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ECAR

EDUCAUSE Center for Applied Research

The ECAR Study of Undergraduate Students and Information Technology, 2009

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EDUCAUSE

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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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Foreword

The EDUCAUSE Center for Applied Research (ECAR) was launched on January 1, 2002, to create a body of research and analysis on important issues at the intersection of higher education and information technology (IT). ECAR is fulfilling its mission through a program of symposia and through the publication of biweekly research bulletins, detailed research studies, occasional papers, executive roadmaps, and case studies. These publications are designed to highlight effective practices, lessons learned, and other insights from the practical experience of campus leaders. Since ECAR's inception, 13 symposia have been held, and more than 400 research publications have been issued.

Study of Students and Information Technology

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, then a modest start-up, might someday institute an ongoing survey of the IT practices, preferences, preparedness, and performance of college students. It took ECAR Fellows Robert Kvavik and Judith Borreson 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 have, at best, 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.

Since 2004, steady progress has been made. Gail Salaway joined the team and has served the community with distinction since serving as principal investigator of the 2006 study. She and ECAR Fellow Judith Borreson Caruso have guided this effort for four years and introduced the idea of the "deep dive" to this effort. In 2008, ECAR dove deep on the topic of undergraduate students and social networking, and this year we look closely at the topic of undergraduates and mobile technologies.

This year ECAR welcomed Shannon Smith to the team. Shannon brings eight years of professorial experience (history) among the

Lakota Indians at Oglala Lakota College. She brings the passion and perspective of the experienced instructor. Gail Salaway and Judith Borreson Caruso continued to serve as investigators, bringing deep expertise to the table. Among other things, Judith facilitated student discussion sessions at Grand Rapids Community College; Hamilton College; University at Albany, SUNY; and the University of Wisconsin–Stevens Point to help us better understand the quantitative data from our survey. And this year, 30,616 students from 115 colleges and universities participated in the study.

Undergraduate Students, 2009

The higher education class of 2013, which passed through our gates this September, will be an interesting class to understand. Their birth year marked the birth of the Linux operating system and of PGP, the e-mail encryption utility. The year of their birth marked the first year that the World Wide Web was released publicly, and the year that Windows 3.0 was released. That release, along with the release of Intel's 80386 processor, made it possible for personal computers to support large graphical applications. Before the students in the class of 2013 were five years old, Netscape and Yahoo were founded, bringing the browser and search technologies to new levels of sophistication in the consumer marketplace. By the time today's freshmen were five years old, the Nintendo 64—a true 64-bit game platform—was commercially available, and before they were 10, the Sony Playstation2 was the "must have" Christmas gift for a great many.

By the time today's first-year undergraduates entered high school in 2005, the number of U.S. homes connected to the Internet by broadband equaled those connected via dial-up.[1] In all, more than 60 million Americans had broadband at home by 2005. Before entering high school in 2005, 45% of American teens had cell phones, and 33% were already texting. Of those who texted, the mode of communication used *most often* when communicating with friends was IM over e-mail in a wide array of contexts.[2] By 2008, the proportion of Americans with broadband to the home had risen to 55%, and 82% of households with household incomes of $75,000–$100,000 per year had broadband.[3]

Many of today's first-year collegians really have grown up digital. The key technologies—the hardware, personal productivity software, communications infrastructure, and search, browser, and 3-D simulation technologies—that continue to define the computing and communications infrastructure today are old friends. Most were in place and reasonably robust before these students became teenagers.

The most technologically able of these new college students are incredible. Can Duruk and his friend illustrate the point. Duruk, a Carnegie Mellon University senior, was attacked and robbed by two armed men just before midnight in August 2009. By 4:00 a.m. he had led the police to the thieves and identified both of them in a police lineup. Duruk's police work was made possible by his knowledge of the technology on his stolen iPhone that he found through the Internet. When the robbers took Duruk's wallet, they also took the PIN for his bank card, and they took his iPhone. Using a friend's iPhone and MobileMe, an online application that synchronizes the iPhone and displays its exact location, Duruk and his friend were able to track the path of the robbers. They also followed the trail of the robbers' financial activity as well and were in constant contact with Pittsburgh police, who ultimately arrested the robbers at a suburban Eat'n Park restaurant.[4]

To a very great extent, anecdotes like Can Duruk's story and the data from ECAR, the Pew Internet & American Life Project, the *Student Monitor*, and other resources

paint a picture of a crop of capable and highly computer literate undergraduates. ECAR survey respondents continue to own a wide variety of technologies. In many cases they arrive on campus with new and mobile technologies, and they are easily acclimated to course management systems (CMSs) and other course and personal productivity tools. Increasingly, they not only read blogs and wikis or watch YouTube and other videos, but they also produce and contribute original text, photographs, and video. Indeed, a central story in the evolution of the ECAR student study is the shift of the web from a repository of others' content to a medium for creative contribution and a medium of social exchange. Undergraduates today extend the length of the shadows they cast via the Internet.

Mobility is becoming a dominant subplot in the story of undergraduates and IT. Today's students overwhelmingly prefer laptop computers to desktop computers, and growing numbers of students own smart handheld devices. Most of the 2009 ECAR survey respondents had a smartphone with a data plan, intended to have one, or would like to have one. The limits on these students' appetite for connectivity seem constrained more by money than by lack of interest.

Confirming, Comforting, and New Findings

It's no surprise that data from the ECAR student studies does not lurch from year to year. This is affirming to us, since it tends to validate past findings. As in the past, this year we found the following:

- Students 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 recreate.
- Students want a "moderate" amount of technology in their courses.
- Freshmen and seniors report different skill levels and different preferences for technology in support of course activities.
- Male and female students continue to report differing hours of use of IT, differing skill levels, and differing IT application preferences, but these differences can be ascribed almost entirely either to the extra time males spend gaming or to the higher enrollment of males in business and engineering disciplines.
- The choice of a student's academic major is closely associated with the student's perceived skills in certain IT applications and in his or her reported preference for technology in courses.
- Students are overwhelmingly positive about CMSs, but they want greater consistency in their use and availability.

With regard to mobile technologies, we found the following:

- Although more than half of respondents (51.2%) owned an Internet-capable handheld device and another 11.8% planned to purchase one in the next 12 months, one-third (35.5%) neither owned such a device nor planned to purchase one in the next 12 months. Almost three-quarters (73.7%) of respondents who currently own such devices expected their use to increase or greatly increase in the next three years.
- Although nearly a third of those who owned such devices (29.0%) used the Internet from their device daily, another third (35.4%) said they never use the Internet from their device. More than three-quarters (76.0%) of the device owners who did not use the Internet capabilities of their device cited the cost of the data service as one of the three reasons that limited its use.
- The top Internet activities performed from a handheld device were checking

information such as news, weather, and sports (76.7%); using e-mail (75.1%) and social networking websites (62.5%); and using maps, getting directions, or planning routes (58.7%).

- Almost a third of respondents (32.2%) regularly used their cell phone or handheld Internet device for non-course activities while in class.

Too Many People to Thank

The ECAR study of students and IT is an ambitious undertaking, and of course there are too many people to thank. All of us owe Shannon Smith, Gail Salaway, and Judith Borreson Caruso a lot for their outstanding work. 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 IRBs. IRB approval is never a foregone conclusion, and it 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 A.

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 also owe this large cadre of active supporters a lot. Sincere thanks also are extended to our colleagues at Grand Rapids Community College; Hamilton College; University at Albany, SUNY; and the University of Wisconsin–Stevens Point who paved the way for us to meet with groups of students from their institutions.

On the content side, we thank Julie Little of EDUCAUSE, who guides EDUCAUSE efforts on the teaching and learning side. She has been a steadfast and thoughtful guide, counselor, and partner on this study. I am grateful for her time, skills, and collegial nature. I also cannot thank enough my colleague Ron Yanosky. Ron represents quite simply the best of what the academy offers—the academic mentor. Ron spent countless hours with Shannon reading and rereading her text and analyses, coaching her gently in the art of data interpretation à la ECAR. We are more cautious than many in interpreting data and careful in our use of adjectives or jargon. That care and caution can only be transmitted to ECAR investigators the old-fashioned way—through discussions between a senior mentor and his or her apprentice. Ron has a penetrating intellect and rabbinical patience. Studies conducted under his guidance simply get better for it.

Of course, after all of this work on content development is complete, the work of the production team begins. The care of our investigators and fellows in constructing and designing surveys and in analyzing responses and checking analyses is matched by a team of editors under the guidance of Gregory Dobbin and Nancy Hays. They are thorough people and work with a team of editors, proofreaders, digital compositors, and printers. In studies where a quarter-inch shift in a column can obliterate a careful analysis, one cannot understate the effort these people make or the successes they claim. And last, but of course not least, Toby Sitko resides at the interface of the research team and the production team and orchestrates the overall project with the skill of a symphony conductor. ECAR depends on her every day.

Richard N. Katz
Boulder, Colorado

Endnotes

1. John Horrigan, "Home Broadband Adoption, 2009," Pew Internet & American Life Project, June 2009, http://www.pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx.
2. Amanda Lenhardt et al., "Teens and Technology," Pew Internet & American Life Project, July 27, 2005, http://www.pewinternet.org/~/media//Files/Reports/2005/PIP_Teens_Tech_July2005web.pdf.pdf.
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1 Executive Summary

Change always comes bearing gifts.
—Price Pritchett

Like the clothes in their suitcases, the technologies students bring to campus change every year. Occasionally, the change can be dramatic. It's hard to believe, but when the college seniors we surveyed for this year's study began their education four years ago, netbooks, iPhones, and the Nintendo Wii had yet to hit the market. When they went home for the holidays during their freshman year, some returned with a brand new game called *Guitar Hero* for the PlayStation 2, and some may have been lucky enough to score a $250 4-GB iPod nano or an ultrathin digital camera. Today's freshmen have mobile phones that hold more songs than that 4-GB nano, and they can use them to take digital photos and videos of the same quality as the $400 camera today's seniors got for their high school graduation.

The same forces of change apply to what college students are doing with their technology. Their written language has adapted to the technology of text messages and 140-character "tweets," and Andy Warhol's famous prediction about everyone eventually having 15 minutes of fame is being proved by the proliferation of social networking and YouTube. In fact, the pervasive uploading of content to blogs, video sites, wikis, and personal Facebook and MySpace pages suggests that "15 megabytes of fame" may be a more appropriate prophecy.

Since 2004, the *ECAR Study of Undergraduate Students and Information Technology* has sought to shed light on how technology affects the college experience. We ask students about the technology they own and how they use it in and out of their academic world. We also ask students about how skilled they believe they are with technologies; how they feel technology is affecting their learning experience; and their preferences for information technology (IT) in courses. Our ultimate goal is to provide college and university administrators, particularly those charged with implementing the technology environments in which these students will learn and grow, with reliable information on undergraduates' behaviors, preferences, and overall satisfaction with technology.

Our survey continuously evolves as technologies that are impacting higher education move through the cycle of user adoption from innovators and early adopters to mainstream and later adopters. However, some findings—particularly about students' beliefs, views, and opinions—resonate year after year regardless of specific technologies under investigation. Some sets of student beliefs and adoption patterns regarding technology are remarkably persistent, even as the technologies themselves change at what seems like breakneck speed. This kind of change, where students adopt technology at varying paces,

can be an opportunity, because even though institutions must prepare to leverage or support new technology, those technologies might be able to be implemented incrementally. Another benefit that comes with this type of change is that students who are technology leaders can provide a glimpse into what higher education can expect, and potentially they can enable institutions to make cost-effective decisions. And in this economic climate, institutions can use all the help they can get.

Methodology

The ECAR Study of Undergraduate Students and Information Technology, 2009 builds on and extends previous studies and consists of the following data collection and analytical initiatives:

- a literature review extending the 2008 literature review, along with a review of other relevant surveys;
- a web-based quantitative survey of college and university freshmen and seniors at 103 four-year institutions and students at 12 two-year institutions;
- student focus groups, providing qualitative data from 62 students from 4 institutions;
- student comments from written responses to the open-ended survey question, used to illustrate discussions of findings; and
- a comparison of longitudinal data from the 2006, 2007, 2008, and 2009 surveys where available.[1]

As in past studies, student respondents were weighted toward what we typically view as traditional students. Of the 30,616 respondents, 91.7% came from four-year institutions (34.2% freshmen, 44.5% seniors, and 13.0% saying "other" when asked about class standing), and the majority of respondents were under 25 years old (81.7%) and attended school full time (87.4%). Responses were also somewhat biased toward doctoral institutions (55.6%), larger institutions (67.3% enroll more than 8,000 students), and public institutions (74.3%).

Key Findings

The responses to our annual student survey continue to reveal themes about undergraduates' IT experience, including student technology ownership, use of and skill with IT, experience with IT in courses, and perceptions about how IT contributes to their academic experience. Our focus topic this year was Internet-capable handheld devices, and survey responses told us a great deal about how students use these devices, both in and out of class. The following sections highlight findings that stand out as especially interesting or relevant for higher education administrators as they develop plans to support the IT requirements and desires of their students.

Student Ownership and Use of Computers

The type of computer students bring to school has evolved along with their other personal technology. Although respondent ownership of computers has remained steady at around 98% the last four years, the ratio of ownership between laptops and desktops has changed notably. For the 39 institutions that participated in each of the last four years' studies, desktop ownership decreased 27 percentage points, while laptop ownership increased almost 23 points (see Figure 1-1). We also found that despite the current economic downturn, students are entering school with newer equipment, since nearly 8 of 10 (79.0%) freshmen owned a laptop that was one year old or less, and more than half of all respondents (52.3%) said their newest computer, whether laptop or desktop, was one year old or less. Two-thirds (67.9%) reported owning a machine two years old or less. This relatively up-to-date profile of computer ownership should reassure IT departments concerned about supporting students with older equipment; however, many respondents did still own older computers, including 17.9% who said their newest computer was four years old or older.

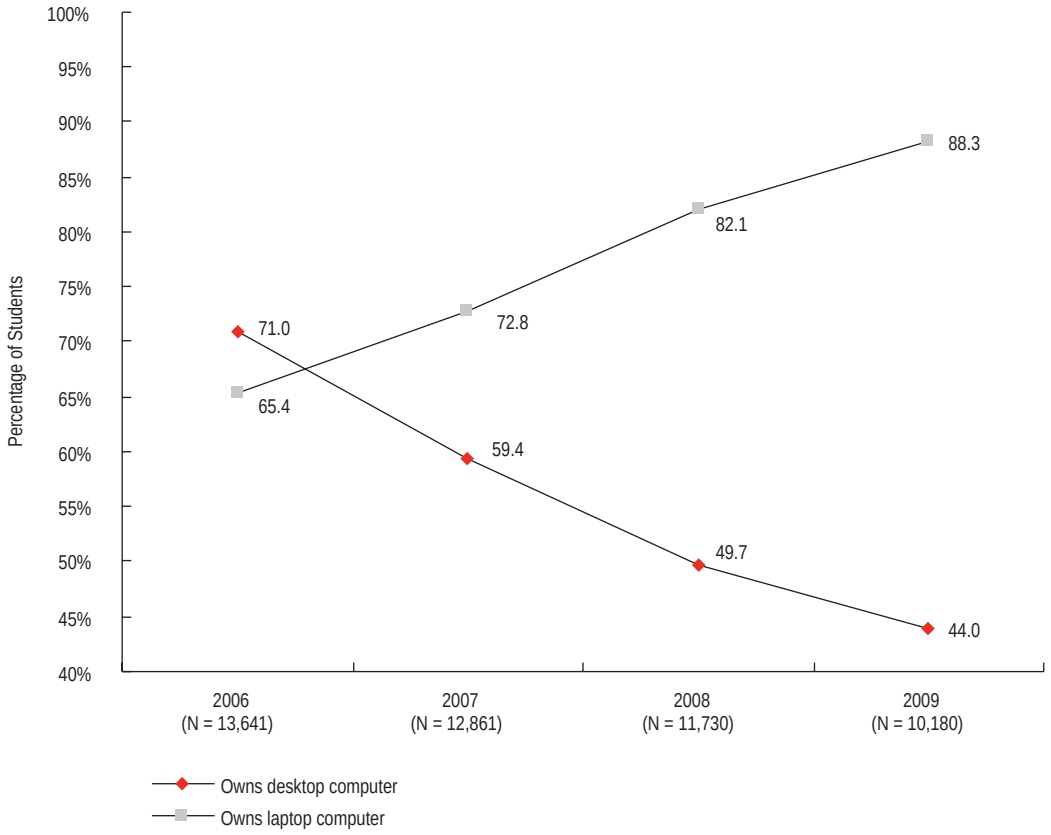

Figure 1-1. Change in Computer Ownership from 2006 to 2009 (39 Institutions*)

**Data are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding were different each year.*

When we asked students about their IT activities for school, work, or recreation, we found that basic technologies common in coursework continue to be very widely used. The vast majority of respondents, 9 out of 10, use the college and university library website (94.6%), with a median frequency of use of weekly, and about 9 in 10 use presentation software (93.8%) and spreadsheets (86.8%), with a median frequency of monthly. Downloading music or videos is also popular; 84.2% said they do it, with a median frequency of weekly. This activity has grown in popularity since 2006—the percentage of students who reported they download music or video has increased from 71.4% to 83.5% in the 39-institution longitudinal data set, and those who download daily increased from 7.2% to 11.0%.

Participation in content creation and sharing is also revealed in students' responses to questions about contributing content to Web 2.0 user-driven sites. Close to the same numbers of respondents said they contributed content to video websites (44.8%) and wikis (41.9%), and a little over a third of respondents said they contribute to blogs (37.3%) and use podcasts (35.0%). This year, we asked students for the first time if they use their computer for phone calls—voice over Internet Protocol, or VoIP (Skype, etc.) and found that more than one-third (37.7%) of the respondents reported using it, and the median frequency of use is monthly.

Interactive Communication Tools

Interactive communication tools such as instant messaging, text messaging, and social networking websites (SNSs) are shaping

how college students connect to the world and each other. The use of SNSs and text messaging is so widespread in some age groups that it has begun to reach a ceiling. This surge in use has been accompanied by a decline in a technology once seen as the definitive mode of teenage online communication: instant messaging. This year, SNSs and text messaging were used by about 9 in 10 respondents (90.3% for SNSs and 89.8% for texting), with a median frequency of use of daily for both, whereas 74.0% said they used instant messaging, with a median of several times per week. Among the 39 institutions in our longitudinal data set, a 23.2% relative decrease appears in the percentage of respondents who reported using instant messaging weekly or more often since 2006, versus a 32.6% relative increase in SNS use during the same time frame (see Figure 1-2).

Although the younger, so-called Net Generation students have more actively integrated social networking into their lives than older students, the gap between older and younger students is shrinking. Respondents ages 18 and 19 had the highest percentage of use (95.4%), with more than three-quarters (76.0%) reporting daily use. Respondents ages 20 to 24 were similarly active, with 94.7% reporting they use SNSs and 62.9% using them daily. Many articles and studies have reported the high rate of SNS use by this age group as well as the substantial growth in older users of SNSs, and the ECAR data corroborate this finding (see Figure 1-3). Whereas 18- and 19-year-old respondents from the 39 institutions that participated in each of the last four years' studies reported a consistently high use of SNSs, use by those ages 30 to 39 more than

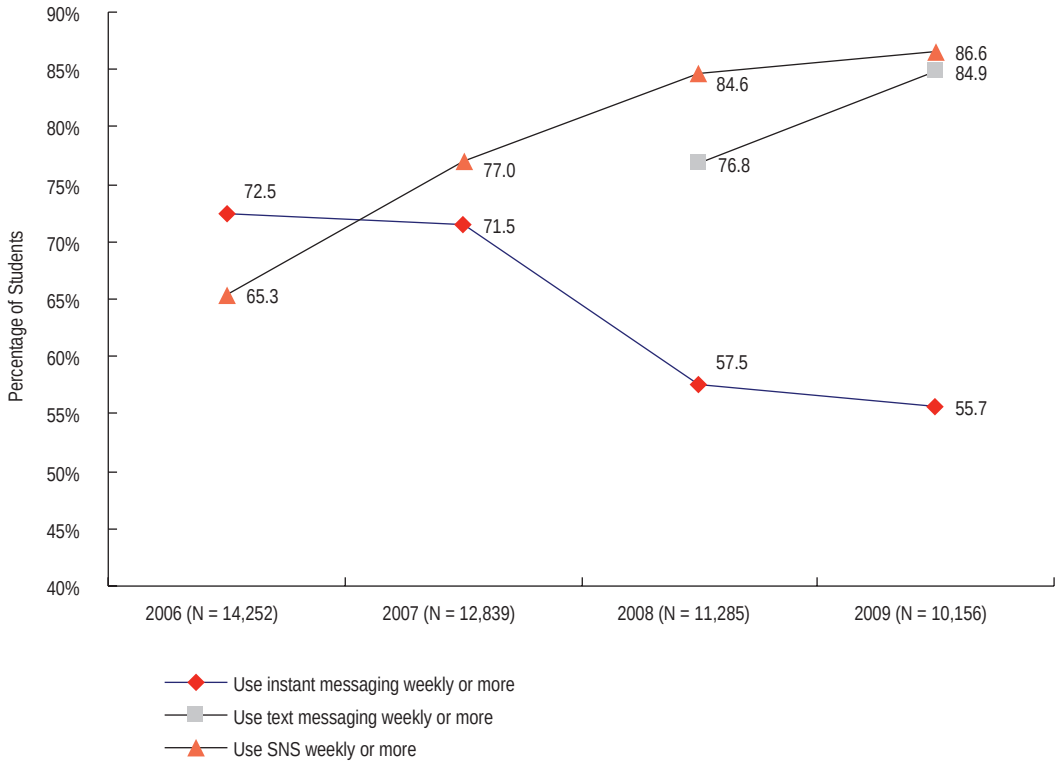

Figure 1-2. Change in Communication Technology Use from 2006 to 2009 (39 Institutions*)

**Data for four-year comparisons are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding each year were different. Use of text messaging was first surveyed in 2008.*

tripled (a 236% increase), and among the respondents 40 and older, SNS use more than quadrupled (a 326% increase).

Technology Being Used the Quarter/Semester of the Survey

After asking about the technologies students use for work, school, or recreation, the 2009 ECAR survey asked respondents which technologies they were actively using as a part of their courses at the time of the survey (February 23 through April 13, 2009). Majorities of respondents said they use the college or university library website (73.1%), a course or learning management system (70.4%), and presentation software such as PowerPoint (66.5%), and almost half (46.3%) said they use spreadsheets such as Excel.

Despite the very high percentages of personal use of SNSs, only 27.8% reported using them in a course during the quarter or semester of the survey. About a quarter (25.3%) of respondents said they use wikis, and fewer than 2 in 10 use instant messaging (18.3%), graphics software (15.5%), blogs (11.5%), and programming languages such as C++ and Java (11.1%).

In addition to the marked difference between overall use of SNSs and their use in a course during the quarter/semester of the survey, we found a similar difference between personal and academic use of podcasts and video- and audio-creation software. Although more than a third of respondents reported using these software tools at least once per year overall, only 5.8% were using podcasts, 6.0% were using video-creation software, and 5.0% were using audio-creation software in courses during the quarter/semester of the survey. These findings, similar to previous years' survey

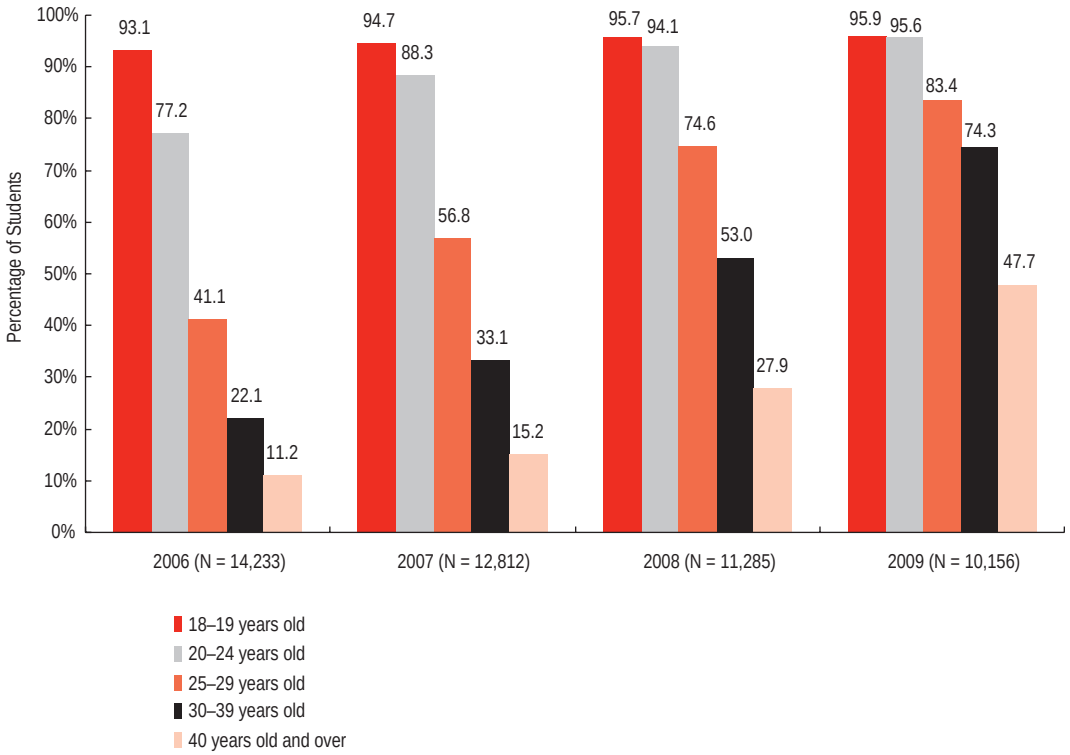

Figure 1-3. Percentage of Students Who Have Used Social Networking Websites (SNSs), by Age, from 2006 to 2009 (39 Institutions*)

**Data for four-year comparisons are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding each year were different.*

results, suggest that students are learning and using these technologies, but not necessarily for formal academic reasons.

How Students View Their Own Technology Adoption and IT Skills

Since 2006, ECAR has asked students about their "technology adoption" tendencies and explored the issue using a scale on the basis of innovativeness and timing of adoption. Respondents are given a set of statements about technology adoption and asked to choose the one that best describes them. ECAR then maps their responses into five categories: innovators, early adopters, mainstream adopters, late adopters, and laggards. Student responses about technology adoption are often strongly associated with their use and experience with IT both generally and in the academic context. Student responses have been quite consistent over the years of the ECAR student studies, and this year's respondents' answers continue the traditional distribution into a rough bell curve, with about half (51.0%) of all respondents identifying themselves as mainstream adopters. However, there is a gender gap, since more than half of males (53.8%) claimed they are early adopters or innovators, whereas only one-fourth of females (25.4%) did so.

Since 2004, ECAR has explored student skills (based on respondent self-assessment) for a set of computer technologies and information literacy practices that have been deemed important to the undergraduate experience and beyond. This year's respondents indicated they have confidence in their skills with presentation software, spreadsheets, course and learning management systems, and college and university library websites, generally rating themselves between fairly skilled and very skilled. Respondents assessed themselves lower on their use of graphics software and on computer maintenance activities such as software updates and security.

ECAR also asked three survey questions about how students view their own information literacy skills and found that respondents considered themselves quite Internet-savvy users. Eight out of 10 (80.0%) said they are very confident in their ability to search the Internet effectively and efficiently. Almost half (45.1%) rated themselves as very skilled, and another third (34.9%) rated themselves as experts. Although students' assessments of their ability to evaluate the reliability and credibility of online sources of information and of their understanding the ethical and legal issues surrounding the access to and use of digital information were lower, overall ratings are still high. Students whose technology adoption responses categorize them as innovators and early adopters ranked their technology and information literacy skills higher than other students.

Course or Learning Management Systems

Many respondents indicated that they have used course or learning management systems (CMSs). From 2006 to 2009, CMS use increased from 79.7% to 91.0% of respondents from the 39 institutions that participated in the last four years of the ECAR student studies. This year, 88.9% of our respondents reported that they have taken a course that used a course or learning management system (see Figure 1-4). Of these students, almost 8 in 10 (79.7%) were using a CMS during the quarter or semester of the survey. This translates to 70.4% of all respondents using a CMS during the current quarter/semester.

Institutions' investments in CMSs seem to be paying off in generally positive student perceptions of their use. In this year's study, most respondents who had used a CMS said their overall experience with them was either positive (52.0%) or very positive (11.2%). We also found that, like last year, respondents who used a CMS more frequently reported

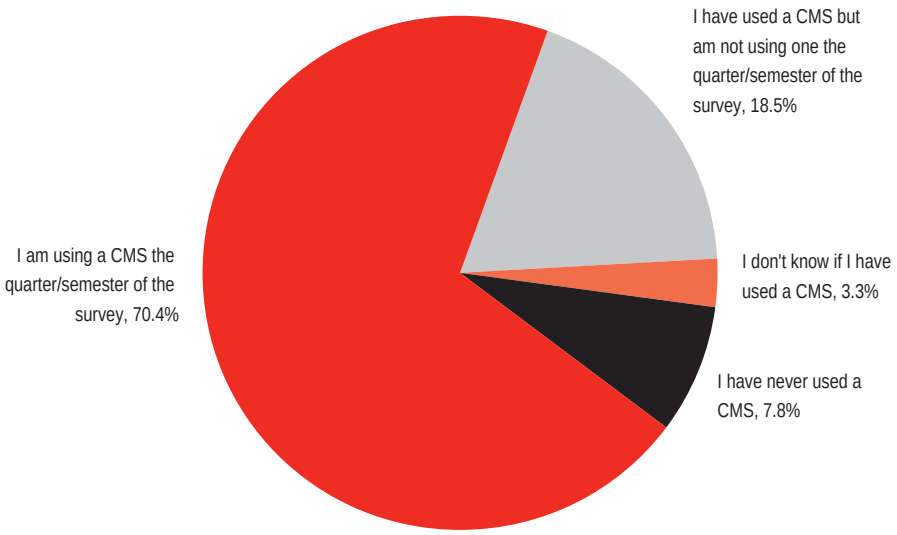

Figure 1-4. Student Use of Course or Learning Management Systems (N = 30,616)

more positive experiences. Instructors who have implemented CMS technology can take heart from our finding that nearly two-thirds (64.7%) said that they disagree or strongly disagree with the statement "I skip classes when materials from course lectures are available online." In fact, ECAR found other research studies that support the idea that posting course materials online can improve student attendance.[2]

Student Perceptions of IT in Courses

In general, respondents were lukewarm about their instructors' use of IT. Fewer than half (45.0%) of the respondents reported that most or almost all of their instructors use IT effectively in their courses. Just under one-half (45.9%) said most or almost all instructors have adequate IT skills for carrying out course instruction, and barely a third of the students (33.8%) said that most or almost all of their instructors provide them with adequate training for the IT in their courses. Like last year, the distributions of responses for these questions are surprisingly consistent across student demographics and types of institutions.

Because IT is integrated with many of the student engagement activities that influence college success, ECAR created four positive "outcome statements" about the impact of IT in courses and asked students whether they agreed or disagreed with them:

- "I get more actively involved in courses that use IT."
- "IT makes doing my course activities more convenient."
- "The use of IT in my courses improves my learning."
- "By the time I graduate, the IT I have used in my courses will have adequately prepared me for the workplace."

As in last year's study, this year's respondents were most positive about IT's impact on convenience. Those who agreed (70.4%) far outnumbered the combined disagree and neutral responses (29.7%). This is not surprising, since we have found in both the quantitative and the qualitative data of past studies—and again this year—that students say convenience is the most valuable benefit to IT in courses. When asked if the use of IT in courses improves their learning, about half (49.4%) of respondents agreed or strongly agreed. Another 39.0% of respondents were neutral about whether the use of IT in classes improves their learning, and 1 in 10 (11.5%) disagreed or strongly disagreed with the statement. About half of respondents (46.8%) agreed

that upon graduation the IT used in their courses will have adequately prepared them for the workplace.

Since ECAR began the student survey in 2004, we have asked students how much IT they prefer in their courses, using a 5-point scale from "no IT" to "exclusive IT." Our respondents have been remarkably consistent in their preference for only a moderate amount of technology in courses (between 55% and 60% for the last four years). Despite the large proportion of our respondents who belong to the Net Generation and have grown up digital, respondents indicate they still appreciate the face-to-face learning experience. Our 2009 survey shows the same trend, with 59.6% of respondents saying they prefer moderate IT in their courses and fewer than 6% of respondents preferring the extremes—either no IT (2.0%) or exclusive IT (3.5%) in their courses.

Because respondents in previous surveys expressed concerns about accessing IT services due to occasional interruptions of the network, unavailability of the CMS, difficulty uploading/downloading files, etc., we asked whether they agree or disagree with the statement "My institution's IT services are always available when I need them for my coursework." In results similar to last year's, only half (52.6%) of the students agreed or strongly agreed with the statement, about a third said they were neutral (32.5%), and 15.0% disagreed or strongly disagreed that their institution's IT services are always available when needed for coursework.

Undergraduates and the Mobile Revolution

This year, ECAR chose student ownership and use of Internet-capable handheld devices for the survey focus area because we felt the appearance and adoption of a new generation of devices could have a significant impact on students and higher education institutions. About half of the respondents (51.2%) indicated they own an Internet-capable handheld device, and another 11.8% said they plan to purchase one in the next 12 months (see Figure 1-5). This figure should be understood in the context of near-ubiquitous cell phone ownership among students; the ECAR 2007 student study reported simple cell phone ownership at 86.1% of respondents (and smartphone ownership at 12.0%). Though this ubiquity led us to drop the simple cell phone ownership question in 2008, very high ownership of at least a basic cell phone is implied in our current study finding that 9 out of 10 student respondents (89.8%) were engaged in text messaging, with a median use of daily. Note that ownership of an Internet-capable handheld device does not ensure that the Internet function will be used, since more than a third (35.4%) of respondents who own them said they never use that feature.

ECAR identified four emerging types of student adopters of mobile Internet use:

- *Power users.* More than a quarter of respondents owned handheld devices and used them to access the Internet weekly or more often.
- *Occasional users.* Fewer than 1 in 10 respondents owned handheld devices but used them to access the Internet monthly or less frequently.
- *Potential users.* About 30% of respondents either currently owned an Internet-capable handheld device but never used it to access the Internet or didn't own an Internet-capable handheld device but said they planned to purchase one in the next 12 months.
- *Non-users.* One-third of this year's respondents didn't own an Internet-capable handheld device and didn't plan to own one in the next 12 months.

To better understand the issues that delineate these users, ECAR asked respondents, regardless of whether they owned an Internet-capable handheld device, to select up to three reasons that kept them from using

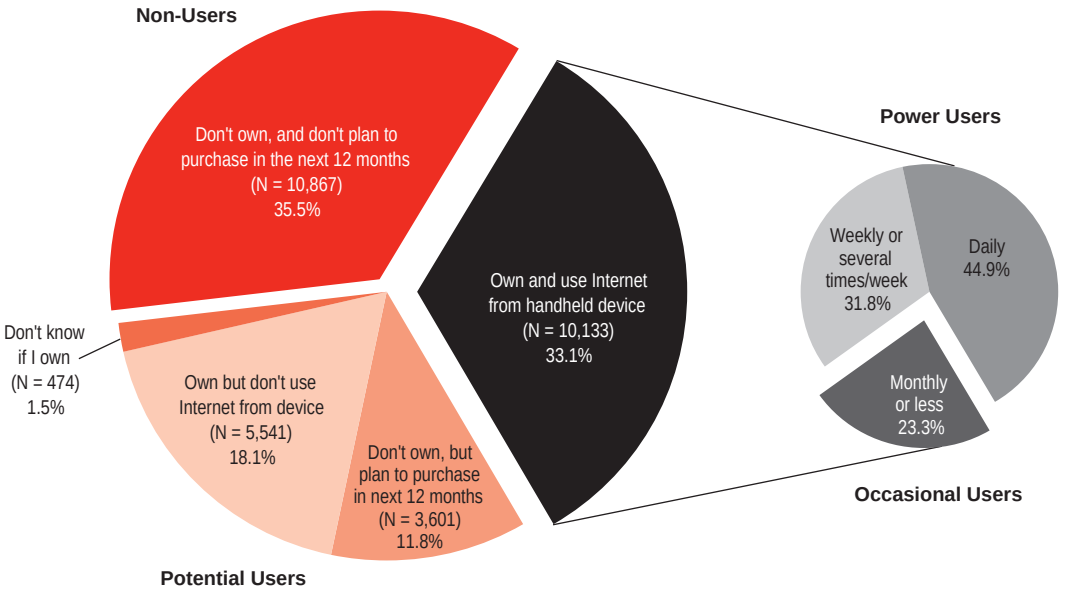

Figure 1-5. Ownership and Use of Internet-Capable Handheld Devices (N = 30,616)

the Internet, or using it more often, from a handheld device.

The reason selected most was that plenty of other ways are available to access the Internet (49.9%). Expense was also a factor: Cost of the data service was selected by 46.2% of the respondents, and cost of the device was chosen by 36.4%. Those who didn't own devices cited such cost factors much more often than those who did. Another 15.4% of student respondents indicated that a reason they don't access the Internet, or use it more often, from a handheld device is that they find no compelling reason to access the Internet.

When ECAR asked respondents who said they use the Internet from a handheld device what Internet activities they do from their devices (selecting all that apply from a list of 13 activities), the most popular activity, chosen by 76.7% of the respondents, was checking for information such as news, weather, sports, specific facts, etc. We also found that more than half of the respondents (58.7%) said they connect to the Internet from their handheld devices to use maps, find places, get directions, or plan routes. Other activities identified by respondents were using e-mail (75.1%) and SNSs (62.5%) from their handheld device.

Those who used the Internet from their handheld device on a daily basis were more likely to be technology early adopters or innovators than were those reporting less frequent use. A majority of those who reported using the Internet monthly or less often were mainstream adopters, and those who said they never use the Internet capability had the highest proportion of laggards and late adopters of all the use frequency categories. Some of these students may eventually become mobile Internet users, since more than 4 in 10 respondents overall (44.5%) agreed or strongly agreed that in the next three years they expect to do many things on a cell phone or handheld Internet device that they currently do on a laptop or desktop computer. Current users also anticipated that their use of mobile services will grow, since almost three-quarters (73.7%) of respondents who currently own an Internet-capable handheld device and access the Internet from their handheld device said they expect their use of the Internet from a handheld device to increase or greatly increase in the next three years.

Mobile Devices in the Academic Environment

ECAR also asked questions regarding respondents' current and expected use of handheld devices in an academic context. The

first thing we wanted to know was whether students were using mobile devices, Internet-capable or not, in the classroom. Instructors will probably not be surprised to learn that almost a third of respondents (32.2%) agreed or strongly agreed with the statement "While in class, I regularly use my cell phone or handheld Internet device for *non-course* activities." When asked if they use their handheld devices for *course*-related activities, only 11.3% agreed or strongly agreed.

Quite a few respondents commented on the distraction that mobile phones were causing in the classroom, and when we asked students if instructors should have the authority to forbid the use of cell phones and handheld Internet devices during class time, half (50.5%) agreed or strongly agreed that they should. Agreement was much higher among older than among younger students.

Asked to select the three institutional IT services they are most likely to use, if available, from an Internet-capable handheld device, respondents who currently own a handheld device and use the Internet from it selected as their top three e-mail system (63.4%), student administrative services (official grades, registration, etc.) (46.8%), and course or learning management system (45.7%).

Emergency Notification

For the first time, the ECAR 2009 student survey asked, "How should your institution first notify you of a campus emergency?" Results indicated a clear preference for using text messaging, with just over half the respondents (55.3%) choosing that option and far fewer choosing e-mail, voice telephone call, public-address systems, and other options. Respondents to the 2009 ECAR study *Spreading the Word: Messaging and Communications in Higher Education* gave SMS text messaging a relatively high mean confidence rating as an emergency notification channel, although it came in lower than e-mail, outdoor public-address systems, and dedicated emergency websites.[3] This evidence of institutional confidence and popularity with students, however, doesn't tell the whole story. As a recent *EDUCAUSE Review* article pointed out, using text messaging as an emergency notification system has several disadvantages, including inherent design problems, the opt-in process, character limits, and vulnerability to abuse.[4]

Conclusion

Most of the respondents to ECAR student studies fall into what is frequently described as the Digital Generation or Net Generation. They are comfortable with many of the technologies we asked about, including some, such as e-mail, that we no longer query about because the technology has moved through the adoption cycle and has become all but ubiquitous. Despite their general comfort with technology, our respondents have been surprisingly consistent over the years in both technology adoption and desire for technology in the classroom. They are more likely to describe themselves in terms of mainstream adoption of technology, and they consistently report that they prefer only a moderate amount of IT when it comes to their courses.

Although a majority of respondents to the ECAR student survey don't identify themselves as what we call early adopters or innovators, it appears that a revolution in undergraduates' use of the mobile Internet has already begun. A quarter of the respondents to this year's study told us they are using handheld devices weekly or more often to access the Internet. This level of use may not be taxing the support capacity of higher education IT departments at the moment, but if the numbers of users increase, as they likely will if the cost of mobile Internet access drops, institutions could be quickly overwhelmed with demands for technical support and development of new mobile services.

Will student adoption outpace institutional support capability, or will institutional support rise to the challenge of student demand? Perhaps institutional implementations of mobile services will encourage even more student use of the Internet from handheld devices. In the *EDUCAUSE Quarterly* article "The Revolution No One Noticed: Mobile Phones and Multimobile Services in Higher Education," Alan Livingston describes college students' use of mobile technology as "a revolution no one noticed," one that is laden with opportunity to improve the educational environment for college students."[5]

No matter how extensively the mobile revolution—or any other technology-based disruption for that matter—impacts higher education, respondents to our survey consistently tell us that they want to see the use of IT balanced with the human touch in their academic environment. In their responses to the final open-ended question of our survey, students wrote explicitly about a preference for "real books and people" and said that "shiny new tech is still no substitute for well-trained, passionate instructors." Of the many comments expressing this sentiment, perhaps this one summed it up best: "There is still a big disparity among academic staff when it comes to use of IT in class. Some professors are obsessed with their technology and some don't like to use it at all. There needs to be a balance between human interaction and IT-based learning."

Endnotes

1. For comparison of 2006, 2007, 2008, and 2009 data, we used data from the 39 institutions that participated in the student study each of these years. Although the institutions remained the same, they surveyed different students each year. [See Gail Salaway, Richard N. Katz, and Judith B. Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2006* (Boulder, CO: EDUCAUSE Center for Applied Research, 2006), Gail Salaway and Judith Borreson Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2007* (Boulder, CO: EDUCAUSE, 2007), and Gail Salaway and Judith Borreson Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2008* (Boulder, CO: EDUCAUSE Center for Applied Research, 2008), all available from http://www.educause/edu/ecar.]
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2
Introduction: Higher Education—A Moveable Feast?

Richard N. Katz, ECAR

Despite our multibillion-dollar place-bound campuses, in spite of our nearly religious devotion to the discipline of the academic calendar, and even in the face of the modern-day linkage of academic success and "time in seat," education is a moveable feast. Close study of Raphael's incomparable painting *The School of Athens* is a study in fluidity. Plato, Aristotle, and other great philosophers engage in inquiry not in orderly rows of chairs facing the sage, but in clumps of discussants in various states of motion. In the Middle Ages, European centers of learning such as Paris, Orleans, and Chartres were familiar with what were known as *vagantes*, "wandering scholars," who had a unique role in transmitting knowledge and developing culture from the 10th century to the end of the 13th. Throughout early modern Europe, roving bands of scholars, dissolute students, minstrels, clerics, and other so-called *ribaldi* (rascals) roamed the countryside in search of *tuition*—a sum of money paid for instruction, inspiration, or entertainment.

The needs of both the Roman Catholic Church and the evolving nation states of Europe for educated men, combined with the increasing immobility of the tools of scholarship, conspired both to suppress the *vagantes* and to nurture the emergence of great universities at Oxford, Salamanca, Pisa, Bologna, Paris, and elsewhere. Early universities amassed and housed great collections, built expensive surgical theaters, and provided safe, dry spaces for the conduct of classes. The medieval lecture theater and seminar rooms are recapitulated in today's modern university, and indeed some medieval lecture halls continue in use today.

Learning has thus become relatively fixed in place. One enrolls at a college or university where one is supposed to engage in formal learning in fixed places and at fixed times. In the American—and increasingly global—form of higher education, "time on task" is the surrogate for academic intensity and depth. Seat time and course credits are linked. Student time in the classroom—believed to be correlated with homework levels—is similarly understood to be one proxy of academic attainment. These careful linkages were not and are not either crazy or unreasoned. Indeed, they reflect the increasing attempts to render the craft of teaching, which is bedeviled with great variability of effort and outcome, into a standardized, industrialized product designed to accelerate the production of literate churchmen and statesmen—and later engineers, military officers, and technocrats. Immobility is efficient, albeit neither fun nor uniformly effective for all learning styles. More important, the tools of our time—until

very recently—left us no practical choice. To a very great extent, the textbook is the first technology to liberate some modern students in institutional settings from the implacable fixity of the classroom. For most of us, with or without the textbook, academic success meant attending class and participating verbally in class as well as succeeding in assessments, writing assignments, experiments, and other course activities. Because we are well socialized to the textbook, we find it easy to forget that both textbooks and graded assessments are only 200 years old, having originated at the U.S. Military Academy at West Point and at Yale University.[1]

Does Learning Happen Only in a Fixed Place?

The question posed at the heart of this ECAR study is whether the emergence of computers and the network, and the proliferation of easy-to-find and easy-to-use web-based information resources, alters the student's relationship to the familiar physical trappings of a higher education. The answer seems unquestionably to be yes when the discussion is limited to the so-called nontraditional student who can be, nearly by definition, only loosely and inconveniently attached to the physical infrastructure of the academy. The accent on this question becomes more striking as new tools emerge that make it possible for us to enjoy the benefits of network connectivity without requiring a physical connection to the campus and its network. These tools, which are breathtakingly good, are communicating devices, computing platforms, e-book readers, GPS devices, and more.

Among other things, this ECAR study takes a closer look at emerging technologies related to so-called mobility and to their socialization (or not) by today's students. ECAR asks the first question: Are you equipping yourselves for a mobile learning possibility? At a deeper level, of course, we are interested in the continuum: Do you own handheld equipment that links you to people and other academic and social resources? Are you using this equipment? Are you using this for academic purposes? If so, is your new tool or new medium changing your experience as a student and as a learner? Are new tools and media simply making what a student does more convenient, or are they changing how and when students engage with the institution as a place?

Even though we are stewards of globally recognized institutional brands and in some cases of very valuable real estate, we need to be aware that the success we have enjoyed in higher education's current form does not assure us of success in the forms that colleges and universities may assume in the future. The art of handwriting—cultivated over centuries—is becoming an artifact of another age. Newspapers—beloved by many for centuries—are being transmogrified or snuffed out. We wonder—as we crawl, walk, run, or race to integrate new technologies *into the classroom*—whether students are organizing these and other technologies to *replace the classroom*. This is no different from the thoughts of some newspaper executives who might have worried that while they were exploring ways to standardize, economize, and globalize print on paper, readers, bloggers, and others were rejecting and replacing newspapers with new and more current and malleable media.

Is the Demise of Place So Far-Fetched?

Between 2004 and 2006, the Oxford University Conference of Colleges, an all-university body in the United Kingdom, debated the concept and the language of contracts that would bind students to attend lectures and tutorials. The measure, had it passed, would have required students to sign a legally enforceable contract stating that the student shall "undertake to pursue such

studies as are required of you by any tutor...or other qualified person assigned by the college to teach you." According to one student reporter, this set of requirements implied "carrying out practicals, the completion of written work, attending tutorials, classes and lectures, and sitting [for] university and college exams."[2]

The issue at Oxford University and elsewhere is one of higher education's dirty little secrets: Lectures, tutorials, and seminars are frequently poorly attended. Enrollment in blended, distance, and other e-learning classes is rising. The empty classroom could become the unintended and ironic icon of the academic institution in the Information Age. Students appear to be using information and communication technologies not only to facilitate their instructor-mediated experiences but also in some cases to replace face-to-face mediation of instruction with other means. In one telling sign, Twitter, a microblogging offering that provides its users the ability to post messages of up to 140 characters, was reported as having won more than 6 million unique monthly visitors as of February 2009. In another, *USA Today* on September 9, 2009, devoted three-quarters of a page to report the story of an "English major, 24, [who] rambunctiously recaps the classics in 60-second Web videos."[3] It seems clear that the nature of discourse, including academic discourse, is changing, perhaps confirming Marshall McLuhan's prediction that "the future of the book is the blurb."

The ECAR data in this 2009 study of students and information technology strongly suggest that significant numbers of students are using a wide variety of technologies in sophisticated ways. They are finding that tools such as the web, course management systems, and others are valuable resources in making their lives convenient, giving them control over broad tracts of their social lives, their work, and their learning experience, and in facilitating their learning. Already a broad base of students have followed the market in their preference for laptop computers. Nearly 9 of 10 (88.3%) students today at the 39 institutions that have participated continually in the ECAR study since 2006 own a laptop computer. Only 65.4% of their predecessors owned such devices. On average, they spend between 19 and 25 hours per week online. More than 4 respondents in 10 (44.8%) contribute content to video websites such as YouTube, and more than 1 in 3 (37.3%) say that they contribute to blogs.

What about Mobility?

Simple observation informs us, as John Horrigan argues, that "mobile access to the Internet is taking root in our society."[4] Starbucks, Borders, Barnes & Noble, and other book and coffee outlets—along with other businesses—have organized to make the retail shop a campus adjunct. Colleges and universities are fighting latte for latte. Many institutions are building so-called "information commons" to keep students on campus. "At the University of Texas at Austin, for example, most of the 90,000 volumes formerly in the undergraduate library were replaced by a coffee shop, public computers, comfortable chairs, and 24-hour technical help."[5]

And what of handheld devices? ECAR studies, the *Student Monitor*, and other resources have long established that young people in many ways have led a mobility revolution in voice communications and mobile music. The Apple iPod has become the iconic symbol of the 21st-century collegiate learner, and creating audio recordings of academic lectures has become accepted and widespread within U.S. higher education. Apple's iTunes U by September 2009 claimed that more than 200,000 educational audio and video recordings were available via their service.[6] The introduction of the iPhone in 2007 and the iPhone 3G in July 2008 have only accelerated a market rush to mobility. Now all of us, including students, have access to handheld

platforms that can perform computationally sophisticated work, carry telephone traffic, play music, make music, and so much more. On September 17, 2009, Apple approved a record 1,394 computer applications for the iPhone platform—in a single day![7]

Beyond our general observations, the literature suggests that students are riding the wave of mobility. E.marketer.com, for example, reported that more than 80% of iPhone users accessed news or information via a browser on their iPhone. That firm also reported that 27% of mobile searchers ages 18–24 were likely to use mobile search frequently or occasionally in the three-month period from October 31, 2008, to January 31, 2009. At the same time, when the University of New Hampshire School of Business students were asked how they used their mobile devices, the dominant uses reported were talking (90%), text messaging (86%), and as an alarm clock (80%).

Chickens and Eggs

The mobility story in higher education, like nearly every story of academic technology adoption, is a story of chickens and eggs. To date, we may infer the following from observation, anecdote, secondary literature, and the ECAR data:

- Converged or "intelligent" mobile devices are being consumed or coveted on a widespread basis both within society at large and among students in higher education.
- Use of a converged mobile device is still immature. The March 2009 Pew study *The Mobile Difference*[8] uncovers 10 distinct segments of adults—including digital collaborators (8%), ambivalent networkers (7%), media movers (7%), roving nodes (9%), mobile newbies (8%), desktop veterans (13%), drifting surfers (14%), information encumbered (10%), the tech indifferent (10%), and those who are "off the network" (14%).
- The "uptake" of mobile technologies likely will be paced by six factors:
  - *Natural segmentation.* The existence of natural segments distinguishes users of technology along a technology diffusion curve.
  - *The economics of mobile computing.* Current high charges for data roaming and other "value-added" services will contain growth, especially among students of limited means. Indeed, to the extent that mobility becomes a core facet of an institution's offering, a new aspect of the digital divide will need to be reconciled.
  - *The dearth of institutional learning, research, and administrative applications.* Although hundreds of thousands of applications have been written for the iPhone already, higher education academics and administrators need to discover, stockpile, and provide access to applications that are built to students' academic purposes.
  - *Training.* Once again, a new set of platforms with three operating systems is being introduced. Faculty need (again) to become conversant with these technologies and also to rethink how fixity and mobility can be rearranged in support of learning and research. Similarly, instructional technologists need to add mobility solutions to their arsenals of instructional support for the faculty. Finally, the enterprise IT staff need to devise a strategy, a funding base, and the competency to deploy enterprise application functionality on mobile platforms.

- *Student preparedness.* Although the popular literature is quick to tout the virtues of the so-called Net Generation, ECAR studies—and others—suggest that students are a more nuanced and segmented population. Many students will struggle with mobility technologies as they have struggled with earlier technologies. Some will reject these technologies categorically. In any case, we must be mindful of the heterogeneous nature of the student population with regard to IT skill, predisposition, interest, and capability as we make plans to integrate mobility into our courses and academic programs.
- *Support and standards.* College and university enterprise IT organizations will need to organize, staff, and resource around support for mobile hardware and software, as well as explore and implement standards. Included in this factor is the need for IT organizations to implement security, e-discovery, risk management, and other forms of policy and operational support for mobility.

The mobility market, perhaps more than others, will mature rapidly, and its maturation will be paced by developments in the broad consumer economy.

The infrastructure, applications, usability, and economic gaps between mobility offerings in the consumer market and in higher education may become problematic. If mobile learning (m-learning) takes root with students and with others outside the traditional colleges and universities, the mobile difference may be one that places our traditional institutions at another competitive disadvantage.

From E-Learning to M-Learning

Networking giant Cisco maintains a variety of indexes to help it forecast trends in network usage. One such index—the Visual Networking Index Mobile Forecast for 2008–2013—predicts that global mobile data traffic will increase 66-fold between 2008 and 2013, with a compound annual growth rate of 131% during that same period.[9] This growth will be driven in part by the deployment of fourth-generation (4G) mobile Internet standards that will increase our capacity to use video mobile, including mobile teleconferencing. These capabilities will once again change how all users, including members of the higher education community, experience the Internet and its services and resources. Combined with ongoing improvements in e-learning tools, the increasing interoperability of so-called open resources, improvements in hardware price performance and in relevant mobile applications, and the evolution of virtual environments purpose-built for learning and collaboration, this progress suggests that the future of much higher education will be mobile, virtual, and accessible as services over networks.

A major driver of the rapid adoption of mobility technologies will be convenience. Mobile technologies enable users to exploit idle time. Sitting on trains, waiting for buses or subways, or lingering over morning coffee, one can read the news, catch up on e-mail, organize calendars, plan travel routes, make reservations, and contact colleagues. Putting the temporal interstices of our lives to good use means that we can recapture time, which is the scarcest resource of all in the Information Age. Additionally, mobile technologies liberate us from factual ignorance. How many of us have sat in a meeting or a classroom where a factual question of consequence is raised, only to be answered in seconds by a person with a smartphone?

A world where convenience and time management mean everything and where mobile access to information and resources makes us all capable of self-organizing and self-servicing suggests an opportunity for us to rethink teaching, learning, and discovery. It suggests a rethinking, in fact, of the very nature of *place* in the educational experience. An important question for members of the college and university community then is whether or not our approaches to mobility will follow the same path as many of our past initiatives—waiting for a critical mass of faculty early adopters or student adopters to wrench slow and grudging investments from the enterprise. The underlying question here is whether higher education is approaching a tipping point. Are the developments in mobility, cloud computing, open access, assessment, and elsewhere substantial enough to create a significant competitive benefit to newcomers who are less inclined by their institutions' governance and history to constrain and condition their approach to the changing environment? Just as high-energy physicists no longer need to be connected to CERN to study data from the Large Hadron Collider, will our students soon be able to take advantage of highly mobile, network-dependent educational offerings?

Conclusion

The technologies and practices lumped together under the broad heading "mobility" are potentially disruptive technologies, especially to institutions for which "place" has special meaning. Higher education, of course, is one such institution. Educators and technologists must begin a dialogue that views place as one important element in a broader educational strategy. Just as many institutions have socialized the concept of study abroad within their academic program offering, so must we now reexamine our deep notions about time-on-task, seat time, residency, and other place-bound notions. Mobile technologies can only for a short time be pushed and bent to fit the forms of our historical delivery approaches. Oxford University is not the only institution stirred—or perhaps haunted—by the specter of empty lecture halls. Marshall McLuhan reminds us that the past dissolves before the future resolves. So now we can imagine students who are empowered with a battery of dazzling technologies to uncover facts, ascertain relationships, test hypotheses, and vertically integrate much of the scholarship that was offered to many of us as fragments. It is possible, within such a vision, to imagine the obsolescence of the academic mentorship, or the inconvenience of the campus. In a world that is being reconfigured by clouds, by mobility, and by the 24-hour-a-day availability of unprecedented news, data, textual resources, services, and videos, our task is one of integration.

For the information technologist, we must create views of the institution and services of the institution that follow the student. If the student is peripatetic, then our IT infrastructure, applications, and services must be mobile. We must continue to improve our ability to express our institutions' uniqueness and character in their online spaces. Although in the future more and more of our students will not need to be "on" the institutional campus, our virtual environments must reinforce those students' sense of affiliation with us. We must work with our instructors to devise new means of making academic mentoring services available 24 hours a day *without* making faculty jobs infeasible. Faculty must deconstruct, debate, and then reconstruct long-cherished beliefs about the nature of scholarship. We must reexamine the meaning of plagiarism in a world of cocreation and ask ourselves what is authorship or "an original contribution" in the digital context. Although a great historian or archaeologist could verify a source's authenticity by touch, sight, or even smell (or by carbon dating or chemical analysis!), the digital presentation of primary information devalues these skills and

calls for the development and enculturation of new ones. Concepts such as reliability, authenticity, provenance—the building blocks of critical thinking—are subject to change and require new conceptualizations in the digital context.

Finally, although mobility and convenience are appropriately and inextricably linked, and although mobile access to data, services, and the like makes it possible to render the dead spots of our lives usable, we need to explore the fundamental price we are paying for admission to the Digital Age. We can accelerate learning, we can make it convenient, and we can arguably improve learning outcomes with a variety of information technologies. Are we improving erudition and the process of scholarship? Are we creating room for reflection, an activity long held to be essential to deep learning and to scholarly preparedness?

The challenges and opportunities posed by mobile technologies are great. We can learn anywhere and anytime, and this is liberating. It is also socially satisfying, since it suggests that learning will also be accessible in new forms to those who have been denied access for a variety of reasons. But the road to acculturating mobile technologies is littered with challenges—organizational, financial, technical, and pedagogical. And although the data suggest that this new revolution is not quite upon us, we clearly do not have a great deal of time to prepare the ground. In addressing these challenges, we must remain aware that whatever technologies we deploy, they must be friendly and unobtrusive elements of the background. For many years now, undergraduate first-year and fourth-year students have told ECAR that they prefer a moderate amount of technology in their academic experience. They want technologies that are not in the way, and they clearly value direct and face-to-face interactions with one another and with the faculty. We need to be mindful that the student body is not monolithic, and therefore place will occupy a different niche in each student's hierarchy of needs.

Educational entrepreneurs likely will run with these new technologies. They will eschew the multimillion- (or billion-) dollar investments we have made in physical infrastructure (place) and instead will focus on student convenience. For those of us who resonate to the background sound of a campus creek as we discuss the Great Books with our classmates and mentors, the call of the newcomers will be tinny and scratchy. For those of us with jobs, husbands, wives, kids, and no time, our idyllic settings pose just another parking problem. Most students will likely toggle between the pressures of busy lives and the sincere love of the physical learning environments we have constructed. Our challenge, again, is to reimagine place as one important element in a broader educational strategy and to temper our deep understanding of place with insights and investments in "connection" in the digital world.

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3
Methodology and Respondent Characteristics

P.S. I completed this survey from my iPod touch.
—An undergraduate student

The ECAR study of undergraduates and information technology (IT) was launched six years ago to help inform college and university leaders, technology staff, and faculty as they make critical decisions about their institutions' technology investments and implementations. To complete this study, ECAR collects, analyzes, and reports on both qualitative and quantitative data that profiles undergraduate use of technology in general and as it pertains to the academic experience. This information is particularly relevant to administrators responsible for deploying the overall campus technology environment and is useful to instructors and instructional technology staff as they decide how to incorporate IT into the curriculum.

Questions about undergraduates' use of IT in and out of their courses as well as perceptions about IT's impact on the academic experience form the core of the survey. Last year, ECAR began to incorporate a special focus area—a more in-depth set of questions about a topic that is currently important to higher education—that will change with each year's study. For 2009, noting the importance of mobile communications in student culture and sensing that a new generation of devices could make computing even more ubiquitous and personal, ECAR chose student ownership and use of Internet-capable handheld devices for the survey focus area. Although this is our special focus area for 2009, we anticipate tracking the impact of handheld Internet devices in the academic environment in future studies as well.

Methodology

The 2009 study builds on and extends previous studies and consists of the following data collection and analytical initiatives.

Literature Review

ECAR conducted a literature review to identify relevant issues as well as to support survey analysis. This year's review expands upon the 2008 literature review and includes a review of other relevant surveys. The bibliography appears in Appendix E.

Web-Based Survey

A web-based survey of college and university undergraduates provided the quantitative data about student experiences with IT in higher education. This year's survey was based on the 2008 survey with a few minor changes to some core questions. In addition, a section was added to include questions about the focus area (student ownership and use of Internet-capable handheld devices). The online survey appears in Appendix B.

ECAR then invited institutions to participate in the survey, asking participating BA, MA, and doctoral institutions to sample their freshman and senior students. Each university used a different sampling model, and a number of them chose to include their entire freshman and senior classes. Associate's institutions were asked to sample their student body without regard to class standing. In the absence of weighting of institutional responses, this means that the results can be generalized to the sampled students but not to the 115 institutions.[1]

Student Focus Groups

ECAR collected qualitative data by means of student focus groups at Grand Rapids Community College; Hamilton College; the University at Albany, SUNY; and the University of Wisconsin–Stevens Point. The interviews included as diverse a group of students as possible. A total of 62 students participated in the focus groups, and each focus group meeting lasted for an hour. The focus group interview questions appear in Appendix C.[2]

Student Comments

Approximately 7,000 students responded to the open-ended survey question to provide more information about their views of IT. They expressed opinions on their use of and skill with IT, the state of their institutions' IT support services, their perceptions of technology use in their courses, and their experiences with handheld devices. These comments were not statistically analyzed using a content analysis tool; however, many comments provided additional insight into the substance of the quantitative data, and a few were incorporated into the text of the study.

Longitudinal Analysis

Data from the 2006, 2007, 2008, and 2009 surveys were compared where possible to identify any significant changes over the past four studies. Where questions were consistent over this time period, ECAR was able to use comparative data from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Where survey questions were consistent over the past three surveys, ECAR used comparative data from the 53 institutions that participated in 2007, 2008, and 2009, and for the past two surveys, ECAR was able to use comparative data from the 71 institutions that participated in both of the 2008 and 2009 studies. However, it is important to note that this study does not attempt to follow the same students over time.

Analysis and Reporting Conventions

The following conventions are observed in analyzing and reporting data results:

- Some tables and figures presented in this study include fewer than the total 30,616 respondents from the 115 U.S. and Canadian institutions. In this case, they were adjusted for missing information or to reflect a subset of responses as indicated by the table or figure title.
- Percentages in some charts and tables may not add up to exactly 100.0% due to rounding.
- The Likert scales used in the online surveys are footnoted in the tables and figures showing results for these survey questions.
- We use the term "four-year institution" to refer generally to institutions that award baccalaureate degrees, regardless of whether those are the highest degrees they award. When we break out results by class standing, "freshmen" and "seniors" always refer to students from four-year institutions who report those class standings, whereas community college students are presented as a single class-standing category.

- Significant associations between survey questions (variables) that were both statistically significant and meaningful were reported in the text and/or supporting figures and tables. Note that a statistically significant relationship between two variables doesn't necessarily indicate a causal relationship.

Participating Institutions

Participation in the study was voluntary, and each institution obtained approvals from its institutional executives and its Institutional Review Board (IRB).[3] Therefore, the institutions participating in the study do not constitute a statistical representation of U.S. and Canadian higher educational diversity as a whole (see Table 3-1). Specifically, they are overwhelmingly four-year institutions (103 out of 115 U.S. and Canadian institutions participating). Responses are further biased toward doctoral institutions (55.6%), larger institutions (67.3% enroll more than 8,000 students), and public institutions (74.3%). Findings are therefore considered to be instructive or indicative rather than conclusive of student experiences at different types of institutions. Even considering these biases, the 114 U.S. institutions that participated in this study do reflect a mix of the different higher education institution types in the United States, in terms of Carnegie class, size of institution, private versus public status, sources of funding, and levels of technology emphasis. In 2009, 12 associate's (AA) institutions accounted for 8.2% of student respondents, whereas in 2008 fewer AA institutions (8) participated, but their respondents made up 12.2% of the respondent base.

Table 3-1. Profile of Participating Institutions

	Number of Institutions (N = 115)	Number of Respondents (N = 30,616)	Percentage of Respondents
Carnegie Class			
DR	53	17,016	55.6%
MA	36	8,219	26.8%
BA	11	1,843	6.0%
AA	12	2,522	8.2%
Other	2	376	1.2%
Canada	1	640	2.1%
Student FTE Enrollment			
1–2,000	10	1,404	4.6%
2,001–4,000	13	1,947	6.4%
4,001–8,000	26	6,679	21.8%
8,001–15,000	31	8,808	28.8%
15,001–25,000	21	7,503	24.5%
More than 25,000	14	4,275	14.0%
Control			
Private	38	7,852	25.7%
Public	77	22,722	74.3%

Respondent Characteristics

Invitations to participate in the survey were sent by e-mail to more than 290,000 students—seniors and freshmen at 103 U.S. and Canadian four-year institutions and to general students at 12 community colleges (see Appendix D).[4] A profile of responding students appears in Table 3-2. Although four-year institutions invited only seniors and freshmen, some students responded "other" when asked "What is your class standing?" These students' understanding of their own standing differed from that of the official institutional record. In addition, 169 students did not respond to this question at all.

Of the respondents from four-year institutions, 34.2% were freshmen, 44.5% were seniors, and 13.0% replied "other" to class standing. Community college students make

Table 3-2. Profile of Student Respondents

	Four-Year Institutions			Two-Year Institutions	Total
	Seniors (N = 13,553)	Freshmen (N = 10,400)	Other (N = 3,972)	All Students (N = 2,522)	All Students (N = 30,447)*
Gender					
Male	39.3%	39.1%	38.0%	32.4%	38.5%
Female	60.7%	60.9%	62.0%	67.6%	61.5%
Age					
18-19	0.5%	92.2%	13.4%	19.4%	35.1%
20-24	76.7%	5.1%	63.2%	30.1%	46.6%
25-29	9.6%	1.2%	8.4%	14.1%	6.9%
30-39	6.8%	0.9%	8.0%	16.5%	5.7%
40-49	4.4%	0.4%	4.9%	12.1%	3.7%
50 and over	2.1%	0.2%	2.1%	7.8%	1.9%
Residence					
On campus	20.9%	75.9%	36.9%	4.2%	40.4%
Off campus	79.1%	24.1%	63.1%	95.8%	59.6%
Full/Part-Time Status					
Full-time	87.1%	97.2%	85.5%	51.3%	87.4%
Part-time	12.9%	2.8%	14.5%	48.7%	12.6%
GPA					
A	19.7%	17.2%	23.1%	24.5%	19.7%
A–	25.7%	22.4%	24.9%	18.4%	23.9%
B+	21.0%	18.8%	18.8%	18.9%	19.8%
B	16.2%	16.9%	15.8%	13.4%	16.1%
B–	8.8%	8.5%	6.8%	7.5%	8.3%
C+	4.9%	4.8%	3.8%	4.1%	4.6%
C	1.9%	2.5%	2.1%	2.4%	2.2%
C– or lower	0.2%	1.2%	0.6%	0.5%	0.6%
Don't know	1.5%	7.7%	4.2%	10.3%	4.7%

**Among the respondents, 169 students did not answer the question about their class standing.*

up 8.3% of the respondents. As in past years, female students make up a larger share of the respondents (61.5%). Student respondents continue to be weighted toward so-called traditional students. Most respondents are under 25 years old (81.7%) and go to school full time (87.4%). Freshmen most often live on campus (75.9%), whereas seniors (79.1%) and community college students (95.8%) most often live off campus. Grade point averages for our respondents show 79.5% having a B or better average.

The overall student response rate in the 2009 study is 10.4%.[5] Significant variation by institution was noted, and the response rate may be affected by a number of factors, including students' growing awareness of malware and computer viruses, making them more cautious about responding to the e-mail invitation, and the fact that students could have survey fatigue, since they receive numerous e-mails throughout the year asking them to take a survey and win a prize.

Respondents identified their majors (see Table 3-3). Note that the total number of responses is larger than the overall number of respondents (N = 30,616) because many respondents reported more than one major (16.0%). More students selected "Other" than any other major category. This is likely due to the proliferation of unique majors and combination majors that don't seem to fit the listed major categories. As would be expected, more freshman respondents said they are undecided (15.5%), as well as about 1 in 10 community college respondents (9.4%).

Research Team

The principal investigators for this year's study are Shannon Smith, Gail Salaway, and Judith Borreson Caruso. Richard Katz, vice president of EDUCAUSE and founder of ECAR, contributed the Introduction.

Shannon D. Smith

Shannon D. Smith began her career in 1983 at Electronic Data Systems and spent 18 years specializing in business intelligence systems for corporate, government, and higher education clients. She began a doctoral program in history at the University of Nebraska–Lincoln in 1999 and has taught at Oglala Lakota College on the Pine Ridge Indian Reservation in South Dakota since 2002. As chair of the college's distance learning committee, she advocated for and oversaw the implementation of policies and technologies to bring a full curriculum of online courses to the geographically dispersed and economically disadvantaged student body. In addition to her research on learning technology and nontraditional students, she has published extensively on Western and American Indian history. Smith is an ECAR Fellow based in Boulder, Colorado.

Table 3-3. Student Respondents' Majors

Major	N	Percentage
Other	5,965	19.5%
Life/biological sciences, including agriculture and health sciences	5,547	18.1%
Social sciences	5,354	17.5%
Business	4,790	15.6%
Humanities	2,863	9.4%
Education, including physical education	2,857	9.3%
Engineering	2,733	8.9%
Fine arts	2,268	7.4%
Undecided	1,927	6.3%
Physical sciences, including math	1,786	5.8%

Gail Salaway

Gail Salaway earned her PhD in management of information systems from UCLA (1984). She is 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 leadership, IT alignment, IT networking, and undergraduates and IT.

Judith Borreson Caruso

Judith Borreson Caruso is Director of Policy and Planning at the University of Wisconsin–Madison and has been an ECAR Research Fellow since July 2002. She has been in higher education IT roles for 30 years in the areas of application development, data management, policy, and security. Caruso is active in several IT professional organizations, including EDUCAUSE. She has served on the EDUCAUSE Current Issues and *EDUCAUSE Quarterly* editorial committees. Currently, she serves on the executive committee 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.

Richard N. Katz

Richard N. Katz has been Vice President of EDUCAUSE since 1996. From 1996 to 2001, Katz was responsible for professional development, conferences, IT, publications, and research. In 2001, he founded the EDUCAUSE Center for Applied Research (ECAR), now the largest research service devoted exclusively to IT issues in higher education contexts. Before joining EDUCAUSE, Katz held a variety of management and executive positions spanning 14 years at the University of California (UC). From 1999 to 2006, he led that university's development and implementation of strategic management initiatives. For this work, he became the second recipient of that university's Award for Innovative Management and Leadership. Katz is the author, coauthor, or editor of seven books, four research studies, and more than 50 articles and monographs on a variety of management and technology topics. His book *Dancing with the Devil* was deemed one of the 10 most important education-related books of 1999 by Lingua Franca. He received his BA from the University of Pittsburgh and his MBA from UCLA.

Previous Years' Studies

In 2004, the first ECAR study was launched with a baseline of 13 institutions. This year, 114 U.S. institutions, 1 Canadian institution, and 3 international institutions participated.[6] The data presented in this study reflect only the results from student respondents of U.S. and Canadian institutions.

The following previous ECAR studies on undergraduate use of IT are publicly available on the EDUCAUSE ECAR website:

- *The ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control,* Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan.
- *The ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning,* Robert B. Kvavik and Judith B. Caruso.
- *The ECAR Study of Undergraduate Students and Information Technology, 2006,* Gail Salaway, Richard N. Katz, and Judith B. Caruso.
- *The ECAR Study of Undergraduate Students and Information Technology, 2007,* Gail Salaway and Judith Borreson Caruso.
- *The ECAR Study of Undergraduate Students and Information Technology, 2008,* Gail Salaway and Judith Borreson Caruso.

Endnotes

1. In addition to potential sampling errors, there are other potential sources of error that are not 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 institutions or of this population in general. Therefore, caution should be exercised in assuming that the findings generalize beyond the sampled students.
2. Staff from participating institutions used a variety of methods to recruit students—posting advertisements in various campus locations, making announcements in large-enrollment classes, and e-mailing 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 Institutional Review Board (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 identifies any individual student. In some instances, we corrected their English but made no change in meaning.
3. Each institution required approvals from institutional executives and their IRB in order to participate in the study. The approval processes, although 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. 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 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.
4. To encourage a larger response from the students, ECAR offered 99 $50 and $100 gift certificates to be awarded to students, using a lottery.
5. Several participating institutions did not provide enrollment and sample information, so these data were not included in the calculation for overall response rate.
6. A single English-language version of the survey was prepared that is designed to work internationally.

4
Ownership of, Use of, and Skill with IT

I guess I don't really think about IT that much…technology is so natural and normal these days. I just do it and use it without thinking.

—An undergraduate student

Key Findings

- For the 39 institutions that participated in each of the last four years' studies, student desktop computer ownership has decreased from 71.0% to 44.0%. Laptop ownership has increased from 65.4% to 88.3%.
- Only 29.5% of seniors owned a laptop one year old or less, compared with 79.0% of freshmen and 34.7% of community college students.
- Greater numbers of males (53.8%) than females (25.4%) perceived that they are early adopters or innovators in regard to technology adoption.
- Respondents reported spending 21.3 hours per week, on average, doing online activities for school, work, and recreation.
- Almost all respondents used the college/university library website (94.6%), presentation software (PowerPoint, etc.) (93.8%), social networking websites (Facebook, MySpace, etc.) (90.3%), and text messaging (89.8%).
- Eighteen- and 19-year-old respondents from the 39 institutions that participated in each of the last four years' studies consistently reported high use of social networking websites (SNSs). Use by those from 30 to 39 years old, however, more than tripled (from 22.1% to 74.3%), and among respondents 40 years old and older, SNS use more than quadrupled (from 11.2% to 47.7%).
- More than half of respondents (55.3%) preferred to be first notified by a text message in case of a campus emergency.
- Eight out of 10 students (80.0%) considered themselves very skilled or expert in their ability to search the Internet effectively and efficiently.

It is hard to believe that Facebook, MySpace, YouTube, and Twitter—names that require no introduction or definition today—were barely more than ideas in the minds of youthful entrepreneurs when ECAR conducted the first study of undergraduates and IT five years ago. This philosophy of communities controlling information—the touchstone of Web 2.0 technology—is changing the very nature of the Internet. Today, these user-driven websites, where people contribute rather than passively consume content, are the rule rather than the exception, and students come to college with ideas about interacting with the world that would have seemed fantastical only a few years ago.

Similarly, the devices and applications used to access these online communities have evolved at the same dramatic rate. The vernacular of mobile technology has turned words such as iPhone, netbook, BlackBerry, smartphone, and Bluetooth into household names in just a few short years. The Internet's evolution from static content-distributing websites to active content-contributing communities that blur the lines between consumer and creator of information, coupled with the dramatic advances in mobile technology, is bringing irrevocable change to higher education. And of course "traditional" IT tools such as search engines and spreadsheet and presentation software continue to be important items in the student toolbox and are being incorporated into the emerging social mode of computing.

The 2009 ECAR study of undergraduates and IT—the sixth installment—reveals some of the remarkable changes in students' ownership, expertise, and opinions regarding the use of IT that have occurred during this short period. This chapter explores student respondents' ownership of computers, their IT activities—including their contributions to emerging media and collaboration sites—and their perceived skill levels. We look more closely at respondents' use of technology in the academic environment in Chapter 5 and ownership and use of mobile devices in Chapter 6.

Computer Ownership

In ECAR's first study of undergraduates and IT in 2004, 62.8% of the students surveyed owned desktop computers, 46.8% owned laptops, and 6.6% reported that they did not own a computer.[1] Since then, overall ownership of computers has increased—this year's study reveals that 98.8% own computers—and the desktop-to-laptop ratios have changed substantially. In the data from the 39 institutions that participated in each of the last four ECAR undergraduate studies, desktop ownership decreased from 71.0% in 2006 to 44.0% in 2009, while laptop ownership increased from 65.4% to 88.3% during the same period. Among all of this year's respondents, almost half (45.8%) still own desktops, but laptops continue to be more prevalent, with 87.8% of students reporting they own one. A little more than one-third (34.5%) of the respondents reported owning both a laptop and a desktop.

IT administrators concerned about supporting obsolete student equipment can take some comfort in the remarkably up-to-date profile of computer ownership from this year's respondents: Slightly more than half (52.3%) said their newest computer, whether laptop or desktop, is one year old or less, and two-thirds (67.9%) reported owning a machine two years old or less (see Figure 4-1). Still, many respondents owned older computers, including 17.9% whose newest computer is four years old or older.

Desktop computer ownership is relatively more common among certain groups in our study. Male respondents were slightly more likely to own desktops (53.4%) than were female respondents (41.0%) (see Figure 4-2). In addition, at four-year institutions, desktop ownership was more prevalent among students who reside off campus (51.2%) than among those living on campus (33.3%), perhaps because they have more room for a desktop machine or because they are more cost conscious. We found no meaningful difference between freshman and senior respondents regarding their ownership of desktops. Since almost all of the community college respondents live off campus, it is not surprising that they were more likely than those at four-year institutions to own desktops. Nearly three-quarters (71.1%) of the community college respondents owned desktops, including more than half (55.0%) who said their machine is two or more years old.

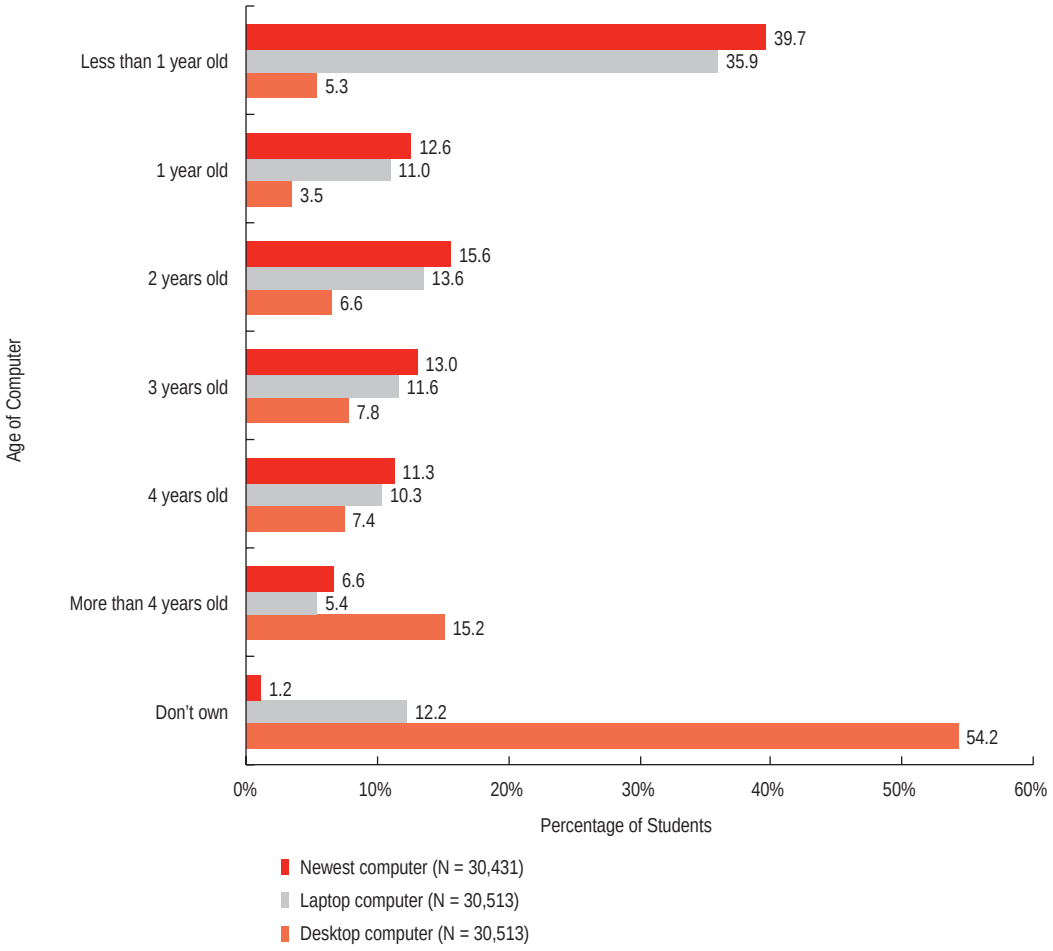


Figure 4-1. Age of Computers Owned by Students

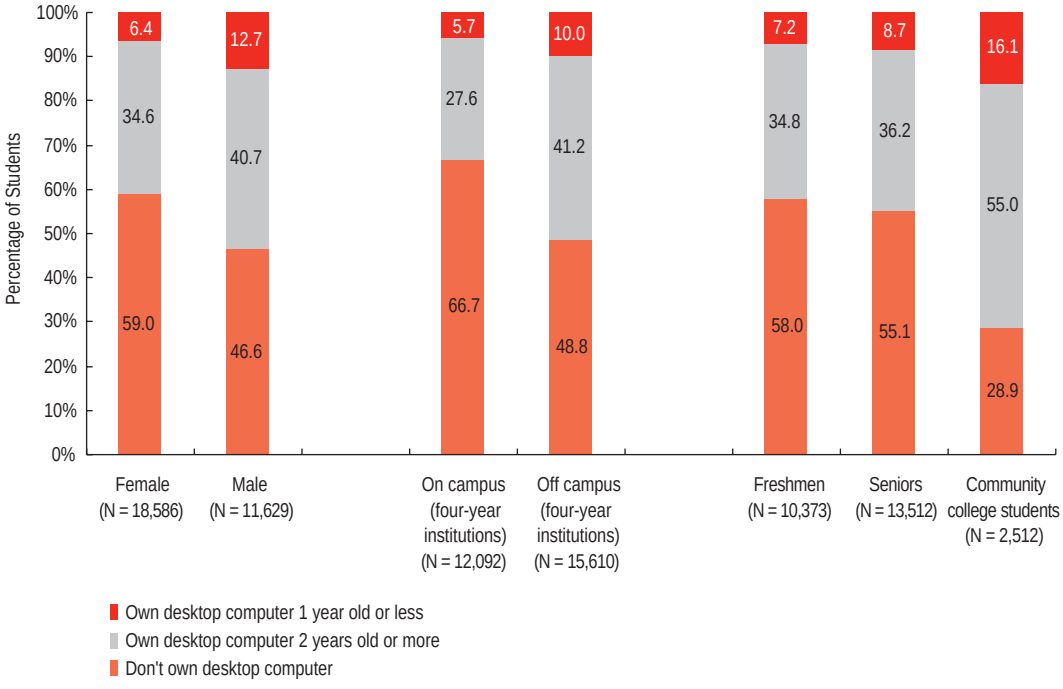


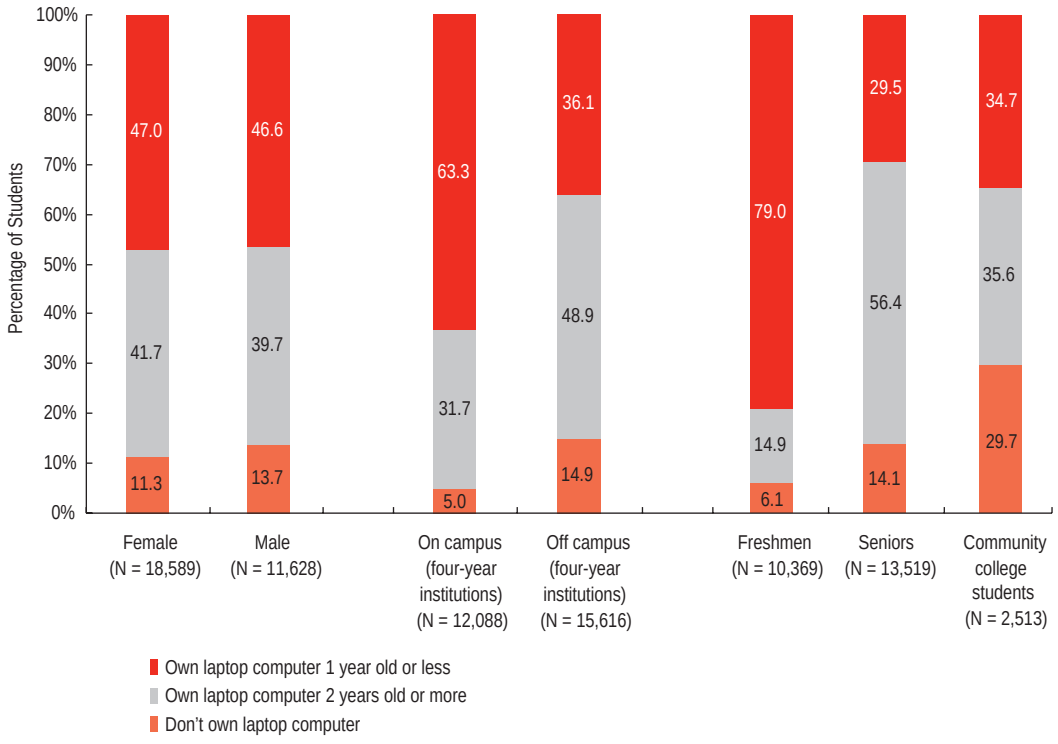
Figure 4-2. Desktop Computer Ownership, by Gender, Residence, and Class Standing*

**Residence data does not include community college respondents.*

Regarding laptop ownership, our study found no meaningful difference between males and females, though we did find that class standing is a factor. More than 9 out of 10 freshmen (93.9%) owned a laptop, and 79.0% said it is one year old or less (see Figure 4-3). Far more on-campus respondents (63.3%) from four-year institutions had laptops one year old or less than did those who live off campus (36.1%). Although 85.9% of senior respondents said they own laptops, these machines, as would be expected, are older—more than half (56.4%) being two or more years old. Respondents from community colleges are the least likely to own a laptop (70.3%), with about a third saying their laptop is two or more years old. This general pattern has held true since 2006, indicating a continuing lag in community college students' upgrading of their personal computer equipment. ECAR did not ask about netbooks this year, but in response to the open-ended final survey question, "Is there anything you would like to tell us about your experience with IT in or out of the courses?" a few students mentioned them. "You only asked whether or not I had a desktop and a laptop," wrote one student. "I have two laptops. One is a very small netbook that I use primarily in class or other contexts where its portability makes it convenient."

Among the 39 institutions that participated in each of the last four years, the trend of growth in laptop ownership alongside the gradual drop in desktop ownership that began in 2004 continued this year (see Figure 4-4). The desktop-to-laptop ownership trend suggests that mobility is trumping the desktop in new machine purchases, since close to half (46.9%) of this year's ECAR respondents reported owning laptops one year old or newer, versus 8.8% who reported that their desktop is one year old or newer. Declining price premiums for laptops versus desktops are probably also playing a role in this trend, and the appearance of inex-

Figure 4-3. Laptop Computer Ownership, by Gender, Residence, and Class Standing*



**Residence data does not include community college respondents.*

pensive netbooks is likely to fuel it. The economy is also having an impact on the desktop market; in one expert's words, the current economic downturn is "kicking the desktop PC industry while it's down."[2]

It may be likely that the decreasing percentage of ownership of desktops by respondents will continue in future surveys, particularly if their ownership reflects industry trends in desktop sales globally. However, 15.4% of this year's survey respondents did own a desktop two years old or newer. This is likely because of a preference or requirement for the increased computing power of a desktop—particularly for online gaming. One student wrote in our survey's open-ended question, "I build computers and update them regularly. My desktop is optimized for gaming."

Despite the declining trend in desktop ownership and potential for smartphones and netbooks to cannibalize the laptop market, and based on the percentages of students who continue to purchase and use both desktops and laptops, it appears that any declaration of the imminent demise of either would be, as Mark Twain famously pronounced upon reading his prematurely published obituary, "greatly exaggerated."

Student Technology Adoption Profile

Since 2006, ECAR has asked students about their "technology adoption" practice and has explored it using a scale developed by Everett Rogers and published in his 1962 book *Diffusion of Innovations*.[3] Rogers defined *diffusion of innovations* as a theory

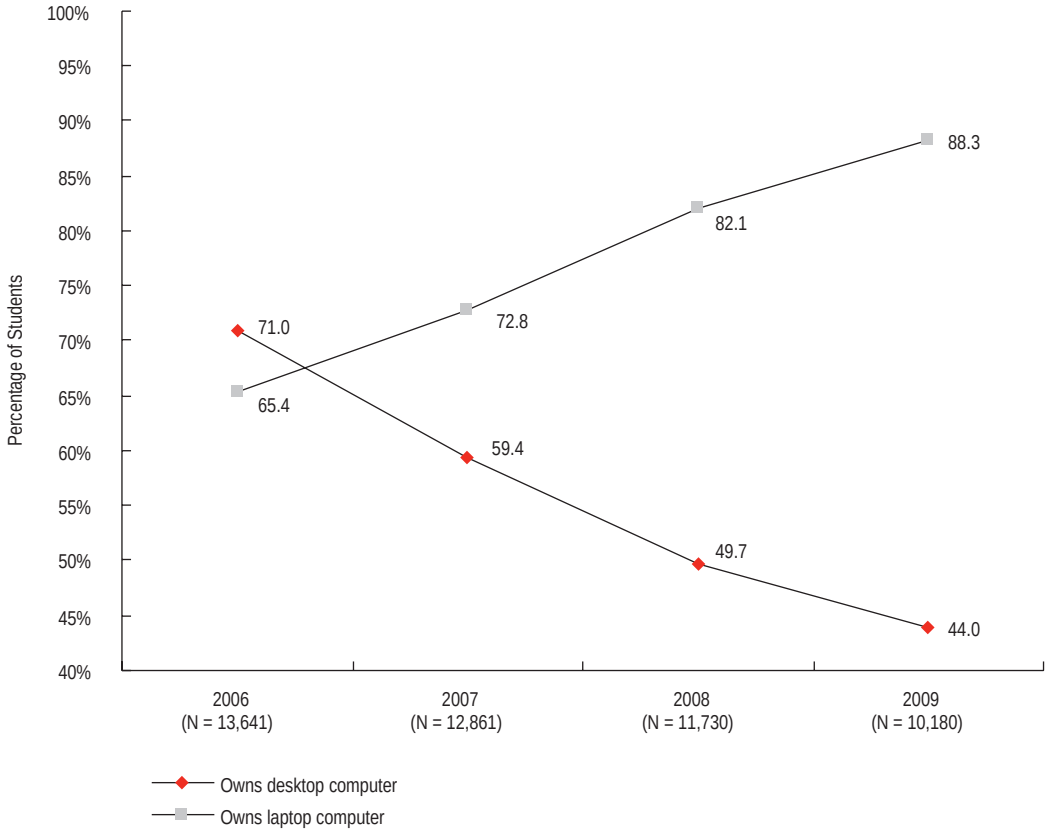


Figure 4-4. Change in Computer Ownership from 2006 to 2009 (39 Institutions)*

**Data are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding are different each year.*

of how, why, and at what rate new ideas and technology spread through cultures. Rogers used five categories of adopters to classify individuals within a social system on the basis of innovativeness and timing of adoption. The categories—innovators, early adopters, early majority, late majority, and laggards—are typically illustrated as a classic bell curve distribution. Subsequent research by industry experts that replicated these innovator-to-laggard models to explore technology adoption found that adopting and engaging with new technology is associated with many factors, including financial capability, perceived difficulty versus perceived benefits, past experience with new technology, and gender.[4]

In our student surveys, respondents are given a set of statements about technology adoption and asked to choose the one that best describes them. ECAR then maps their responses into an adapted Rogers technology adoption model (see Table 4-1). These categories are very meaningful in the ECAR student studies because student responses about technology adoption are often strongly associated with their use of and experience with IT both generally and in the academic context.

Figure 4-5 shows that the answers from this year's respondents distribute into a rough bell curve, with about half (51.0%) of all respondents identifying themselves as mainstream adopters. Note that more

Table 4-1. Technology Adoption Categories

Which best describes you?	ECAR Descriptor
I am skeptical of new technologies and use them only when I have to.	Laggard
I am usually one of the last people I know to use new technologies.	Late adopter
I usually use new technologies when most people I know do.	Mainstream adopter
I like new technologies and use them before most people I know.	Early adopter
I love new technologies and am among the first to experiment with and use them.	Innovator

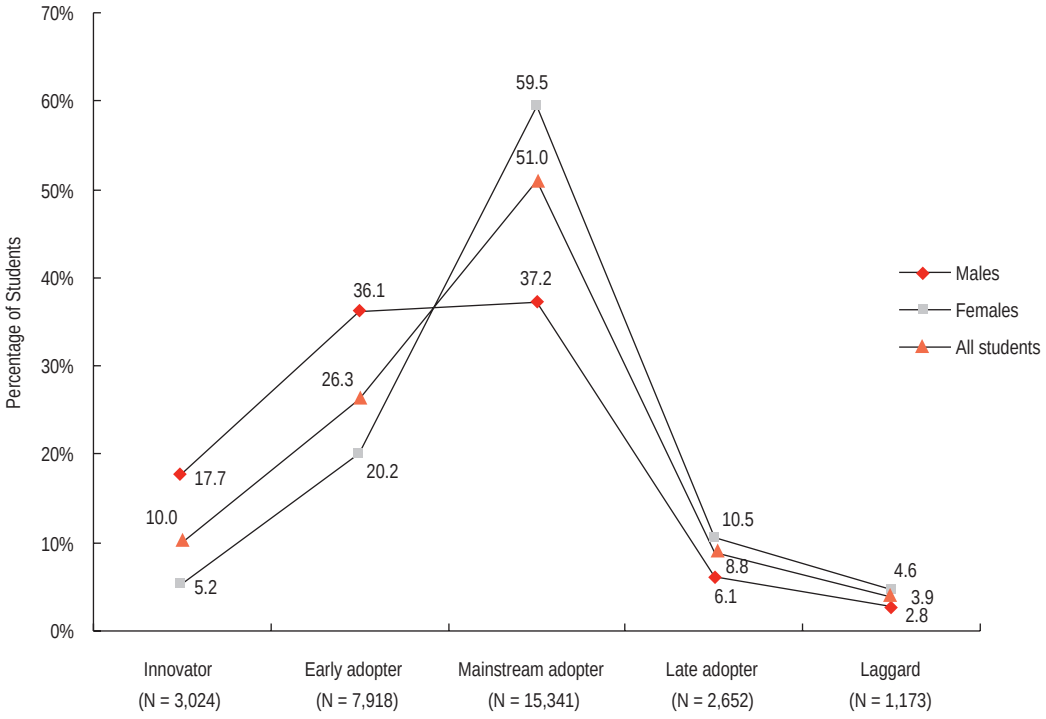


Figure 4-5. Respondent Technology Adoption, Overall and by Gender

than half of males (53.8%) claimed they are early adopters or innovators, whereas only one-fourth of females (25.4%) did so. These findings are consistent with those of earlier ECAR studies.

The influence of gender on new technology adoption has received a significant amount of attention, and some studies claim that the gender gap is lessening as more people are exposed to and using technology. However, contradictory results exist, and recent literature has called for more research to shed light on what, if any, role gender currently plays in technology adoption.[5] The ECAR technology adoption results are also potentially influenced by the tendency for women to assess their technical skills lower than men, as other research has found.[6] Nonetheless, monitoring innovator/early adopters' use of new technologies is quite valuable because it may provide early information in preparation for mainstream adopters' use that will follow. It can also reveal variations in how students respond to their institutions' applications and technologies and assist in decisions related to technology deployment. This technology adoption scale is an informative factor and is used in several sections of this study.

Hours Online

Respondents continue to vary widely in how much time they spend each week actively doing Internet activities for school, work, and recreation (see Figure 4-6). One in three students (30.7%) was online 10 hours or less each week, and about another third (34.4%) reported spending 11 to 20 hours per week online. At the high end of time spent online, 8.8% of respondents spent more than 40 hours per week on the Internet. The overall mean of time spent doing online activities was 21.3 hours per week, whereas the median was 16 hours per week for this year's respondents. In the focus groups, students noted that the time spent online can be a distraction. Losing access to the Internet as a result of a broken laptop revealed just how much of a distraction the Internet had been to one student, who shared with us, "I can do homework now that I don't have my laptop to distract me."

Student major is a factor when it comes to online hours (see Table 4-2). Engineering majors spend the most time online, with a mean of almost 25 hours per week, whereas education majors reported a mean of 19 hours per week. We found no significant differences in online activity based on class

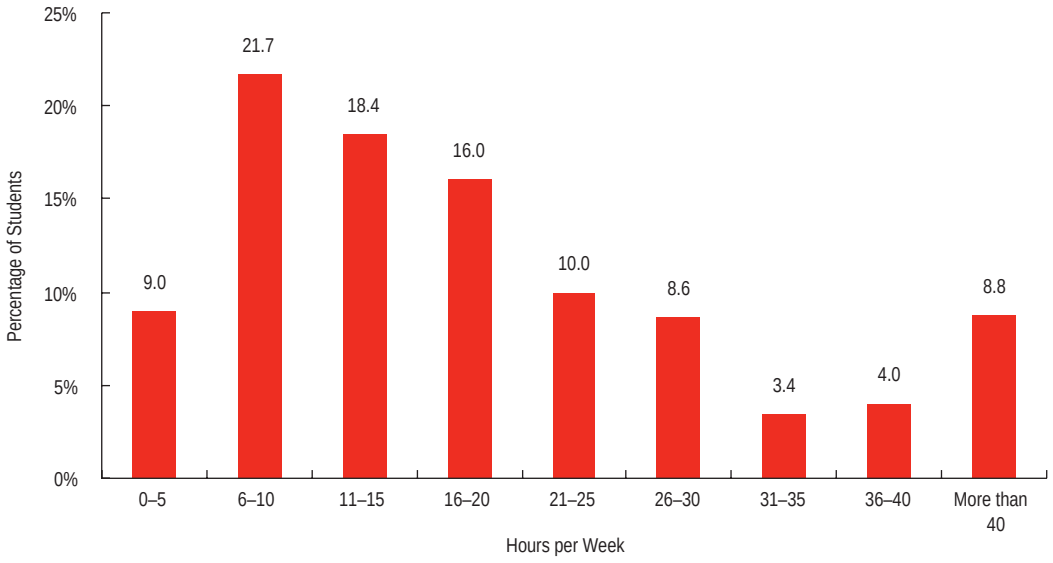


Figure 4-6. Hours per Week Actively Doing Internet Activities for School, Work, and Recreation (N = 30,270)

Table 4-2. Hours per Week Actively Doing Internet Activities, by Major

Major	N	Mean Hours per Week	Median Hours per Week
Engineering	2,699	24.9	20
Physical sciences, including math	1,771	22.4	19
Humanities	2,830	22.3	20
Business	4,733	22.0	18
Social sciences	5,286	21.6	18
Fine arts	2,240	20.4	15
Life/biological sciences, including agriculture and health sciences	5,494	20.3	15
Education, including physical education	2,836	19.0	15

standing, GPA, age, or gender. Students at different Carnegie class institutions also do not show significant differences.

As could be expected, respondents who identified themselves as early adopters or innovators spent more time actively doing Internet activities than those who identified themselves as late adopters or laggards (see Figure 4-7). Other studies have found that the amount of time spent using a computer correlates positively with self-perceived experience and with a more positive attitude toward technology.[7]

Computer and Online Activities

The ECAR survey asked students about their IT activities, including basic core applications, communications technologies, and some new or emerging technologies. We then explored the results in terms of how many students are engaged, how frequently they use the technology, and demographic factors that may be associated with the activity (see Table 4-3).[8]

This year we found that basic technologies used in coursework—college and university library websites, presentation software, and spreadsheets—remain very widely used. More than 8 out of 10 respondents (84.4%) used both spreadsheets and presentation software, and only 3.9% used neither. For the 39 institutions that participated in each of the last four years' studies, respondents' use of their institutions' library websites has hovered right around 95% all four years, but the percentage of students who reported using the library website daily has increased from 7.1% in 2006 to 16.9% in 2009.

There is little change in the median frequency of use for most of these tools—from daily to once a year—between this year and last year. However, in the 39-institution longitudinal data set, the percentage of students who reported they download music or video has increased from 71.4% in 2006 to 83.5% in 2009, with an increase from 7.2% to 11.0% in those who reported downloading daily.

This increase may reflect the increase in popularity of video "streaming" or downloading music, since our survey question described the IT activity as "Download web-based music or videos." Although we cannot conclude what portion of the reported increase in this activity is related to video as opposed to music, we have reason to think the popularity of accessing online video content may be a factor. The April 2009 report "The Global Online Media Landscape" by the Nielsen Company market research firm pointed out that accessing videos online "has gone mainstream at an extraordinary pace." According to the report, online video audiences surpassed e-mail audiences in November 2007 and have

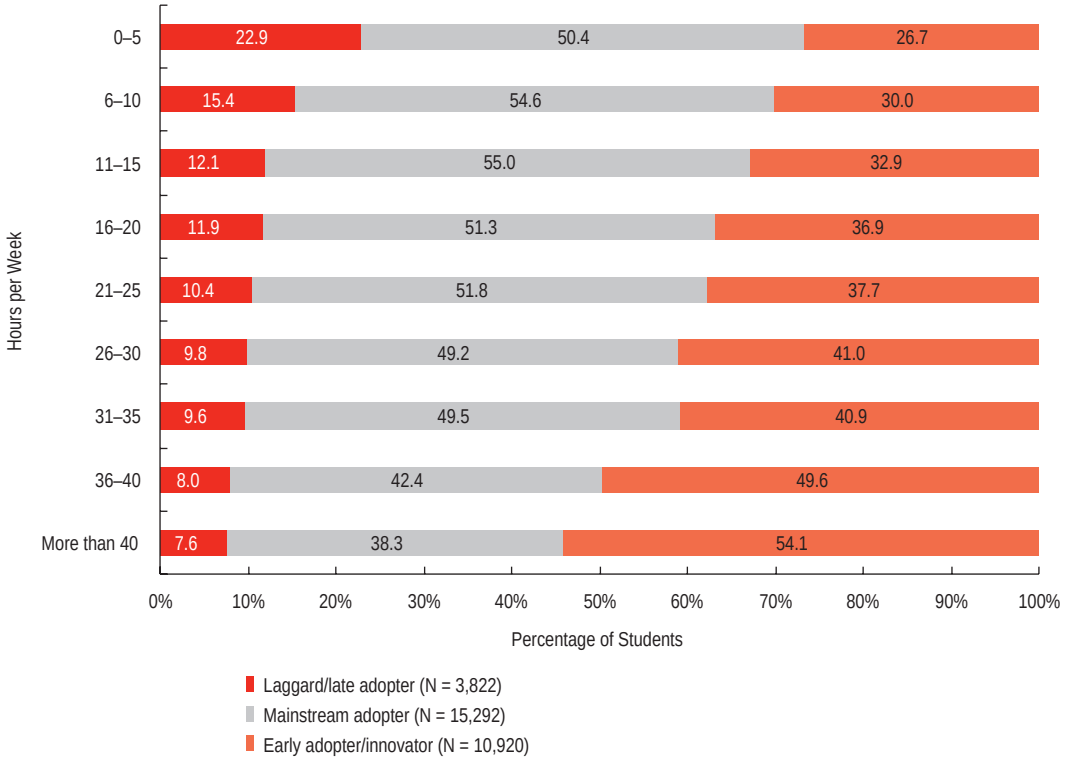


Figure 4-7. Hours per Week Actively Doing Internet Activities, by Technology Adoption

continued growing at meteoric rates: Between February 2008 and February 2009, viewers of online videos grew 10%, the number of streams grew 41%, the streams per user grew 27%, and the total minutes engaged with online video grew 71%.[9]

This year's ECAR student study found other evidence suggesting college student participation in the unfolding digital video revolution. Although we didn't specifically ask about downloading video content, we did ask if students contributed content to video websites (YouTube, etc.), and more than 4 in 10 respondents (44.8%) said they do. In the focus groups, many students commented about their viewing of online videos. Almost all said they watch YouTube, and many also talked about watching television shows on Hulu. One student said, "I like TV shows, but I don't watch my TV anymore. I like using my laptop for this. I can also watch anytime I want." The exponential growth of content is a factor in the increasing access of online video; as another student raved, one could find "every season of TV shows online."

Participation in content creation and sharing is also revealed in students' responses to questions about contributing to wikis (Wikipedia, course wikis, etc.) or blogs. Four in 10 respondents contributed to wikis (41.9%), and a little over a third of respondents (37.3%) said they contribute to blogs. Other resources have confirmed that blogging is a popular activity among college students; according to the annual Anderson Analytics' GenX2Z survey, the blogging website LiveJournal is now in sixth place among college students' top 10 most popular websites, and students are four times more likely than other online adults to blog.[10] Still, though contributing various types of content to the Internet is becoming a mainstream activity, well over a third of our student respondents (38.8%) said they do not add content to wikis, blogs, or video websites.

The ECAR 2009 survey also asked about online multiuser computer games and online virtual worlds. About 8% of this year's respon-

Table 4-3. Student Computer and Internet Activities (N = 30,616)

	Students Engaged	Median Frequency of Use*	Associated Demographic Factors
Almost All Students Engaged			
Using the college/university library website	94.6%	Weekly	Full-time students/four-year institutions
Presentation software (PowerPoint, etc.)	93.8%	Monthly	Business/seniors
Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)	90.3%	Daily	Age (younger)/reside on campus
Text message	89.8%	Daily	–
Most Students Engaged			
Spreadsheets (Excel, etc.)	86.8%	Monthly	Seniors/business/engineering
Course or learning management system	86.0%	Several times per week	–
Download web-based music or videos	84.2%	Weekly	Male
Instant message	74.0%	Several times per week	Reside on campus
Graphics software (Photoshop, Flash, etc.)	73.3%	Monthly	–
Some Students Engaged			
Contribute content to video websites (YouTube, etc.)	44.8%	Monthly	–
Contribute content to wikis (Wikipedia, course wiki, etc.)	41.9%	Monthly	–
Video-creation software (MovieMaker, iMovie, etc.)	39.4%	Once per quarter or semester	Male
Voice over Internet Protocol (VoIP) from your computer (Skype, etc.)	37.7%	Monthly	Reside on campus
Contribute content to blogs	37.3%	Monthly	–
Audio-creation software (Audacity, GarageBand, etc.)	35.1%	Once per quarter or semester	Male
Podcasts	35.0%	Monthly	Male
Use the Internet from handheld device (iPhone, Treo, BlackBerry, other Internet-capable cell phone, iPod touch, PDA, Pocket PC, etc.)	33.6%	Several times per week	–
Online multiuser computer games (World of Warcraft, EverQuest, poker, etc.)	29.0%	Monthly	Male
Social bookmark/tagging (del.icio.us, etc.)	17.4%	Monthly	–
Online virtual worlds (Second Life, Forterra, etc.)	8.1%	Once per quarter or semester	–

**The median frequency of use is calculated only for those students engaged in an activity. Technically, the median is the midpoint in a series of data values; half the data values are above the median, and half are below. Data values are once a year, once per quarter/semester, monthly, weekly, several times/week, and daily.*

dents said they visit online virtual worlds such as Second Life or Forterra, about the same as last year's respondents. Almost one-third (29.0%) of this year's respondents engaged in online multiuser computer games, and 12.6% said they play these games once per week or more—numbers that are also similar to last year's. Despite the fact that a minority of respondents are engaged in online gaming, in focus groups some students complained about what they saw as a prevalence of gaming. One student said, "I can't believe the amount of gaming going on at this school. Whenever I walk around, they are doing online gaming." Another complained, "I hate it when I go to the computer lab and they are gaming. I need to do real work."

This year we asked students for the first time if they use their computer for phone calls—voice over Internet Protocol, or VoIP (Skype, etc.). More than one-third (37.7%) of the respondents reported using it, and the median frequency of use is monthly. Campus residency is the most significant factor in the use of VoIP, with almost half (48.1%) of the respondents who live on campus reporting they have used VoIP, versus fewer than a third (30.7%) of off-campus respondents. Because a higher percentage of early adopters/innovators used VoIP (46.2%) than late adopters/laggards (24.4%) in this year's survey, and VoIP as a technology is becoming more widespread, we may see an increase in use by mainstream and later adopters in the future.

Many institutions have chosen to discontinue all or most landline telephone service in their residence halls because of the ubiquity in student ownership of cell phones, and what was once a lucrative business of selling long-distance services to student residents has all but disappeared. With the high percentage of ownership of PCs and high-speed access in residence halls, there may be an increase in VoIP use by students who are concerned about cell phone charges. Some institutions are already addressing PC-based VoIP use on campus. In the 2009 ECAR study *Spreading the Word: Messaging and Communications in Higher Education*, ECAR found that about a third of the surveyed institutions that reported having residential students had a policy concerning use of PC-based VoIP services by students. Among the 93 institutions that did report having such a policy, almost two-thirds reported policies that allow the use of PC-based VoIP but neither encourage nor discourage it. Use was discouraged at 20.4% of the institutions and prohibited at 12.9%.[11]

Of the ECAR 2009 student respondents who indicated they own a handheld device that is capable of accessing the Internet, almost half (49.5%) said they access the Internet from their handheld device weekly or more often. Mobile communications habits are reported in greater detail in Chapter 6.

Gender Still Makes a Difference in Some Technologies

Gender has become less a factor in such areas as computer ownership and time spent on the Internet since ECAR began this study. However, in addition to the gender differences in technology adoption (refer to Figure 4-5), persistent gender differences exist in the use of certain technologies, particularly audio and video creation and multiuser gaming. Figure 4-8 shows that of the respondents who are engaged in the technologies, males are twice as likely as females to play multiuser online games and use audio-creation software (Audacity, GarageBand, etc.) and about 50% more likely to use video-creation software (MovieMaker, iMovie, etc.).

Communications Technology

Interactive communication tools such as instant messaging, text messaging, and SNSs are shaping how the world population

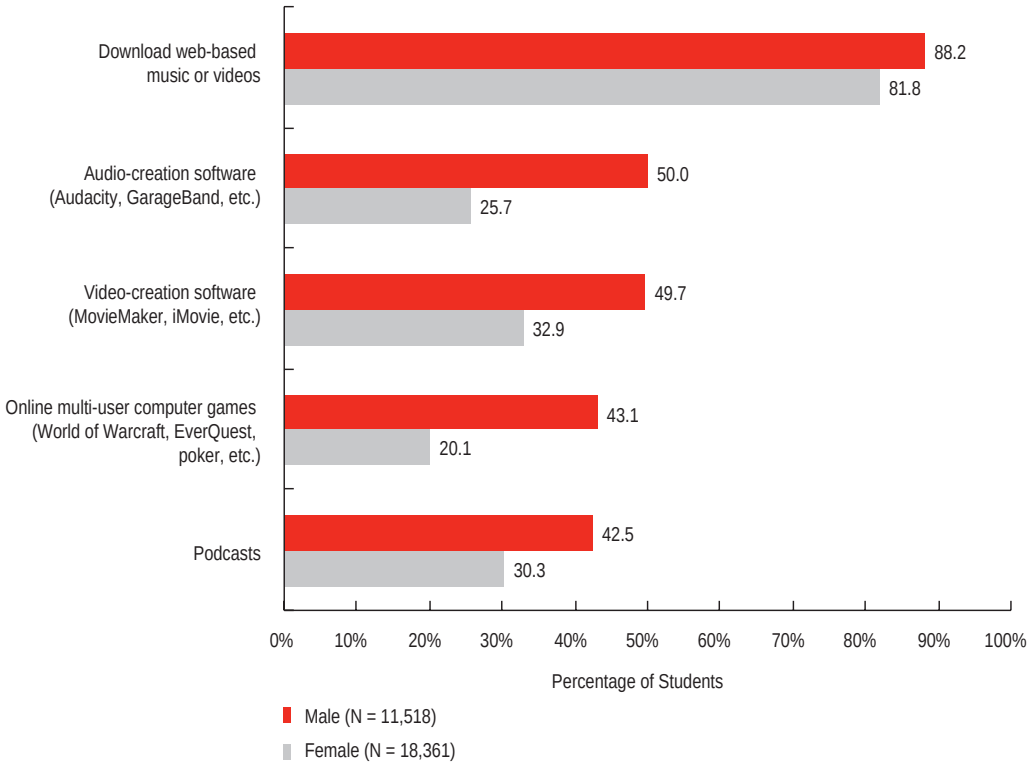


Figure 4-8. Use of Selected Technologies, by Gender

is connecting and socializing, and college students are no exception. Indeed, traditional-aged undergraduates are part of the generation that has been at the heart of this communications revolution. As any parent of a teenager knows, text messaging has changed how the so-called Net Generation communicates. One father in Wyoming found out the hard way when the family's Verizon phone bill revealed his 13-year-old daughter had sent more than 10,000 text messages and had received about the same—in one month. When he recovered from the shock of opening the nearly $5,000 bill, he took a hammer to her cell phone![12] When asked about texting, several students in the focus groups commented on how much it is used. One reason mentioned for its popularity is convenience. "I know [that] people who text often do so because they think that making a phone call is more of an intrusion," an interviewee explained. "With a phone call you have to answer; with text you can answer when you want to."

Although the ECAR survey didn't ask the total number of text messages students send per month, almost 9 in 10 (89.8%) of the student respondents said they text, and almost two-thirds of all respondents (65.9%) send text messages daily. As we might expect, 18- and 19-year-old respondents texted more than other groups within our respondent age categories, with more than three-quarters (75.6%) texting daily. The growing use of text messaging is reflected in our results from the 71 institutions that participated in both this year's and last year's surveys, with respondents who indicated they send text messages daily increasing from 54.1% to 66.3%.

We also found an ongoing surge in the use of SNSs, though usage is so widespread in some age groups that it has begun to reach a ceiling. Among the 39 institutions that participated in each of the last four years, there has been an increase from 32.9% to 66.2% of students who reported accessing SNSs daily. The dominance of texting and SNS use has

been paralleled by a decline in a technology once seen as the definitive mode of teenage online communication: instant messaging. Among the 39 institutions in our longitudinal data set, we found a 23.2% relative decrease in the percentage of respondents who reported using instant messaging weekly or more often since 2006, versus a 32.6% relative increase in SNS use during the same time frame (see Figure 4-9). A Nielsen Company March 2009 report on social networking appears to corroborate these findings in its own research, concluding that instant messaging "has been a casualty of social networking in terms of a falling share of online time."[13] It may be that students are finding that integration of chat tools into SNSs and the many options available to communicate their current status accomplishes what they formerly used IM to do.

Undergraduates are in constant communication—whether with their parents, friends, classmates, or even instructors. The use of technology to connect with others is a major aspect of the overarching concept of Web 2.0 that is clearly having an impact on the college experience. Despite the decline in use of what student respondents consider to be instant messaging, the connectivity indicated in this year's survey results is impressive. Majorities reported using each of these three technologies—instant messaging, text messaging, and SNSs—weekly or more often, and of this year's respondents, almost half (45.7%) use all three at least weekly. The culture of connectivity in which the Net Generation has grown up will certainly continue to shape its needs and expectations when these students come to college, and it is likely that newer, less expensive technology will increase this already remarkable level of interpersonal communication.

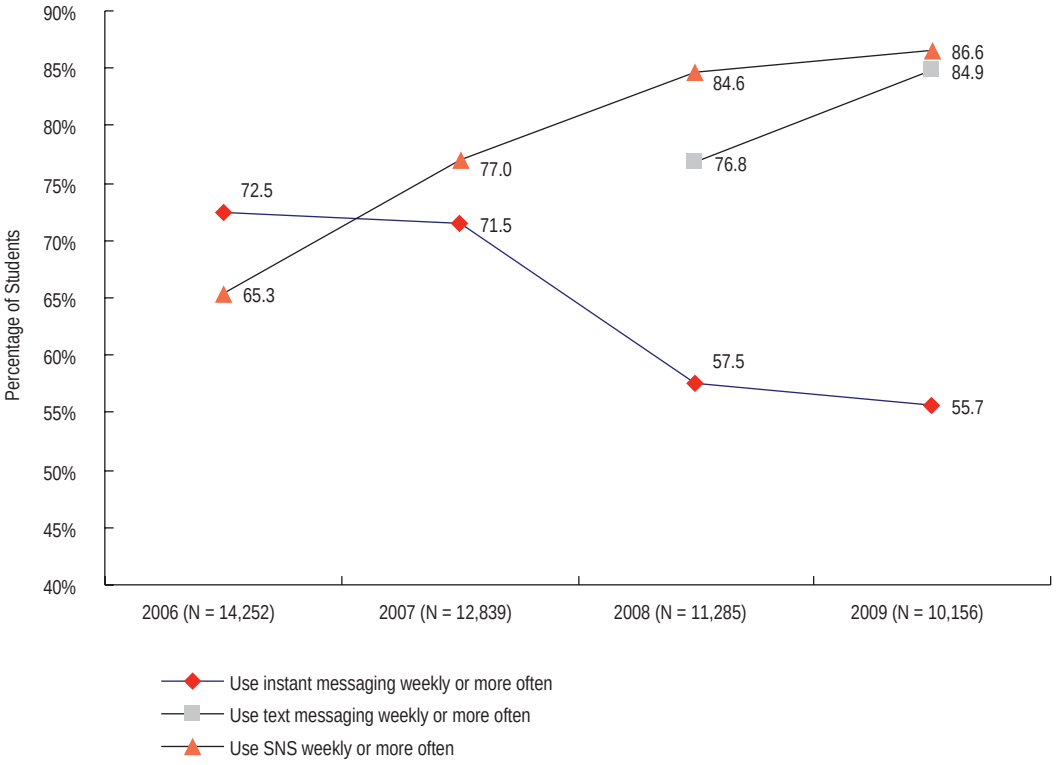


Figure 4-9. Change in Communication Technology Use from 2006 to 2009*

**Data for four-year comparisons are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Use of text messaging was first surveyed in 2008. Although institutions remained the same, the actual students responding each year are different.*

The Closing Age Gap in SNS Use

Nine out of 10 (90.3%) of the respondents to the ECAR 2009 survey use SNSs. Respondents ages 18 and 19 had the highest percentage of use (95.4%), with more than three-quarters (76.0%) reporting daily use. Respondents from 20 to 24 were similarly active, with 94.7% reporting they use SNSs and 62.9% using them daily. However, although the younger Net Generation students have more actively integrated social networking into their lives than older students, the gap between older and younger students is shrinking. The Nielsen March 2009 report explains that SNSs started out among a younger audience, but the audience is becoming broader and older, with the greatest growth in 2008 coming from people 35 to 49 years of age. As a consequence, "people under 18 years old are making up less of the social network and blogging audience."[14]

The ECAR data corroborate this finding (see Figure 4-10). Although 18- and 19-year-old respondents from the 39 institutions that participated in each of the last four years' studies reported a consistently high use of SNSs, use by those from 30 to 39 years old more than tripled (a 236% increase), and among respondents 40 years old and older, SNS use more than quadrupled (a 326% increase).

The extensive use of SNSs was reflected in focus groups, where several students expressed concern about the amount of time students spend on them—especially Facebook. A typical comment was, "I try and stay away from Facebook—otherwise you could be on it all day." In observing that "a lot of student time is spent on MySpace or Facebook," another student confessed, "I spend about 5 hours per day. You don't think about it, but you are spending that

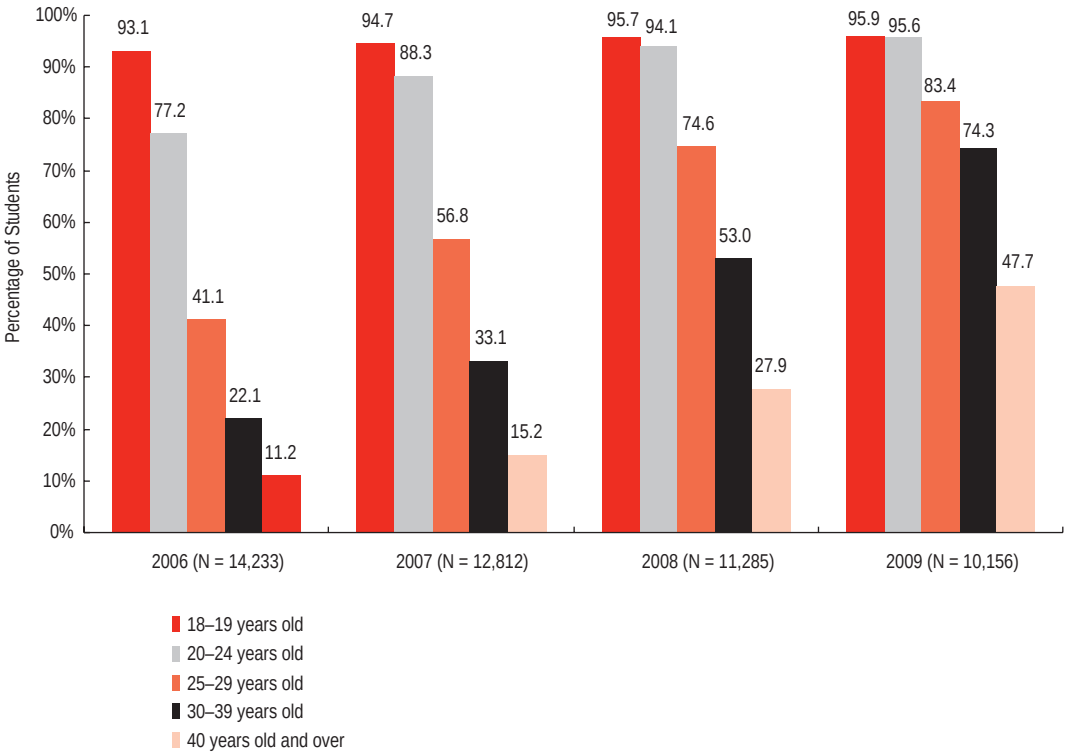


Figure 4-10. Percentage of Students Who Have Used Social Networking Websites, by Age, from 2006 to 2009 (39 Institutions)*

**Data are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding are different each year.*

much time." One of the more unusual references to the omnipresent access to and use of SNSs came from an equestrian in the focus group. "My friend posted something to Facebook while riding horses," the student said, quickly pointing out why this wasn't necessarily an activity for all horse enthusiasts: "I have a more hyperactive horse—I need to pay attention."

Emergency Notification Preferences

A series of both natural and man-made catastrophes affecting campuses in the past five years has greatly heightened leadership concern about emergency notification and communication. In the ECAR 2009 study *Spreading the Word: Messaging and Communications in Higher Education*, ECAR found that formal planning to communicate emergencies was common to three-quarters of the responding institutions, and most of those without a plan had one under development. The study reported that the most common emergency notification channels were e-mail (97.5%), automated telephone messaging (86.1%), human-mediated telephone trees (79.7%), SMS text messaging (77.8%), dedicated emergency websites (74.8%), and outdoor public-address systems (50.3%).[15]

For the first time, the ECAR 2009 student survey asked, "How should your institution first notify you of a campus emergency?" Results indicate a clear preference for using text messaging, with just over half the respondents (55.3%) choosing that option (see Table 4-4). Students have a much lower preference for e-mail, voice telephone call, and public-address systems, and the other options—social networking sites, instant messages, or the institution's general information website—are even less popular, with 1% or fewer responses. Given the prevalence of cell phone ownership by college students and the high use of text messaging revealed in Table 4-3, this is not a surprising result. Respondents to the ECAR messaging and communication study gave SMS text messaging a relatively high mean confidence rating as an emergency notification channel, although it came in lower than e-mail, outdoor public-address systems, and dedicated emergency websites. This evidence of institutional confidence and popularity with students, however, doesn't tell the whole story. As a recent *EDUCAUSE Review* article pointed out, using text messaging as an emergency notification system has several disadvantages, including inherent design problems, the opt-in process, character limits, and vulnerability to abuse.[16]

Table 4-4. Campus Emergency Notification Preference (N = 30,523)

Notification Technology	Percentage of Students
Text message	55.3%
E-mail	17.6%
Voice telephone call	12.2%
Public-address systems (sirens, loudspeakers, intercoms, etc.)	11.1%
The institution's general information website	1.2%
Facebook	1.0%
Instant message	0.6%
Other	0.5%
A special emergency website for the institution	0.4%
MySpace	0.1%
Other social network site (e.g., Bebo, LinkedIn, etc.)	0.0%

Several student comments mentioned students' preference for emergency notification via cell phone and their concerns about teachers requiring the phones to be turned off during class. As one noted, "I think that if the school is going to notify students of emergencies via text messaging, that the banning of cell phones during class time doesn't make much sense. I totally agree that no one should be talking or texting during class, but it is silly to utilize that method of emergency warning if it isn't accessible." Others voiced concerns about the reliability of text messaging as an emergency notification channel. "The text alert system is very beneficial, but the texts should be sent as soon as the PA alarm system goes off," one student wrote. "The last time the system was tested, I did not get the text until 10 to 15 minutes after the PA alarm went off. Whether that is the fault of my service provider or the text alert system, that time period can make a critical difference if an emergency were to really happen."

One student suggested Twitter as a multi-communication vehicle to get emergency notifications out. "The emergency service notification should be run through Twitter. This will allow for the message to be sent instantly and effectively to a variety of different mediums, including cell phones via text message." Another pointed out one of the weaknesses of using e-mail for emergency notification: "I like the idea of sending e-mails to warn of campus emergencies, but the school and its departments already send me too many e-mails about things I have no care about and [that] don't really concern me, so I think that these emergency e-mails might sometimes be deleted without being read."

Student Technology Skills

As our student surveys have done since 2004, the 2009 ECAR study looks once again at student skills (based on respondent self-assessment) for a set of computer technologies and information literacy practices that have been deemed important to the undergraduate experience and beyond. We acknowledge that self-assessment is not a perfect proxy for actual skills and that males often rate their skills higher than females; nonetheless, the ECAR student respondents' answers provide insight into their perceptions about their IT skills and where they are most and least comfortable with these skills.[17]

Technology Skills Self-Assessment

Respondents indicated they have confidence in their skills with presentation software, spreadsheets, course and learning management systems, and college and university library websites, generally rating themselves between fairly skilled and very skilled (see Table 4-5). Students assessed themselves lower on their use of graphics software, where just under a quarter (23.4%) of the students who do use graphics software described themselves as very skilled or expert, and 4 in 10 (41.0%) perceived that they are not at all skilled or not very skilled.

In the student focus groups, a number of interviewees who had observed others' technology skills agreed that basic skills were widespread but also added some qualifications about students' deeper understanding of the technology. One who worked at the help desk said, "Students are good at using technology, but when it comes to understanding the fundamentals of the software and deeper, we are not skilled." Another student, who told us "I help my friends out with their computer problems," concluded that "most people are at least technology competent—they might have trouble doing more complicated things, but most people don't have too many issues." Students generally agreed that knowing how to use technology was a fundamental requirement in school and in life. "Being tech savvy

Table 4-5. Student Technology and Information Literacy Skills Self-Assessment

	Students Using the Technology	Mean*	Std. Deviation	Associated Demographic Factors
Technology Skills				
Presentation software (PowerPoint, etc.)	28,522	3.63	0.821	–
Using the college/university library website	28,844	3.46	0.853	Senior
Course or learning management system	27,081	3.39	0.884	–
Spreadsheets (Excel, etc.)	26,477	3.35	0.900	Business/ engineering
Computer maintenance (software updates, security, etc.)	30,355	2.88	1.131	Male/ engineering
Graphics (Photoshop, Flash, etc.)	22,324	2.81	1.023	Fine arts
Information Literacy Skills				
Using the Internet to effectively and efficiently search for information	30,454	4.12	0.785	–
Evaluating the reliability and credibility of online sources of information	30,428	3.66	0.912	–
Understanding the ethical/legal issues surrounding the access and use of digital information	30,462	3.43	1.015	–

**Scale: 1 = not at all skilled, 2 = not very skilled, 3 = fairly skilled, 4 = very skilled, 5 = expert*
Note: Means and standard deviation calculations include only the students who use the technology.

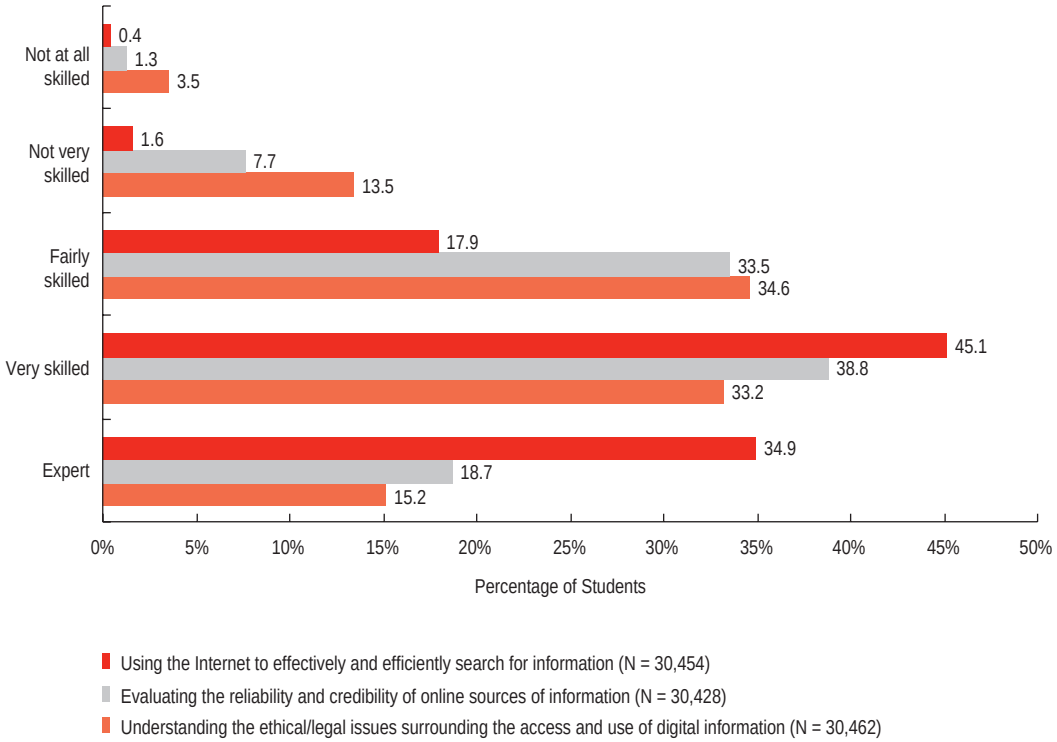
is not so much a choice but a necessity," as one focus group participant observed. "Regardless of what your major is or what your goals are in life, you are going to have to use tech a lot."

Information Literacy Skills Self-Assessment

There are several definitions and notions of what it means to be information literate. According to the National Forum on Information Literacy, "Information literacy refers to a constellation of skills revolving around information research and use." In 1989, the American Library Association's Presidential Committee on Information Literacy issued a report stating, "To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information."[18] Despite the variety of nuanced definitions of information literacy that institutions have put forward, it is widely accepted that it is a fundamental skill that should be taught and reinforced in higher education. In this year's survey, ECAR once again asked three survey questions about information literacy derived from the Association of College and Research Libraries' (ACRL) "Information Literacy Competency Standards for Higher Education"—now the most used framework for creating information literacy initiatives and programs.[19] Results show that, overall, respondents considered themselves quite Internet-savvy users (see Table 4-5 and Figure 4-11).

Eight out of 10 students (80.0%) were very confident in their ability to search the Internet effectively and efficiently; almost half (45.1%) rated themselves very skilled, and another third (34.9%) rated themselves as experts. Although students' assessment of their ability to evaluate the reliability and credibility of online information and to understand related ethical and legal issues

Figure 4-11. Student Information Literacy Self-Assessment



is lower, overall ratings were still high. These positive perceptions are generally consistent across age, gender, major, and Carnegie class.

Self-Assessed Technology and Information Literacy Skills and Technology Adoption

Students who saw themselves as innovators and early adopters ranked their technology and information literacy skills higher than other students (see Figure 4-12). As we saw in Figure 4-11, overall, 80.0% of this year's respondents rated their information literacy skill "using the Internet to effectively and efficiently search for information" as very skilled or expert, whereas 91.5% of early adopter/innovator respondents saw themselves as very skilled or expert. However, just 6 out of 10 (59.1%) of the respondents who categorized themselves as late adopters or laggards rated their skill level at very skilled or expert. We see the same trend in the technologies where students reported lower overall skill levels (see Table 4-5). For example, just over a third (35.6%) of the early adopter/innovators perceived themselves as very skilled or expert in the use of graphics software, and only 12.3% of the late adopters/laggards rated their skills at that level.

The difference between early adopter/innovators and late adopter/laggards becomes more pronounced with technology that is generally viewed as challenging or complex. For instance, more than half of the early adopter/innovators (54.2%) viewed themselves as very skilled or expert in computer maintenance, but fewer than 1 in 10 (9.7%) of the late adopter/laggards rated themselves this highly.

These technology adoption practice patterns are also associated with new technology. For instance, of the students who reported owning a handheld device capable of accessing the Internet, 39.3% of the early adopter/innovators reported accessing the Internet daily from their device, versus 21.7% of mainstream adopters and 16.2% of late adopter/laggards. We explore this data in greater detail in Chapter 6

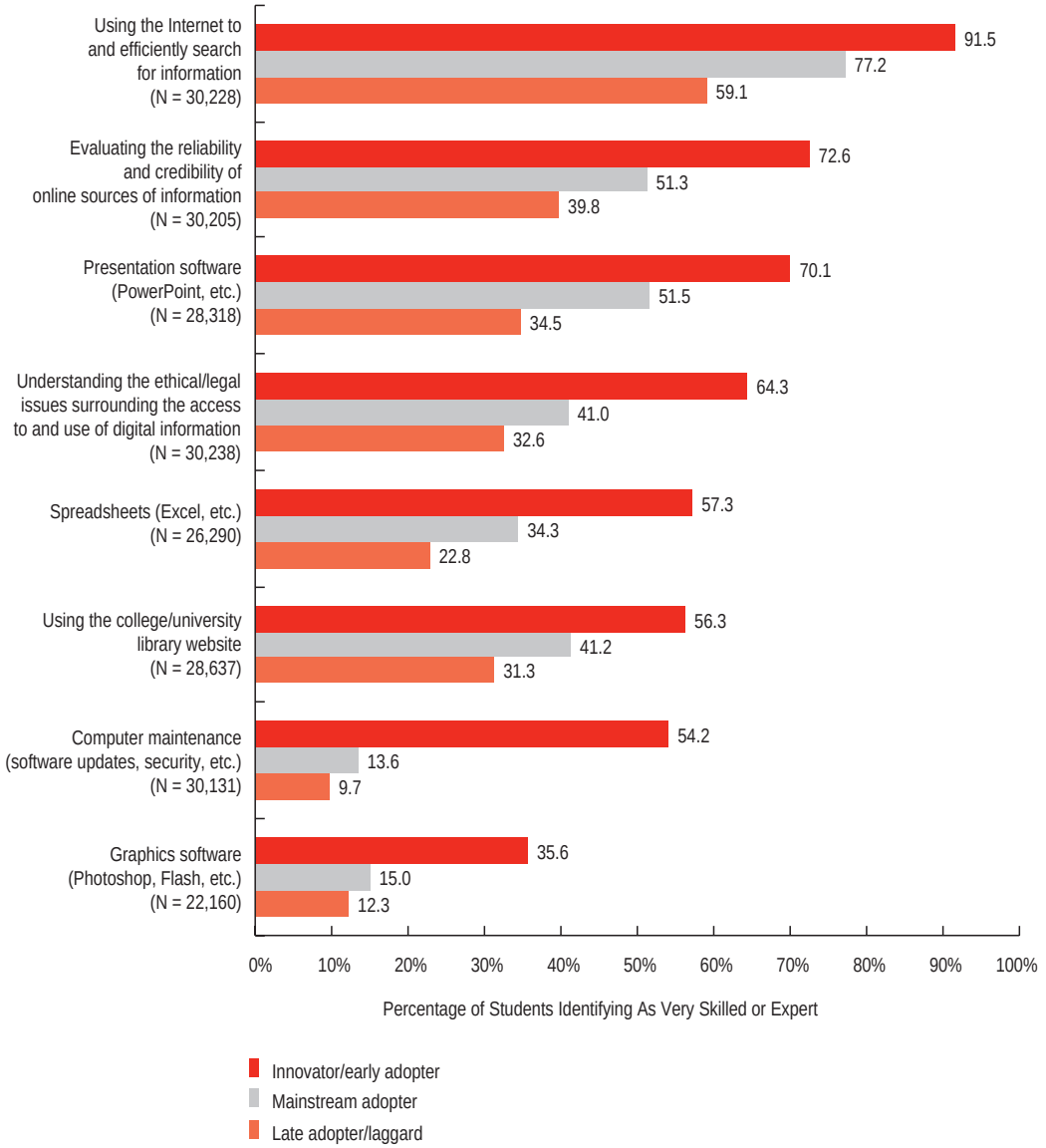


Figure 4-12. Students Who Identify as Very Skilled or Expert with Technology and Information Literacy Skills, by Technology Adoption

Note: This includes only respondents who use the technology or information literacy skill.

when we look at respondents' use of mobile technology. In some cases, it is possible that the difference between laggards and innovators is a reflection of individual interests or other factors, but as mentioned earlier, innovators and early adopters can sometimes be seen as blazing a trail upon which mainstream and late adopters could potentially follow, and ECAR will continue to monitor their use of new technologies.

Students themselves acknowledge the importance of keeping up with new technology, and many of their final comments in this year's survey reflect this sentiment. A common theme is the impact on future employment. As one student concluded, "IT at the university level has been helpful for me as a nontraditional student to upgrade my expertise and prepare me for IT at the workplace. I enjoy learning new technology that helps make my work easier and ultimately feel like this makes me a winner in all ways for taking the time to learn these new products and applications."

Endnotes

1. Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *The ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control* (Research Study, Vol. 5) (Boulder, CO: EDUCAUSE Center for Applied Research, 2004), available from http://www.educause.edu/ecar. This initial study had fewer institutions (13) than the following studies in 2005, 2006, 2007, and 2008.
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5
IT and the Academic Experience

I like the idea of professors using technology as an aid rather than being dependent on it. Find a happy medium.
—An elementary education major

Key Findings

- Nine out of 10 respondents (88.9%) have used a course or learning management system (CMS), and 7 out of 10 (70.4%) were using one during the quarter/semester of the survey.
- From 2006 to 2009, reported use of CMSs increased from 79.7% to 91.0% of respondents from the 39 institutions that participated in all four years of the ECAR student studies.
- From 2006 to 2009, the percentage of respondents who felt positive or very positive about their CMS experience dropped from 76.1% to 63.4% of those from the 39 institutions that participated in all four years of the ECAR student studies.
- Just under one-half (45.0%) of the respondents reported that most or almost all of the instructors use IT effectively in their courses.
- A majority of students (67.7%) disagreed with the statement "I skip classes when materials from course lectures are available online."
- Almost one-half (49.4%) of respondents agreed that IT in courses improves learning.
- When asked how much technology they would like in their courses, 59.6% indicated they prefer a moderate amount of technology.
- Eight out of 10 respondents (79.5%) said they like to learn through running Internet searches.
- About one-third (31.7%) of respondents said they like to learn through creating or listening to podcasts or webcasts.
- For the courses they were taking during the quarter/semester of the survey, 73.1% of the students reported using the college/university library website, 66.5% used presentation software (PowerPoint, etc.), and 46.3% used spreadsheets.

In the century or so since electricity was introduced into the classroom, technological innovations used to communicate educational information and support the process of teaching—film, radio, television, computers, and the Internet—have influenced instructional design in successively more rapid and dramatic ways. Some argue that the type and characteristics of the technology used to convey knowledge strongly influence how the knowledge is perceived, or, as Marshall McLuhan famously proposed in his study of communications media, "the medium is the message." They believe information delivery

technology is inseparable from the educational content it is delivering, and therefore the technology itself should be the focus of research when assessing educational performance. Others view information and communication technologies as merely tools in the education process, like the dialogues of Socrates or the chalkboards of the one-room schoolhouse, and maintain that they should be approached as a subset of instructional design when exploring the efficacy of the educational process. In *E-Learning in the 21st Century: A Framework for Research and Practice,* D. R. Garrison and Terry Anderson observe that education should not be defined as "totally within or totally outside of the tools used to support, deliver, confine and define it." They further point out that although educational technology sustains the "educational transaction," it is just one of several critical components, not the least of which is the participants themselves—including their personalities, motivations, and teaching and learning styles.[1]

The influence of information and communication technology on the academic experience is undeniable. Old ways of teaching wherein college students were thought to be empty vessels into which educators poured knowledge via one-way information transference have evolved into strategies through which students participate more actively in the learning process in a bidirectional flow of knowledge dissemination. The communications technologies that support this flow are at the core of the changing face of postsecondary education. However, institutions seeking to leverage technology to improve educational outcomes face a conundrum—how to balance the expectations of younger, traditional-aged digital natives coming to campus, while supporting the growing cadre of older students who may be less technically savvy. Indeed, when looking at ways to improve the process of teaching and learning, it is important to understand the range of students' uses of and perspectives about technology. In this chapter, ECAR seeks to expand upon the previous chapter's exploration of students' information technology (IT) experience in general to look more in depth at findings about

- what types of technologies students like to use for learning;
- how much IT students prefer in their courses;
- what technologies students were using in courses during the quarter/semester of the survey;
- whether students were using course management systems (CMSs) and, if so, whether their experiences with them were positive or negative;
- student opinions about their instructors' use of IT in courses; and
- student perceptions about the impact of IT on their courses.

How Students Like to Learn with Technology

For our 2007 survey, Edward Dieterle, an expert in the psychosocial aspects of learning and teaching with current and emerging technologies, designed a set of questions we could use to better understand how students think about technologies as learning tools. This year, we asked the same questions, along with a question ECAR added in 2008 about learning through creating or listening to podcasts or webcasts (see Figure 5-1). The technologies described in these questions represent, for the most part, means of transferring information—communication—which is the very core of the educational process. These newer, faster, more powerful ways to find, use, and exchange content are considered by many to be shaping and fundamentally transforming the teaching and learning process in higher education, and understanding how students think about them as learning tools can help educators prepare effective learning environments.

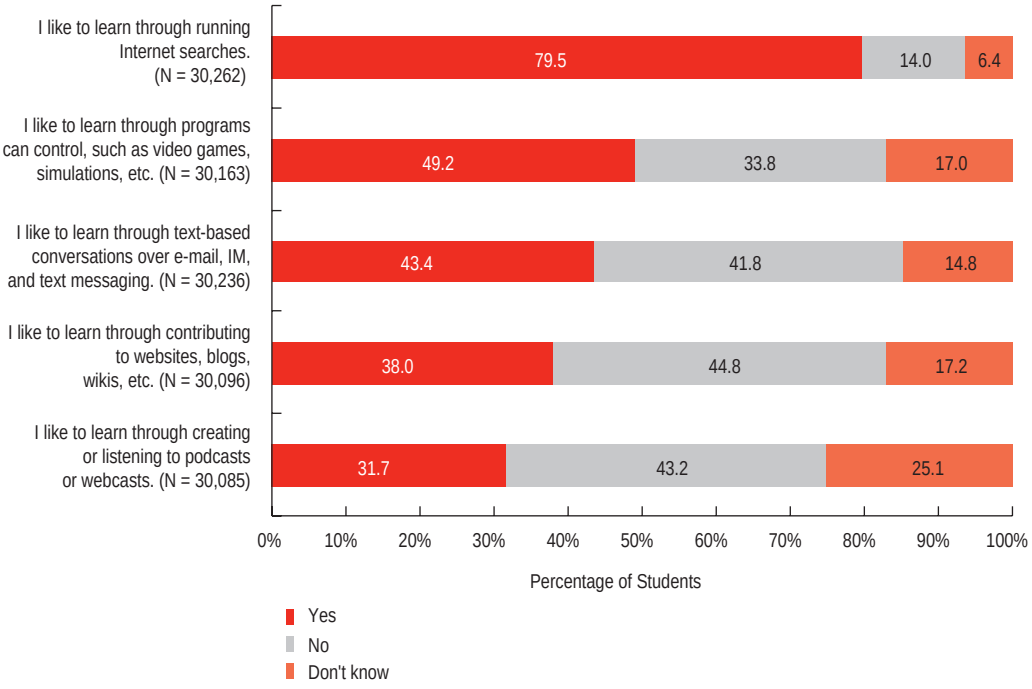


Figure 5-1. How Students Like to Learn with Technology

We have found little change in respondents' preferences for learning with all the technologies mentioned in Figure 5-1 since we began asking. As in 2007 and 2008, 8 out of 10 of this year's respondents (79.5%) like to learn by running Internet searches—noticeably more than through any of the other technologies we asked about. Many students commented on how much they like and value searching the Internet. For instance, after complaining about overreliance on IT in other academic situations, a student offered this caveat: "I do think that web-based information search-and-retrieval functions are extraordinarily useful." In a similar vein, another concluded, "Usually, just going to lectures, doing the reading, and using IT in the form of Internet searches for external research is the best way to learn."

About half of respondents said they like to learn through programs they can control such as video games and simulations. More males (63.6%) than females (40.1%) said they like to learn this way—the only learning technology we asked about where gender made a difference. In the *EDUCAUSE Review* article "Games for Education: 2008," Bryan Alexander wrote of the benefits and opportunities games offer as pedagogical devices, but he cautioned that technological demands on campus IT can represent a support challenge as the demands of a game increase. This is particularly important when looking at full-media mass streaming of simulations such as Second Life, where network management must be considered. "As with so many other digital media, the strategic decision on gaming support involves balancing IT resources with pedagogical or other benefits."[2]

Although almost half of our respondents felt positive about learning through games and considerable research is available on the educational potential for digital game-based learning (DGBL) and multiuser virtual environments (MUVEs), institutions' adoption rates of educational games and simulations are still fairly low. Citing a lack of evidence demonstrating that these types of games as learning environments are effective, experts have called for more research to understand the barriers to the adoption of these learning innovations in institutions.[3]

Fewer than half of respondents (43.4%) like to learn through text-based conversations over e-mail, IM, and text messaging. In the

open-ended comments, a student mentioned using text messaging in a learning environment: After describing the institution's library system as "amazing," the student wrote, "I love it how I can send a text message on my phone to locate the book." Instant messaging, or using some form of chat system, was also referred to in the comments. A student who said "Online courses are great" went on to say, "The feature of real-time chat is a great way to simulate a class discussion. It works very well and allows students to become familiar with others in the course." Some comments, however, emphasized a preference for face-to-face interaction, as exemplified in this student's conclusion: "Having chats on the system can be time-consuming and confusing to use, rather than having the teacher be present in front of the class. I had the experience of having one of my classes meet online every other week, and it was okay with the comforts of home, but when we really learned was when we were in the classroom."

Just over a third of the respondents said they like to learn by contributing to websites, blogs, wikis, etc. Blogging in the academic context received mixed reviews in the open-ended comments. Several students could not see the benefit of blogging. "I had one student instructor who insisted we do online blog discussions on our course website for credit," one wrote, "but I felt it was just to use the IT to use it instead of to enhance my education." Another wrote, "The use of 'blogs' or 'Wikis' rarely contributes anything to my learning. To me, and to many of my peers, they seem like using technology for technology's sake." But some students found contributing to blogs quite valuable, like the student who said, "I get a lot of practice for my writing through blogs and forums. I'm a better writer because of IT." Another positive comment on blogs and wikis was exemplified by the student who wrote, "I love it when instructors use wikis or blogs for class. It's much easier to stay organized, prepared, and aware. I wish more instructors would use them."

Fewer respondents said they like to learn through creating or listening to podcasts or webcasts than through the other four technologies listed. However, several respondents mentioned podcasts, webcasts, and video-streamed lecture content in the student comments, primarily as a means to help retention. "Podcasts would be a great thing, especially for engineering students [who] may not get something right away," wrote one, who concluded that podcast lectures would "reinforce ideas and difficult subjects." Another simply wrote, "I found online video lecture streaming very valuable for exam reviewing." Using YouTube in courses came up several times in comments and in the focus group interviews, where a creative writing major told us, "In my class we watched a YouTube video just before we discussed a poem; it was good to hear, see, and better understand the poem. It was a much better discussion because of it."

From our list of five ways to learn through technology, about half of the respondents (50.9%) said they like to learn through two or three of the options, whereas only 8.4% said they like to learn through all five technologies, and only 9.3% said they don't like to learn using any of the technologies. Because some respondents may not be experienced in these technologies in a learning context, it is not surprising that a large proportion (6.4% to 25.1%) reported that they do not know whether or not they like to learn using them.

We found a few associations between respondents' self-assessed skill levels in some of these technologies and whether they like to learn with the technology, particularly in running searches on the Internet. Students who like to learn through Internet searches were more likely to describe themselves as expert in their ability to search the Internet effectively and efficiently (90.2%) than students who do not like to learn this way (9.8%) (see Figure 5-2). Despite these relative differences, it's worth noting that majori-

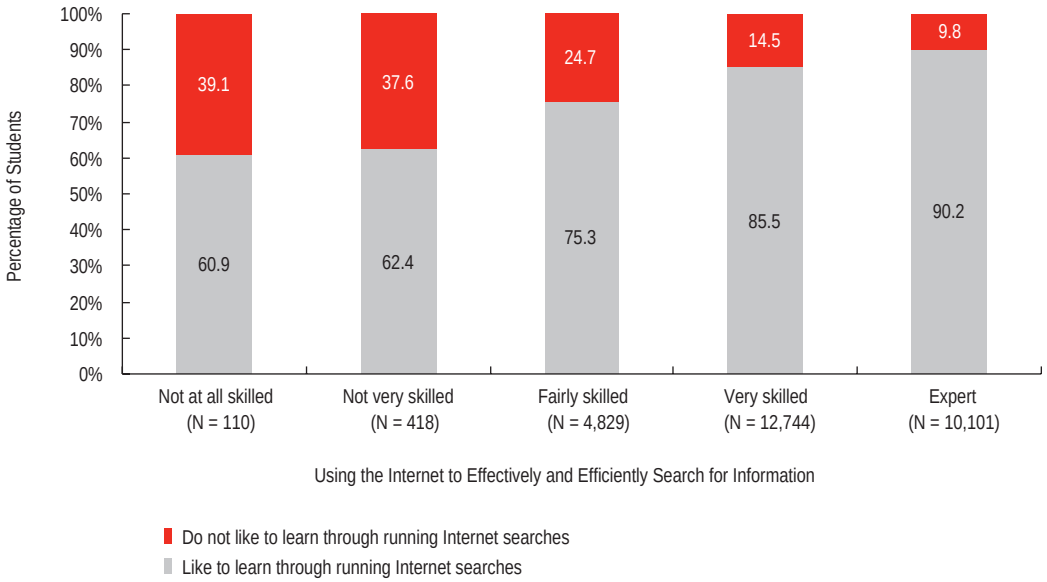


Figure 5-2. How Students Like to Learn with Technology, by Internet Search Skill Self-Assessment

ties in both groups gave themselves one of the top two skill ratings for Internet search ability. Quite a few students commented on their Internet searching prowess. A student who reported using IT every day at work, school, and home wrote, "I am exceptionally skilled in searching for information," and another expounded the convenience of web searching: "I'll never take 30 minutes to get to the library when I can figure out problems myself or spend two minutes to Google it." A more circumspect student simply wrote, "I heart Google."

Although we found that liking to learn by using the Internet to search for information is positively associated with respondents' self-assessed information literacy skill at using the Internet to effectively and efficiently search for information, we did not find a similar association with two other information literacy skills: evaluating the reliability and credibility of online information, and understanding ethical and legal issues related to digital information access and use. As we reported in Chapter 4 (refer to Table 4-5 and Figure 4-11), students tended to give themselves lower ratings on these information literacy skills than on their Internet search skills. Thus, though they seem to think they're skilled at searching for information and enjoy learning through doing it, students on average said they are less skilled at discerning key qualities about information that could be relevant to learning.

Other researchers have suggested that students may find that the ready availability of search tools brings its own challenges. Project Information Literacy, a national multiyear research study of how college students function in the digital age, found that in general students reported being "challenged, confused, and frustrated by the research process, despite the convenience, relative ease, or ubiquity of the Internet." The study's 2009 progress report concluded that "no matter what information resources they may have at their disposal, and no matter how much time they have, the abundance of information technology and the proliferation of digital information resources make conducting research uniquely paradoxical: Research seems to be far more difficult to conduct in the digital age" than previously.[4]

Although our findings do not confirm or disprove those of the Project Information Literacy study, they do show some relative self-assessed skills difference between searching for information and making use of it. In addition, some respondents' comments

indicated frustration about searching and about the sheer volume of information to be screened. Writing "I have had trouble on search sites like Google to find info that I need," a student complained that "a lot of times I know the info is out there but I just can't find it." Another student summarized, "IT is good, but sometimes there is too much information."

We also found that respondents who identified themselves as early adopters of technology were more likely than mainstream or laggard adopters to report liking to learn with all the technologies we asked about (see Figure 5-3). At least half or more of early adopters/innovators like to learn using each of these technologies, and the differences between early and late adopters were especially large for the newer technologies on the list. As technologies become more mature and more students perceive themselves as skilled in their use, we may see an increase in the overall percentage of students who like to learn with these technologies.

Technologies Used the Quarter/Semester of the Survey

The 2009 ECAR survey asked respondents which technologies they were actively using as a part of their courses at the time of the survey (February 23 through April 13, 2009). Majorities of respondents used the college or university library website, a course or learning management system, and presentation software (PowerPoint, etc.), while almost half used spreadsheets such as Excel (see Table 5-1).

Almost three-fourths of respondents (73.1%) reported using their institution's library website for a course during the quarter/semester of the survey. ECAR also

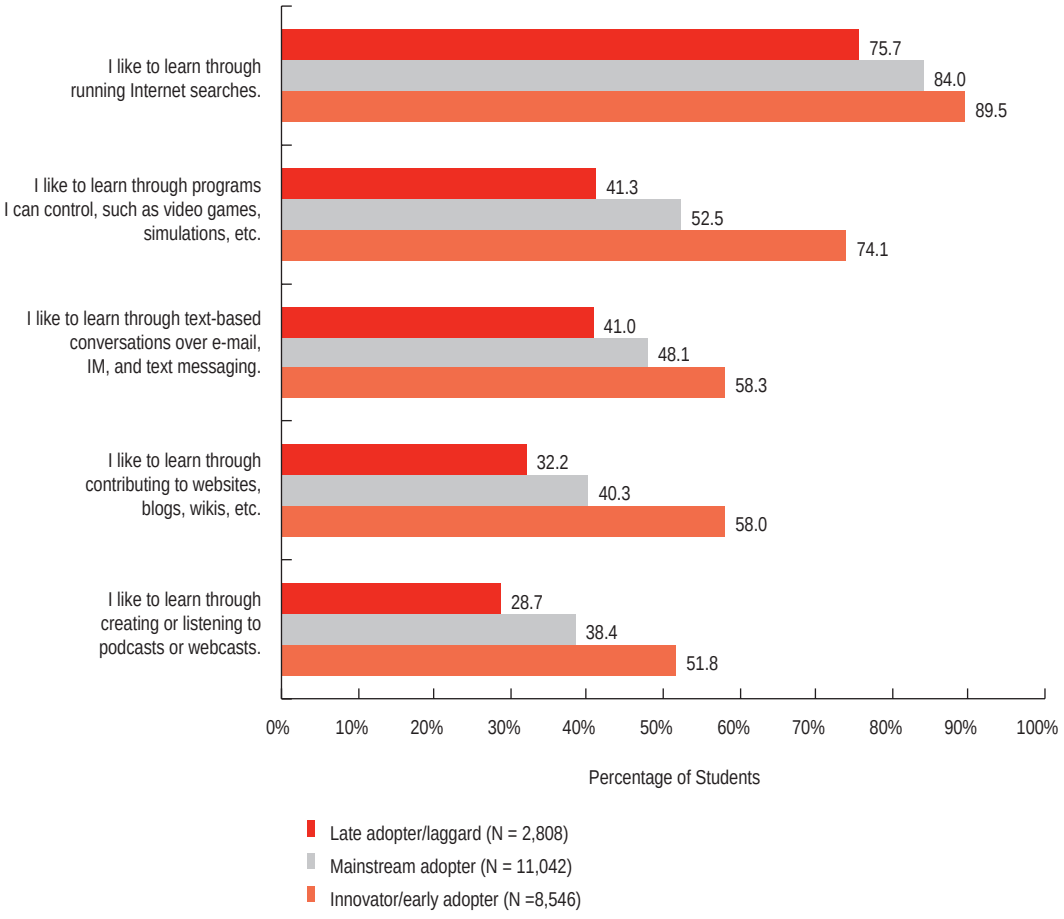


Figure 5-3. How Students Like to Learn with Technologies, by Technology Adoption

Table 5-1. Technologies Used in Courses the Quarter/Semester of the Survey, by Class Standing

	Senior (N = 13,553)	Freshman (N = 10,400)	Community College Students (N = 2,522)	All Students (N = 30,616)
Many Students Used the Quarter/Semester of the Survey				
College/university library website	75.6%	72.9%	59.6%	73.1%
Course or learning management system	73.0%	68.3%	59.7%	70.4%
Presentation software (PowerPoint, etc.)	73.5%	60.1%	55.0%	66.5%
Spreadsheets (Excel, etc.)	53.2%	39.9%	32.0%	46.3%
Few Students Used the Quarter/Semester of the Survey				
Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)	27.1%	31.6%	19.5%	27.8%
Wikis	25.2%	25.6%	23.3%	25.3%
Instant messaging	18.0%	20.3%	13.9%	18.3%
Graphics software (Photoshop, Flash, etc.)	18.8%	11.5%	14.9%	15.5%
Blogs	12.1%	11.2%	11.1%	11.5%
Programming languages (C++, Java, etc.)	11.2%	11.4%	9.0%	11.1%
Discipline-specific technologies (Mathematica, AutoCAD, STELLA, etc.)	12.0%	9.1%	6.3%	10.7%
Simulations or educational games	10.1%	10.1%	11.5%	10.3%
E-portfolios	7.9%	6.2%	5.2%	6.9%
Video-creation software (MovieMaker, iMovie, etc.)	6.8%	5.7%	4.4%	6.0%
Podcasts	5.8%	5.8%	5.0%	5.8%
Audio-creation software (Audacity, GarageBand, etc.)	5.3%	4.8%	3.4%	5.0%
Online virtual worlds (Second Life, Forterra, etc.)	1.2%	1.1%	2.3%	1.3%

found that seniors from four-year institutions reported using more presentation and spreadsheet software in courses this quarter/semester than either freshmen or community college respondents—a pattern reflected in last year's study. This usage profile probably reflects the fact that upper-division courses, often focused on student major, make more use of these core applications.

Past ECAR student studies found that students' majors are associated with the IT skills they develop, presumably because required technologies vary by major. This year's responses on technologies used in courses this quarter/semester support this idea once again (see Table 5-2).

As in previous years, engineering respondents used the college/university library website less than all other majors. However, engineering majors remained at the top among users of spreadsheets, programming languages, and discipline-specific technologies. Business majors, as would be expected, were also heavier users of spreadsheets in their courses. Fine arts majors indicated they make greater use of graphics and video- and audio-creation software than respondents with other majors.

Table 5-2. Technologies Used in Courses the Quarter/Semester of the Survey, by Major

	Students in Major	Percentage Using Technology
College or University Library Website		
All other majors*	25,465	76.70%
Engineering	2,733	61.50%
Spreadsheets (Excel, etc.)		
Engineering	2,733	75.90%
Business	4,790	68.60%
Physical sciences	1,786	61.20%
Life/biological sciences	5,547	54.00%
All other majors*	13,342	34.40%
Graphics Software (Photoshop, Flash, etc.)		
Fine arts	2,268	34.50%
Engineering	2,733	20.50%
All other majors*	23,197	12.80%
Audio-Creation Software (Audacity, GarageBand, etc.)		
Fine arts	2,268	17.10%
All other majors*	25,930	4.40%
Video-Creation Software (Director, iMovie, etc.)		
Fine arts	2,268	13.60%
Education	2,857	10.60%
All other majors*	23,073	5.00%
Programming Languages (C++, Java, etc.)		
Engineering	2,733	43.40%
Physical sciences	1,786	27.20%
All other majors*	23,679	6.40%
Discipline-Specific Technologies (Mathematica, AutoCAD, STELLA, etc.)		
Engineering	2.733	45.10%
Physical sciences	1,786	29.10%
All other majors*	23,679	7.20%
E-Portfolios		
Education	2,857	20.20%
All other majors*	25,341	6.10%

**Excludes responses that were not coded as one of the standard majors (e.g., "other" or "undecided").*

Interestingly, besides fine arts majors, this year's education majors indicated a higher percentage of use of video-creation software than other majors. This may be related to the growth in use of video technology in K–12 classrooms and the need for educators to be fluent in these tools. E-portfolios continue to be used primarily by education majors, since they are often used as a tool for teacher applicants to communicate the status of their teacher education requirements and qualifications to school district administra-

tors. This year's survey results do not indicate appreciably different rates of e-portfolio adoption for students in other majors linked to professions requiring professional certifications, and the overall use of e-portfolios has not significantly changed since 2006, when ECAR first asked this question.

Although 35.0% of the respondents overall use podcasts (refer to Table 4-3), only 5.8% reported using them in courses this quarter/semester. A marked difference also was found between overall use of audio- and video-creation software and their use in a course this quarter/semester. Although more than a third of respondents overall reported using these software tools, only 6.0% were using video-creation software and 5.0% were using audio-creation software in courses during the quarter/semester of the survey. These findings, similar to previous years' survey results, suggest that students are learning and using these technologies, but not necessarily for formal academic reasons—a possibility consistent with the 2007 ECAR survey finding that two-thirds of respondents reported learning video/audio software out of personal interest.[5]

Just 8.1% of this year's respondents were using online virtual worlds, and 1.2% used them in courses the quarter/semester of the survey. Other researchers are projecting extraordinary growth in use of online virtual worlds on the basis of current usage and conversion rates of registrants to active users.[6] Industry experts estimate that there are as many as 303 million registered accounts in 21 virtual worlds. Most of the users are under 20, with only four worlds reporting user numbers in the 20- to 30-year-old category, and only the market leader in virtual worlds, Second Life, reports users in the 30-plus sector.[7] Second Life has more than 180 higher education institutions listed as having presences in their virtual world. According to the May 2008 metrics of Second Life, residents of traditional college age, 18–24, make up 22.71% of the membership; ages 25–34 make up 35.14%, and users 35–44 constitute 24.18%.[8] In his October 2008 *EDUCAUSE Review* article, "Virtual Worlds? 'Outlook Good,'" AJ Kelton points out that this large base of traditional and nontraditional college-aged Second Life residents is "a very nice pool of potential students."[9] Because these online environments are in very early stages of adoption and growth, ECAR will track their usage in future studies.

As would be expected, we found a consistency among technologies respondents said they like to learn with; use of corresponding technologies in courses during the quarter/semester; and reported use for school, work, or recreational activities. For example, respondents who like to learn through text-based conversations using e-mail, IM, and text messaging more often reported using IM in a course during the semester/quarter of the survey as well as using it generally. Students who said they like to learn through programs they can control, such as video games, simulations, etc., more often reported using simulations or educational games during the current quarter/semester and using online multiuser computer games in general. The same pattern holds for students who like to learn through contributing to websites, blogs, wikis, etc., since they reported using blogs and wikis in courses this quarter/semester as well as contributing to blogs and wikis and video websites more frequently in general. The respondents who said they like to learn through creating or listening to podcasts or webcasts also reported using podcasts during a course this quarter/semester as well as greater overall use of podcasts and audio- and video-creation software.

Course or Learning Management Systems

The recent U.S. Department of Education report "Evaluation of Evidence-Based Practices in Online Learning," a meta-analysis involving

research published from 1996 to July 2008, found the results of the analysis leaned in favor of blended and online learning. The report emphasized that conditions vary with instructor and content, and that it is likely that other elements, such as additional learning time and materials and additional opportunities for collaboration, had an influence. However, the study ultimately concluded that although the reported meta-analysis findings don't support simply putting existing courses online, they do support "redesigning instruction to incorporate additional learning opportunities online."[10]

If respondent use of CMSs is any indication, it appears that faculty from the institutions that have participated in the ECAR student studies since 2005 are using online content in some way in their curriculum, because a lot of students report using CMSs.[11] This year, 88.9% of our respondents reported that they have taken a course that used a course or learning management system (see Figure 5-4). Of these students, almost 8 in 10 (79.7%) were using a CMS during the quarter or semester of the survey. This translates to 70.4% of all respondents using a CMS during the current quarter/semester. Research from the 2008 EDUCAUSE Core Data Service confirms a prevalence of CMS availability, with an overwhelming majority of responding institutions (94.5%) confirming they have at least one commercial, homegrown, or open source course management system.[12]

Among the 39 institutions that participated in the ECAR student studies from 2006 to 2009, reported CMS use increased from 79.7% to 91.0% (see Figure 5-5), and research from EDUCAUSE and other sources corroborates an increase during this time frame.[13] Although previous years' ECAR data indicated that more seniors had taken a class using a CMS than freshmen and community college students, this year the data do not show a difference based on class standing.

Most respondents who had used a CMS said that their overall experience with them was either positive (52.0%) or very positive (11.2%). However, in the 39-institution longitudinal comparison data, we found that the percentage of respondents who felt positive or very positive about the CMS experience had dropped from 76.1% in 2006 to 63.4% in 2009 (see Figure 5-6). This is offset primarily by respondents who felt neutral about their experience rather than by the proportion who reported that their experience was negative or very negative, which has remained fairly constant (varying from 4.5% to 5.8%). Other research has found that as use of CMSs has grown, instructors and students have begun to express frustration

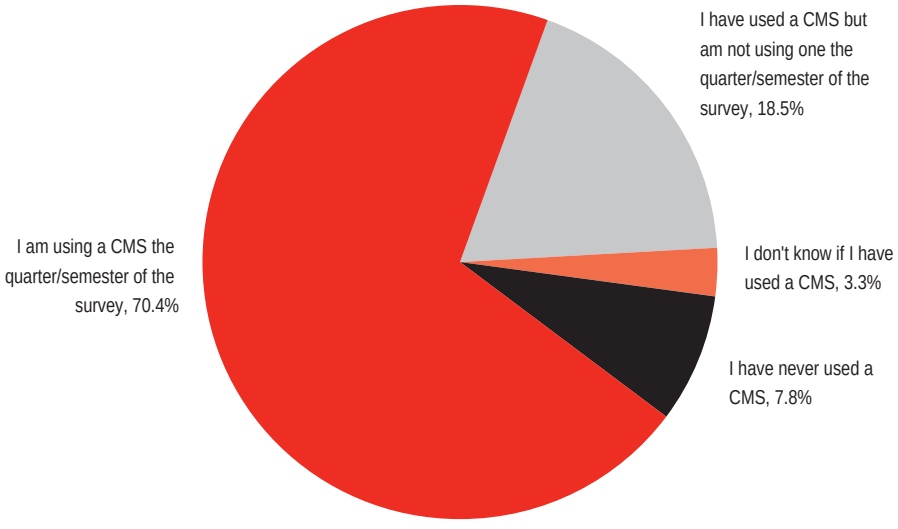


Figure 5-4. Student Use of Course or Learning Management Systems (N = 30,616)

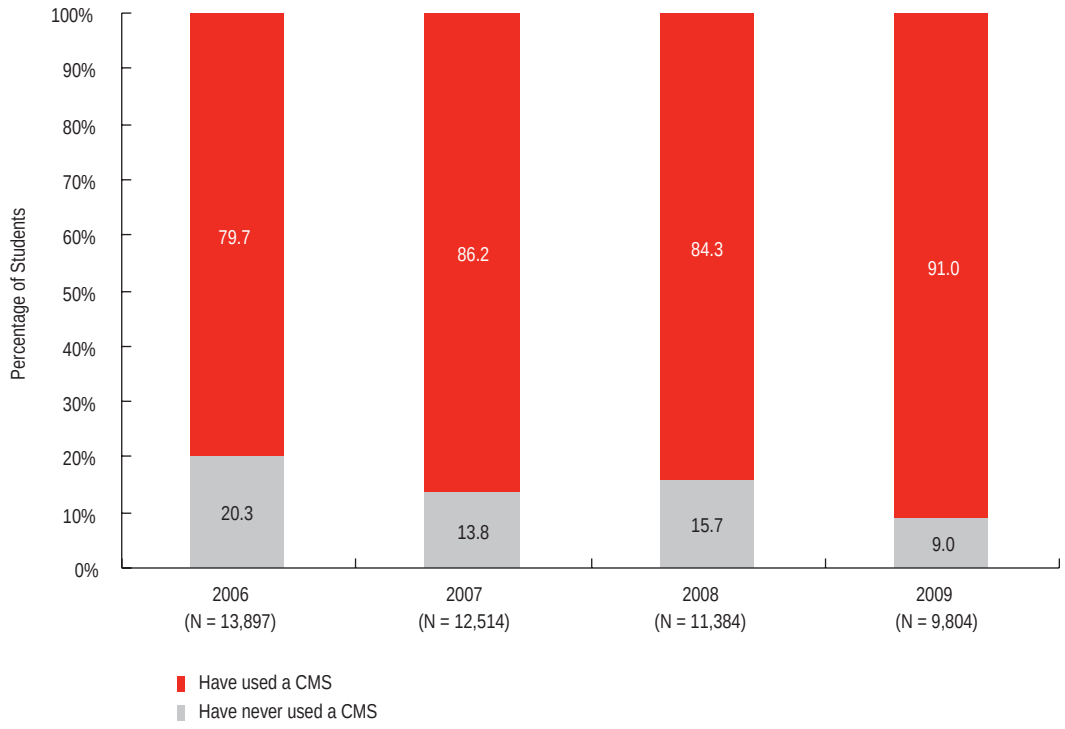


Figure 5-5. Change in CMS Use from 2006 to 2009 (39 Institutions*)

**Data are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding are different each year.*

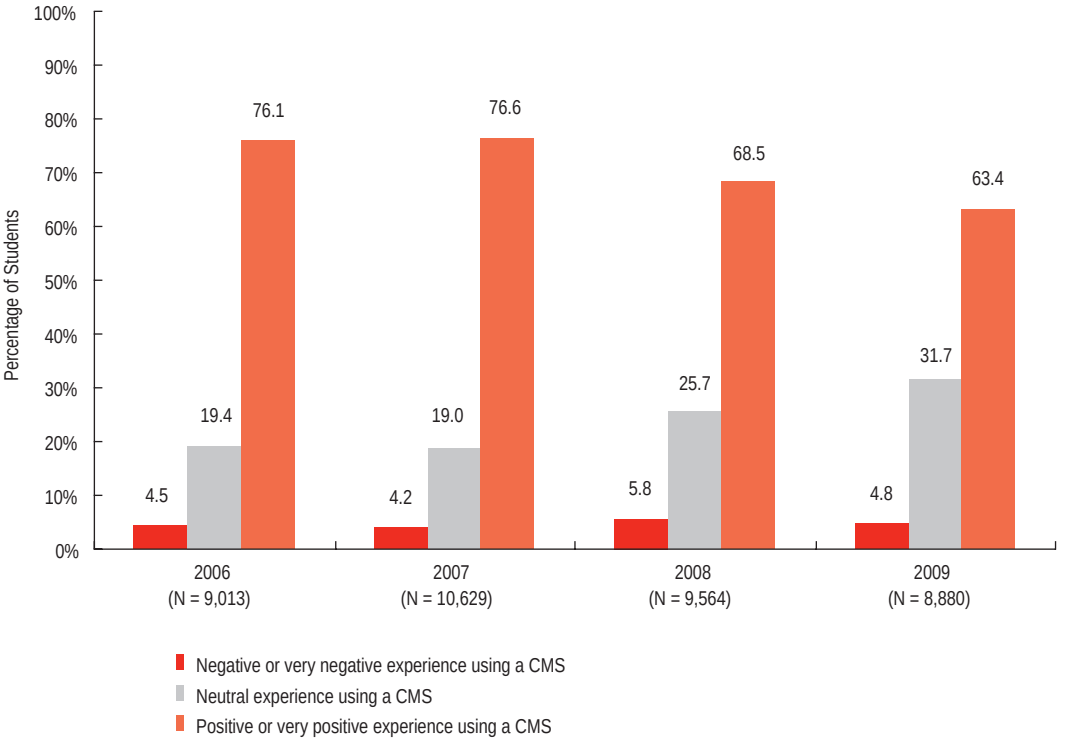


Figure 5-6. Change in Positive/Negative Experience Using a CMS from 2006 to 2009 (39 Institutions*)

**Data are based on student responses from the 39 institutions that participated in each of the 2006, 2007, 2008, and 2009 studies. Although institutions remained the same, the actual students responding are different each year. The 2009 survey data are for all respondents of this year's survey who reported they have used a CMS.*

over design and performance issues. A recent study published in *The Quarterly Review of Distance Education* summarized research on the deficiencies of CMSs and noted that many students complained about both speed and ease of use.[14]

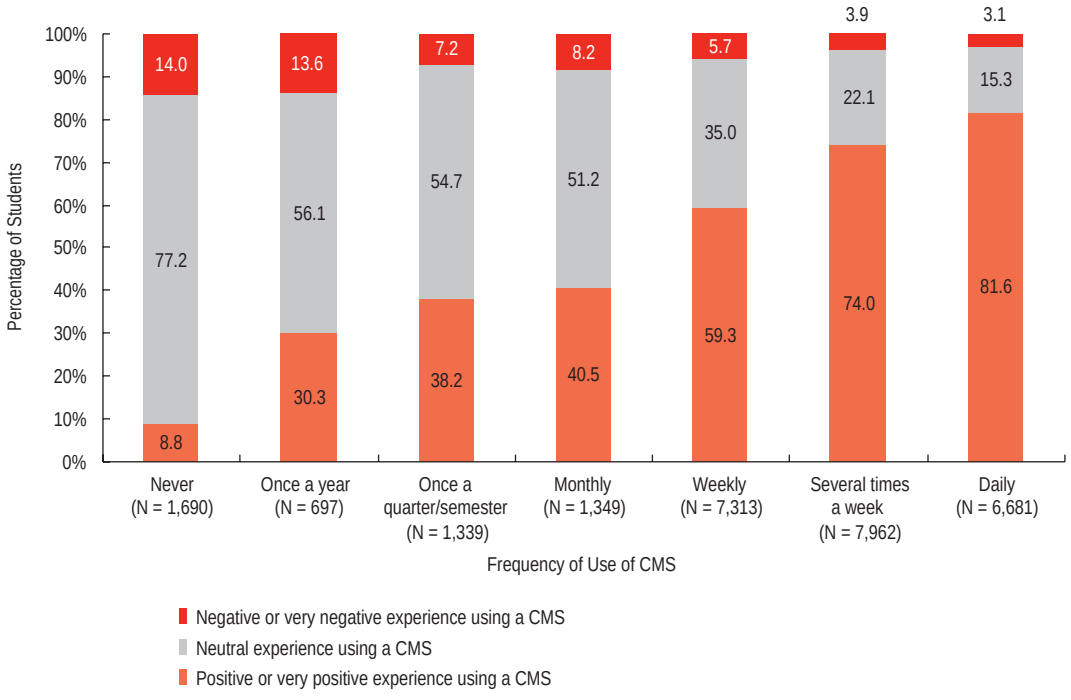
ECAR's survey did not ask respondents what influenced the positive or negative view they reported, but many student comments in the final open-ended survey question mentioned that their institution's CMS was slow or glitchy. A student who said "I'm taking my first online course this semester" commented regarding the CMS: "I really don't like this program as it is slow, and I mean extremely slow. We have an hour to take our online tests and normally, because of the slow loading times between questions, I'm lucky to get 25 questions answered in an hour. I've tried this from home and on campus and it's just horrible either way."

Once again, we found in this year's study that respondents who use a CMS more frequently were more likely to report positive experiences using a CMS (see Figure 5-7). It may be that as students use a CMS, they become more comfortable within the CMS environment and have less anxiety about or problems with using the system. As discussed earlier, other researchers have found that anxiety influences both perceived skill level and satisfaction with technology.[15] Results from the EDUCAUSE 2008 Core Data Report suggest that there is plenty of room for growth in CMS use because, despite the near ubiquity of CMSs on campuses, the vast majority of institutions reported that faculty use CMSs selectively, and fewer than 40% of institutions reported that the CMS is used for all or nearly all courses.[16]

Instructor Use of IT in Courses

In the past two ECAR student studies, we asked about respondents' views on instructors' use of IT in courses. In the 2008 survey we modified the questions to get more granular data on student perceptions. We added more specific questions and implemented a measurement scale to ask respondents to estimate how many of their instructors—almost none, some, about half, most, and almost all—met the criteria of the question (see Figure 5-8).

Figure 5-7. Positive/Negative Experience Using a CMS, by Frequency of CMS Use



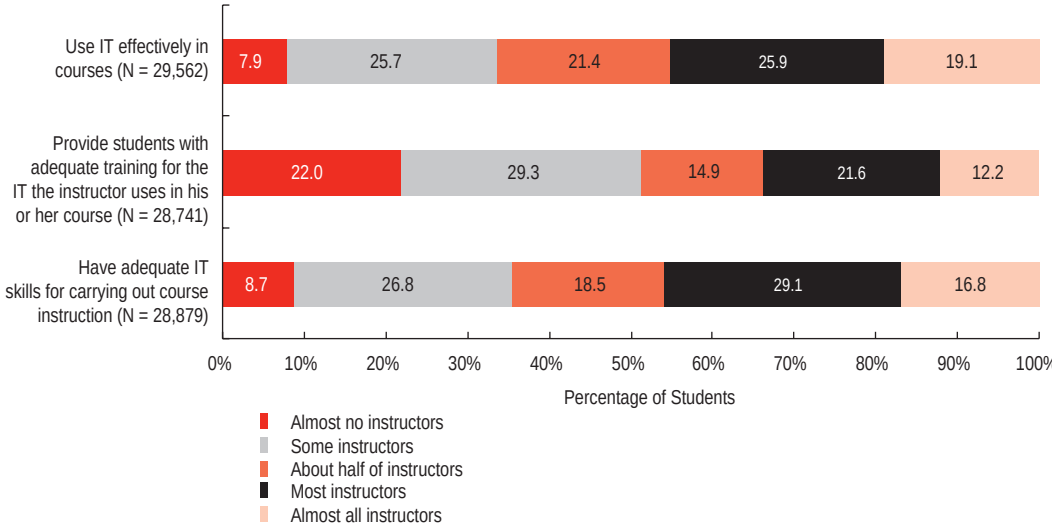


Figure 5-8. Instructors and IT in Courses

Last year's survey reported a bottom-line finding that fewer than half of students thought that most or almost all of their instructors met the criteria stated in each question about IT in courses. This year's respondents reported a similar pattern in that fewer than half reported most or almost all of their instructors meet the criteria of the three questions. Like last year, the distributions of responses for these questions are surprisingly consistent across student demographics and institution types.

About the same number of respondents said that most or almost all of their instructors use IT effectively in courses and that the instructors have adequate IT skills for carrying out course instruction. Respondents reported the greatest weakness when asked how many instructors provide students with adequate training for the IT used in the instructor's course. Barely a third of the students (33.8%) said that most or almost all of their instructors provide them with adequate training for IT in their course. And nearly a quarter of respondents said that almost no instructors meet this criteria.

Students also commented about instructors and technology in the open-ended question at the end of the survey. Describing an online course being taken the current semester, a student wrote, "This instructor has had 20 years of experience teaching online—and it shows. Instructors who are new to online teaching need to understand it is nothing like classroom instructing. Students are often handicapped by instructors who do not understand the limitations and advantages of online teaching." Some students mentioned the convenience of instructors posting PowerPoint slides online, whereas some felt that it made students lazy. "I hate it when full class lectures are put on PowerPoint and posted on the course management system," explained one student. "It takes away the need to take notes, listen, come to class, or actively learn when the lecture consists of the instructor reading off a PowerPoint presentation." Students also criticized instructors' lecture technique with PowerPoint: "I dislike it when professors use PowerPoint presentations in their lectures. I prefer the use of a chalkboard or overhead projector. I feel that when PowerPoint is used, the professor is more likely to go faster, write excess information on a slide, and allow less flexibility for the students to ask questions and guide the class."

One of the frustrations with instructors expressed by students in the focus groups was a lack of consistency in technology use by instructors. A community college student said, "One instructor uses things like the course management system and others don't.

But if everyone used it we'd have to learn it." Another noted, "Sometimes teachers start the semester using technology such as the course management system and then they just stop using it. The assignments are not up to date." A third student advised, "If instructors are going to use the course management system, they need to use it throughout the semester and use it consistently." An elementary education major recommended, "Keep everything current. Everything the instructor puts out there. Sometimes there is a syllabus that dates from the last semester. Sometimes they don't even update the PowerPoints. If it's going to be a problem for an instructor to keep it up to date, they shouldn't use it at all."

Skipping Classes When Materials Are Online

In the ECAR 2007 student study, we found that almost all respondents with access to a CMS used the online syllabus (97.7%) and online readings and links to other text-based course materials (96.5%).[17] Because these course materials are made available online through the campus CMS and other venues, we wondered if students were tempted to skip class. Last year, we asked students to respond to the statement "I skip classes when materials from course lectures are available online" on a scale of strongly disagree, disagree, neutral, agree, and strongly agree. We asked the question again this year, and nearly two-thirds (64.7%) said that they disagree or strongly disagree with the statement (see Figure 5-9). The mean value is 2.20 on the scale of 1 = strongly disagree to 5 = strongly agree. These figures are consistent with last year's data, and we found little change between this year's and last year's respondents' views about skipping class among the 71 institutions that participated in 2008 and 2009.

Other research has explored the question of whether attendance drops when instructors post material online. A study reported in a *Teaching of Psychology* journal article, "If You Post It, Will They Come? Lecture Availability in Introductory Psychology," focused specifically on video lectures and found that unlimited online access to lecture presentations did not negatively affect students' attendance rates. In fact, because attendance was found to have a direct positive effect on students' grades, the study findings reviewed in this article suggested that supplementing the course with online lectures was associated with higher overall course grades among students with lower rates of attendance.[18] Another study

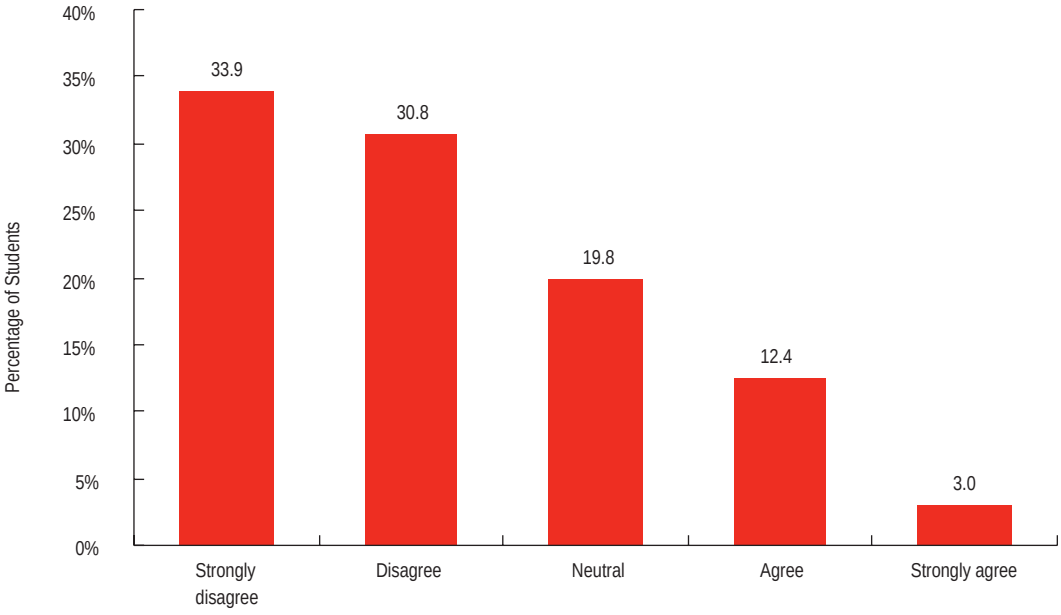


Figure 5-9. I Skip Classes When Materials from Course Lectures Are Available Online (N = 30,324)

found that posting course slides before classes had a very positive effect on attendance; students who more often downloaded slides before attending lecture were more likely to attend class. The study authors postulated that students prefer having lecture slides to use as a note-taking guide because it helps direct their attention to key information in the lecture and that having access to the lecture's slides prior to class alerted students that difficult material was going to be presented in class, motivating them to attend.[19]

Undergraduate students in our focus groups discussed the pros and cons of podcasting of lectures and skipping class. Regarding the value of having the lecture available, one commented, "I have a professor who is podcasting his lectures. It is useful if you can't come to class." A business major said, "You know when to skip class. The PowerPoint should be the basis for the lecture, not having the professor just read from it." One community college student summed up the pros and cons of skipping class by saying, "We can look at this [podcasting lectures and skipping class] positively and negatively. I can skip—but this will define the difference between an A and a C student. I choose to go to class and get the better grade."

Availability of IT Services for Coursework

In 2008, as a result of previous surveys' respondents bringing up concerns about accessing IT services due to occasional interruptions of the network, unavailability of the CMS, difficulty uploading/downloading files, etc., we asked respondents whether they agreed or disagreed with the statement "My institution's IT services are always available when I need them for my coursework." In 2008, only half (49.8%) of the students agreed or strongly agreed with the statement, and this year's response was similar, at 52.6% (see Figure 5-10). About a third (32.5%) of respondents said they are neutral, which leaves 15.0% who disagreed or strongly disagreed that their institution's IT services are always available when needed for coursework.

We found no association between respondents' opinions about IT service availability and Carnegie classification. Indeed, the results were largely consistent across participating institutions; a large majority of institutions showed between 45% and 59% of students agreeing or strongly agreeing that IT services are always available for coursework (see Figure 5-11).

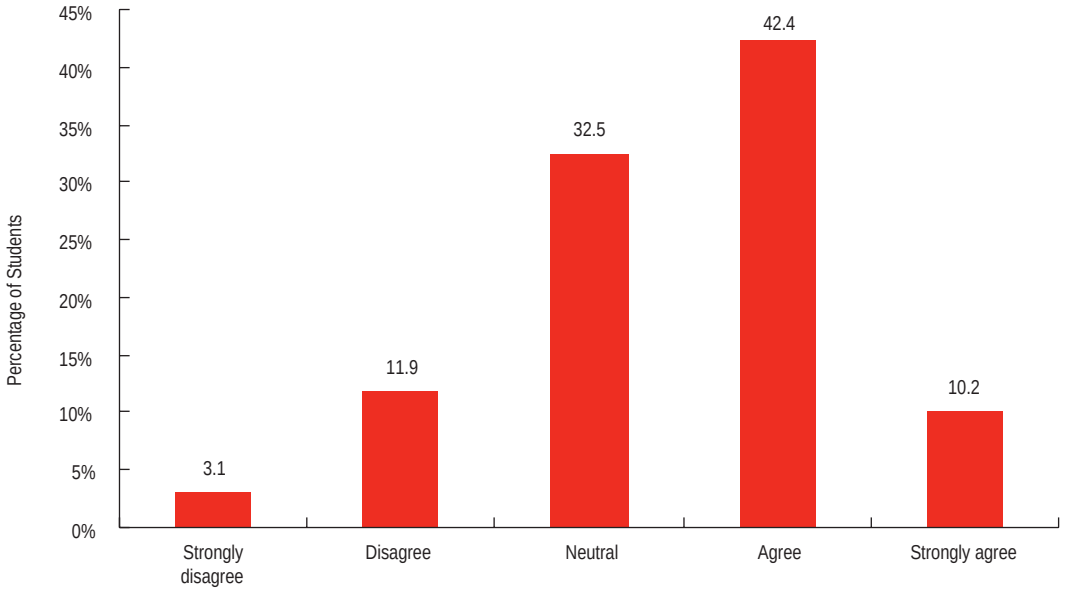
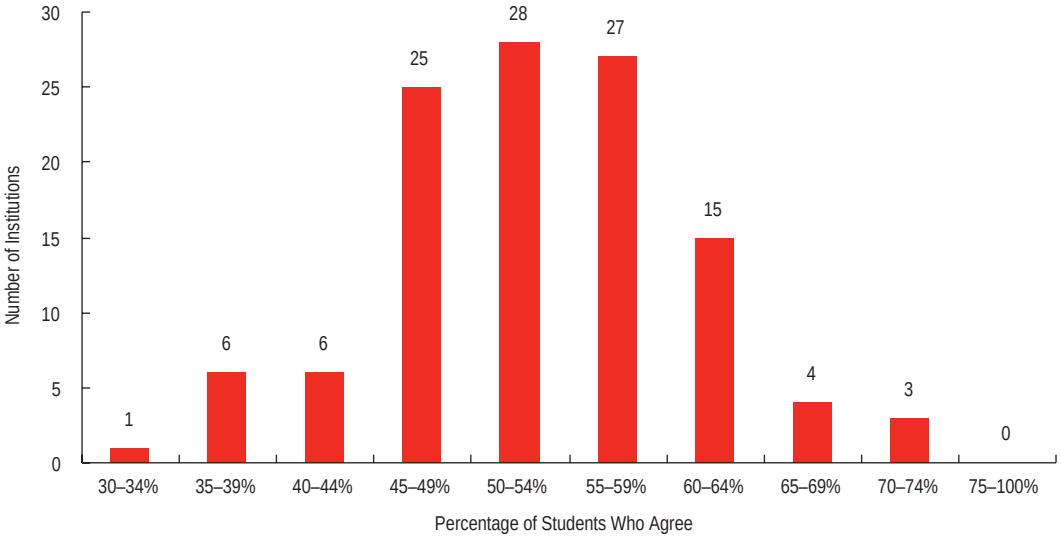


Figure 5-10. My Institution's IT Services Are Always Available When I Need Them for My Coursework (N = 30,261)

Figure 5-11. Distribution of Student Agreement That IT Services Are Always Available for Coursework (N = 115)



Although few institutions received lower marks from students, these findings do indicate that, from a student perspective, IT delivery could be better.

A factor that may influence respondents' perceptions about institutional IT service regarding coursework availability is CMS experience (see Table 5-3). Students who reported more satisfaction with IT service availability said they feel more positive about their experience with the institution's CMS. Of those who agreed or strongly agreed that IT services are always available, 72.9% reported a positive or very positive CMS experience; of those who disagreed or strongly disagreed, only 46.6% did so. This is not surprising, considering the various comments about CMSs that mentioned downtime and slowness in the open-ended survey question.

IT Outcomes Related to Student Success

The diversity of higher education institutions—in size, location, mission, and type of students they enroll—makes it difficult to define just what is meant by "college success." Numerous approaches are taken in defining college success and devising metrics to measure against the definition. Most works center on measuring previously acquired skills and academic ability—as revealed in college admission examinations—and comparing them with degree attainment. However, what students do in college and the degree to which they become involved—engagement theories of success and retention—are also acknowledged as effective measurements and predictors of college success. Research continues to prove that the academic behaviors of students, such as attending class, reading, reviewing course material, etc., not only influence course success as measured by grades but also influence other indices of college success, including an increased probability of degree completion, less time to degree completion, and greater grade-measured college success.[20]

Because IT is integrated with many of the student engagement activities that influence college success, ECAR created four positive "outcome statements" about the impact of IT in courses and asked students whether they agreed or disagreed with them. These questions are derived from the significant body of literature generated by a National Postsecondary Education Cooperative (NPEC) three-year initiative to deepen higher education's knowledge of student success.[21] Each of these questions represents a key dimension of student success, and findings about these outcome statements are described in the sections that follow.

Table 5-3. IT Services Are Always Available for Coursework, by Positive/Negative Experience Using a CMS

IT Services Are Always Available for Coursework	N	CMS Experience Mean*	Std. Deviation
Strongly disagree	755	2.97	1.048
Disagree	3,232	3.44	0.814
Neutral	8,411	3.55	0.733
Agree	11,637	3.79	0.699
Strongly agree	2,794	4.05	0.804

**Scale: 1 = very negative, 2 = negative, 3 = neutral, 4 = positive, 5 = very positive*

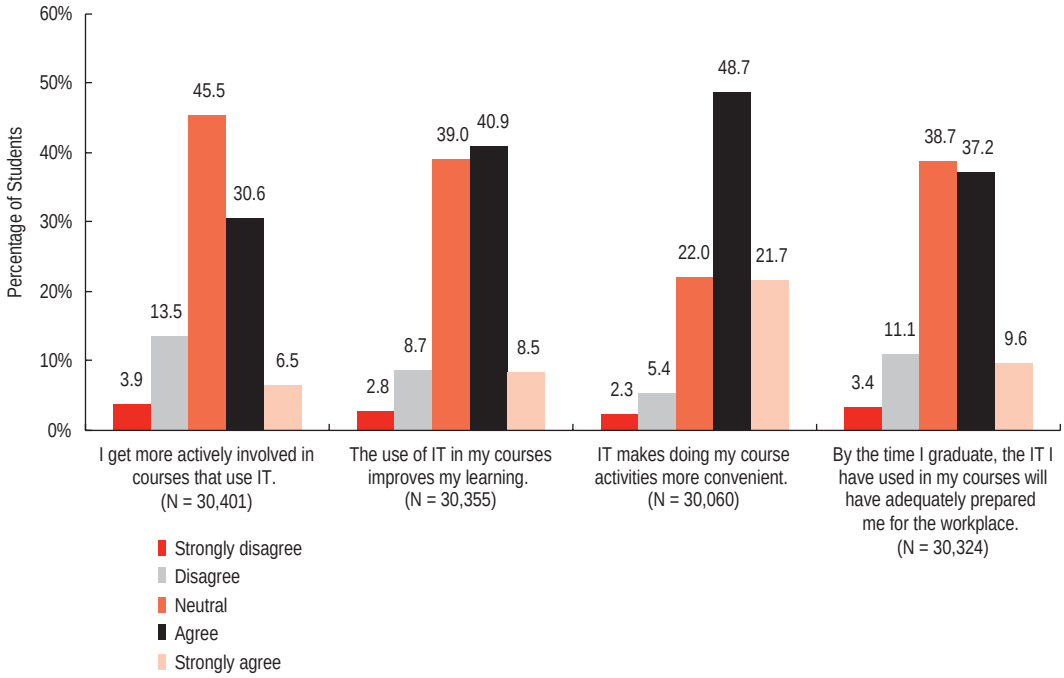
- *Student engagement.* As discussed earlier, student engagement has been consistently and positively linked to student success.[22] ECAR asked if students agreed with the statement "I get more actively involved in courses that use IT."
- *Convenience.* Support for course activities is known to be associated with learning.[23] ECAR asked if students agreed with the statement "IT makes doing my course activities more convenient."[24]
- *Learning.* ECAR included an overall self-assessment by students, asking them if they agreed with the statement "The use of IT in my courses improves my learning."
- *Workplace preparedness.* In our past studies, students expressed their desire to be prepared, IT-wise, for jobs upon graduation. ECAR asked students if they agreed with the statement "By the time I graduate, the IT I have used in my courses will have adequately prepared me for the workplace."

Because grades are an obvious measure of student success, ECAR asked students for a self-reported cumulative GPA and looked at how GPA is related to other survey data.[25] We originally thought that some technologies—such as the Internet, spreadsheets, video- and audio-creation software, or complex gaming learning tools—might be associated with higher GPA, whereas other technology-related activities—such as downloading music and video, gaming, or participating in social networking sites—might be distracting to academic studies and negatively affect GPA. The ECAR data continue to suggest that after controlling for known demographics that are related to GPA, such as age and gender, the other factors that ECAR analyzes are not strongly associated with respondent GPA.

Overview of Student Perceptions about IT's Impact on Courses

The distribution of responses to the ECAR outcome questions about student engagement, learning, convenience, and workplace preparedness appear in Figure 5-12. As in last year's study, this year's respondents viewed convenience as the clear front-runner. Those who agreed (70.4%) far outnumber the combined disagree and neutral responses (29.7%). This is not surprising, since we have found in both the quantitative data and the qualitative data of past studies—and again this year—that students say convenience is the most valuable benefit of IT in courses. As one student wrote in this year's comments, "IT in the classroom is an extremely convenient and helpful tool for the teacher to better give information, but the best use of IT is course management systems that allow anytime access to course information, up-to-date detailed syllabus, and interaction with the

Figure 5-12. Student Perceptions about IT in Courses



teacher." A senior in the focus group, who said, "I love the course management system," spoke to the convenience of IT in courses: "I am not the most organized person and I like the convenience of being able to go online and find what I need." The convenience of electronic communication was voiced by a sophomore, who said, "I like the communications aspect of IT. Twenty years ago, if a teacher had to cancel class, you had to drive. Now it's convenient. They can tell you via an e-mail. Also, if you have one simple question and you don't have time to go to the instructor's office, you can shoot him an e-mail."

When asked whether the use of IT in courses improves their learning, about half (49.4%) of respondents agreed or strongly agreed. Another 39.0% of respondents were neutral about whether the use of IT in classes improves their learning, and 1 in 10 (11.5%) disagreed or strongly disagreed with the statement. In our studies between 2005 and 2007, student responses to this question were more positive. Up to 2007, more than 60% agreed that IT in their courses had improved their learning, but the figure dropped to 45.7% in 2008, then rose to 49.4% this year. A similar pattern was found among the 39 institutions that took part in all surveys from 2006 to 2009. Although it may be that these results reflect a decline in student perceptions that IT enhances learning, the drop also coincides with changes in the wording and placement of the question in the 2008 survey, and we regard the evidence as inconclusive. We will continue to track this issue in future studies.

This year, respondents commented both positively and negatively on how IT in courses impacts their learning. "The more competent instructors are with IT, the more they make use of its capabilities, which enhances the learning experience of their course content," wrote a student in this year's survey. "There is a direct correlation between my enthusiasm for courses and the extent to which instructors use IT." However, some comments indicated that students prefer traditional forms of teaching: "I believe courses heavy in IT hinder the learning experience," wrote one student, who went on to say, "Face-to-face, verbal interactions are the best way to teach." Students in the focus groups also talked about IT's impact on learning. "IT does improve learning," a communications

major shared. "Currently I am reading a book for one of my classes and I was able to download a lecture on the book from a Yale professor." Waxing on about the wide variety of online material available to support courses, this student concluded, "There are 20 lectures on any topic available—this is true if you're taking a class from particle physics to hamburgers. It's phenomenal."

About half of respondents (46.8%) agreed that upon graduation the IT used in their courses will have adequately prepared them for the workplace. An education major who was initially worried about a course that was heavily immersed in technology said, "I ended up learning a lot from the class and I'm really glad I got to take it. I learned how to use a lot of software I hadn't before, like iMovie, and I even got to build my own website. I feel like this class prepared me very well for my future career as a high school teacher." Some older students mentioned that IT in their academic experience helped prepare them for their career—for example, the student who said, "I think that the whole experience has been beneficial as a whole for me, both for my career goals and to help me keep up with the types of applications which my kids might be using, such as Internet applications."

As with last year's survey responses, we see less agreement about IT contributing to student engagement than with any of the other outcome questions. Rather than responses skewing toward agreement, as with the other outcome statements, responses to this question form a more traditional bell-shaped curve. More than one-third (37.1%) agreed, but large majorities of respondents were either neutral or actually disagreed with the statement "I get more actively involved in courses that use IT." In the next section we look more closely at IT impact on student engagement.

We saw in Chapter 4 that student use of and skill with IT varies on the basis of student major. ECAR also found that although the pattern of responses is similar for each of the four outcome statements, student perceptions about the impact of IT on courses also vary slightly by major (see Table 5-4). Business and engineering majors were somewhat more positive about the value of IT to their academic experience than students in the other disciplines. For example, 57.8% of business majors and 54.8% of engineering majors agreed that IT in courses improves their learning, whereas only 40.7% of humanities majors and 46.5% of social sciences majors did so. This might be explained by the results reported in Table 5-2: Students in disciplines such as business and engineering reported using in their courses more IT (for example, spreadsheets or programming languages) that directly applies to the course subject, whereas students in majors such as social sciences and humanities, where face-to-face discussions are likely more central to the course subject matter, may use IT more as a support function—for example, using the university website or CMSs.

As in previous years, response patterns for the ECAR outcome statements about the impact of IT on courses are consistent across demographic factors—gender, age, class standing, GPA, part-time versus full-time enrollment status, on-campus versus off-campus residence, Carnegie class, institution size, and private versus public status. The ECAR data, however, show that several factors are strongly associated with the four outcome statements, and these are discussed in the sections that follow.

Instructor Use of IT, Student Experience Using CMSs, and Outcomes

As we saw in Figure 5-8, 45.0% of respondents reported that most or almost all of their instructors use IT effectively in their courses. When instructors do integrate IT effectively, it is possible that students would be more likely to perceive both that their instructors use IT well in courses and that the effect of IT on

Table 5-4. Student Perceptions about IT in Courses, by Major

Major	N	I get more actively involved in courses that use IT.*	The use of IT in my courses improves my learning.*	IT makes doing my course activities more convenient.*	By the time I graduate, the IT I have used in my courses will have adequately prepared me for the workplace.*
Business	4,702	3.40	3.59	3.96	3.56
Engineering	2,694	3.37	3.54	3.89	3.53
Physical sciences, including math	1,762	3.23	3.44	3.86	3.42
Life/biological sciences, including agriculture and health sciences	5,466	3.22	3.46	3.85	3.39
Social sciences	5,266	3.14	3.37	3.82	3.28
Education, including physical education	2,814	3.13	3.35	3.70	3.38
Fine arts	2,231	3.06	3.27	3.67	3.24
Humanities	2,823	3.01	3.26	3.72	3.22
All students**	30,060	3.22	3.44	3.82	3.39

**Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*
***This includes responses for "other" and "undecided" majors.*

their courses is positive. Our results support this premise (see Figure 5-13). Among those who agreed that IT in courses improves their learning, 59.6% of respondents reported that most or almost all of their instructors use IT effectively, whereas among those who disagreed, only 7.4% reported that most or all instructors use IT effectively.

We also found that CMS experience is a strong differentiator when it comes to the ECAR questions about IT's impact on courses: Respondents having an overall positive CMS experience more often reported that IT in courses improves learning, convenience, and student engagement (see Figure 5-14).

Preference for IT in Courses

Since ECAR began the student survey in 2004, we have asked students how much IT they prefer in their courses, using a 5-point scale from no IT to exclusive IT. Our respondents have been remarkably consistent in their preference for only a moderate amount of technology in courses (between 55% and 60% for the last four years). Despite the large proportion of our respondents who belong to the Net Generation and have grown up digital, respondents indicated they still appreciate the face-to-face learning experience. Our 2009 survey shows the same trend, with 59.6% of respondents saying they prefer a moderate amount of IT in their courses (see Figure 5-15).[26] Fewer than 6% of respondents preferred the extremes—either no IT (2.0%) or exclusive IT (3.5%)—in their courses.

As in previous years' studies, male respondents expressed a stronger preference for IT in courses, with 32.7% preferring extensive or exclusive IT in courses compared with 19.2% of females. ECAR found in 2008 that previous years' trends of younger students preferring less technology in courses and older students preferring more had dissipated and that age no longer made a meaningful difference. Little difference also was found for the other student demographics of age, class standing, major, part-time or full-time status, and on-campus or off-campus residence.

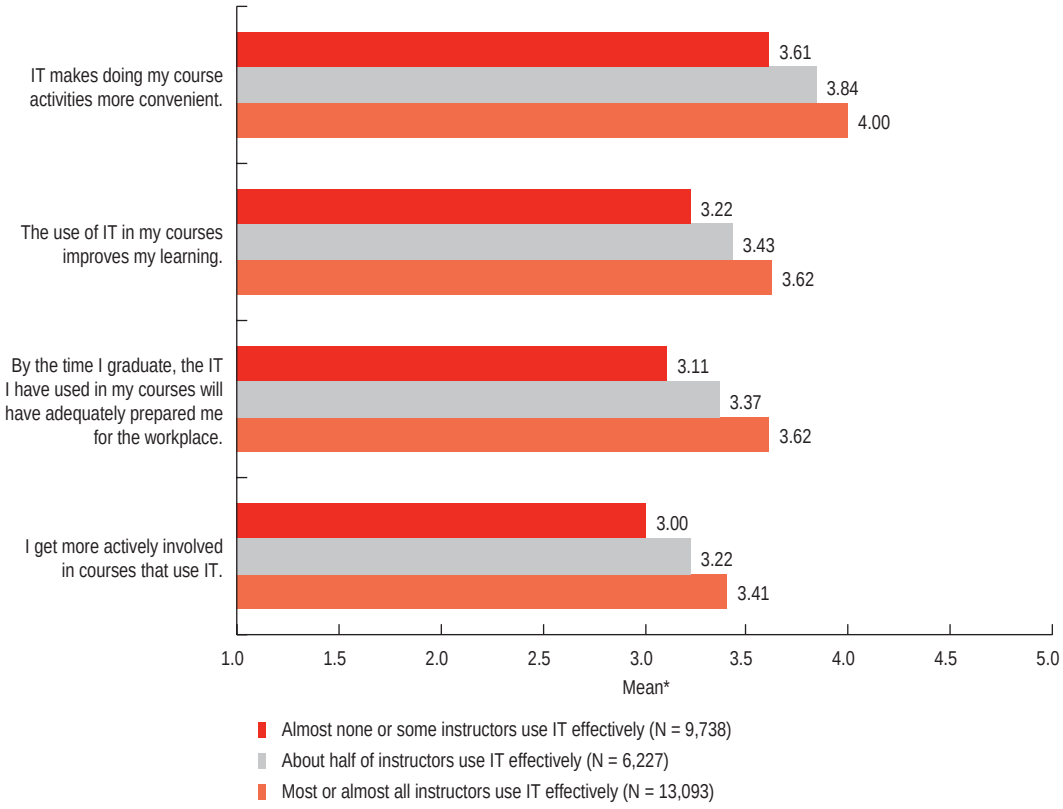


Figure 5-13. Student Perceptions about IT in Courses, by Instructors' Effective Use of IT in Course

**Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*

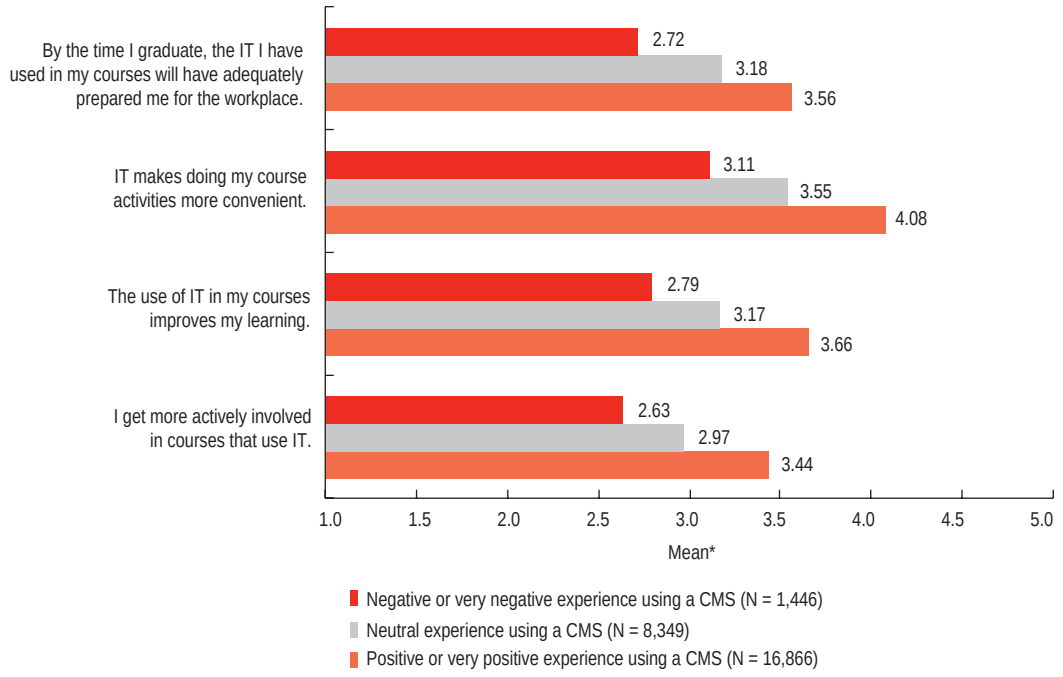
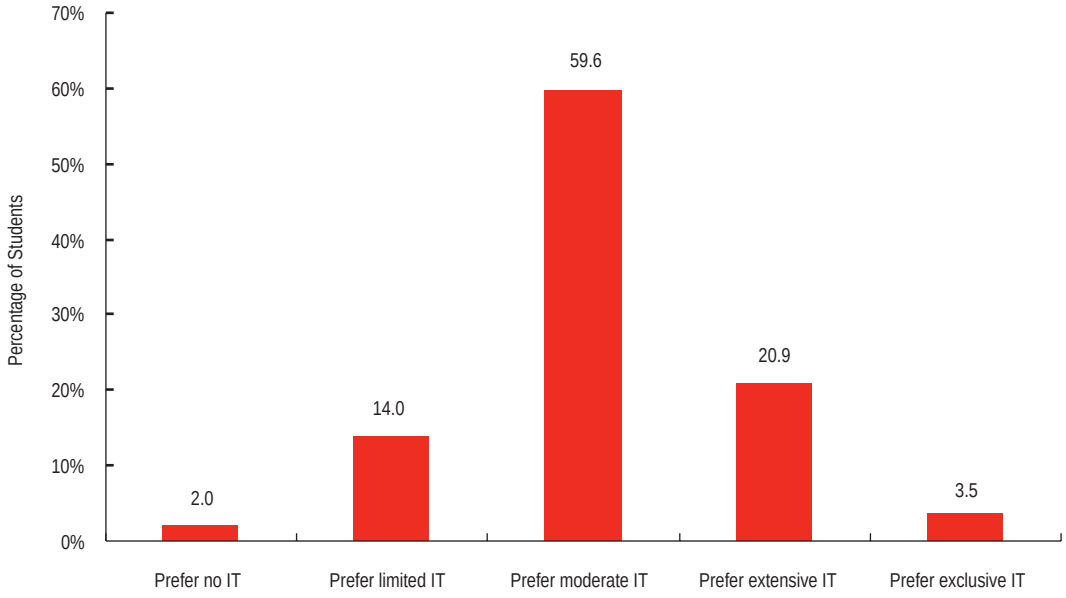


Figure 5-14. Student Perceptions about IT in Courses, by Positive/Negative Experience Using a CMS

**Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*

Figure 5-15. Preference for IT in Courses (N = 30,071)



It is surprising that the desire for a moderate amount of IT in courses has been this consistent over the years, whereas students' use of technology in their personal lives, such as text messaging, social networking, and using mobile devices, has increased, as discussed in Chapter 4. College students of both traditional and nontraditional age are heavily immersed in Internet use. According to the Pew Internet & American Life Project *November 19–December 20, 2008, Tracking Survey,* 87% of Americans ages 18–29 use the Internet, and 72% of American adult Internet users use it on a typical day.[27] Students' desire to learn technology is also high. A November 2008 IBM and Marist survey of college students found that three-quarters of the polled students were "inspired by computers and technology," and 8 in 10 expect to encounter new technology that they will need to learn, adapt to, and master once they enter the workforce. In that survey, 7 in 10 viewed technology as "the future," and more than 50% said they were seeking to improve their own technology skills before they graduate.[28]

Despite the fact that typical college students today are immersed in technology, and despite studies indicating they acknowledge that it will be a major part of their lives after graduation, respondents' preference for IT in courses remains persistently "moderate." One possible explanation is that what respondents considered "IT" in 2004 is different from what they consider "IT" today, and so the consistent preference for moderation masks a growth in the actual amount or capability of technology they expect. The "commoditization of IT," as debated in IT circles for the last few years, spills over into the consumer world as users encounter and make use of IT without even thinking about it. Do students think of a professor's lecture supported by PowerPoint slides connected to websites with video as use of "information technology"?

Although the ubiquity of IT may make it invisible to some students, several respondents contributed comments about the use of technology that suggest they consciously wish to limit its role in their lives. "Technology doesn't do what it tells you it will," wrote one student, who concluded that "It claims to make life easier, but in actuality, makes your life more complicated." A somewhat similar philosophical response was offered by a respondent who wrote, "Our society is becoming less face-to-face and more

screen-to-screen." Another student was more circumspect, writing that "Technology can be incredibly useful and beneficial, but it is a double-edged sword; it can also be harmful and destructive when not used with some thought, care, and balance." Whatever the underlying reasons, ECAR student survey respondents' views of IT in courses suggest that they still want face-to-face interactions in the classroom and with faculty.

Just as reported positive or negative experience with CMSs was strongly associated with students' IT course outcome responses, a similar close relationship exists between CMS experience and student preference for IT in courses (see Figure 5-16). This may be comparable to the proverbial chicken-or-the-egg conundrum: Are student preferences shaped by experiences, or do preferences influence experience? A fairly extensive body of research that explores the nature of preferences generally agrees that, either directly or indirectly, knowledge can influence preferences. In the *Journal of Consumer Psychology* article "Constructing Stable Preferences: A Look into Dimensions of Experience and Their Impact on Preference Stability," Steve Hoeffler and Dan Ariely state that "Preferences are constructed when users are new to a category and eventually develop more stable preferences with experience in a domain."[29] Therefore, it seems logical to consider that if students have better experiences with IT, they may prefer more IT in courses.

Preference for IT in Courses, IT Adoption Practice, and Outcomes

ECAR found that the factor most strongly associated with the outcome statements about IT's impact on courses is how much IT respondents prefer in their courses (see Figure 5-17). Respondents who preferred more IT in courses agreed more that IT has a positive impact on coursework. For instance, only 19.1% of respondents who preferred limited or no IT in courses agreed that IT improves their learning, as opposed to more than three-quarters of respondents (76.6%) who preferred extensive or exclusive IT and who said that IT improves their learning. As in last year's results, these relationships remain

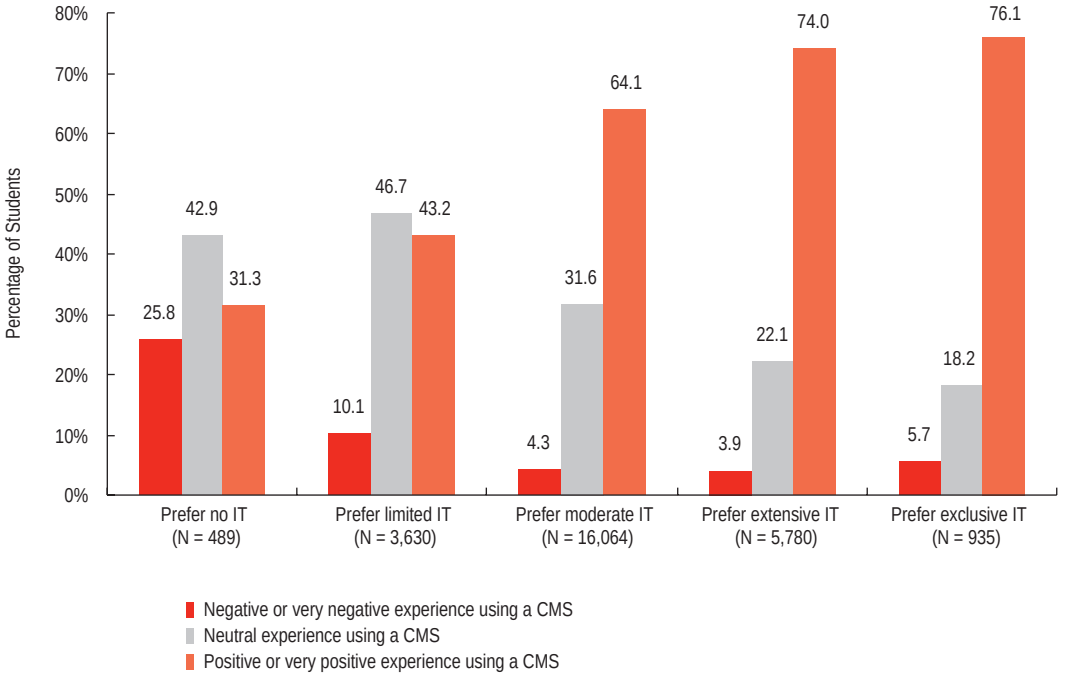


Figure 5-16. Preference for IT in Courses, by Positive/Negative Experience Using a CMS

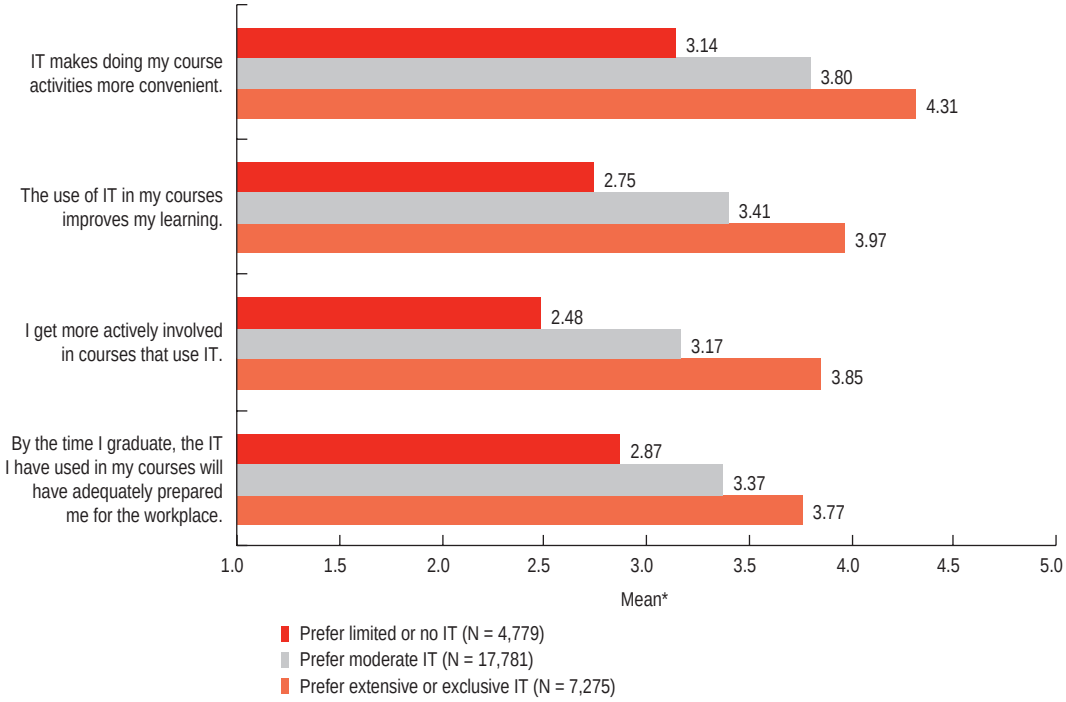


Figure 5-17. Student Perceptions about IT in Courses, by Preference for IT in Courses

**Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*

quite strong, and the wide range of student preference for IT is important to recognize and integrate into institutional decisions. For example, some institutions now provide information about the IT that will be used in scheduled courses so that students can factor this into their course enrollment choices.

Additionally, a similar stair-step pattern exists between respondents' technology adoption practices and the outcome statements. Respondents who were early adopters of technology were more apt to be positive about the impact of IT on courses and learning. This is not surprising, because students' technology adoption practices and their preference for IT in courses are highly correlated.

Finally, two other factors are associated with positive outcomes of IT in courses, although not nearly as strongly as the factors already discussed. Respondents reporting stronger IT skills and respondents who said they like to learn through the technologies asked about in the survey—i.e., by using programs they can control; contributing to websites, blogs, wikis, etc.; creating or listening to podcasts or webcasts; and conducting text-based conversations over e-mail, IM, and text messaging—were more positive about the benefits of IT in courses.

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11. The wording of this question has changed slightly in different ECAR surveys since 2005, most recently (2009) to broaden the terminology from "course" to "course or learning" management systems. (For the sake of simplicity, we continue to use the acronym CMS to refer to these systems.) These changes in the question text appear to have had a negligible effect on responses from institutions that participated in the survey across multiple years. For the most recent survey text, see Appendix B. Previous ECAR surveys are available from http://www.educause.edu/ECAR/ResearchPublications/SurveyInstruments/1004.
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22. The National Survey of Student Engagement defines student engagement to mean student participation in course activities that are provided for their learning and personal development. See The National Survey of Student Engagement, "Engaged Learning: Fostering Success for All Students" (2006), http://nsse.iub.edu/NSSE_2006_Annual_Report/docs/NSSE_2006_Annual_Report.pdf.; and George D. Kuh et al., *What Matters to Student Success: A Review of the Literature. Commissioned Report for the National Symposium of Postsecondary Student Success: Spearheading a Dialog on Student Success* (National Postsecondary Education Commission, 2006), http://nces.ed.gov/npec/pdf/Kuh_Team_Report.pdf. These themes are discussed and references provided throughout this paper.
23. Ibid.
24. For the 2005 through 2007 surveys, several questions were asked about different aspects of convenience, such as providing support for communication and collaboration, prompt feedback from instructors, and controlling of course activities. These questions received similar responses, so in

2008 they were combined into one question about convenience: "IT makes doing my course activities more convenient."

25. In previous years' studies, the GPA categories in the survey were numerical (for example, under 2.00 to 4.00 in increments of 0.25). Starting in 2008, ECAR began using the more standard letters A to C–, as shown in Table 3-2 of this study.
26. The distribution of responses in 2009 forms a bell-shaped curve, as did the distribution of responses in each of the 2004, 2005, 2006, 2007, and 2008 studies [see Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *The ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control* (Boulder, CO: EDUCAUSE Center for Applied Research, 2004); Robert B. Kvavik and Judith B. Caruso, *The ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning* (Boulder, CO: EDUCAUSE Center for Applied Research, 2005); Gail Salaway, Richard N. Katz, and Judith B. Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2006* (Boulder, CO: EDUCAUSE Center for Applied Research, 2006); Salaway and Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2007;* and Gail Salaway and Judith Borreson Caruso, *The ECAR Study of Undergraduate Students and Information Technology, 2008* (Boulder, CO: EDUCAUSE Center for Applied Research, 2008), all available from http://www.educause/edu/ecar.]
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6

Undergraduates and the Mobile Revolution

Do you think you could have my professors text me before I get out of bed if they are going to be absent from class?
—An undergraduate student

Key Findings

- More than half of respondents (51.2%) owned an Internet-capable handheld device and another 11.8% planned to purchase one in the next 12 months. One-third of respondents (35.5%) did not own such a device and did not plan to purchase one in the next 12 months.
- Internet use among device owners varies widely: Although nearly a third (29.0%) said they use the Internet from their device daily, another third (35.4%) said they never use the Internet from their device.
- Among those who never use their Internet-capable handheld device to access the Internet, more than three-quarters (76.0%) selected cost of the data service as one of the three reasons that limit their use.
- Half of all respondents (49.9%) chose "Plenty of other ways to access the Internet" as one of three reasons that kept them from using the Internet, or using it more often, from a handheld device.
- The top Internet activities performed from a handheld device were checking information such as news, weather, and sports (76.7%); accessing e-mail (75.1%); using social networking websites (62.5%); and using maps, finding places, getting directions, or planning routes (58.7%).
- Almost a third of respondents (32.2%) agreed or strongly agreed with the statement "While in class, I regularly use my cell phone or handheld Internet device for non-course activities."
- Almost three-quarters (73.7%) of respondents who currently own and use the Internet from a handheld device said they expect their use will increase or greatly increase in the next three years.
- Just under half (44.5%) of respondents agreed or strongly agreed that in the next three years they expect to do many things on a cell phone or handheld Internet device that they currently do on a laptop or desktop computer.
- When asked to select three institutional IT services they are most likely to use from an Internet-capable handheld device, if available, respondents who owned a handheld device and used the Internet from it selected these as the top three: e-mail system (63.4%), student administrative services (46.8%), and course or learning management system (45.7%).

According to CTIA–The Wireless Association, at the end of 2008 more than 270 million Americans, about 87% of the total population, had mobile phones.[1] Other research has placed ownership of mobile or cell phones in the United States anywhere between 78% and 89%.[2] These mobile phone owners are increasingly using their

devices for much more than any of us could have imagined when we first used wireless cell phone technology—remember bag phones, or the wireless "brick" phone that was so cool on *Magnum P.I.* and *Miami Vice* in the 1980s? Beyond the ability to call anyone, anywhere around the world, our tiny little devices are sending text messages, taking photos and videos, playing MP3 files, managing appointment calendars, and waking us up in the morning as a primary alarm clock. Research by Harris Interactive in 2007 found that 49% of mobile phone owners ages 18 and older used their phones for more than just making and receiving phone calls, and 57% anticipated doing so in the next three years.[3]

Internet access from mobile phones is increasing in popularity, and current research is drawing a picture of continued growth in use of this feature. The Pew Internet & American Life Project recently reported that one-third (32%) of Americans have used a cell phone or smartphone to access the Internet for e-mailing, instant messaging, or information seeking—up from 24% just 16 months earlier, in December 2007. The same report found that nearly one-fifth (19%) use the Internet on a mobile device daily, which is up from 11% recorded in December 2007.[4] A March 2009 Nielsen poll reported that 52% of Americans who were currently accessing the Internet from their mobile phones expected to use the mobile Internet more frequently within the next 24 months—including 71% who expected to use it daily—and more than 25% of non-users planned to adopt mobile web services during the same time frame.[5]

As one would expect, the prevalence of mobile phone ownership in America is reflected in the college student population. But how is this shaping their academic experience? In the *EDUCAUSE Quarterly* article "The Revolution No One Noticed: Mobile Phones and Multimobile Services in Higher Education," Alan Livingston writes about two communications technology revolutions in the last decade and their impact on the university: "The first—the Internet revolution—has changed everything in higher education. The second—the mobile phone revolution—has changed nothing." According to Livingston, although mobile phone usage among students has become virtually universal, higher education has yet to take advantage of this phenomenon, which he believes holds enormous potential to improve the educational environment.[6] In this chapter, we look at students' ownership and use of Internet-capable handheld devices, how the devices are currently being used on campus, and how students anticipate they will be used. Perhaps this snapshot of students' current and expected use of mobile devices will indicate whether or not, as Livingston writes, "This is a case of a revolution having occurred while we weren't looking."

Ownership of Internet-Capable Handheld Devices

One look around the local coffee shop reveals just how conventional wireless access to the Internet has become. The term "Wi-Fi," virtually unknown at the beginning of this decade, is now a key marketing tool advertised on billboards to lure truckers into truck stops and tourists into hotels. Although laptops are the primary tools using Wi-Fi to connect to the Internet when within range of a wireless network, Wi-Fi–enabled devices now include mobile phones, PDAs, smartphones, MP3 players, and game devices. Many of these smaller, handheld devices are also able to seamlessly switch between local Wi-Fi connections and long-distance cellular networks to provide Internet access almost anywhere. Because of the variety of types and functions of handheld wireless devices and options available to connect to the Internet, it can be difficult to come up with a common descriptor for them without loading the terminology with a long string of qualifiers.

The availability of a broad range of handheld devices caused an evolution of survey questions over the years. In 2008, the question was "Do you own a cell phone that is capable of accessing the Internet (whether you use that capability or not)?" This year, because we intended to drill deeper into respondents' use of Internet-capable handheld devices, we incorporated examples into the question: "Do you own a handheld device that is capable of accessing the Internet (whether or not you use that capability)? Examples include iPhone, Treo, BlackBerry, other Internet-capable cell phone, iPod touch, PDA, Pocket PC, etc."[7] In this report, for simplicity's sake, we refer to these devices as "Internet-capable handheld devices" or "handheld devices."

This year, about half of the respondents (51.2%) indicated they own an Internet-capable handheld device, and another 11.8% said they plan to purchase one in the next 12 months (see Figure 6-1). This figure should be understood in the context of near-ubiquitous cell phone ownership among students; the ECAR 2007 student study found simple cell phone ownership at 86.1% of respondents (and smartphone ownership at 12.0% and growing), so in 2008 we stopped asking about basic cell phone ownership. A very high level of ownership of at least a basic cell phone is implied in our current study findings that 9 out of 10 student respondents (89.8%) are engaged in text messaging and the median use is daily (refer to Table 4-3).

If student ownership of cell phones is indeed as prevalent as our studies and other studies of the general population suggest, it is notable that more than a third of the respondents (35.5%) said they do not own an Internet-capable handheld device and do not plan to purchase one in the next year. Presumably this means that many of these students own cell phones lacking Internet capabilities. Many possible factors may influence the likelihood of owning an Internet-capable handheld device, such as price of the device, being locked into an existing cell phone contract, or not finding a need for the functionality. We investigate some of these factors later in this chapter. Technology adoption (refer to Table 4-1) does appear to come into play, since those who owned or planned to purchase an Internet-capable handheld device were more likely to be early adopters and innovators than those who did not own or plan to own a device (see Figure 6-2).

Respondents who owned and those who planned to own an Internet-capable handheld device fall into nearly identical patterns of technology adoption, with about 1 in 10 (8.9% and

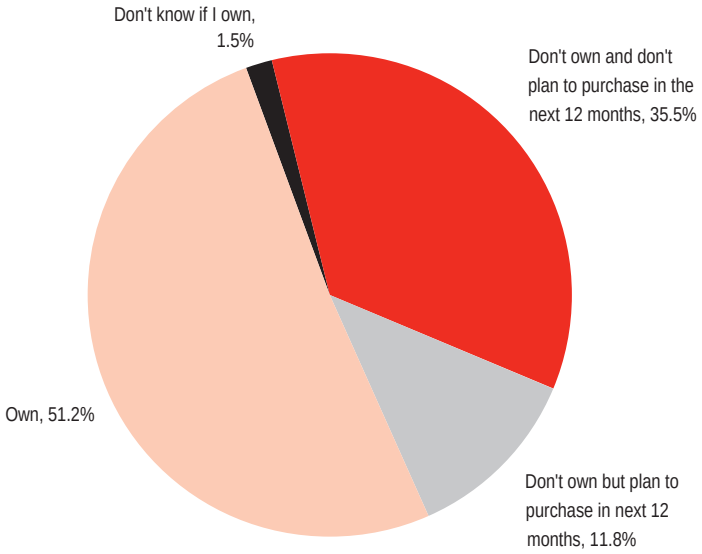
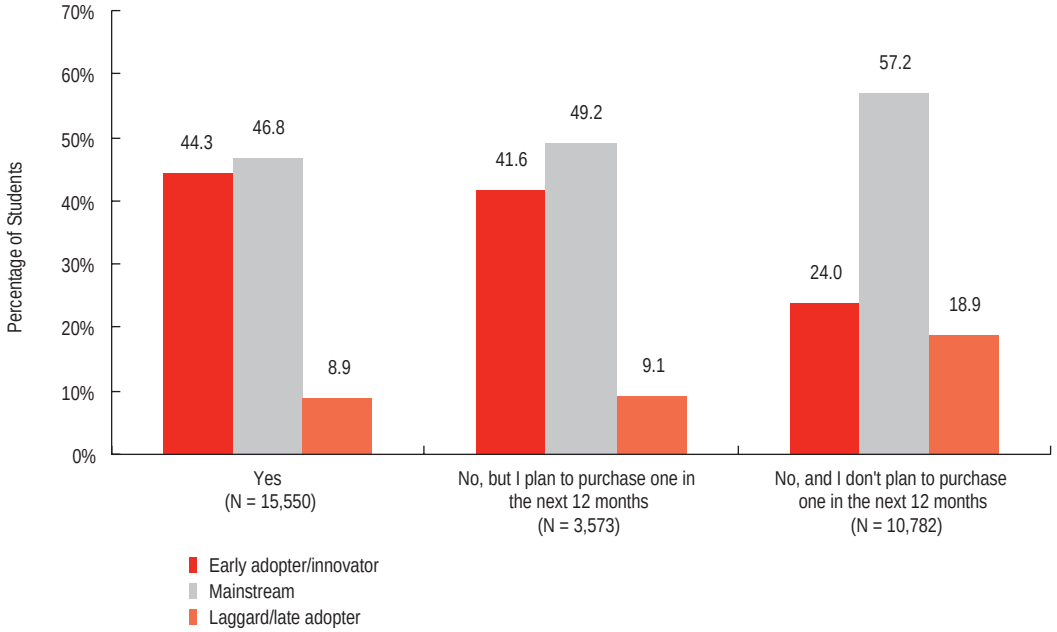


Figure 6-1. Ownership of Internet-Capable Handheld Device (N = 30,616)

Figure 6-2. Ownership of Internet-Capable Handheld Device, by Technology Adoption



9.1%) saying they are laggards/late adopters and 4 in 10 (44.3% and 41.6%) saying they are early adopters/innovators. Twice as many of those who didn't own and didn't plan to buy an Internet-capable handheld device identified themselves as laggards/late adopters (18.9%), and fewer than a quarter (24.0%) identified themselves as early adopters/innovators. Despite these differences, more than 8 of 10 who didn't own and didn't plan to own an Internet-capable handheld device viewed themselves as mainstream or early adopters. This led us to wonder if other factors, aside from technology adoption, were associated with ownership. However, the data reveal no demographic associations, including age, with ownership of an Internet-capable handheld device, so the reasons respondents cite for not owning and/or not using one of these devices to access the Internet become all the more interesting.

Reasons Students Do Not Use Internet from Handheld Device

In the March 2009 report "The Mobile Difference," the Pew Internet & American Life Project updated its original 2007 typology of information and communications technology users by pointing out that broadband Internet access was no longer the cutting edge of technology and declaring mobile connectivity to be the "new centerpiece of high-tech life." One of the key findings of the Pew report is that the groups that are the heaviest users of mobile devices are using them in a symbiotic relationship with their already-existing broadband access. These so-called "motivated by mobility" users jointly use wired and wireless access in a "continual information exchange." However, this report also found that 61% of the adult population "[does] not feel the pull of mobility—or anything else—further into the digital world." Although they have a lot of technology at hand, they remain ambivalent about the technology and prefer to keep it at the periphery of their lives. These groups know how to use the Internet and generally believe they have enough access to it, and, at least for now, the report speculates that some Americans may have reached a plateau in their technology use.[8]

ECAR asked respondents, regardless of whether they own an Internet-capable handheld device, to select up to three reasons that kept them from using the Internet, or using it more often, from a handheld device (see Figure 6-3). The top reason respondents

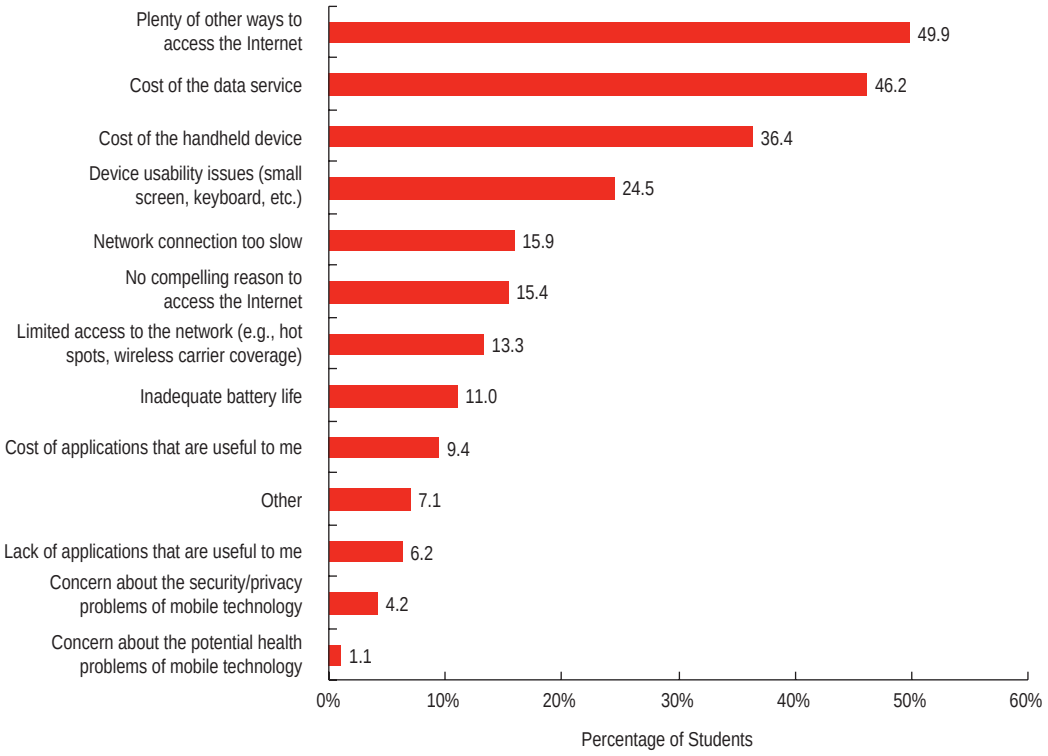


Figure 6-3. What Keeps You from Using the Internet, or Using It More Often, from a Handheld Device?* (N = 30,616)

**Respondents were asked to check up to three reasons.*

selected is that plenty of other ways are available to access the Internet (49.9%). Although the ECAR student study findings should not be construed to support or refute the Pew report's conclusions, nearly half of the students surveyed do seem to believe, much like those identified by the Pew study, that suitable alternatives exist for Internet access.

In the student focus groups, several students emphasized that they had plenty of access to the Internet and did not need to access it from a mobile device. A senior commented, "My cell phone has Internet capability but I don't use it. My plan allows me to, but there are so many computers on campus I don't need to." Another student agreed about not needing to access the Internet from a mobile device, saying, "I'm always on the Internet at work. When I need access, I always have it." ECAR found that ownership of a device had no significant relationship with whether students selected this as a reason for why they didn't use the Internet from their device.

Expense is also clearly a factor: Cost of the data service was selected by 46.2% of the respondents, and cost of the device was chosen by 36.4%. In the responses to the student survey's open-ended question, students mentioned cost when describing their views of handheld access to the Internet. "Handheld devices are way too expensive or I would get one," wrote one student, who went on to say, "I don't have hundreds of dollars to spend on the device and monthly fees (I am a poor college student, sorry)." Another concluded, "In all, cost is the biggest issue—why my laptop is 2½ years old and will only get older, and why I don't pay for extended Internet use with my cell phone or get a phone more [I]nternet friendly. And I'm probably not alone with that."

Another 15.4% of student respondents indicated that a reason they don't access the Internet, or use it more often, from a handheld device is that they find no compelling

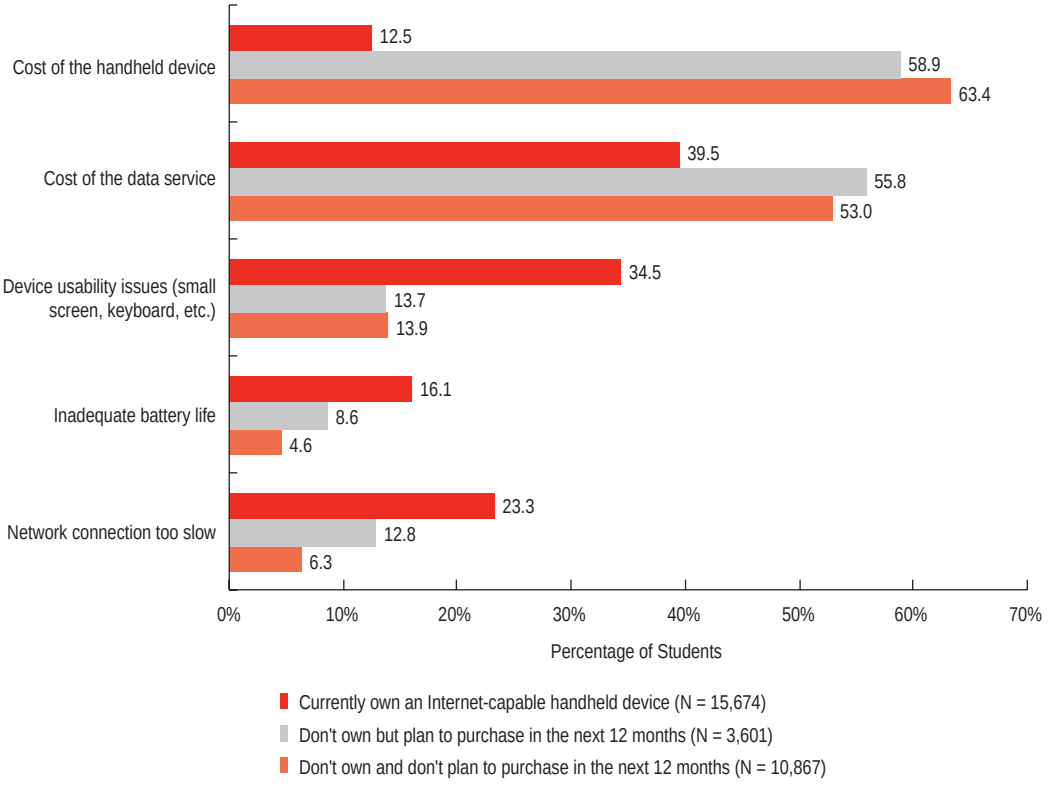
reason to access the Internet. Surprisingly, among students who cited this reason and those who didn't, no difference was found in the amount of time they said they spend actively doing Internet activities for school, work, or recreation.

The reasons that keep respondents from using the Internet, or using it more frequently, from a handheld device differ between those who said they currently own an Internet-capable handheld device and those who said they do not own one (see Figure 6-4). As one would expect, those who did not own devices were more likely to select concerns about cost of the device or the data service. Those who owned devices were more likely to select reasons related to functionality, such as network connection speeds, poor battery life, and device usability issues such as screen size.

Such functionality and usability issues were evident in student focus group comments. A senior IT management major, an avid mobile device user, complained about using the campus website from his mobile device: "Some websites like those with Flash have too much functionality to work on my BlackBerry. My institution's website is one of the worst. Often the script won't run. It's problematic. The JavaScript is bad." A senior noted, "The screen is just too small. It's hard to read sometimes. It's not practical to bring up a big page on your mobile device." An older student said, "I don't use the mobile device for Internet access because the screen is so small. My eyes aren't as good as they once were."

A few students mentioned technical issues with their handheld devices in open-ended comments. For instance, one student wrote, "The biggest obstacle to my use of the Internet on my mobile device (iPod Touch) is the wireless network (poor or nonexistent signal in some areas) and lack of VPN support for this device—the device has the capability, but the university doesn't make the information available for me to configure VPN access.

Figure 6-4. What Keeps You from Using the Internet, or Using It More Often, from a Handheld Device,* by Device Ownership



**Respondents were asked to check up to three reasons.*

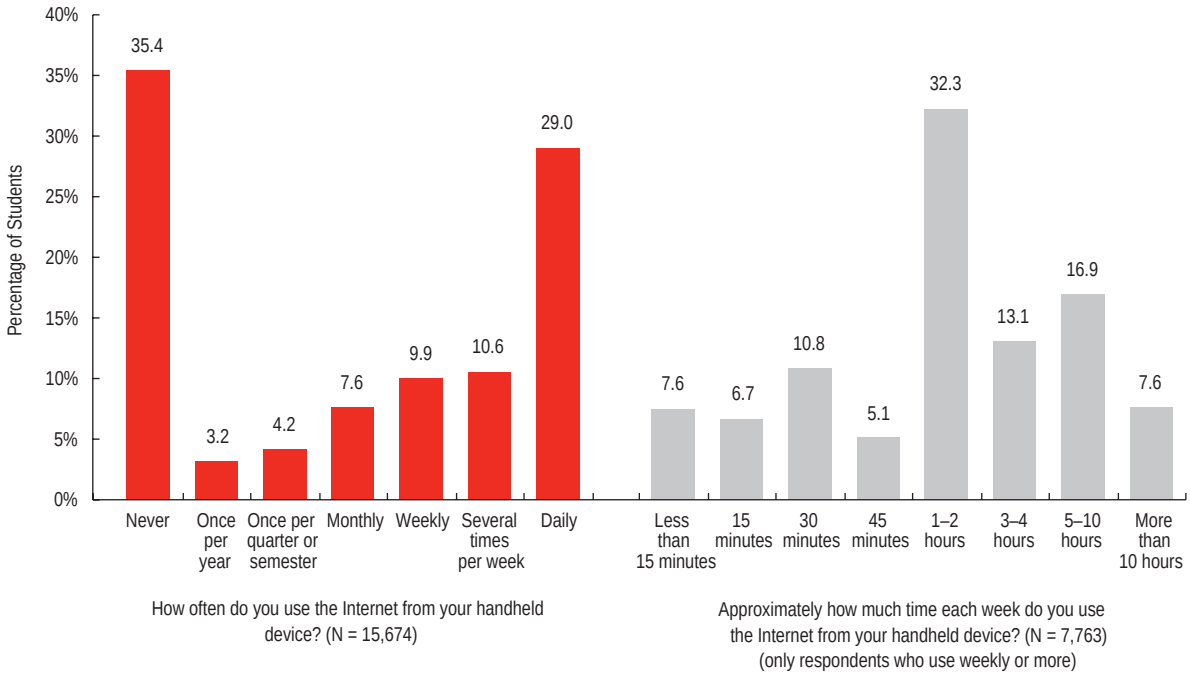
I have to use the less secure method of signing in through a web-based authorization page." Another student's comment was a bit more concise: "The Internet connection on handheld devices is so slow that it's faster to just walk to the library and make the search."

Time Spent Using Internet from Handheld Device

Ownership of an Internet-capable handheld device does not ensure that the function will be used. ECAR asked students who reported owning a handheld device how often they use it to access the Internet, and more than a third (35.4%) said they never use that feature (see Figure 6-5). Yet nearly another third (29.0%) said they access the Internet daily from their devices, and an additional 20.5% did so weekly or several times a week. In short, about half of device owners accessed the Internet at least weekly.

ECAR also asked the subset of respondents who said they access the Internet weekly or more often from a handheld device approximately how much time each week they spend doing so; 30.2% said they use it less than an hour a week, and nearly two-thirds (62.5%) said they use it two or fewer hours per week. This led us to wonder if even those students who access the Internet daily from their handheld device use it for short periods of time, and we found that, indeed, just under half (46.1%) of the respondents who said they use the Internet daily use it approximately two or fewer hours per week. Some students, however, do use the Internet from their handheld device for longer periods of time: 7.6% said they use it more than 10 hours per week. The numbers of students with this high level of use may continue to grow; according to the Pew Internet & American Life Project and several other research studies, the number of people worldwide who access the Internet from a mobile device on a daily basis is growing even faster than the rapidly growing number of people using their mobile device to access the Internet at all.[9]

Figure 6-5. Frequency of Use and Time Spent Using Internet from Handheld Device*

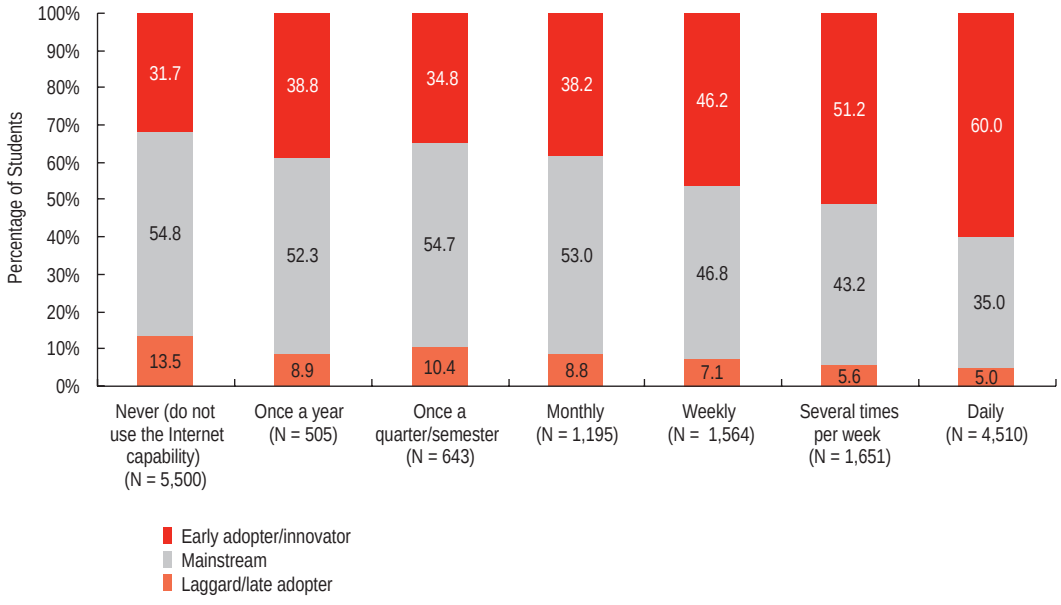


**Includes only respondents who owned an Internet-capable handheld device.*

As with ownership of Internet-capable handheld devices (refer to Figure 6-2), technology adoption is associated with frequency and time spent using the Internet from a handheld device. Those who used the Internet from their handheld device on a daily basis were more likely to be early adopters or innovators than were those reporting less frequent use (see Figure 6-6). A majority of those who reported using the Internet monthly or less often were mainstream adopters, and those who said they never use the Internet capability had the highest proportion of laggards and late adopters of all the use frequency categories. It is possible that as use of the Internet from handheld devices becomes more of a mainstream activity and more mainstream adopters begin to use it, we will see a significant increase in time spent online from a handheld device. However, given that more than a third (35.5%) did not own or intend to purchase an Internet-capable handheld device within the next 12 months (refer to Figure 6-1) and that more than a third (35.4%) who did own a device never accessed the Internet with it (refer to Figure 6-5), the possibility exists that these students represent a type of student similar to the Pew report's finding that a substantial percentage of Americans simply do not feel the "pull of mobility" into the digital world.

The reasons device-owning Internet users and non-users identified about what keeps them from using the Internet or using it more often differ in ways similar to the differences between device owners and non-owners (examined in Figure 6-4). As Figure 6-7 shows, non-users tended to select cost issues more than users, whereas device and performance issues were selected more by users, especially heavy users. Non-users may fit the Pew study's profile of technology users who do not feel the pull of mobility, or they may simply be later adopters, but our study found that more than three-quarters of non-users (76.0%) included cost of the data service among the three reasons they selected to explain why they don't use the Internet, far more than among even the least-frequent users. Device usability issues (small screen, keyboard, etc.) were important to daily users (42.0%), as were network connection too slow (33.5%) and inadequate battery life (28.0%). For those students who said they use the Internet

Figure 6-6. Frequency of Internet Use from Handheld Device, by Technology Adoption*



**Includes only respondents who owned an Internet-capable handheld device.*

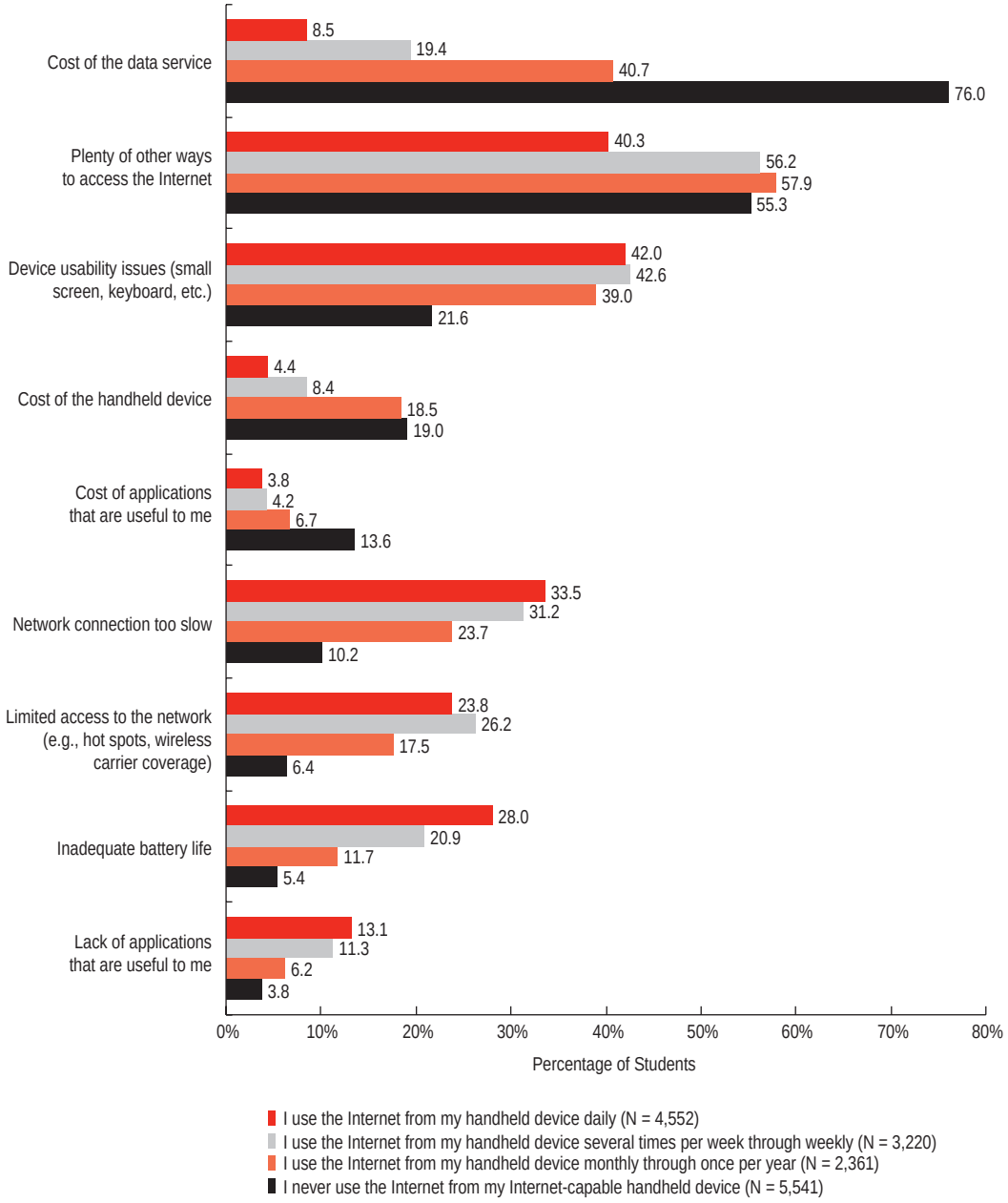


Figure 6-7. What Prevents Internet-Capable Handheld Device Owners from Using the Internet, or Using It More Often, from Their Device,* by Frequency of Use**

**Respondents were asked to check up to three reasons.*

***Includes only respondents who owned an Internet-capable handheld device.*

from their device less frequently than daily, somewhat of a balance was found between technical concerns and issues pertaining to cost, but the reason selected more than any other was that plenty of other ways are available to access the Internet.

Half (55.3%) of owners who never use their devices to access the Internet said that the availability of plenty of other ways to access the Internet was a reason, as did just over half of the moderate users, who use their handheld devices several times per week through weekly (56.2%) and monthly through once per year (57.9%). Even 4 out of 10 (40.3%) daily users cited the availability of plenty of other ways to access the Internet as a reason they don't use the Internet from their devices more often. The fact that many

respondents say that the availability of other ways to access the Internet deters them from using it more frequently from a handheld is corroborated by another question from our survey. We asked if respondents use the Internet from their handheld device even when a networked laptop or desktop computer is easily available and found that a quarter (26.0%) said never and almost three-quarters said seldom, very seldom, or never (see Figure 6-8).

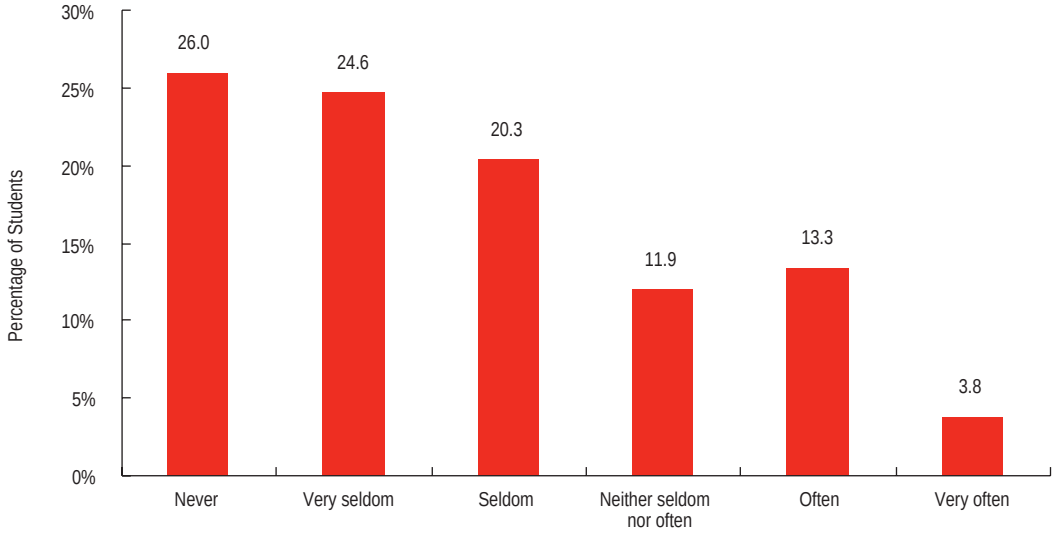
Surprisingly, the number of weekly hours students report actively doing Internet activities for school, work, or recreation is not associated with how often, or whether, they use the Internet from their handheld device. It appears that, for now, despite traditional-aged college students being known as the always-connected "Digital Generation," the mobile web must break some barriers in both cost and technical performance to penetrate the student population in greater numbers. The types of Internet activities those who have already been drawn into the mobile web actually use from their handheld devices may illustrate what could attract more students to use it as these barriers start to come down.

Internet Activities from Handheld Device

External evidence is available of the rapid growth in mobile web use. The online audience measurement service comScore reported in March 2009 that the number of people in the United States using their mobile devices to access news and information on the Internet more than doubled from January 2008 to January 2009. Noting the "torrid pace" of growth in using handheld devices to access social networking and blogging sites and that the increasing popularity of iPhone applications is driving tremendous growth in news and information services—maps being the most popular—comScore identified 18- to 34-year-old males and 18- to 24-year-old females as two of the most engaged demographics.[10]

ECAR asked survey respondents what Internet activities they do from their handheld devices (selecting all that apply from a list of 13 activities) and found that some of the categories mentioned in external research are showing up as popular activities in our results. Of the respondents who owned an Internet-capable handheld device and accessed the Internet with the device, more than three-

Figure 6-8. Do You Use the Internet from Your Handheld Device Even When a Networked Computer (Laptop or Desktop) Is Easily Available? (N = 10,086)*



**Includes only respondents who owned an Internet-capable handheld device and used the Internet from the device.*

quarters (76.7%) said they use it to check for information such as news, weather, sports, specific facts, etc., and more than half of the respondents (58.7%) said they connect to the Internet from their handheld device to use maps to find places, get directions, or plan routes (see Table 6-1).

Using a handheld device to send and receive e-mail is also a popular activity, performed by three-quarters of respondents (75.1%). Nearly two-thirds (62.5%) said they use social networking sites from their handheld device. These respondents tended to be younger and more frequently used social networking websites overall as well as in their courses during the quarter/semester of the survey. More respondents who use their handheld device to send and receive e-mail also reported sending text messages and using instant messaging on their networked computer than other respondents. The 4 of 10 respondents (43.3%) who said they use instant messaging from their handheld also tended to use instant messaging from their networked computer more frequently, and they also reported using instant messaging for courses during the quarter/semester of the survey.

In the focus groups, several students commented on using their mobile device to access their e-mail. A freshman told us, "I use my mobile device for e-mailing a lot to my Gmail account," and shared why: "I'm not paying for texting—I just use e-mail." Several seniors with smartphones said they use them extensively for checking e-mail. One, who owned a BlackBerry Curve, said, "I have multiple e-mail addresses and all my addresses are channeled to my phone."

About a quarter of respondents said they conduct personal business such as banking or shopping from their handheld devices. Our younger respondents, 18- and 19-year-old freshmen, were somewhat less likely to conduct personal business from their devices. Despite the relatively low percentage of adoption at this time, using mobile phones to conduct personal business is expected to grow at a rapid pace, according to industry research. For instance, mobile banking services are

Table 6-1. Internet Activities from Handheld Device, by Technology Adoption (N = 10,133)*

Internet Activities Performed from Handheld Device	Percentage of Students Who Perform Activity	More Early Adopter/Innovators Engaged
Check information (news, weather, sports, specific facts, etc.)	76.7%	–
E-mail	75.1%	Yes
Use social networking websites (Facebook, MySpace, Bebo, etc.)	62.5%	–
Use maps (e.g., find places, get directions, or plan routes)	58.7%	–
Instant message	43.3%	Yes
Conduct personal business (banking, shopping, etc.)	26.9%	Yes
Download/stream music	22.8%	–
Download or watch videos online	20.1%	Yes
Download or play games online	17.0%	–
Read or contribute to blogs	12.4%	Yes
Use Internet photo sites	11.4%	–
Watch mobile TV	11.3%	–
Report what you're doing on Twitter	6.4%	Yes

**Includes only respondents who owned an Internet-capable handheld device and used the Internet from the device.*

projected to skyrocket during the next few years, with the number of U.S. banks offering mobile banking nearly tripling in 2009, and by 2012, 108 million consumers are expected to use the service.[11]

We asked about using handheld devices for Internet-based entertainment activities and found that about the same percentages of respondents said they use their handheld device for downloading/streaming music (22.8%), downloading or watching videos online (20.1%), and downloading or playing games online (17.0%). Research indicates the global mobile entertainment industry—now reported to be worth $32 billion and predicted to grow 28% in 2010—is anticipating robust growth based on the market penetration of more sophisticated mobile devices.[12] Other research finds that growth in mobile gaming is being driven by growth in smartphone adoption in the United States. According to comScore digital metrics measurements, no smartphones appeared in the top 10 devices used for mobile game downloads last year, but this year, 6 out of the top 10 are smartphones, and iPhone owners accounted for 14% of mobile game downloaders in November, with 32.4% of all iPhone users reporting they downloaded a game during the month.[13]

Among our respondents, early adopters or innovators were more likely to use their handheld devices to e-mail, instant message, conduct personal business, download or watch videos online, read or contribute to blogs, or report what they were doing on Twitter. Some of these activities could possibly see an increase in use if devices and data-plan prices drop, particularly activities that typically use more online time, such as reading or contributing to blogs, watching mobile TV, streaming video or music, or playing online games. The number of activities that users perform may also increase, although 2 in 10 respondents to this year's ECAR student study said they already do 7 or more of the 13 activities we asked about (see Figure 6-9).

Handheld Devices in the Academic Environment

The mobile devices that so many students come to campus with, whether they are Internet-capable or not, inevitably have an impact on students' daily lives in and out of class. Students, and much of the American population, are becoming reliant on their devices to accomplish many things. As we saw in Chapter 4, not only did 9 out of 10 students use text messaging, but also a majority of students (55.3%) preferred receiving a text message on their mobile phone as first notification of a campus emergency—far more than any other option ECAR asked about (refer to Table 4-4).

With the ubiquity of devices and their increasing functionality, ECAR wondered how much they were being used in class. We asked students their level of agreement with the statement "While I'm in class, I regularly use my cell phone or handheld Internet device for course activities (texting, Internet access, etc.)." In addition, because many students and faculty have expressed concern about students using their devices while in class for reasons that are obviously not class related, we asked respondents about the statement "While I'm in class, I regularly use my cell phone or handheld Internet device for non-course activities (texting, Internet access, playing games, etc.)." Both questions asked students to select among five levels of agreement, from strongly agree to strongly disagree (see Figure 6-10).

Though majorities of students disagreed with each statement, they were considerably more likely to agree about using their devices for non-course-related than course-related activities in the classroom. Although a third (32.2%) of the students agreed or strongly agreed that they use their cell phone or handheld Internet device for non-course activities, more than half (53.5%) disagreed or strongly disagreed, including one-third (33.1%) who strongly disagreed.

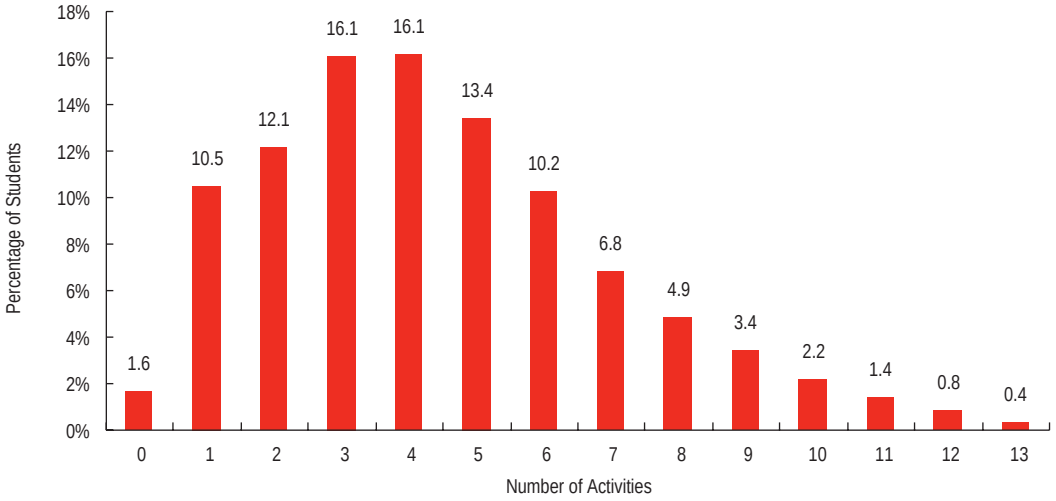


Figure 6-9. Number of Internet Activities Students Perform from Handheld Device (N = 10,133*)

**Includes only respondents who owned an Internet-capable handheld device and used the Internet from the device.*

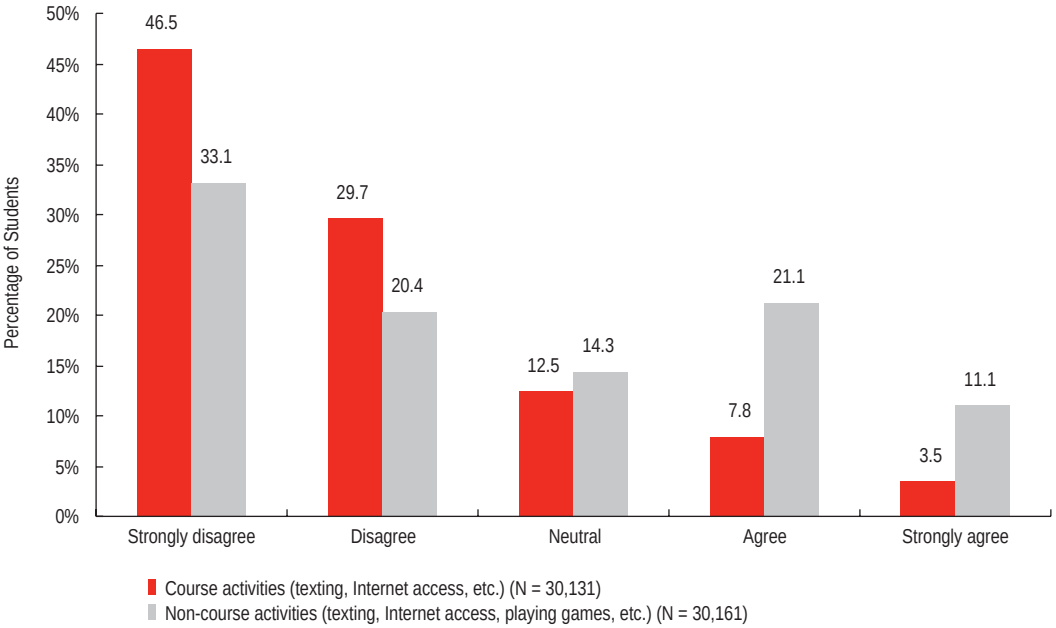


Figure 6-10. While in Class, I Regularly Use My Cell Phone or Handheld Internet Device for Course Activities/ Non-Course Activities

We didn't specifically ask students about their use of academic applications such as the course management system from their handheld devices, but several students in the focus groups commented on their use of their handheld devices for academic activities. A senior who said, "The course management system works on my device," went on to say, "I used our campus portal and registered for classes with my iPod Touch." An information technology management major also used campus resources from a handheld device: "I use our institution's website. I also take online tests for my classes with my BlackBerry Curve. I also attend another institution where I use it to check grades and download assignments." One student participated in the beta testing for the institution's mobile access to the CMS. He said, "I was a part of the beta test of the iPhone interface to the CMS. It is a very clean interface and it works well. I used it to view course materials and grades."

Just over 1 in 10 (11.3%) students agreed or strongly agreed that they use their cell phone or handheld Internet device in class

for course-related activities. Although the concept of "m-learning," or mobile learning, has received much interest, student use of mobile device features for classroom learning appears to be minimal. We look at what students said they would like to do with their mobile devices on campus and in the classroom later in this chapter.

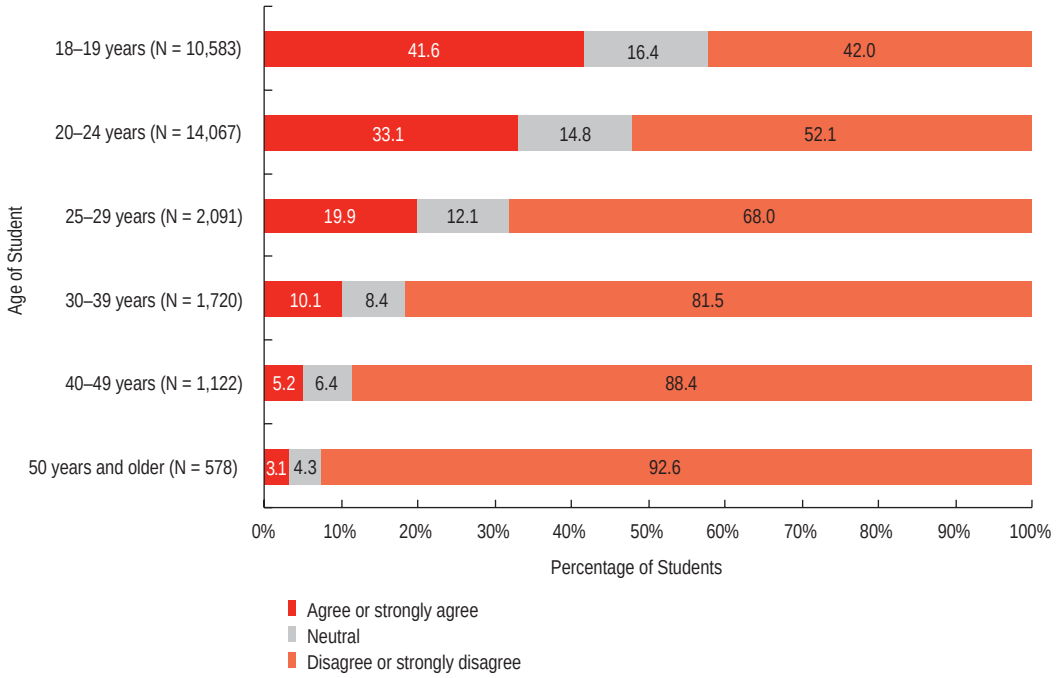
Age was associated with respondents' agreement about using their device for non-course activities (see Figure 6-11). Agreement about such use declined steadily with age—so much so that students under 25 years of age were more than 10 times as likely to agree as were students ages 50 and older. It's worth noting that because we asked this question of all students, regardless of whether they owned an Internet-capable handheld device, responses included many individuals who probably own only a relatively low-functioning cell phone. If ownership of more powerful devices grows among the student population, the opportunities for use could grow accordingly.

ECAR also asked whether students agreed with the statement "Instructors should have the authority to forbid the use of cell phones and handheld Internet devices during class time." Not surprisingly, we found that younger students disagreed more than older students (see Figure 6-12). Students who agreed more that they use their devices in class for either course-related or non-course-related activities were more likely to disagree with the statement that instructors should have the authority to forbid their use in class.

Expectations for Future Use of the Internet from Handheld Devices

According to recent research conducted by the Nielsen Company, of the 200 million current users of advanced mobile data services across the United States and Europe, almost 60% intend to use mobile data services more in the next 24 months, and of the millions of non-users, more than 25% intend to adopt mobile data services in the next 24 months. U.S. users are leading other countries in their expectation of growing use of the mobile Internet, a factor that is driven by their expectation of how using mobile data services will add convenience and make their lives easier.[14]

Figure 6-11. While in Class, I Regularly Use My Cell Phone or Handheld Internet Device for Non-Course Activities, by Age



Respondents to this year's ECAR student survey also anticipate their use of mobile services to grow. Almost three-quarters (73.7%) of respondents who currently own Internet-capable handheld devices and access the Internet from their devices said they expect their use of the Internet from a handheld device to increase or greatly increase (see Figure 6-13).

A Pew Internet & American Life study reports that users who are "motivated by mobility" don't necessarily substitute going online with a networked computer for using the Internet from their handheld device; rather, they use them as reinforcement to each other. The ascent of broadband "always on" Internet now has an additional layer of mobile "always

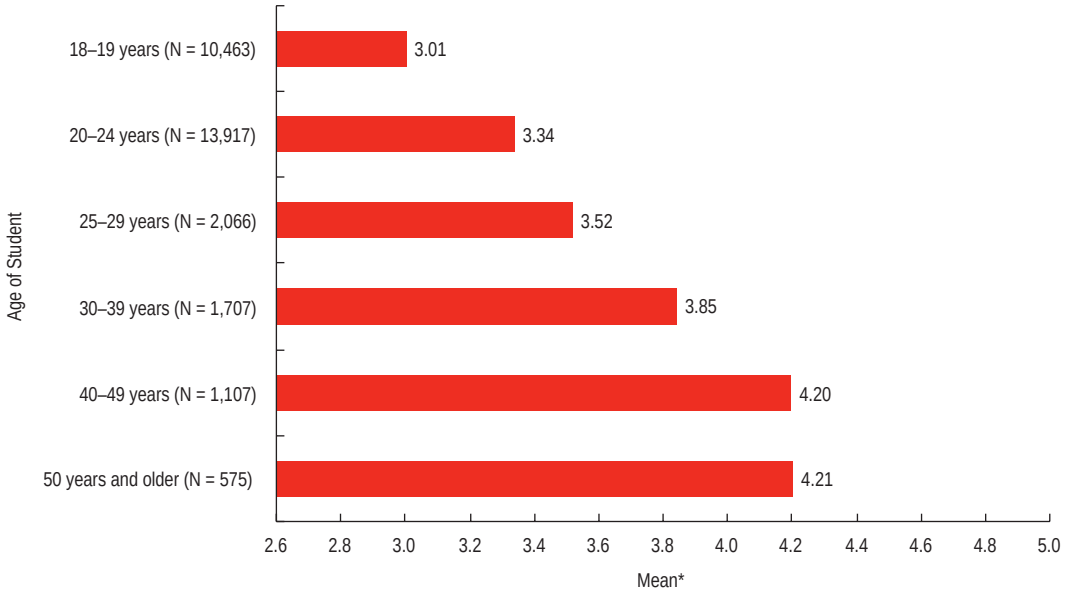


Figure 6-12. Instructors Should Have the Authority to Forbid the Use of Cell Phones and Handheld Internet Devices during Class Time, by Age

**Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*

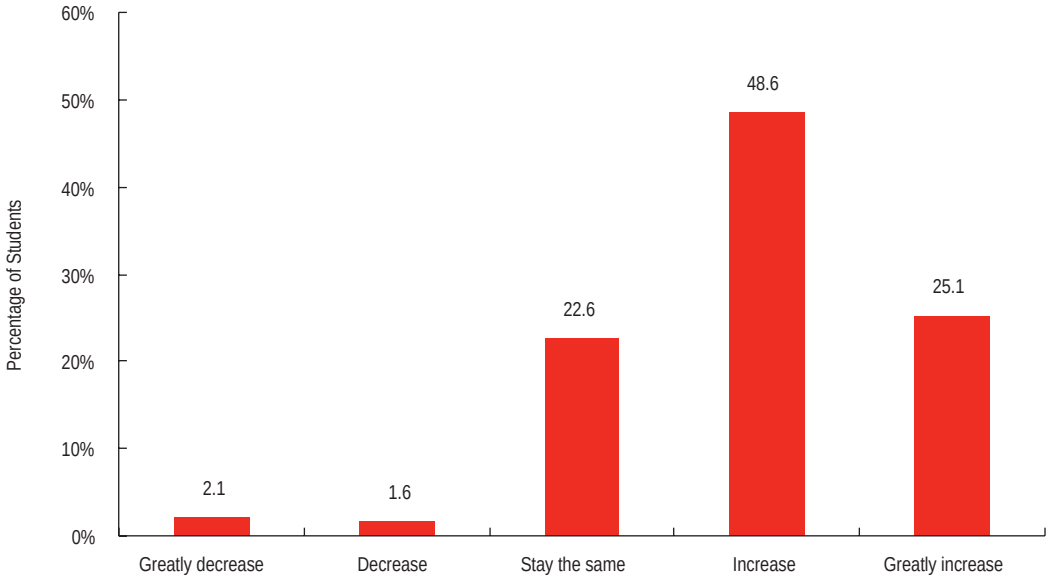


Figure 6-13. Anticipated Increase/Decrease in Use of the Internet from a Handheld Device in the Next Three Years (N = 10,085)*

**Includes only respondents who owned an Internet-capable handheld device and used the Internet from the device.*

connected" Internet, shaping a way of life whereby continual information exchange is the norm.[15] In our study, we asked students where they saw mobile Internet access fitting within their future information access strategy. Although almost three-quarters said seldom, very seldom, or never when asked if they use the Internet from their handheld device even when a networked laptop or desktop computer is easily available (refer to Figure 6-8), respondents apparently believed that this pattern will change. Nearly half (44.5%) of the respondents agreed or strongly agreed that in the next three years they expect to do many things on a cell phone or handheld Internet device that they currently do on a laptop or desktop computer (see Figure 6-14). About a quarter of the respondents (23.9%) were neutral about the statement, and about another quarter (28.1%) disagreed or strongly disagreed—perhaps supporting the Pew classification of users who do not feel the pull of mobility bringing them further into the world of digital information.

Those who owned Internet-capable handheld devices and those who planned to purchase one in the next 12 months tended to agree more that in the next three years they expect to do on a cell phone or handheld device many things that they currently do on a laptop or desktop computer (see Figure 6-15). Although almost half (52.5%) of the respondents who currently own an Internet-capable handheld device said they expect to do more, just over a quarter (27.4%) of those who did not own one or plan to own one in the next 12 months said they expect to do more.

Our respondents seem to be answering in ways consistent with research on the American public in general that indicates growth in the use of the Internet from handheld devices during the next few years. If, as the Nielsen research finds, convenience is a factor that drives this potential growth, what functions would students consider to be most convenient? In particular, we wanted to know what services students would like to see higher education institutions provide for their handheld devices, so we asked our respondents who currently own Internet-capable handheld devices and use them to access the Internet to select up to three IT services they would be most likely to use from their device if the services were available (see Figure 6-16).

The service selected by the largest percentage of respondents is e-mail; nearly

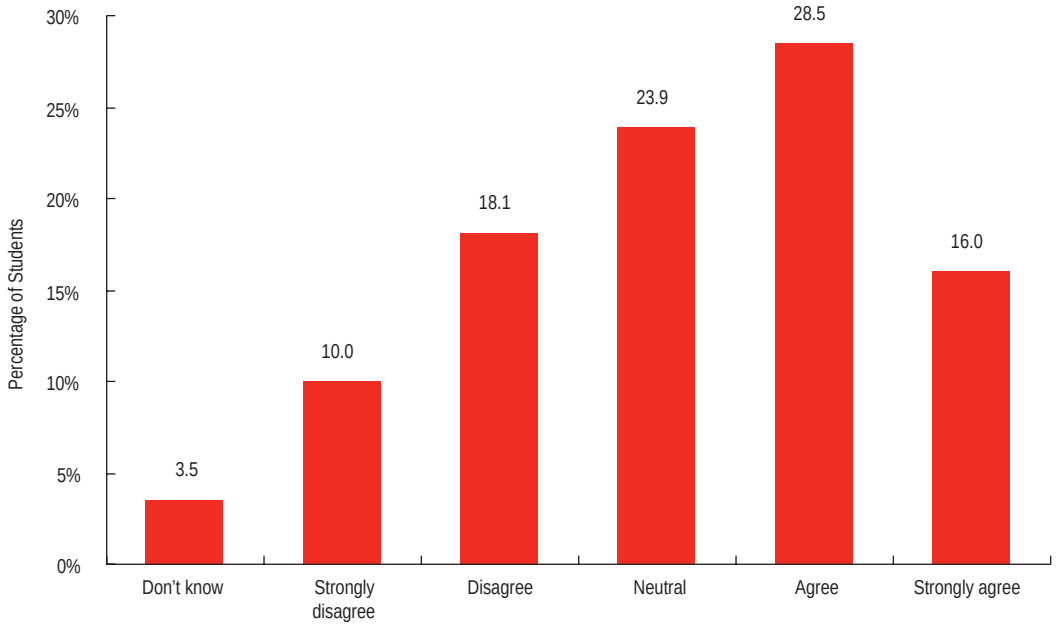


Figure 6-14. In the Next Three Years, I Expect to Do Many Things on a Cell Phone or Handheld Internet Device That I Currently Do on a Laptop or Desktop Computer (N = 30,299)

two-thirds (63.4%) of the respondents who owned Internet-capable handheld devices said they are likely to use their institution's e-mail service. Close to half the respondents (46.8%) said they are likely to use student administrative services (official grades, registration, etc.) from a handheld device if offered as an IT service from their institution.

About half (45.7%) said they would be likely to use a course or learning management system (CMS) from their handheld device. The other class-related IT services they would be likely to use from their handheld device were selected by fewer respondents: 20.8% said they would use them to download/stream course lectures (podcasts), and 17.6% said

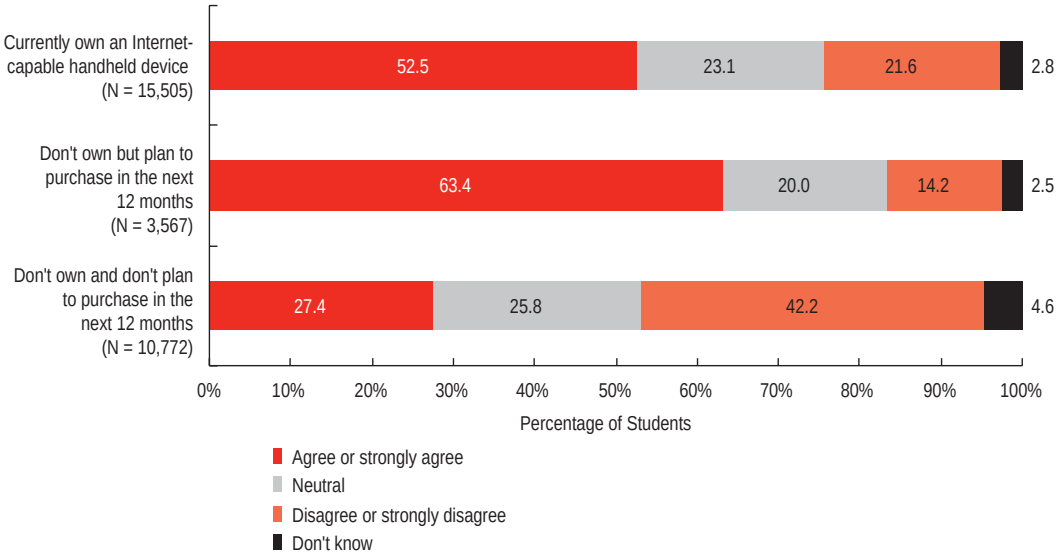


Figure 6-15. In the Next Three Years, I Expect to Do Many Things on a Cell Phone or Handheld Internet Device That I Currently Do on a Laptop or Desktop Computer, by Device Ownership

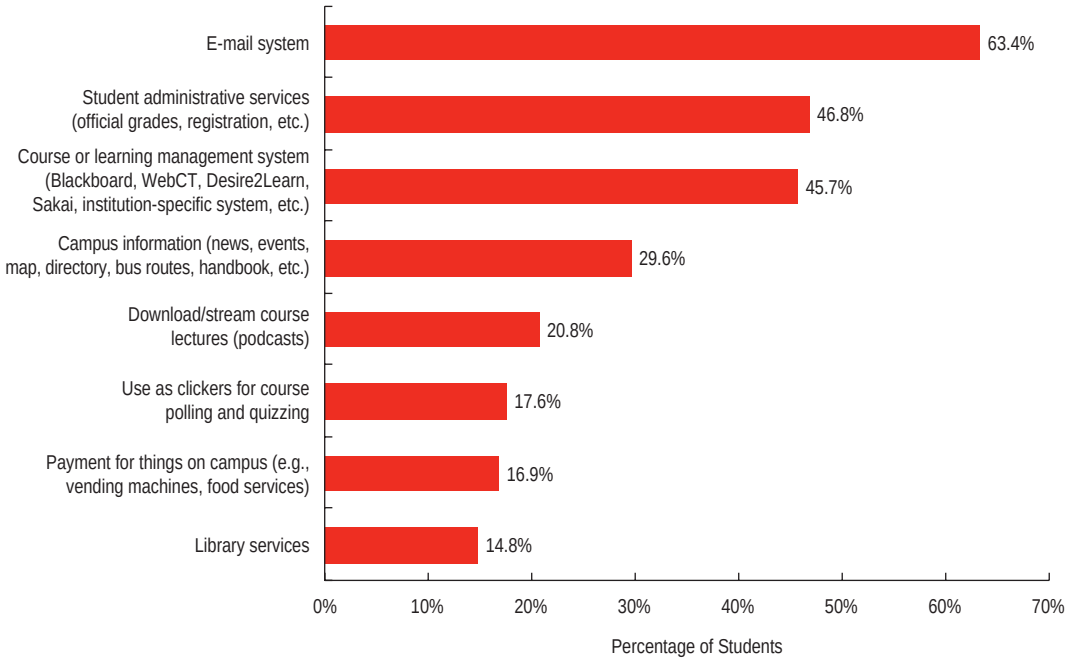


Figure 6-16. Institution IT Services Respondents Would Most Likely Use from Internet-Capable Handheld Device If Available* (N = 10,133)**

**Respondents were asked to check up to three reasons.*

***Includes only respondents who owned an Internet-capable handheld device and used the Internet from the device.*

they would use their devices as clickers for course polling and quizzing.

Looking up campus information (news, events, map, directory, bus routes, handbook, etc.) is a service that 29.6% of respondents chose, whereas paying for things on campus (for example, vending machines, food services) was selected by 16.9%, and fewer respondents selected library services (14.8%) as one of the three institution IT services they would most likely use from an Internet-capable handheld device.

In the student focus groups, students had a number of recommendations for institutionally provided services for their mobile devices. Comments included:

- "I would like, for our sports away games, to have up-to-the-minute updates on how we are doing available on my mobile device."
- "I would like to access the CMS and our student administrative system with it."
- "I want to register for classes with my mobile device. Also, I'd like to pay tuition with it."
- "I'd like to do videoconferencing."
- "Mobile CMS would be nice."
- "I'd like electronic reserve."
- "Definitely the campus e-mail system."
- "I'd like to know my test scores as soon as they become available. Please text them to me."
- "How about if the school closing was texted to me?"

Portraits of Student Mobility

Clearly, many users are already deeply invested—financially and personally—in using the Internet from handheld devices. On July 14, 2009, Apple announced that customers had downloaded more than 1.5 billion applications in the one year since the company's App Store opened.[16] The amazing growth in mobile Internet technology is also expected to continue. In August 2009, RBC Capital Markets reported that by the end of 2011, worldwide smartphone sales will pass worldwide PC sales, estimating nearly 400 million annual shipments of each.[17]

These numbers could mean an approaching storm for institutions that are not prepared. In the 2009 ECAR study *Spreading the Word: Messaging and Communications in Higher Education*, ECAR Fellow Mark C. Sheehan found that although three-quarters of responding institutions agreed at some level that the ubiquity of Internet-capable handheld devices will cause their institution to make significant changes to online services in the next three years, a "troubling lack of preparation by higher education to handle growing demand for mobile services" was apparent. Only half of respondent institutions reported they had adapted any preexisting web-based services for mobile services, and 6 in 10 said they had developed no new services.[18]

In the 2009 student study, we found that an overwhelming majority of respondents (85.6%) said they have never contacted IT for technical support for their handheld device, so it appears that IT departments are able to adequately support the current level of student ownership and use of Internet-capable handheld devices. But for how long? How will this level of student ownership and use, a summary of which appears in Figure 6-17, change over the next three years, and will higher education institutions be equipped to handle it?

This year, we found that students are moving into the mobile Internet, but in complex, nuanced ways. From our results, four types of student adopters of mobile Internet use are emerging:

- *Power users.* More than a quarter of this year's respondents owned handheld devices and used them to access the Internet weekly or more often. These users anticipated integrating the

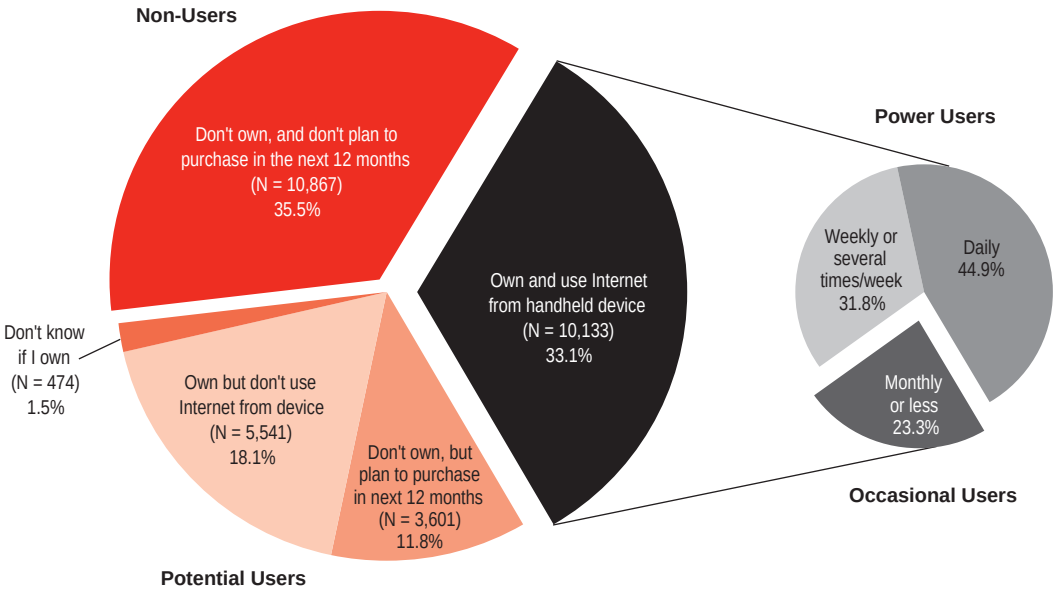


Figure 6-17. Ownership and Use of Internet-Capable Handheld Devices (N = 30,616)

mobile Internet even more into their lives, since three-quarters of them said they expect their use will increase in the next three years, and two-thirds of these power users also agreed that in the next three years they expect to do many things on a cell phone or handheld device that they currently do on a laptop or desktop computer.

- *Occasional users.* Fewer than 1 in 10 respondents owned handheld devices and used them monthly or less frequently. However, many of those users also expected to be drawn more into the mobile Internet, perhaps even becoming power users, since two-thirds said they expect their use will increase in the next three years and almost half expected to do many things on a cell phone or handheld device that they currently do on a laptop or desktop computer. Many factors exist that could be preventing these owners from using their devices more frequently today, including the cost of data plans, functionality of the devices, and perceived value of available mobile services. As these issues are addressed, these users will likely use their devices to access the Internet more often.
- *Potential users.* About 30% of respondents fell into this category. About 2 in 10 respondents currently own an Internet-capable handheld device but never use it to access the Internet, and another 1 in 10 said they didn't own an Internet-capable handheld device but they did plan to purchase one in the next 12 months. Because these respondents did not currently use the Internet from their devices, ECAR did not ask them if they thought their personal use would increase. However, about 40% of the current owners who didn't use the Internet from their device agreed that in the next three years they expect to do many things on a cell phone or handheld device that they currently do on a laptop or desktop computer, as did two-thirds of those planning to purchase a device in the next 12 months. These users could soon migrate into either the power user or occasional user category after barriers that are currently preventing them from accessing the mobile web are eliminated.
- *Non-users.* One-third of this year's respondents didn't own an Internet-capable handheld device and didn't

plan to own one in the next 12 months. Some of these respondents may eventually move into one of the device-owning categories, since a little over a third agreed or strongly agreed that in the next three years they expect to do many things on a cell phone or handheld device that they currently do on a laptop or desktop computer. In addition, almost two-thirds of these non-owners selected cost of the device and more than half selected cost of the data service as reasons they did not use the Internet from a handheld device, signaling that some may move into the owner-user categories if these costs decrease. However, more than 4 in 10 of these respondents didn't expect to do many things from their cell phone or handheld device in the next three years that they currently do from a desktop or laptop. Again, various reasons may be preventing these respondents from moving into the mobile web, but this subset of non-users who don't anticipate doing more things on the Internet from a handheld device seems to be saying they plan to resist the pull of mobility.

Of course, this typology is specific to this year's set of participating institutions and respondents and should not be construed to mean that every campus will have this exact categorization of mobile device users. In addition, some respondents were neutral on future ownership of a handheld device and on their expected change in use of the Internet from such a device, or they may have been saying they simply don't know whether they will own one or whether they will be using it to do more things in the future. They may be unsure of their future use for a variety of reasons, and we may see these types of students migrating into other usage groups as the barriers are removed or their personal situations change. One thing does seem to be clear: A solid base of respondents who are actively using the Internet from handheld devices already exists, and a sizeable percentage of respondents anticipate joining them.

According to Sheehan's *Messaging and Communications* study, as of summer 2008 many institutions were not prepared for a significant base of handheld device users[19]; this may be a reason for concern if student adoption far outpaces institutional support capability. In a proverbial chicken-or-the-egg conundrum, we wonder: Will students' growing demand shape higher education's response, or will institutional implementations of mobile services encourage more student use of the Internet from handheld devices? Alan Livingston describes college students' use of mobile technology as "a revolution no one noticed."[20] Perhaps it is better thought of as a revolution-in-process, one that holds great promise if higher education rises to the challenge, and to which we say, "*Viva la Revolución!*"

Endnotes

1. CTIA–The Wireless Association, "Wireless Quick Facts, Year End Figures," http://ctia.org/media/industry_info/index.cfm/AID/10323.
2. A September 2008 Pew Internet & American Life Project report places the percentage at 78%, whereas an April 2008 Harris Interactive poll found 89% ownership of cell phones in the United States. Mary Madden and Sydney Jones, "Networked Workers" (Washington, DC: Pew Internet & American Life Project), September 24, 2008, http://www.pewinternet.org/~/media/Files/Reports/2008/PIP_Networked_Workers_FINAL.pdf.pdf.; and Harris Interactive Public Relations Research, "Cell Phone Usage Continue to Increase," April 4, 2008, http://www.harrisinteractive.com/harris_poll/index.asp?PID=890.
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5. Jeff Herrmann, "Desire for Convenience, Features Drives Phone Innovation" (The Nielsen Company, Nielsen Wire), March 30, 2009, http://blog.nielsen.com/nielsenwire/consumer/desire-for-convenience-features-drives-phone-innovation/.
6. Alan Livingston, "The Revolution No One Noticed: Mobile Phones and Multimobile Services in Higher Education," *EDUCAUSE Quarterly* 32, no. 1 (2009).
7. This change in language may have had an impact on how students interpreted the question, because this year the combined percentage of those who owned an Internet-capable handheld device (52.0%) or planned to purchase one within the next 12 months (11.8%) was less than last year's (66.1% and 5.3%, respectively). We are unable to determine whether the decline is a result of this change in our survey, whether students are more familiar with the functionality of their devices and thus more accurate in their responses, or whether a true decline occurred in ownership of Internet-capable handheld devices in the 2009 respondent population. For the text of the most recent survey and the location of the question, see Appendix B. For comparison, previous ECAR surveys are available at http://www.educause.edu/ECAR/ResearchPublications/SurveyInstruments/1004.
8. John Horrigan, *The Mobile Difference* (Washington, DC: Pew Internet & American Life Project, March 2009), http://www.pewinternet.org/Reports/2009/5-The-Mobile-Difference--Typology/1-Summary-of-Findings.aspx?r=1.
9. The digital market intelligence company comScore reported that the number of people using their mobile device to access news and information on the Internet more than doubled from January 2008 to January 2009 and that among the audience of 63.2 million people who accessed news and information on their mobile devices in January 2009, 22.4 million (35%) did so daily—more than double the size of the audience last year. comScore, "Mobile Internet Becoming a Daily Activity for Many," March 16, 2009, http://www.comscore.com/Press_Events/Press_Releases/2009/3/Daily_Mobile_Internet_Usage_Grows; and GSMA, "Global Mobile Broadband Connections to Pass 150 million," July 22, 2009, http://www.gsmworld.com/newsroom/press-releases/2009/3494.htm.
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Appendix A

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Wynd, Matt—Towson University
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Appendix B

Students and Information Technology in Higher Education:

2009 Survey Questionnaire

1. **How old are you?** *We may only survey students 18 years or older. Required***.**

   (Dropdown list including Under 18 and 18 through 99. Respondents under 18 must exit the survey.)

2. **To enter the drawing for gift certificates, please enter your e-mail address.**
   *Optional.*_____

3. **How old is your personal desktop computer?**

   [ ] Don't own a desktop computer
   [ ] Less than 1 year old
   [ ] 1 year old
   [ ] 2 years old
   [ ] 3 years old
   [ ] 4 years old
   [ ] More than 4 years old

4. **How old is your personal laptop computer?**

   [ ] Don't own a laptop computer
   [ ] Less than 1 year old
   [ ] 1 year old
   [ ] 2 years old
   [ ] 3 years old
   [ ] 4 years old
   [ ] More than 4 years old

5. **Approximately how many hours each week do you spend actively doing Internet activities for school, work, or recreation?**

   (Dropdown list including Less than 1, 1 to 168, in 1 hour increments.)

6. How often do you do the following for school, work, or recreation?

	Never	Once per year	Once per quarter or semester	Monthly	Weekly	Several times per week	Daily
a. Instant message							
b. Text message							
c. Download web-based music or videos							
d. Use the college/university library website							
e. Spreadsheets (Excel, etc.)							
f. Presentation software (PowerPoint, etc.)							
g. Graphics software (Photoshop, Flash, etc.)							
h. Audio-creation software (Audacity, GarageBand, etc.)							
i. Video-creation software (MovieMaker, iMovie, etc.)							
j. Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)							
k. Online multi-user computer games (World of Warcraft, Everquest, poker, etc.)							
l. Online virtual worlds (Second Life, Forterra, etc.)							
m. Podcasts							
n. Social bookmarking/ tagging (del.icio.us, etc.)							
o. Voice over Internet Protocol (VoIP) from your computer (Skype, etc.)							

7. How often do you contribute content to the following for school, work, or recreation?

	Never	Once per year	Once per quarter or semester	Monthly	Weekly	Several times per week	Daily
a. Wikis (Wikipedia, course wiki, etc.)							
b. Blogs							
c. Video websites (YouTube, etc.)							

8. Which best describes your preference?

[ ] I prefer taking courses that use *no* information technology.
[ ] I prefer taking courses that use *limited* information technology.
[ ] I prefer taking courses that use a *moderate level* of information technology.
[ ] I prefer taking courses that use information technology *extensively*.
[ ] I prefer taking courses that use information technology *exclusively.*

9. What is your skill level for the following?

	Not at all skilled	Not very skilled	Fairly skilled	Very skilled	Expert
a. Using the college/university library website					
b. Spreadsheets (Excel, etc.)					
c. Presentation software (PowerPoint, etc.)					
d. Graphics software (Photoshop, Flash, etc.)					
e. Computer maintenance (software updates, security, etc.)					
f. Using the Internet to effectively and efficiently search for information					
g. Evaluating the reliability and credibility of online sources of information					
h. Understanding the ethical/legal issues surrounding the access to and use of digital information					

10. Are you using the following for any of your courses this quarter/semester?
Check all that you are using.

[ ] a. Spreadsheets (Excel, etc.)
[ ] b. Presentation software (PowerPoint, etc.)
[ ] c. Graphics software (Photoshop, Flash, etc.)
[ ] d. Audio-creation software (Audacity, GarageBand, etc.)
[ ] e. Video-creation software (MovieMaker, iMovie, etc.)
[ ] f. Programming languages (C++, Java, etc.)
[ ] g. Podcasts
[ ] h. E-portfolios
[ ] i. Discipline-specific technologies (Mathematica, AutoCAD, STELLA, etc.)
[ ] j. Instant messaging
[ ] k. Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)
[ ] l. Wikis
[ ] m. Blogs
[ ] n. Online virtual worlds (Second Life, Forterra, etc.)
[ ] o. College/university library website
[ ] p. Simulations or educational games

11. How many of your instructors:

	Almost none	Some	About half	Most	Almost all	Don't know
a. Use information technology (IT) effectively in courses						
b. Provide students with adequate training for the IT the instructor uses in his or her course						
c. Have adequate IT skills for carrying out course instruction						

12. Have you ever taken a course that used a course or learning management system (a system that provides tools such as online syllabi, sample exams, and gradebook)? Examples include WebCT, Blackboard, Desire2Learn, Sakai, or an institution-specific system). *Required.*

[ ] No. Go to 17.
[ ] Yes. Go to 13.
[ ] Don't know. Go to 17.

13. How often do you use course or learning management systems?

[ ] Never
[ ] Once a year
[ ] Once a quarter/semester
[ ] Monthly
[ ] Weekly
[ ] Several times per week
[ ] Daily

14. Are you using a course or learning management system for any of your courses this quarter/semester?

[ ] No
[ ] Yes

15. What is your skill level using course or learning management systems?

[ ] Not at all skilled
[ ] Not very skilled
[ ] Fairly skilled
[ ] Very skilled
[ ] Expert

16. Describe your overall experience using course or learning management systems.

[ ] Very negative
[ ] Negative
[ ] Neutral
[ ] Positive
[ ] Very positive

17. What is your opinion about the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. I get more actively involved in courses that use IT.					
b. The use of IT in my courses improves my learning.					
c. IT makes doing my course activities more convenient.					
d. By the time I graduate, the IT I have used in my courses will have adequately prepared me for the workplace.					
e. My institution's IT services are always available when I need them for my coursework.					
f. I skip classes when materials from course lectures are available online.					

18. Which of the following best describes you?

[ ] I am skeptical of new technologies and use them only when I have to.
[ ] I am usually one of the last people I know to use new technologies.
[ ] I usually use new technologies when most people I know do.
[ ] I like new technologies and use them before most people I know.
[ ] I love new technologies and am among the first to experiment with and use them.

19. I like to learn through:

	No	Yes	Don't know
a. Text-based conversations over e-mail, IM, and text messaging			
b. Programs I can control, such as video games, simulations, etc.			
c. Contributing to websites, blogs, wikis, etc.			
d. Running Internet searches			
e. Creating or listening to podcasts or webcasts			

20. How should your institution first notify you of a campus emergency?

[ ] E-mail
[ ] Text message
[ ] Instant message
[ ] Facebook
[ ] MySpace
[ ] Other social network site (e.g. Bebo, LinkedIn, etc.)
[ ] Public-address systems (sirens, loudspeakers, intercoms, etc.)
[ ] The institution's general information website
[ ] A special emergency website for the institution
[ ] Voice telephone call
[ ] Other

21. Do you own a handheld device that is capable of accessing the Internet (whether or not you use that capability)? Examples include iPhone, Treo, BlackBerry, other Internet-capable cell phone, iPod touch, PDA, Pocket PC, etc. *Required.*

[ ] No, and I don't plan to purchase one in the next 12 months. Go to 29.
[ ] No, but I plan to purchase one in the next 12 months. Go to 29.
[ ] Yes. Go to 22.
[ ] Don't know. Go to 29.

22. How often do you use the Internet from your handheld device? *Required.*

[ ] Never (do not use the Internet capability). Go to 29.
[ ] Once a year. Go to 24.
[ ] Once a quarter/semester. Go to 24.
[ ] Monthly. Go to 24.
[ ] Weekly. Go to 23.
[ ] Several times per week. Go to 23.
[ ] Daily. Go to 23.

23. Approximately how much time each week do you use the Internet from your handheld device? *(Dropdown menu of Less than 15 minutes, 15 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, up to 100 hours, plus More than 100 hours (in one-hour increments).)*

24. Which of these Internet activities do you do from your handheld device? *Check all that apply.*

[ ] a. Instant message
[ ] b. E-mail
[ ] c. Report what you're doing on Twitter
[ ] d. Use social networking websites (Facebook, MySpace, Bebo, etc.)
[ ] e. Check information (news, weather, sports, specific facts, etc.)
[ ] f. Read or contribute to blogs
[ ] g. Use maps (e.g., find places, get directions or plan routes)
[ ] h. Conduct personal business (banking, shopping, etc.)
[ ] i. Use Internet photo sites
[ ] j. Watch mobile TV
[ ] k. Download/stream music
[ ] l. Download or watch videos online
[ ] m. Download or play games online

25. In the next three years, I expect my use of the Internet from a handheld device will:

[ ] Greatly decrease
[ ] Decrease
[ ] Stay the same
[ ] Increase
[ ] Greatly increase

26. Do you use the Internet from your handheld device even when a networked computer (laptop or desktop) is easily available?

[ ] Never
[ ] Very seldom
[ ] Seldom
[ ] Neither seldom or often
[ ] Often
[ ] Very often

27. Which of your institution's IT services would you be most likely to use if they were available on your handheld Internet device? *Check up to 3.*

[ ] a. Student administrative services (official grades, registration, etc.)
[ ] b. Library services
[ ] c. Course or learning management system (Blackboard, WebCT, Desire2Learn, Sakai, an institution-specific system, etc.)
[ ] d. E-mail system
[ ] e. Campus information (news, events, map, directory, bus routes, handbook, etc.)
[ ] f. Payment for things on campus (e.g., vending machines, food services)
[ ] g. Download/stream course lectures (podcasts)
[ ] h. Use as clickers for course polling and quizzing

28. How many times this year have you contacted the campus IT organization for technical support related to your handheld Internet device? *(Dropdown menu of Never, 1 time to 40 times, More than 40 times.)*

29. What keeps you from using the Internet, or using it more often, from a handheld device? *Check up to 3.*

[ ] a. Plenty of other ways to access the Internet
[ ] b. No compelling reason to access the Internet
[ ] c. Cost of the handheld device
[ ] d. Cost of the data service
[ ] e. Device usability issues (small screen, keyboard, etc.)
[ ] f. Inadequate battery life
[ ] g. Limited access to the network (e.g., hot spots, wireless carrier coverage)
[ ] h. Network connection too slow
[ ] i. Lack of applications that are useful to me
[ ] j. Cost of applications that are useful to me
[ ] k. Concern about the security/privacy problems of mobile technology
[ ] l. Concern about the potential health problems of mobile technology
[ ] m. Other

30. What is your opinion about the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know
a. While I'm in class, I regularly use my cell phone or handheld Internet device for course activities (texting, Internet access, etc.).						
b. While I'm in class, I regularly use my cell phone or handheld Internet device for non-course activities (texting, Internet access, playing games, etc.).						
c. Instructors should have the authority to forbid the use of cell phones and handheld Internet devices during class time.						
d. In the next three years, I expect to do many things on a cell phone or handheld Internet device that I currently do on a laptop or desktop computer.						

31. What is your gender?

[ ] Male
[ ] Female

32. What is your cumulative grade point average (GPA)?

[ ] A
[ ] A-
[ ] B+
[ ] B
[ ] B-
[ ] C+
[ ] C
[ ] C- or lower
[ ] Don't know

33. What is your class standing?

[ ] Senior or final year
[ ] Freshman or first year
[ ] Other

34. Are you currently a full-time or part-time student? Part-time is fewer than 12 credit hours per quarter/semester.

[ ] Full-time
[ ] Part-time

35. Do you reside on campus or off campus?

[ ] On campus
[ ] Off campus

36. What are you majoring in? *Check all that apply.*

[ ] a. Social sciences
[ ] b. Humanities
[ ] c. Fine arts
[ ] d. Life/biological sciences, including agriculture and health sciences
[ ] e. Physical sciences, including math
[ ] f. Education, including physical education
[ ] g. Engineering
[ ] h. Business
[ ] i. Other
[ ] j. Undecided

37. Which institution are you attending? Required. *(Dropdown list of institutions.)*

Before proceeding, please confirm that the name of your institution is correct in the answer box above.

38. Is there anything you would like to tell us about your experience with IT in or out of courses?

_____

Thank you! You have reached the end of the survey. Visit the ECAR website to see our research and learn more about the EDUCAUSE Center for Applied Research. If you have any questions or concerns, please e-mail ecar@educause.edu.

Just one more step!

Click "Finish" to submit your survey.

Once you click "Finish," you will see confirmation that your survey has been submitted.

— END SURVEY —

Appendix C

Qualitative Interview Questions

1. Background

a. Student information: age, gender, senior/freshman, full/part time, on/off campus, discipline.
b. How many computers do you own? What kinds? How long have you owned them?
c. Do you own a smartphone or PDA that can access the Internet? Do you use it to access the Internet? What other electronic devices do you own?
d. What do you use your smartphone or PDA for?
e. Are there any barriers to your use of your smartphone or PDA to access to Internet?
f. Have you used your smartphone or PDA for any university applications? Which ones? Instruction?
g. How do you think you will be using your mobile device in the future? Are there university applications you'd like to see on your mobile device?

2. Skill and use

a. How skilled are you at using computer technology to do the work required for your classes?
b. Much is being said and written about the current generation of students using information technology extensively and being tech savvy. Do you think this statement is true of yourself? Of your friends?
c. What kinds of technology skills are you weak in? What are you strong in?
d. What kinds of technology skills do you think students in general are weak in?
e. Do you use computers and the Internet for entertainment? If so, what kinds of activities do you engage in for entertainment?
f. What impact do you think a student's major has on his or her use and skills with technology?
g. What sorts of things do you use on the Internet (blogs, wikis, YouTube, etc.)? How much do you use them?

3. Your use of technology in courses

a. How have instructors used information technology in the courses you have taken thus far?

b. How effective are your instructors with these information technologies?

c. What are the major advantages that you see in the use of information technology in your courses?

d. What is the major disadvantage that you see in the use of information technology in your courses?

e. Do you think that the use of information technology in your courses has helped you in your learning?

   If so, how?

   If not, why not?

f. What are the major obstacles you see to more effective use of computer and information technology in your courses?

g. One of the findings of last year's study was that students indicated that technology in their classes was primarily about convenience. While improved learning was also mentioned, it seemed to play a lesser role. Can you please comment on this?

h. 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

a. 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 Comments?

Appendix D

Participating Institutions and Survey Response Rates

Four-Year Institutions

Institution	Freshman and Senior Enrollment*	Freshman and Senior Sample*	Sample Percentage of Enrollment	Number of Student Respondents	Response Rate
Arizona State University	24,597	6,150	25.0%	583	9.5%
Auburn University	11,133	2,000	18.0%	159	8.0%
Baylor University	6,285	1,600	25.5%	273	17.1%
Boise State University	7,358	1,500	20.4%	271	18.1%
Brandeis University	1,660	1,660	100.0%	524	31.6%
Bridgewater State College	4,217	4,217	100.0%	138	3.3%
Brown University	3,042	1,521	50.0%	349	22.9%
Bucknell University	1,801	1,801	100.0%	163	9.1%
Butler University	–	–	–	235	–
California Lutheran University	958	958	100.0%	153	16.0%
California State University, East Bay	5,126	5,126	100.0%	679	13.2%
California State University, Fullerton	14,758	4,070	27.6%	436	10.7%
California State University, Los Angeles	10,234	9,915	96.9%	120	1.2%
California State University, Sacramento	12,168	1,000	8.2%	89	8.9%
Case Western Reserve University	–	–	–	65	–
Catawba College	671	671	100.0%	60	8.9%
Central Connecticut State University	5,369	5,369	100.0%	282	5.3%
Central Michigan University	9,671	9,671	100.0%	988	10.2%
Clemson University	7,798	1,000	12.8%	127	12.7%
College of Saint Benedict/Saint John's University	2,110	2,110	100.0%	255	12.1%
Colorado College	1,079	323	29.9%	65	20.1%
Coppin State University	1,303	1,303	100.0%	113	8.7%
Dartmouth College	–	–	–	147	–
Drexel University	7,659	2,035	26.6%	228	11.2%

Institution	Freshman and Senior Enrollment*	Freshman and Senior Sample*	Sample Percentage of Enrollment	Number of Student Respondents	Response Rate
Eastern Michigan University	8,719	2,197	25.2%	147	6.7%
Embry-Riddle Aeronautical–Prescott Campus	832	824	99.0%	144	17.5%
Embry-Riddle Aeronautical University	2,490	2,470	99.2%	326	13.2%
Embry-Riddle Aeronautical University–Worldwide	6,533	3,230	49.4%	365	11.3%
Emory University	2,841	1,448	51.0%	150	10.4%
Franklin W. Olin College of Engineering	158	158	100.0%	50	31.6%
Furman University	1,413	1,413	100.0%	286	20.2%
Georgia Southern University	5,259	2,000	38.0%	114	5.7%
Georgia State University	11,150	5,600	50.2%	359	6.4%
Gettysburg College	1,262	350	27.7%	54	15.4%
Hamilton College	968	968	100.0%	283	29.2%
Indiana State University	4,317	1,600	37.1%	187	11.7%
Indiana University	15,897	700	4.4%	68	9.7%
Indiana University–Purdue University Indianapolis	11,628	700	6.0%	73	10.4%
The Johns Hopkins University	2,332	584	25.0%	127	21.7%
Keene State College	2,588	2,588	100.0%	462	17.9%
Louisiana State University	11,574	2,896	25.0%	138	4.8%
Macalester College	899	400	44.5%	179	44.8%
McGill University	11,105	4,000	36.0%	640	16.0%
Miami University	7,393	2,705	36.6%	200	7.4%
Michigan State University	15,677	2,352	15.0%	174	7.4%
Middle Tennessee State University	10,950	3,000	27.4%	212	7.1%
Missouri University of Science and Technology	2,894	1,157	40.0%	181	15.6%
Monmouth College	638	638	100.0%	156	24.5%
Monmouth University	2,280	700	30.7%	66	9.4%
Montana State University	4,851	2,000	41.2%	255	12.8%
New Jersey Institute of Technology	–	–	–	144	–
North Greenville University	1,066	1,066	100.0%	125	11.7%
Northwestern University	4,338	1,500	34.6%	128	8.5%
Oakland University	7,256	7,256	100.0%	969	13.4%
Pepperdine University	1,695	1,695	100.0%	391	23.1%
Purdue University	17,246	1,600	9.3%	106	6.6%
Saint Mary's University of Minnesota	648	648	100.0%	95	14.7%
Seton Hall University	2,626	2,456	93.5%	489	19.9%
Skidmore College	1,258	700	55.6%	217	31.0%

Institution	Freshman and Senior Enrollment*	Freshman and Senior Sample*	Sample Percentage of Enrollment	Number of Student Respondents	Response Rate
South Dakota State University	3,530	705	20.0%	146	20.7%
Stevens Institute of Technology	1,166	769	66.0%	230	29.9%
SUNY College at Oswego	3,354	3,354	100.0%	237	7.1%
Towson University	7,695	7,695	100.0%	439	5.7%
Tulane University	3,941	3,941	100.0%	676	17.2%
University at Albany, SUNY	6,294	2,531	40.2%	246	9.7%
University of Delaware	7,829	7,829	100.0%	394	5.0%
University of Indianapolis	1,316	1,316	100.0%	97	7.4%
University of La Verne	4,017	1,406	35.0%	98	7.0%
University of Maryland	12,256	4,000	32.6%	379	9.5%
University of Maryland, Baltimore County	3,940	1,132	28.7%	84	7.4%
University of Massachusetts Boston	4,652	4,652	100.0%	337	7.2%
The University of Memphis	8,527	8,527	100.0%	635	7.4%
University of Michigan–Ann Arbor	13,526	3,380	25.0%	216	6.4%
University of Missouri–Columbia	12,053	2,936	24.4%	235	8.0%
University of Nevada, Las Vegas	9,554	9,554	100.0%	30	0.3%
University of New Hampshire	5,324	2,000	37.6%	335	16.8%
University of New Mexico	9,455	4,584	48.5%	390	8.5%
University of North Carolina at Pembroke	2,549	1,163	45.6%	171	14.7%
University of Oregon	9,360	9,360	100.0%	1926	20.6%
University of Rhode Island	5,247	2,125	40.5%	497	23.4%
University of Richmond	1,428	714	50.0%	119	16.7%
University of San Diego	2,627	1,102	41.9%	155	14.1%
The University of South Dakota	2,930	1,500	51.2%	219	14.6%
University of St. Thomas	3,034	1,400	46.1%	329	23.5%
University of Washington	13,248	2,000	15.1%	397	19.9%
University of West Georgia	4,652	1,163	25.0%	104	8.9%
University of Wisconsin–Eau Claire	5,056	1,600	31.6%	261	16.3%
University of Wisconsin–Green Bay	2,971	2,971	100.0%	129	4.3%
University of Wisconsin–LaCrosse	4,215	2,700	64.1%	514	19.0%
University of Wisconsin–Madison	14,883	2,000	13.4%	305	15.3%
University of Wisconsin–Milwaukee	12,229	1,600	13.1%	109	6.8%
University of Wisconsin–Oshkosh	5,203	2,617	50.3%	168	6.4%
University of Wisconsin–Parkside	2,470	2,470	100.0%	142	5.7%
University of Wisconsin–Platteville	3,089	3,089	100.0%	421	13.6%
University of Wisconsin–River Falls	2,532	3,214	126.9%	527	16.4%
University of Wisconsin–Stevens Point	4,210	2,500	59.4%	368	14.7%

Institution	Freshman and Senior Enrollment*	Freshman and Senior Sample*	Sample Percentage of Enrollment	Number of Student Respondents	Response Rate
University of Wisconsin–Superior	1,340	1,340	100.0%	227	16.9%
University of Wisconsin–Whitewater	4,848	1,000	20.6%	131	13.1%
Virginia Tech	11,281	2,000	17.7%	350	17.5%
Wayne State University	9,505	6,747	71.0%	504	7.5%
Weber State University	10,340	1,121	10.8%	127	11.3%
Western Carolina University	3,851	3,851	100.0%	16	0.4%
William Paterson University of New Jersey	4,607	1,308	28.4%	112	8.6%

Associate's Institutions

Institution	Total Enrollment*	Sample*	Sample Percentage of Enrollment	Number of Student Respondents	Response Rate
Brazosport College	3,887	903	23.2%	89	9.9%
Bucks County Community College	10,366	10,366	100.0%	175	1.7%
Chandler Gilbert Community College	–	–	–	136	–
Estrella Mountain Community College	5,577	1,500	26.9%	128	8.5%
Florida Keys Community College	2,047	2,047	100.0%	42	2.1%
Glendale Community College	7,720	4,266	55.3%	215	5.0%
Grand Rapids Community College	12,484	2,150	17.2%	276	12.8%
Johnson County Community College	4,705	700	14.9%	122	17.4%
Mesa Community College	–	–	–	496	–
Miami Dade College	39,710	1,974	5.0%	248	12.6%
Seminole Community College	13,870	3,500	25.2%	319	9.1%
South Mountain Community College	5,138	5,138	100.0%	276	5.4%

**Enrollment and sample information are displayed only for those institutions that provided this data to ECAR.*

Appendix E

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The bibliography contains all cited sources as well as additional material influential in preparing the study.

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