Carr, Daryl – Monmouth College
Carrier, Linda – James Madison University
Casto, Mary Jane – Georgia State University
Chichester, Susan – SUNY College at Geneseo
Clark, Chris – The University of Iowa
Cleek, Dick – University of Wisconsin Colleges
Conrad, Larry – Florida State University
Cromwell, Dennis – Indiana University
Cunningham, Barbara – Pace University
Davis, Jim – Iowa State University
Davis, William – Bridgewater State College
Deneen, Linda – University of Minnesota Duluth
Denman, Chip – University of Maryland
DiGangi, Sam – Arizona State University
Doetkott, Curt – North Dakota State University
Draude, Barbara – Middle Tennessee State University
Dumke, David – University of Wisconsin–Stevens Point
Durso, Ann Marie – University of Wisconsin–Parkside
Dzuiban, Charles – University of Central Florida
Eckardt, Chip – University of Wisconsin–Eau Claire
Elarde, Chris – Pace University
Elmore, Garland – Indiana University-Purdue University Indianapolis
El-haggan, Ahmed – Coppin State University
Foster, Susan – University of Delaware
Franke, Marc – The University of Iowa
Fritz, John – University of Maryland, Baltimore County
Getman, Joan Falkenberg – Cornell University
Gibson, Robert – Friends University
Hartman, Joel – University of Central Florida
Heasley, Ron – Elizabethtown College
Hill, Janet – Brandeis University
Hilton, Linda – Vermont State Colleges
Hurley, Doug – The University of Memphis
Huskamp, Jeff – University of Maryland
Huxley, Dale – James Madison University
Jonas, James – University of Wisconsin–Madison
Justice, Debbie – Western Carolina University
Kearns, Tim – California Polytechnic State University, San Luis Obispo
Kendall, Kim – Santa Fe Community College
Kerian, Dorette – University of North Dakota
King, Rebecca – Baylor University
Knaapen, Laura – University of Wisconsin–Oshkosh
Kossuth, Joanne – Franklin W. Olin College of Engineering
Kress, Anne – Santa Fe Community College
Krogman, John – University of Wisconsin–Platteville
LaManque, Andrew – Foothill-DeAnza Community College District
Landry, Stephen – Seton Hall University
Langston, Cheryl – Iowa State University
Lassner, David – The University of Hawaii at Manoa
Lasswell, Susan – California State University, Fullerton
Lazor, Joseph – Florida State University
Lea, Lucinda – Middle Tennessee State University
Lepak, Jack – University of Wisconsin–Madison
Levy, Samuel – University of St. Thomas
Lightfoot, Ed – University of Washington
Litten, Larry – Dartmouth College
Little, Julie – The University of Tennessee
Maas, Bruce – University of Wisconsin–Milwaukee
McClure, Polley Ann – Cornell University
Mirliss, Danielle – Seton Hall University
Moberg, Tom – North Dakota State University
Monaghan, Tom – University of Notre Dame
Oates, Karen – Georgia State University
O’Bryan, Cathy – University of Wisconsin–Madison
Okimoto, Hae – University of Hawaii at Manoa
Ormand, Brian – New Mexico State University
Orr, Pattie – Wellesley College
Parker, Ronald – Brazosport College
Pflueger, Kenneth – Pomona College
Pitt, Sharon – North Carolina State University
Pletcher, Kathy – University of Wisconsin–Green Bay
Pokot, Elena – University of Wisconsin–Whitewater
Pritchard, William – Foothill-DeAnza Community College District
Rowe, Theresa – Oakland University
Sacher, Dick – University of Delaware
Sakai, Eric – Vermont State Colleges
Samuel, John – Indiana University
Sannier, Adrian – Arizona State University
Schaeffer, Sandy III – The University of Memphis
Schaffer, Connie – Eastern Michigan University
Schaffer, Mary – California Polytechnic State University, San Luis Obispo
Servadio-Coyne, Claudia – Colgate University
Seuss, Jack – University of Maryland, Baltimore County
Smallen, David – Hamilton College
Smith, Gary – University of Wisconsin–River Falls
Sorensen, Roger – College of Saint Benedict/Saint John’s University
Speck, Francis – Saint Mary’s University of Minnesota
Splittberger, Kenneth – University of Wisconsin–Oshkosh
Stahl, Wilson – Western Carolina University
Steinbrenner, Karin – University of North Carolina at Charlotte
Stern, Nadine – The College of New Jersey
Still, Amye – Auburn University
Stunden, Annie – University of Wisconsin–Madison
Tillman, John – University of Wisconsin–La Crosse
Trietsch, Jim – Abilene Christian University
Trinkle, Dennis – DePauw University
Vandever, Jennifer – Southern Illinois University, Edwardsville
Waitrovich, Mary – University of Wisconsin–Madison
Walsh, Theresa – Indiana University-Purdue University Indianapolis
White, Marshall – University of New Hampshire
Wilhelm, Thomas – Wellesley College
Willan, Dawn – The College of New Jersey
Williams, Calvin – Monmouth University
Wilson, William – Gettysburg College
Woody, Karalee – University of Washington
Wong, Lorna – University of Wisconsin–Whitewater
Wong, Victor – University of Michigan–Ann Arbor
Appendix C

Students and Information Technology in Higher Education: 2006 Survey Questionnaire

Thank you for your willingness to answer this survey, which focuses on your experiences with and opinions about information technology. The information you and other undergraduate students provide will be reported in a national study that will be available to higher education institutions. We will also make available to your school’s leaders data that you and your classmates give us about your school. The primary goal of the study is to better understand student experiences with information technology, which, in turn, can help your school’s leadership to respond to your IT needs.

Your answers are confidential, and neither your school nor the EDUCAUSE Center for Applied Research will be able to identify you.

For the purposes of this survey, information technology refers to “personal electronic devices such as laptops and handheld computers, smart phones, and your institution’s computers and associated devices.”

Please submit your survey responses as soon as possible within the next two weeks. It should take you approximately 15 minutes to complete the survey.

You may print a blank copy of the survey, if you’d like, before completing it by clicking “Printable version of the survey” in the header. To print your responses after completing the survey, select the “Review” button at the end of the survey.

We appreciate your time and participation. If you have any questions or concerns, please contact the campus representative specified in the e-mail you were sent.

Click the “Next” button to begin the survey. Once again, thank you for your assistance!

Section 1.
We may only survey students age 18 or older.

1.1 I am 18 years old or older. <Required>
   ○ No <Proceed to Section 5>
   ○ Yes <Proceed to 1.2>

I give my consent to the following:
   For this survey you were selected at random from a list of freshmen and seniors at your institution. We ask that you read this form and ask any questions you may have before agreeing to be in the study.
Sponsored by the EDUCAUSE Center for Applied Research, this study is being conducted by Dr. Robert Kvavik of the University of Minnesota and Judy Caruso of the University of Wisconsin–Madison. EDUCAUSE is a nonprofit association whose members include information technology leaders in higher education. Its mission is to advance higher education by promoting the intelligent use of information technology.

**Background Information**

If you agree to be in this study, please complete and submit the following survey. The survey asks for basic background information and questions you about:

- What kinds of information technologies you use and how often.
- What your level of skill is at using different information technologies.
- How these technologies contribute to your undergraduate experience.
- What value information technologies provide in teaching and learning in higher education.

It will take about 15 minutes to complete the survey. Please answer the questions to the best of your ability. There is no right or wrong answer. You only need to fill out the survey once.

**Risks and Benefits of Being in the Study**

There are no physical, psychological, social, or medical risks associated with your participation in this study. The benefit of your participation is to inform school officials of the benefits of their technology investments for students.

**Compensation**

There is no compensation for participating.

**Confidentiality**

The records of this study will be kept private. In any report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely.

**Voluntary Nature of the Study**

Participation in this study is voluntary. Your decision about whether to participate will not affect your current or future relations with your institution, with any of the institutions participating in this survey, or with EDUCAUSE. If you decide to participate, you are free not to answer any non-required question or withdraw at any time without affecting those relationships.

**Contacts and Questions**

You may direct any questions to the researchers conducting this study, Robert Kvavik, 612-625-2400, kvavik@umn.edu, and Judy Caruso, 608-263-7318, judy.caruso@doit.wisc.edu, or to a representative of your institution’s Institutional Review Board.

If you wish to print a copy of the survey before completing it online, a PDF version is available from the link in the online survey header. Once you complete and submit the survey by clicking the Finish button, a summary of your responses will be displayed with the option to print and/or save them.
Statement of Consent

1.2 I have read the above information and have had the opportunity to ask questions and receive answers. I consent to participate in the study. <Required>
   ○ No <Proceed to Section 5>
   ○ Yes <Proceed to next question>

1.3 If you are interested in entering the drawing for gift certificates, please enter your e-mail address. <Optional>

Section 2. Your Use of Electronic Devices

2.1 How old is your personal desktop computer? <Drop-down list including less than 1 year, 1 to 10 years (increments of 1), More than 10 years, and Don’t own>

2.2 How old is your personal laptop computer? <Drop-down list including less than 1 year, 1 to 10 years (increments of 1), More than 10 years, and Don’t own>

2.3-2.8 Which of the following electronic devices do you own?

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
</table>
| ○  | ○   | 2.3 Personal digital assistant (PDA) (Palm, etc.)
| ○  | ○   | 2.4 Smart phone (combination cell phone and PDA device) (Blackberry, etc.)
| ○  | ○   | 2.5 Electronic music/video device (iPod, etc.)
| ○  | ○   | 2.6 Digital camera
| ○  | ○   | 2.7 Electronic game device (Game Boy, Xbox, etc.)
| ○  | ○   | 2.8 Wireless hub

2.9 How many active e-mail accounts do you maintain? <Drop-down list including 1 to 10 (increments of 1), More than 10>

2.10 Which e-mail account is your preferred e-mail account?
   ○ University account
   ○ Other account

2.11 If your institution could communicate with you in any form, what would your first choice be?
   ○ Instant messaging
   ○ E-mail
   ○ Text messaging
   ○ Personally authenticated Web site (portal)
   ○ Paper mail
   ○ No preference

2.12 Excluding your use of cell phones, how many hours each week do you normally spend using an electronic device (computer, PDA, etc.) for school, work, and recreation? <Drop-down list including Less than one, 1-168 (increments of 1)>
2.13 How often do you use an electronic device for course activities?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.14 How often do you use an electronic device to access a library resource on an official college or university library Web site?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.15 How often do you use an electronic device as an in-class requirement?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.16 How often do you use an electronic device for writing documents for your coursework?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.17 How often do you create, read, and send e-mail?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily
2.18 How often do you create, read, and send instant messages?
   ○ Never
   ○ Once per year
   ○ Once per semester/quarter
   ○ Monthly
   ○ Weekly
   ○ Several times per week
   ○ Daily

2.19 How often do you play computer games?
   ○ Never
   ○ Once per year
   ○ Once per semester/quarter
   ○ Monthly
   ○ Weekly
   ○ Several times per week
   ○ Daily

2.20 How often do you download Web-based music or videos?
   ○ Never
   ○ Once per year
   ○ Once per semester/quarter
   ○ Monthly
   ○ Weekly
   ○ Several times per week
   ○ Daily

2.21 How often are you doing online shopping?
   ○ Never
   ○ Once per year
   ○ Once per semester/quarter
   ○ Monthly
   ○ Weekly
   ○ Several times per week
   ○ Daily

2.22 How often are you doing online gaming (partypoker.com, etc.)?
   ○ Never
   ○ Once per year
   ○ Once per semester/quarter
   ○ Monthly
   ○ Weekly
   ○ Several times per week
   ○ Daily
2.23 How often are you blogging?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.24 How often do you participate in online social networks (thefacebook.com, friendster.com, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.25 How often do you use an electronic device for creating spreadsheets or charts (Excel, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.26 How often do you use an electronic device for creating presentations (PowerPoint, Keynote, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.27 How often do you use an electronic device for creating graphics (Photoshop, Flash, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily
2.28 How often do you create audio/video (Director, iMovie, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.29 How often do you create Web pages (Dreamweaver, FrontPage, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.30 How often do you access a course management system (ANGEL, WebCT, Blackboard, Desire2Learn, FirstClass, Moodle, Sakai, OnCourse, etc.)?
- Never
- Once per year
- Once per semester/quarter
- Monthly
- Weekly
- Several times per week
- Daily

2.31-2.35 Which of the following software have you purchased for your own use?

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| ○  | ○   | 2.31 Spreadsheets (Excel, etc.)
| ○  | ○   | 2.32 Presentation software (PowerPoint, etc.)
| ○  | ○   | 2.33 Graphics (Photoshop, Flash, etc.)
| ○  | ○   | 2.34 Video/audio (Director, iMovie, etc.)
| ○  | ○   | 2.35 Web pages (Dreamweaver, FrontPage, etc.)
2.36-2.44 What is your skill level using the following computer technologies and applications? <Minimal=very little use of basic features; Basic=some use of basic features; Conversant=full use of basic features but not advanced features; Accomplished=full use of basic features and many of the advanced features; Fluent=ability to use advanced features with ease>

<table>
<thead>
<tr>
<th></th>
<th>Minimal</th>
<th>Basic</th>
<th>Conversant</th>
<th>Accomplished</th>
<th>Fluent</th>
<th>Do not use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36 Spreadsheets (Excel, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.37 Presentation software (PowerPoint, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.38 Graphics (Photoshop, Flash, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.39 Video/audio (Director, iMovie, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.40 Web pages (Dreamweaver, FrontPage, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.41 Online library resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.42 Computer maintenance (downloading software updates, installing additional memory, organizing files, etc.)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.43 Computer security (firewalls, antivirus software, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.44 Course management system (ANGEL, WebCT, Blackboard, Desire2Learn, FirstClass, Moodle, Sakai, OnCourse, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.45 Why did you learn spreadsheet software (Excel, etc.)?
- Improve my course performance
- Course or major requirement
- Campus requirement
- Required for student organization activities
- Personal interest
- Job requirement
- To enhance future job opportunities
- Other
- Do not use

2.46 Why did you learn presentation software (PowerPoint, Keynote, etc.)?
- Improve my course performance
- Course or major requirement
- Campus requirement
- Required for student organization activities
- Personal interest
- Job requirement
- To enhance future job opportunities
- Other
- Do not use
2.47 Why did you learn graphics software (Photoshop, Flash, etc.)?  
- Improve my course performance  
- Course or major requirement  
- Campus requirement  
- Required for student organization activities  
- Personal interest  
- Job requirement  
- To enhance future job opportunities  
- Other  
- Do not use

2.48 Why did you learn video/audio software (Director, iMovie, etc.)?  
- Improve my course performance  
- Course or major requirement  
- Campus requirement  
- Required for student organization activities  
- Personal interest  
- Job requirement  
- To enhance future job opportunities  
- Other  
- Do not use

2.49 Why did you learn Web page creation software (Dreamweaver, FrontPage, etc.)?  
- Improve my course performance  
- Course or major requirement  
- Campus requirement  
- Required for student organization activities  
- Personal interest  
- Job requirement  
- To enhance future job opportunities  
- Other  
- Do not use

2.50 During the academic year, what is your most frequently used method for access to the Internet?  
- Commercial dial-up modem service (AOL, EarthLink, etc.)  
- College- or university-operated dial-up modem service  
- Commercial broadband service (DSL modem, cable modem, etc.)  
- College- or university-operated wired broadband service  
- Commercial wireless network  
- College- or university-operated wireless network
2.51_2.61 If additional monies were available to improve computing services at your institution, select the top 3 items you would like it spent on. <Select up to 3>
- 2.51 Student IT training
- 2.52 Faculty IT training
- 2.53 Computer labs
- 2.54 Software required for courses (spreadsheets, PowerPoint, etc.)
- 2.55 Help desk
- 2.56 Network speed
- 2.57 Network availability
- 2.58 IT security (virus software, spam filtering, etc.)
- 2.59 Printing
- 2.60 Music (Napster subscription, etc.)
- 2.61 Other

Section 3. Your Use of Technology in Courses

3.1 Which of the following best describes your preference with regard to the use of technology in your courses?
- I prefer taking courses that use no information technology.
- I prefer taking courses that use limited technology.
- I prefer taking courses that use a moderate level of technology.
- I prefer taking courses that use technology extensively.
- I prefer taking courses that use technology exclusively.
3.2-3.18 Are any of the following technologies used in your courses during the current semester or quarter?

<table>
<thead>
<tr>
<th>Technology</th>
<th>Not using this semester/quarter</th>
<th>Using this semester/quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 E-mail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Instant messaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.4 Presentation software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PowerPoint, Keynote, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 Course management system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ANGEL, WebCT, Blackboard, Desire2Learn, Moodle, Sakai, OnCourse, FirstClass, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.6 Course Web site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 Clickers (student response systems)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.8 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.9 Online discussions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.10 Online quizzes or tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.11 Online gradebook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.12 Podcast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.13 Webcast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.14 Blogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.15 Social networking software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(thefacebook.com, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.16 E-portfolios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.17 Spreadsheets (Excel, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.18 Discipline-specific technologies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Mathematica, Matlab, AutoCAD, Stella, etc.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.19_3.21 Please give us your opinion about the following statements regarding your experiences with IT in your courses.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.19 I am more engaged in courses that require me to use technology than in courses that do not use technology.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.20 Overall, my instructors use information technology well in my courses.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.21 My school needs to give me more training on the information technology that I am required to use in my courses.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### 3.22_3.25 The use of information technology in my courses:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.22 Helps me better communicate and collaborate with my classmates than in courses that do not use technology.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3.23 Results in more prompt feedback from my instructor than in courses that do not use technology.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.24 Allows me to take greater control of my course activities than in courses that do not use technology.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3.25 Helps me do better research for my courses than in courses that do not use technology.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### 3.26 Have you ever taken a course that used a course management system (e.g., ANGEL, WebCT, Blackboard, Desire2Learn, Moodle, Sakai, OnCourse, or FirstClass)? <Required>
- No <Proceed to 3.37>
- Yes <Proceed to 3.27>
- Don’t know <Proceed to 3.37>
### 3.27 How would you describe your own overall experience using a course management system?
- Very negative
- Negative
- Neutral
- Positive
- Very positive

### 3.28_3.36 How useful did you find the following course management system features?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Not useful</th>
<th>Somewhat useful</th>
<th>Useful</th>
<th>Very useful</th>
<th>Extremely useful</th>
<th>Did not use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syllabus</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Online readings and links to other text-based course materials</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Online discussion board (posting comments, questions, and responses)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Access to sample exams and quizzes for learning purposes</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Taking exams and quizzes online for grading purposes</td>
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<td></td>
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<tr>
<td>Turning in assignments online</td>
<td></td>
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<tr>
<td>Getting assignments back from instructors with comments and grades</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Sharing materials among students</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Keeping track of grades on assignments and tests</td>
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</tr>
</tbody>
</table>

### 3.37_3.38 Which of the following benefits from using information technology in your courses was the most valuable to you?
- Improved my learning
- Convenience
- Helped me manage my course activities (planning, apportioning time, noting success and failure, etc.)
- Helped me communicate with my classmates and instructors
- No benefits
- Other

### 3.38 Please describe ___________________________________________________________
3.39 The use of information technology in my courses has improved my learning.
  ○ Strongly disagree
  ○ Disagree
  ○ Neutral
  ○ Agree
  ○ Strongly agree
3.40 How often do you bring your laptop to class?
  ○ Never
  ○ Once per year
  ○ Once per semester/quarter
  ○ Monthly
  ○ Weekly
  ○ Several times per week
  ○ Daily
3.41 Is bringing your laptop to class a requirement in any of your courses?
  ○ No
  ○ Yes
3.42 Which of the following best describes you?
  ○ I love new technologies and am among the first to experiment with and use them.
  ○ I like new technologies and use them before most people I know.
  ○ I usually use new technologies when most people I know do.
  ○ I am usually one of the last people I know to use new technologies.
  ○ I am skeptical of new technologies and use them only when I have to.

Section 4. Information About You
4.1 What is your gender?
  ○ Male
  ○ Female
4.2 What is your age? <Drop down menu with ages from 18 to 99>
4.3 What is your cumulative grade point average (GPA)?
  ○ Under 2.00
  ○ 2.00–2.24
  ○ 2.25–2.49
  ○ 2.50–2.99
  ○ 3.00–3.24
  ○ 3.25–3.49
  ○ 3.50–3.74
  ○ 3.75–4.00
  ○ Don’t know
4.4 Are you a senior or a freshman?
  ○ Senior
  ○ Freshman
  ○ Other
4.5 If you are a student at a community college, what percentage of your degree program have you completed?
   ○ I am not in a degree program.
   ○ I have completed less than 25% of the degree program.
   ○ I have completed between 25% and 50% of the degree program.
   ○ I have completed between 51% and 75% of the degree program.
   ○ I have completed between 76% and 100% of the degree program.
   ○ I am not attending a community college.

4.6 Are you currently a full-time or part-time student? <Part time is fewer than 12 credit hours per semester/quarter> 
   ○ Full time
   ○ Part time

4.7 Do you reside on campus or off campus?
   ○ On campus
   ○ Off campus

4.8 What disciplines are you majoring in? Check all that apply.
   ○ 4.8 Social sciences
   ○ 4.9 Humanities
   ○ 4.10 Fine arts
   ○ 4.11 Life sciences, including agriculture and health sciences
   ○ 4.12 Physical sciences
   ○ 4.13 Education, including physical education
   ○ 4.14 Engineering
   ○ 4.15 Business
   ○ 4.16 Other
   ○ 4.17 Undecided

4.18 Which institution are you attending? <Required> <Drop-down list of institutions>
Before proceeding, please confirm that the name of your institution appears in box 4.18.

4.19 If you have any other comments or insights about your information technology use and skills or about how IT has helped or not helped your undergraduate experience, please feel free to share them with us. __________________________
   __________________________________________________________________________

Section 5. Thank You.
You have reached the end of the survey. Thank you! Please submit the survey by clicking the Finish button now, or if you wish to review, print, or save your responses, click “Review.”

– END SURVEY –
Appendix D

Qualitative Interview Questions

Questions for Student Focus Groups

1. Background
   1.1 Student information: age, gender, senior/freshman, full/part-time, on/off campus, discipline, ethnicity
   1.2 How many computers do you own? What kinds? How long have you owned them?

2. Skill and use
   2.1 How skilled are you at using computer technology to do work required for your classes?
   2.2 There is a lot being said and written about the current generation of students being good at using technology and being tech savvy. Do you think this statement is true of yourself? Of your friends?
   2.3 What kinds of technology skills do you have? (Last year’s students reported being good at communications and Web surfing but less skilled at things like creating Web pages, graphics, video.)
   2.4 What kinds of technology skills are you weak in?
   2.5 What kinds of technology skills do you think students in general are weak in?
   2.6 How good do you think students are at dealing with changes in technology (e.g. when you get a new course management system, such as WebCT or Learn@UW, a new set of programs, or when what you are used to using isn’t available)?
   2.7 Do you use computers and the Internet for entertainment? If so, what kinds of activities do you engage in for entertainment?
   2.8 What impact do you think a student’s major has on his or her use and skills with technology?

3. Your use of technology in courses
   3.1 Do you think that the skills you may acquire in using the Internet for entertainment transfer to your school work? If so, what are the components of those skills? If not, why not?
   3.2 How have instructors used technology in the courses you have taken thus far?
   3.3 What are the major advantages that you see in the use of technology in your courses?
   3.4 What is the major disadvantage that you see in the use of technology in your courses?
3.5 Do you think that the use of technology in your courses has helped you in your learning?
3.5.1 If so, how?
3.5.2 If not, why not?
3.6 Do you think that in general your instructors are skilled in the use of technology in teaching?
3.7 What are the major obstacles that you see to more effective use of computer and information technology in your courses?
3.8 One of the findings of last year’s study was that students indicated that technology in their classes was about convenience, communication, and control of the learning experience. While improved learning was also mentioned, it seemed to play a lesser role. Can you please comment on this?
3.9 If there was one thing your professors could do or not do with respect to technology in your course, what would it be?

4. Future
4.1 What advice would you give university administrators who are keen to encourage the effective use of technology in college courses? What sorts of things should they be doing?

5. Other
## Appendix E

### Participating Institutions and Survey Response Rates

<table>
<thead>
<tr>
<th>Institution</th>
<th>Freshman and Senior Student Enrollment</th>
<th>Freshman and Senior Student Sample</th>
<th>Sample Percentage of Enrollment</th>
<th>Student Responses</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abilene Christian University</td>
<td>2,094</td>
<td>641</td>
<td>30.6%</td>
<td>55</td>
<td>8.6%</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>22,723</td>
<td>22,723</td>
<td>100.0%</td>
<td>1,939</td>
<td>8.5%</td>
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(Continued)
### Four-Year Institutions (Continued)

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<th>Institution</th>
<th>Freshman and Senior Student Enrollment</th>
<th>Freshman and Senior Student Sample</th>
<th>Sample Percentage of Enrollment</th>
<th>Student Responses</th>
<th>Response Rate</th>
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(Continued)
## Four-Year Institutions (Continued)

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<th>Institution</th>
<th>Freshman and Senior Student Enrollment</th>
<th>Freshman and Senior Student Sample</th>
<th>Sample Percentage of Enrollment</th>
<th>Student Responses</th>
<th>Response Rate</th>
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### Two-Year Colleges

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<th>Two-Year College Degree-Seeking Student Sample</th>
<th>Sample Percentage of Enrollment</th>
<th>Student Responses</th>
<th>Response Rate</th>
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