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The ECAR Study of Undergraduate Students and Information Technology, 2007

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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.

Contents

Foreword

In this fourth annual ECAR study of how undergraduates use and think about information technology (IT), we turn a demographic corner: Many of the student respondents who we report on here as seniors were freshmen when we launched our first study in 2004. Along the way, our study has matured as well, inspiring feelings among the ECAR team that any parent of college-age children will surely recognize. There is shock at how fast time has gone by, pride in the way a cherished child has grown, and excitement about what lies ahead. Beginning with 13 venturesome institutions and 4,374 student respondents in 2004, we now present the results of our 2007 survey of 27,864 students at 103 colleges, universities, and community colleges. The ECAR "student study" is now widely cited as the richest available source of data and insight regarding undergraduates' experiences with and attitudes toward using IT in their academic lives.

As in previous years, the conclusions we draw here must be limited to the cohort of participating institutions. Yet we also believe that our findings are indicative (if not conclusive) about student behavior and attitudes at similar institutions, and that they contribute valuable empirical information and much-needed nuance to descriptions of the "digital natives" and "millennials" who now purportedly make up the student body. In this study as in its predecessors, we have indeed found student respondents to be immersed in technology ownership and use, and impatient with instructors who don't have adequate technical skills. Responding to questions new to this year's study, majorities of student respondents told us that they like to learn by using Internet searches and programs they can control, such as video games and simulations.

But our respondents have also been far from monolithic, and their responses include themes of skepticism and moderation alongside enthusiasm. They consistently report a greater preference for moderate rather than extensive use of IT in courses (59 percent versus 20 percent in the current study); differ in their self-evaluation of IT skills by freshman/senior standing, gender, and major; and eloquently describe the value they see in face-to-face interaction and personal contact, often in explicit contrast to online tools. This year, more students said they didn't like learning through some otherwise popular technologies such as instant messaging (IM) than said they did—perhaps because they want to protect those tools' personal nature. Findings like these illustrate the value of going to the source to study student attitudes and the subtleties that may color a digitally "native" outlook.

We also offer some clues about where that outlook may be headed. This year's findings show substantial growth in several facets of mobility, such as laptop and smartphone ownership and wireless connectivity to the Internet, and a continued rise in the popularity of social networking sites. The push-pull effect of simultaneously untethering students and linking them together lies at the heart of the emerging Web 2.0 paradigm, which stresses complex personal interactions, collaboration, dynamic rather than static information, and immersive environments. It is too early to tell whether or how our student respondents will embrace these emerging capabilities, but as Chris Dede of the Harvard Graduate School of Education makes clear in his fine Introduction to this study (Chapter 2), they have profound implications not only for pedagogy but also for "our ways of thinking and knowing." Future ECAR studies will keep an eye on these developments.

This study is the result of collaborative work by many people inside and outside of ECAR. The ECAR fellowship has, as always, pursued this project with dedication and meticulous care. Judy Caruso managed a demanding institutional review board (IRB) process and greatly enriched the text by leading student focus groups and synthesizing other qualitative and secondary sources. Coauthor Gail Salaway's superb methodological talents and passion for clear, accurate analysis have graced many ECAR studies and are just as evident in this one. Mark Nelson also assisted with methodology and performed a heroic analysis of the thousands of qualitative comments collected by our survey's open response questions. We are also grateful for reviews of the text by ECAR Fellow Robert Albrecht and our EDUCAUSE colleague Diana Oblinger.

Our work was aided and enriched by the contributions of individuals at many institutions of higher education. We are especially grateful to Chris Dede, Timothy E. Wirth Professor in Learning Technologies at the Harvard Graduate School of Education, for writing the Introduction and reviewing the quantitative chapters. Chris was exceedingly generous in sharing the insights that have made him a stellar figure in the study of technology and learning. Chris's doctoral student at Harvard, Edward Dieterle, graciously contributed the "how students like to learn with technology" survey questions that are analyzed in Chapter 5. James Jonas, Information Services/Electronic Resources Librarian at the University of Wisconsin–Madison, gave us invaluable assistance with our literature search.

The study of students is particularly sensitive, and much of our work has fallen under the purview of college and university institutional review boards. At each of the many institutions we worked with, individuals assisted us with the essential and often laborious coordination of IRB approvals. Others helped develop randomized samplings of their freshman and senior student populations, deployed the survey, or helped us coordinate focus groups. Our debt to these colleagues for their generous and professional assistance is enormous, but the space available in this Foreword is not, and so we direct the reader to Appendix A to find their names.

ECAR Fellow Toby Sitko has the not always serene task of asking authors to deliver final drafts on time and then making sure they get turned into finished products. It's a demanding role, which in this as in other studies she has performed with perfect tact and skill. Toby, Gregory Dobbin, and Nancy Hays contribute much of the expertise that delivers polished publications to our subscribers, and they oversee the work of a talented body of editors, typographers, and printers who contribute the rest.

Forewords to our studies rarely mention the work of ECAR Founder and Director Richard Katz, in part because he usually writes the forewords and in part because his brilliance is self-evident in everything ECAR publishes. But Richard's absence on an assignment to expand

ECAR's international research provides a rare opportunity to recognize his achievements more explicitly. As a researcher, Richard was part of the ECAR team that conceived of an annual study that would give higher education leaders (and anyone else who was interested) sound empirical evidence about a topic too often dominated by speculation and self-interest. As a leader, he pushed past the many practical difficulties that, once appreciated, go a long way toward explaining why there aren't more studies of this type. And as impresario and sometime author of the student studies, Richard has made a powerful contribution to improving higher education. His generous acknowledgments of the work of the ECAR fellowship run through everything he writes, and it is a privilege, on behalf of that talented group, to return the compliment.

Ron Yanosky
Boulder, Colorado

1
Executive Summary

I use lots of technology, but my sister who is a sophomore in high school knows more about technology than I do. I've been too busy to keep up and I am getting outdated. I guess we are all dinosaurs to some extent.
—A graduating senior

Chris Dede's Introduction to this study (Chapter 2) argues that the ongoing technology revolution is driving a sea change in communicating, teaching, and learning. Further, while faculty and institutions have automated conventional forms of instruction and made some steps in using technology to expand the range of students' academic experiences, we have barely scratched the surface. He points to a spectrum of information technologies (IT) that should cause the academy to rethink the very creation, sharing, and mastery of knowledge. These include

- the familiar "world-to-the-desktop" providing access to distributed knowledge and expertise across time and space through networked media;
- sociosemantic networking and the social bookmarking/tagging revolution;
- massively multiplayer online games (MMOGs) and multiuser virtual environment (MUVE) interfaces;
- augmented reality (AR) interfaces; and
- the evolving National Science Foundation (NSF) vision of the cyberinfrastructure, integrating computing, data and networks, digitally enabled sensors, and experimental facilities.

To help the academy navigate these times, Dede notes the need for both faculty experimentation and rigorous research. Using analytic methods to study how undergraduates use electronic devices—and in turn how they are actively and tacitly shaped by their media—will provide insight about students' cognition, motivation, self-image, and learning that can inform designs for academic instruction and enculturation. Dialogues with students around research findings can deepen our understanding and help us identify which IT trends are merely stylish and which are truly transformational.

In fact, a new but growing literature focuses on undergraduate students and IT.[1] In 2004, the EDUCAUSE Center for Applied Research (ECAR) joined this effort and began its annual survey of undergraduates and IT with a threefold purpose:

- to provide information on the technology behaviors, preferences, and attitudes of higher education's undergraduates, especially as it relates to their academic experience;
- to provide information to college and university administrators that will help them implement campus technology environments for students; and
- to inform the practices of teaching faculty who are working to incorporate information technologies in rich and meaningful ways into their curricula and pedagogies.[2]

Methodology

In this latest ECAR study, 103 institutions invited a sample of their students to participate in a survey about how they use technologies and the impact that technology has on their academic experience. The 2007 study builds on previous ECAR studies of undergraduates and IT and uses a multipart research approach, including

- a literature review (extending the 2006 literature review) and review of other relevant surveys;
- a quantitative Web-based survey of college and university freshmen and seniors at 99 four-year institutions (26,022 respondents, or 93.4 percent of the total) and general students at four two-year institutions (1,824 respondents, or 6.6 percent of the total);
- student focus groups, which provided qualitative data from 50 students at four institutions;
- analysis of qualitative data from 4,752 responses to the survey's open-ended question; and
- comparison of longitudinal data collected in the 2005, 2006, and 2007 surveys where available.[3]

Most respondents attended public institutions (79.8 percent), and more than a third (36.0 percent) attended institutions with enrollments greater than 15,000 students.

Key Findings

ECAR learned much about undergraduates' IT experiences, and several themes emerged as we reviewed our results. These themes cover student technology ownership, use and skill with IT, student experience with IT in courses, and student perceptions about how IT contributes to their academic experience.

Technology Ownership

While nearly all of our respondents own a computer (98.4 percent), laptops continue to gain as the computer of choice. Nearly three-quarters (73.7 percent) of respondents own them. Longitudinal data for those institutions that have participated in ECAR studies over the past three years show that laptop ownership has increased from 52.8 percent in 2005 to 75.8 percent in 2007 (see Figure 1-1). In fact, students at our respondent institutions are entering college with new laptops in hand; this year, 64.0 percent of entering freshmen at four-year institutions have a laptop less than one year old. And most respondents (65.5 percent) own a computer two years old or less, well within recommended equipment replacement cycles. Yet one-fifth of respondents (20.4 percent) have a computer four years old or older, more likely to pose reliability and performance problems.

The majority of laptop owners tell us they are not bringing them to class; half (52.4 percent) never bring them at all. Weight and the risk of theft are frequently cited as reasons. However, at the other end of the scale, one in four respondents (25.0 percent) do make a habit of bringing their laptop to class regularly—weekly or more often.

Smartphones are also on the rise, owned by more than 1 in 10 (12.0 percent) of the full 2007 respondent population. Review of the longitudinal data in Figure 1-1 shows a significant but not startling increase over last year. For the 40 institutions participating in the past three years' studies, the percentage of smartphone ownership increased from 7.8 percent in 2006 to 10.1 percent in 2007. Ownership of PDAs, on the other hand, is slightly down from 2005. This is consistent with market research data, which points to the fact that the key features that once distinguished PDAs can now be found commonly on converged mobile devices. Among respondents who say they are early technology adopters, nearly one-fifth (18.0 percent) already own smartphones. Mainstream adopters will likely be close behind. This finding is important to institutions that closely watch the maturation

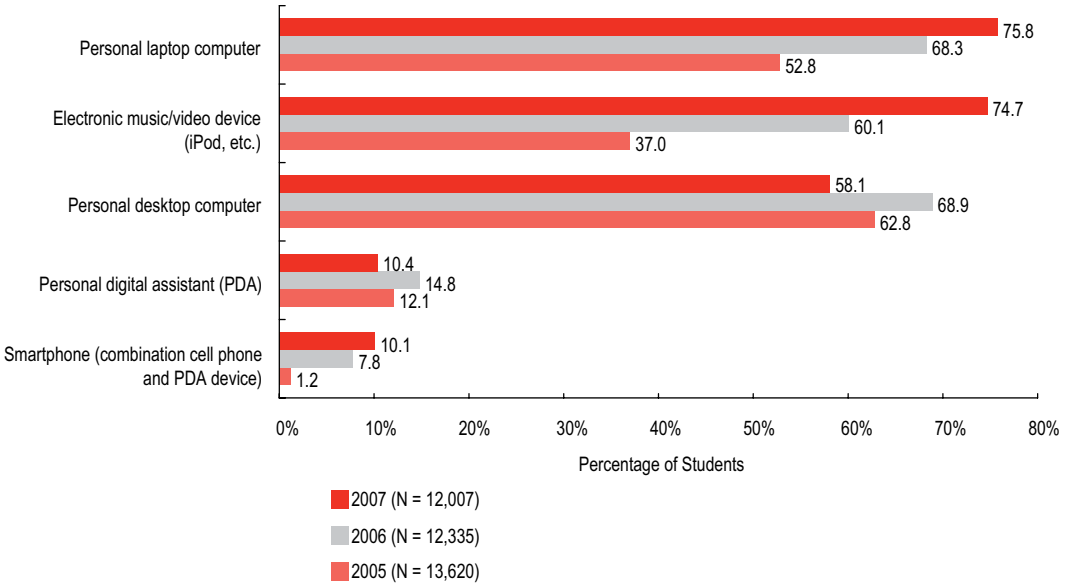


Figure 1-1. Change in Technology Ownership from 2005 to 2007*

**Data for three-year comparisons are based on student responses from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. While institutions remain the same, the actual students responding are different for each year.*

of handheld converged mobile devices as a Web-enabled technology that students can potentially use to access a wide variety of institutional services.

Using Computers and the Internet

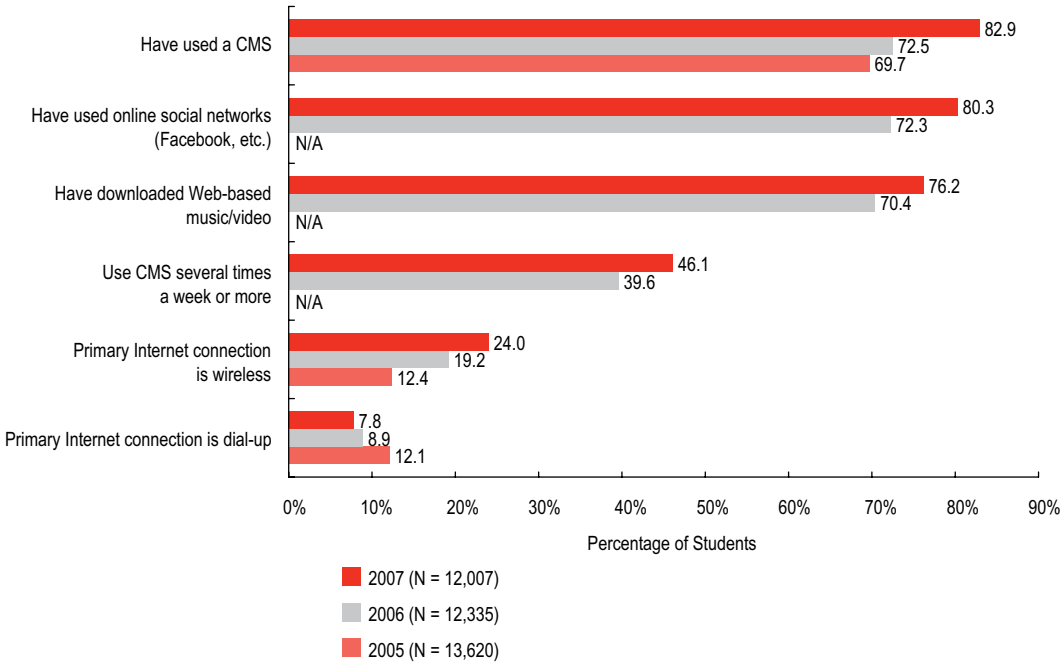
Today's students spend a lot of time online. Respondents report spending an average of 18 hours per week actively doing online activities for work, school, or recreation, and 6.6 percent (more often male) spend more than 40 hours per week. Engineering and business majors use the Internet more often than others, a finding that echoes ECAR findings in 2005 and 2006.

Our responding undergraduates overwhelmingly prefer high-speed Internet connections (91.5 percent). Only 8.4 percent depend on dial-up access to the Internet, and the longitudinal data in Figure 1-2 shows that the percentage of respondents depending on dial-up has steadily decreased since 2005. Those respondents who do not yet own a laptop or who attend associate's institutions are the most likely to still depend on dial-up. Even though respondents who use dial-up connections spend less time online overall (an average of 14.3 hours per week), they generally access e-mail, course management systems, and library Web sites with the same regularity as respondents using broadband.

Wireless as the first line of contact is increasing, with 21.8 percent of respondents now using this as their primary Internet connection. Again looking at longitudinal data, we find that wireless connectivity has increased from 12.4 percent in 2005 to 24.0 percent in 2007. The increase holds for both respondents using commercial Internet providers and those using their college or university as their Internet provider, reflecting the progress colleges and universities are making in rolling out wireless access in campus housing, classrooms, and public areas.

For our respondents, technology is first about communication. Nearly all (99.9 percent) create, read, and send e-mail, and 84.1 percent use instant messages (IM). The large majority of respondents also perform activities normally associated with

Figure 1-2. Change in Technology Use from 2005 to 2007*



**Data for three-year comparisons are based on student responses from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. Data for two-year comparisons are based on student responses from the 65 institutions that participated in each of the 2006 and 2007 studies. While institutions remain the same, the actual students responding each year are different.*

coursework. Most use an institutional library resource (94.7 percent), create presentations (91.7 percent) and spreadsheets (87.9 percent), and use course management systems (83.0 percent). Recreationally, 77.8 percent of responding students download music or video, and most do so on at least a weekly basis. Many (81.6 percent) use social networks such as Facebook, and most do so daily. They also play computer and video games either online or offline (78.3 percent). Not surprisingly, younger students report more frequent engagement in these recreational activities, as well as IM use. A smaller but still impressive number of students report using more complicated software: about a third (32.6 percent) use software to create or edit video and audio files, and 29.1 percent create Web pages.

We asked respondents how they liked to learn using various types of technologies. Most prefer to learn by running Internet searches (72.0 percent); about one-third like to learn through text-based conversations (such as e-mail, IM, or text messaging) or by contributing to Web sites such as blogs and wikis. Interestingly, a solid half (53.3 percent) like to learn through programs they can control such as simulations or video games. This is important in the context of discussions about digital game-based learning in higher education and whether the extent of learning justifies the resources required to implement a game.[4]

Communicating with Their College or University

Some speculate that students are shifting away from e-mail to more real-time data communication modes such as IM and text messaging, and that this shift might carry over into how they want to communicate with their institution. This is not the case among our respondents. Again this year, they overwhelm-

ingly (85.1 percent) favor e-mail for official college and university communications.

College and university leaders also debate about whether e-mail accounts are best provided by the institution or the private sector. To inform this discussion, we asked respondents if they preferred a college e-mail account or a commercial one for official communication with their institutions. A resounding 82.5 percent say they prefer a university account. As might be expected, this preference is strongest for 18- to 19-year-olds, especially those residing on campus.

IT Skills and Training

ECAR survey respondents generally say they have "good" to "very good" skills for those core applications commonly used for coursework, including presentation software, spreadsheets, course management systems, and the institution's online library system. This response is likely overstated, considering that the literature on self-assessment of skills finds that students overrate their skills in general, men more so than women. Seniors report higher skills than freshmen in using spreadsheets and online library resources, reflecting their experience gained from taking more courses. Gender differences are not great, with males and females reporting similar skill levels for common applications. Males do, however, report much stronger skills for computer maintenance and somewhat stronger skills using video/audio software. For the relatively few respondents who use graphics and video/audio software, skill levels reported are slightly less than "good." In addition to thinking their skills are generally adequate, most respondents do not feel their institution needs to give them more training (34.0 percent are neutral and 40.2 percent disagree).

While the ECAR quantitative data indicates that respondents are fairly comfortable with their IT skills, analysis of respondents' written comments paints a slightly different picture. Students raised three major issues about training and support. Two are focused on faculty—the need for instructors to give students more training on technologies specifically required for courses, and the need for the faculty themselves to get more training so they can make better use of IT in their teaching. The third theme came from several hundred comments about the central and departmental help desks. While there were some positive comments about the helpfulness of staff in fixing technical problems, negative comments were far more frequent. These pointed most often to a lack of customer service orientation but also addressed problems with help desk availability, wait times, and fees. This suggests that the help desk function appears to be a relatively high priority for many students and is an important finding for IT leaders.

IT in Courses

While most respondents are enthusiastic IT users and use it to support many aspects of their academic lives, most prefer only a "moderate" amount of IT in their courses (59.3 percent). This finding has been consistent over the past three years' studies, and students continue to tell us that they do not want technology to eclipse valuable face-to-face interaction with instructors. Some recent research validates what these students say. An examination of more than 400 studies about factors contributing to student retention and degree completion concludes that "face time" with faculty and peers contributes to students' feeling included and integrated into the academic environment, and this ultimately contributes to their academic success.[5]

Engineering and business majors prefer more IT in courses than others. Also, respondents who claim strong skills with software applications prefer more IT in their courses, as do those who say they are early adopters of technology. Important, though, is that again this year females and younger respondents

prefer slightly less technology in their courses than others.

ECAR looked specifically at what IT respondents were actively using as part of their coursework at the time of the ECAR survey (March/April 2007). The data identifies a set of core technologies used regularly by the majority of respondents during that quarter or semester: e-mail, course management systems, course Web sites, spreadsheets, and presentation software. Major requirements also play a role, with engineering majors using more discipline-specific IT and programming languages, business majors using more spreadsheet and presentation software, fine arts majors using more graphics software, and education majors using more e-portfolios. Community college students showed generally less use during this time for all these technologies. While few respondents used podcasts this quarter/semester (5.0 percent), student comments from the survey were overwhelmingly positive about podcasts as a supplemental tool for courses. A typical comment was, "I have a professor that puts all of his lectures online as podcasts, and it has been *extremely* helpful."

An important finding is that while more than 80 percent of respondents use IM and online social networking, they do not use these technologies much as part of their coursework. Students in our focus groups were quite consistent on this topic, saying that they prefer that IM and social networking remain within the scope of their private lives. The thread of their comments included such statements as, "It would be crossing the line for my advisor or instructors to find me on Facebook. But it's open to everyone!"

Increased CMS Use

This year, 82 percent of respondents said they had used a CMS at some time. In four-year institutions, more seniors (86.8 percent) have used a CMS than freshmen (78.3 percent). Among respondents from the four participating community colleges, only 67.7 percent have used a CMS. Students generally like using a CMS; 58.9 percent of survey respondents are positive about these systems, and 17.6 percent are very positive. Only 4.6 percent of those who use a CMS report an overall negative experience. In particular, respondents value most the ability to keep track of assignments and grades and to gain access to sample exams and quizzes through their CMS. These features directly relate to grade performance. From an institutional perspective, almost half of the 103 participating institutions show that 90 percent or more of their respondents have used a CMS.

For the first time since 2004, when ECAR began its studies of undergraduates and IT, the number of respondents reporting that they have used a CMS has increased significantly. Figure 1-2 shows that for longitudinal data, the percentage of respondents who have used a CMS has risen from 69.7 percent in 2005 to 82.9 percent in 2007. Longitudinal data also show that respondents now make more frequent use of a CMS, with 46.1 percent of respondents in 2007 reporting CMS use at least several times a week, compared with 39.6 percent in 2006. The ECAR findings about increased CMS activity are corroborated by current data from both EDUCAUSE and the Campus Computing 2006 survey.[6] These reports point to course management systems' accelerating role as a mission-critical application for teaching and learning.

The Impact of IT in Courses

Respondents in 2007 continue to be generally positive in their views about IT's contribution to their academic experience and success. ECAR asked students whether they agreed or disagreed with the following statements:

- IT in courses improved my learning (60.9 percent agree).

- I am more engaged in courses that use technology (40.4 percent agree).
- IT in courses results in more prompt feedback from my instructor (73.1 percent agree).
- IT helps me do better research for my courses (70.5 percent agree).
- IT helps me better communicate and collaborate with my classmates (58.8 percent agree).
- IT allows me to take greater control of course activities (59.5 percent agree).

This distribution of responses is consistent across most demographic factors, with a few exceptions. Males report more engagement in courses requiring IT, and engineering and business majors agree more with all of these statements about the academic outcomes of IT. However, the respondents who are most positive about the impact of IT are those who prefer more IT in their courses, are positive about their CMS experience, describe themselves as early IT adopters, or think their instructors use IT well in courses.

It is important that three out of five respondents agree or strongly agree that IT in their courses has improved their learning. While this is a welcome finding, and consistent across the past three years' studies, we also acknowledge that 29.9 percent are neutral, and nearly 1 in 10 respondents (9.3 percent) disagree with that statement. Bottom line, a large minority of respondents chose not to assert that IT has a positive role in their learning.

IT seems to exert less of a pull on respondents with respect to its value as a tool of engagement. Most respondents are either neutral (38.8 percent) or disagree (20.8 percent) that they are more engaged in courses requiring IT. This may partially reflect respondent opinions expressed in the open-ended comments—that there is a very wide range in how well instructors use IT in courses.

Again this year, convenience is the clear winner for the "most valuable benefit of IT in courses." More than half of respondents (55.5 percent) tell us that technology's contribution to "convenience" trumped technology's support for communicating with classmates and instructors, managing course activities, or improving learning. In fact, even though 60.9 percent of respondents agreed that IT in courses improved their learning, only about 1 in 10 respondents (10.3 percent) identified "improved my learning" as the most valuable benefit of IT in courses.

The Digital Divide

Taking the pulse of the mainstream ECAR respondent provides important information for university administrators and faculty about where to focus resources that will benefit the most students. However, a one-size-fits-all technology strategy for teaching and learning must be tempered by a full understanding of the remainder of the student population. ECAR data also generate a profile of leading-edge and trailing-edge undergraduates so that their needs can be explicitly acknowledged and factored into institutional strategies.

Those who are high tech tell us they want much more technology; they experiment with new technologies and want to use these in courses. They are more engaged in sophisticated software such as that for creating graphics, video/audio, and Web pages. They spend a great deal of time online and like to learn through programs such as simulations and video games, and by contributing to Web sites such as blogs and wikis. They report strong IT skills across the board, and many own PDAs or smartphones and are ready to use them for institutional applications. They are often found majoring in engineering or business and are more often males than females. In fact, a surprising number of students exited the survey with a quick one-liner saying, "I just LOVE technology."

At the other extreme is a class of students who through choice or circumstance make less use of technology. These respondents prefer limited or no technology in courses

and adopt technologies only when they have to. Like others, they use IT for communicating with their peers, but they are far less likely to claim advanced IT skills in the basics required for courses—course management systems, presentation software, and spreadsheets. More often, members of this group are female and attend associate's institutions. They do not spend as much time engaged in Internet activities and more often depend on dial-up connections. The technology they own is more often old, and some respondents do not even own a computer. Numerous comments were of this nature: "I'm a quick learner, but I'm a little nervous around new technology. It's useful, but I don't like to have to rely on it daily, in case I can't get to a computer with Internet access. I do appreciate what is currently offered at the computer labs."

Students Speak About Faculty, Technology, and Learning

ECAR analyzed the 4,752 written comments from the open-ended survey question to get an in-depth understanding of what respondents were thinking when they generally agreed or disagreed with our survey outcome statement, "IT in courses improves my learning." Responses were categorized into three major themes that emerged: IT as an enabler of learning, IT as a barrier to learning, and the balance between technology and face-to-face interactions with instructors.

Major categories of respondent comments about *IT as an enabler of learning* were the observations that technology

- facilitates organization and control in the learning environment;
- facilitates communication with faculty and classmates;
- can make content more accessible, including class materials and Internet resources;
- is valuable in courses when directly linked to applications useful to future employment; and
- enables learning when professors use it effectively.

The first three categories about IT as a support for course activities—control, communication, and content—align nicely with ECAR findings that respondents are positive about these IT benefits. But perhaps the most important way students identify IT as an enabler of learning is when faculty use it well in courses. It is not surprising that students volunteered many instances where they learned more because of effective or creative use of IT in their courses. However, more students talked about the reverse, where an instructor's poor use of IT appeared as a barrier to learning.

Respondent comments about *IT as a barrier to learning* generated the following major categories:

- Problems exist with technologies themselves and their institutional implementations, especially campus networks and the course management systems students depend on for critical coursework such as submitting exams.
- The proliferation of technology has created a more complex learning environment, and faculty need to recognize this and factor it into their teaching.
- Faculty's poor use of technology (underuse, overuse, inappropriate use, and overdependence) detracts from the learning experience.
- Instructors sometimes overestimate student comfort with or access to technology resources.

The last three categories center on faculty. Just as an instructor's effective use of IT is a major enabler of learning, instructors' poor use of IT is perceived as creating a barrier to learning. Specifically, respondents are extremely sensitive to both how and how much technology is used in their courses—including underuse (not using basic IT available, such as grade posting), overuse (making the coursework overly

cumbersome), misuse (PowerPoint replacing active teaching), and overdependence on technology. Interpreting these comments as a whole is difficult because each student has unique ideas about what constitutes "underuse," "overuse," or "inappropriate use" of IT in the academic context.

The third theme concerns *the balance between IT and face-to-face interaction.* In both the open-ended survey comments and the student focus groups, students wanted us to know that technology is not a substitute for face-to-face interaction with faculty. This is also consistent with our quantitative findings that most students (59.3 percent) prefer only "moderate" technology in their courses.

Conclusion

Revisiting the "rich and strange" sea change in teaching and learning described by Dede, what does the ECAR data tell us? Overall, we see evolutionary rather than revolutionary change. And as the pace of technology change continues to escalate, the challenge of keeping the best of the old and adding the best of the new gets harder. The gap between our low- and high-tech students may widen. The gap may also widen between instructors who are skilled at integrating technology when and where it can truly enhance learning both subject matter and new IT literacies, and instructors whose attempts to integrate technology do more harm than good.

For better or worse, students put responsibility for the link between technology and their learning squarely on the shoulders of instructors and administrators. With rare exception, students do not attribute IT-related learning problems to their own technical limitations. Instead, they comment, "Granted, some students need training at using information technology, but it's mostly the *professors* who need help, not the students," and "Technology seems to benefit me academically only when my professors know how to properly employ the technologies afforded them." If, on the basis of our survey comments, the student conclusions are correct, institutional strategies for optimizing technology effectiveness for learning are best focused in four areas:

- developing instructors' technology skill sets;
- training instructors on how and when to effectively integrate technology and pedagogy;
- increasing instructor and administrator awareness about how their students differ in technology savvy and access to technology resources, and how to factor that into instruction; and
- improving the speed, reliability, and support of the institution's network and academic applications, especially course management systems.

Future Research: 2008 and Beyond

ECAR will again conduct the survey of undergraduates and IT in 2008. The survey will be updated to reflect changes in technology and to incorporate what we've learned from the 2007 study. Questions about IT use in and out of courses and student perceptions about IT's impact on their academic experience will continue to form the core of the survey.

Beginning in 2008, each year's survey will also feature a special topic area that is both important and timely to higher education. For 2008, ECAR will look at undergraduate use of online social networking. In its broadest sense, this encompasses traditional social networking sites (such as Facebook), multiuser virtual environments (MUVE), and massively multiplayer online games (MMOGs). ECAR will ask respondents how and why they use these technologies and how they view their potential as a learning tool.

ECAR invites colleges and universities to participate in the 2008 survey and, in return, receive information about their institution's respondents.[7]

Endnotes

1. ECAR is grateful to the many organizations like the Pew Charitable Trusts, NetDay, Student Monitor, and e-Marketer for furthering our understanding of evolving Internet (and related) student behaviors and consumer preferences of college age and younger populations.
2. In the initial 2004 study, 13 colleges and universities participated; in 2005, 63 institutions participated; and in 2006, 96 institutions participated. (See Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *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, *ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning* [Boulder, CO: EDUCAUSE Center for Applied Research, 2005]; and 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]).
3. Absolute change and relative change are calculated using longitudinal data available for the years 2005, 2006, and 2007. For comparison of 2005, 2006, and 2007 data, we use the 40 institutions that participated in the student study each of these years. For comparison where data is available only for 2006 and 2007, we use the 65 institutions that participated in the student study for both of these years. While these institutions are the same over these time periods, they have surveyed different students each year.
4. Richard Van Eck, "Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless," *EDUCAUSE Review* 41, no. 2 (March/April 2006): 20, http://www.connect.educause.edu/library/abstract/DigitalGameBasedLear/40614.
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6. The 2005 EDUCAUSE Core Data Service reported an increase in faculty use of course management systems, finding that 22.5 percent of institutions reported that a CMS was used by faculty in all or nearly all of the institutions' courses. This number increased to 25.6 percent in 2006. Casey Green's 2006 Campus Computing report finds that the percentage of courses using a C/LMS has been steadily rising since 2000 and increased about 5 percent from 2005 to 2006 to 46.8 percent. Further, the number of institutions having a strategic plan for C/LMS deployment is up from 52.4 percent in 2005 to 56.5 percent in 2006.
7. Students participating in the survey are assured that no confidential information about them will be made available to their institutions.

2

Introduction: A Sea Change in Thinking, Knowing, Learning, and Teaching

Chris Dede, Harvard Graduate School of Education

Forty years ago, Marshall McLuhan discussed how media at that time influenced both messages and users.[1] Today, we see a broader spectrum of more powerful information technologies (IT) providing a much wider range of capabilities for communication, entertainment, personal expression, and education. Studying how undergraduates use electronic devices to these ends—and in turn how they are actively and tacitly shaped by their media—provides insights on important aspects of students' cognition, motivation, self-image, and learning that can inform our designs for academic instruction and enculturation.

Our Tools Shape Our Communicating, Thinking, and Learning

Long ago, I wrote my doctoral dissertation on a typewriter, since word processors did not then exist. This was an agonizing process in which I spent a couple of minutes pondering the wording of each sentence, not setting it to paper until I felt confident, because I knew how difficult later changes would be. Inevitably, despite my best efforts at initial composition, I found myself struggling with whiteout and correction tape, cursing my inability to achieve perfection in a single intellectual leap.

Now, with word processing, I write in a completely different manner, setting down a sentence almost immediately, then rewording and reshuffling and reviewing until ultimately after many drafts I am satisfied. Writing as revision is a much better experience both intellectually (a higher-quality expressive product) and emotionally (no time lost to whitewashing the sepulchers of past suboptimal phrasings). However, as a cost of this advance, I find I cannot write fluently with paper and pencil anymore; because I am used to writing as revision, I wear out the eraser before I dull the point of the pencil!

Through modern media, my interactions with students and colleagues have changed in other ways. As I write, I am 2,000 miles from campus, yet I am providing individual advice to students via e-mail, responding just a few hours after they query me, without both of us having to find common time for a synchronous telephone conversation or face-to-face meeting—although of course I do these too, as needed. When we use "mediated" communication in moderation, the convenience, efficiency, and timeliness of interaction seem reasonable benefits to compensate for some loss of psychosocial presence. I don't know my students' faces as well, but I have a deeper, richer understanding of their needs and

issues than I did before communication across distance was so facile.

Earlier this morning, I posted into an asynchronous threaded discussion I am having in one of my courses. I noted that students who are silent and passive in class sessions, despite my best efforts to draw them out, often "find their voices" in this medium—or in simultaneous virtual interactions for those who feel async is too slow for their communicative style. Also, in our online discussions students are more likely to respond to each other's points and to contribute their own insights, rather than seeing me as the only source of knowledge in spite of my efforts to avoid the "sage on the stage" role. In addition, we increase our opportunities for sharing information and co-constructing meaning, since in class only one person at a time can speak during the limited number of hours we have available. Late in the semester, when each student reflects on what he or she has learned, examining the transcripts of these dialogues for evidence of intellectual evolution over the course of the semester is a very useful assessment of progress and accomplishment.

And yet, despite my pleasure in these advances in my instructional and advisory capacity, how superannuated this description seems to some of today's undergraduates! Why bother with a word processor when one can create a rich multimedia representation on MySpace or YouTube? Why use e-mail when one can instant message? Why have a written dialogue as opposed to reciprocal blogging, or co-creating a wiki entry, or developing interrelated structures of tags on a social networking site? Why not have our avatars meet in an immersive virtual environment instead of co-locating in a physical classroom? For that matter, once we are in cyberspace, why not experience an immersive simulation together as opposed to just talking back and forth?

These questions illustrate that thus far faculty have typically used advances in IT either to automate conventional forms of instruction or to make small steps in expanding the range of communicative and experiential patterns we accommodate. I am not belittling this progress; in my own instruction and research, the innovations I describe above are very useful. But we have just scratched the surface in examining the options emerging technologies offer for expanding the repertoire of ways we think and learn together.

We face a whole series of unknowns now in our instructional designs. As one illustration, for the purpose of negotiating shared meaning about a complex phenomenon, how do we determine the conditions under which one might want students to co-construct a wiki entry, rather than to have a virtual discussion or a face-to-face dialogue? Much research is needed to establish the complementary strengths and limits of the many types of media now in our instructional toolbox. One place to begin is using analytic methods like the ECAR surveys to examine the ways undergraduates use electronic devices throughout their lives, sifting out the dross of behaviors adopted just because they are novel and stylish from the ore of transformational approaches to creating, sharing, and mastering knowledge.

Beyond Automation to Transformation

The implications for institutions of higher education go well beyond the surface conclusion that students are using interactive media, so we had better use them too. To the extent that powerful engagement and learning, thinking styles, and new literacies are emerging from students' usage, the academy should rethink how we view the creation, sharing, and mastery of knowledge. The findings from these ECAR surveys may be the initial tremors of larger tectonic shifts in the fundamental nature of research and instruction.

For example, wikis provide the opportunity for multiple participants to co-create

documents across distance. We know this capability is very useful in face-to-face collaborative learning, exemplified by such activities as design team members sketching simultaneously on a large, shared whiteboard, annotating each other's ideas. I know several academic research teams now using wikis very effectively to develop common terminology and shared meaning for the theoretical position the group is developing. As the curriculum standards championed by the Partnership for 21st Century Skills illustrate, the capability to provide virtual collaborative workspaces shared across distance is valuable not only for learning but also for preparing students to work in a global, knowledge-based economy.[2]

Another emerging technology likely to add significant value for learning is "sociosemantic networking." The many Web sites created early in the 21st century fueled efforts to categorize and organize the Web in order to empower users seeking "needles in haystacks." Google, Yahoo!, AOL, and others developed complex page ranking systems and algorithms to link information seekers to pertinent resources. Finding what one wanted on the Web became easier, but organizing and saving these resources was increasingly harder. Online communities clamored for intuitive ways to store and share their "gold mine" resources with friends and colleagues—enter the social bookmarking revolution.[3]

The years 2003–2004 marked the release of del.icio.us, Furl, Simpy, and Flickr, some of the more popular online social bookmarking communities. Instead of saving Web sites to their browsers and photos to their computers, individuals began saving bookmarks and photos online, sharing them with others and—most important—labeling the items with words they could remember. This bottom-up, participant-driven method of identifying bookmarks and photos with personalized keywords adopted the industry moniker "social tagging," and the process of creating online, community-based meaning for content was born.

Due to their ability to quickly identify and adapt to changes in colloquial language, social tagging applications are of particular interest to instructors teaching introductory courses. When given access to complex, interlinked resources in a new subject domain, students' emergent language to describe what they are finding evolves faster than most faculty can follow. Social tagging affords students the ability to use their words to describe content and their words to search for content, as well as a tacit mechanism to articulate perceived relationships among content items. Seldow proposes that social tagging of files and Web pages within student communities is a direct and intuitive way to label and correlate ideas, easier for novices than the top-down, elaborate, nested hierarchies of prespecified, narrowly defined terms that characterize formal classification frameworks from the academic disciplines.[4]

Beyond providing vehicles for sharing resources, sociosemantic networking helps participants to develop evolving, collective knowledge structures that reflect interrelationships among tags. For faculty, these bottom-up depictions of conceptual frameworks may aid in diagnosing what students do and do not understand about the ideas presented in courses and degree programs. Faculty may also gain insights about how to teach material from the bottom-up vocabulary and systemic interconnections that emerge through students' collective tagging. With a grant from Harvard's provost, my colleagues and I are studying how an academic social networking tool we have designed (http://www.edtags.org) aggregates tags across a broad community. This type of electronic resource may help entire degree programs improve cross-course instruction that goes beyond individual faculty insights from the subset of students in each particular course.

New Interfaces, "Neomillennial" Learning Styles, and Novel Literacies

At a deeper level, three complementary technological interfaces are now shaping how people learn, with multiple implications for higher education:

- The familiar "world-to-the-desktop" interface provides access to distributed knowledge and expertise across space and time through networked media.
- Multiuser virtual environment (MUVE) interfaces offer students an engaging "Alice in Wonderland" experience in which their digital emissaries in a graphical virtual context actively engage in experiences with the avatars of other participants and with computerized agents. MUVEs provide rich environments in which participants interact with digital objects and tools, such as historical photographs or virtual microscopes. Moreover, this interface facilitates novel forms of communication among avatars, using media such as text chat and virtual gestures.[5]
- Augmented reality (AR) interfaces enable "ubiquitous computing" models. Students carrying mobile wireless devices through real-world contexts engage with virtual information superimposed on physical landscapes (such as a tree describing its botanical characteristics or a historic photograph offering a contrast with the present scene). This type of mediated immersion infuses digital resources throughout the real world, augmenting students' experiences and interactions.[6]

My colleagues and I are studying how immersion in virtual environments and augmented realities shapes participants' learning styles, strengths, and preferences in new ways beyond what using sophisticated computers and telecommunications has generated thus far, with many potential consequences for the academy. One of my advanced doctoral students, Ed Dieterle, describes in his dissertation proposal how the "styles" by which people think and act and learn are theoretical constructs designed to help explain these processes: complex patterns shaped by physical and mental development, personal interests, and sociocultural influences.[7]

Scholarly ruminations on styles are disparate and complex, encompassing "cognitive style, conceptual tempo, decision-making and problem-solving style, learning style, mind style, perceptual style, and thinking style."[8] Learning styles, as Keefe explains, are a composite of cognitive styles, which consider concept formation and retention and sensory reception; affective styles, which consider attention, expectancy, and incentive; and physiological styles, which consider the functions and activities, including all physical and chemical processes, of human organisms.[9] The cognitive component of learning styles is synonymous with thinking styles; in general, these characterize "how one prefers to think about material as one is learning it or after one already knows it."[10]

In my research, I have described the types of learning strengths, styles, and preferences that "neomillennial" students acquire from their use of immersive collaborative media, such as multiplayer online games.[11] These include

- fluency in multiple media, valuing each for the types of communication, activities, experiences, and expressions it empowers;
- learning based on collectively seeking, sieving, and synthesizing experiences, rather than individually locating and absorbing information from some single best source;
- active learning based on experience (real and simulated) that includes frequent opportunities for reflection;

- expression through nonlinear, associational webs of representations rather than linear "stories" (for example, authoring a simulation and a Web page rather than a paper to express understanding); and
- codesign of learning experiences personalized to individual needs and preferences.

Ed Dieterle's dissertation research is studying whether using immersive collaborative simulations in classroom settings offers a powerful method for building on these learning strengths and preferences to nurture 21st-century understandings and performances.[12]

Rather than learning styles, Jenkins and his colleagues delineate a set of novel literacies based on usage of new media:

- play, the capacity to experiment with one's surroundings as a form of problem solving;
- performance, the ability to adopt alternative identities for the purpose of improvisation and discovery;
- simulation, the ability to interpret and construct dynamic models of real-world processes;
- appropriation, the ability to meaningfully sample and remix media content;
- multitasking, the ability to scan one's environment and shift focus as needed to salient details;
- distributed cognition, the ability to interact meaningfully with tools that expand mental capacities;
- collective intelligence, the ability to pool knowledge and compare notes with others toward a common goal;
- judgment, the ability to evaluate the reliability and credibility of different information sources;
- transmedia navigation, the ability to follow the flow of stories and information across multiple modalities;
- networking, the ability to search for, synthesize, and disseminate information; and
- negotiation, the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.[13]

Students who develop these literacies via their activities in communication, entertainment, and personal expression outside academic settings may well push for—and benefit from—instruction that builds on these capabilities.

Leu and his colleagues describe four characteristics of these "new literacies" generated by information technologies. First, emerging computer-based tools, applications, media, and environments require novel skills, strategies, and dispositions for their effective use. Second, new literacies are central to full economic, civic, and personal participation in a globalized society. Third, new literacies constantly evolve as their defining information and communication technologies (ICT) are renewed continuously through innovation. Fourth, new literacies are multiple, multimodal, and multifaceted. These characteristics are in accord with the media-based styles of learning presented above.[14]

Leu's third point raises important issues about stability: How durable are these literacies in their applicability to 21st-century work, citizenship, and self-actualization? How quickly will additional, important learning styles emerge as computers and telecommunications continue to evolve? Certainly tools, applications, media, and environments are changing rapidly, with no end in sight. Typically, despite predictions of paperless offices or the end of the book, this evolution involves adding new literacies and thinking styles rather than new capabilities undercutting the value of older skills. Hence the value of longitudinal usage data, as collected in these ECAR surveys.

Throwing Gasoline on the Fire

In recent years, the National Science Foundation (NSF) has championed a vision of the future of research that centers on "cyberinfrastructure"—the integration of computing, data and networks, digitally enabled sensors, observatories and experimental facilities, and an interoperable suite of software and middleware services and tools.[15] Gains in computational speed, high-bandwidth networking, software development, databases, visualization tools, and collaboration platforms are reshaping the practices of scholarship and beginning to transform teaching.[16] Cyberinfrastructures developed for research purposes also create intriguing opportunities to transform education, in part by infusing research into teaching and in part by adapting powerful mechanisms for "mediated" knowledge creation and sharing in scholarly communities to teaching and learning in course settings.

During 2004–2005, with NSF funding, the Computing Research Association convened four workshops attended by experts in education. These workshops focused on

- modeling, simulation, and gaming technologies applied to education;
- cognitive implications of virtual or Web-enabled environments;
- how emerging technology and cyberinfrastructure might revolutionize the role of assessment in learning; and
- the interplay between communities of learning or practice and cyberinfrastructure.

Collectively, these groups envisioned a cyberinfrastructure that "provides: 1) unprecedented access to educational resources, mentors, experts, and online educational activities and virtual environments; 2) timely, accurate assessment of student learning; and 3) a platform for large-scale research on education and the sciences of learning. Moreover, the new educational cyberinfrastructure will make it possible to collect and analyze data continually from millions of educational activities nationwide over a period of years, enabling new advances in the sciences of learning and providing systematic ways of measuring progress at all levels."[17]

The NSF Cyberinfrastructure Council provides a scenario of how advanced visualization and simulation capabilities could advance education.[18] Imagine an interdisciplinary course in the design and construction of large public works projects, attracting student–faculty teams from different engineering disciplines, urban planning, environmental science, and economics, and from around the globe. To develop their understanding, the students combine relatively small, self-contained digital simulations that capture both simple behavior and geometry to model more complex scientific and engineering phenomena. Modules share inputs and outputs and otherwise interoperate. These "building blocks" maintain sensitivity across multiple scales of phenomena.

For example, component models of transportation subsystems from one site combine with structural and geotechnical models from other collections to simulate dynamic loading within a complex bridge and tunnel environment. Computational models from faculty research efforts are used to generate numerical data sets for comparison with data from physical observations of real transportation systems obtained from various (international) locations via access to remote instrumentation. Learners can also explore influences on air quality and tap into the expertise of practicing environmental scientists through either real-time or asynchronous communication. This networked learning environment increases the impact and accessibility of all resources by allowing students to search for and discover content, assemble curricular and learning modules from component pieces in a flexible manner, and communicate and

collaborate with others, leading to a deep change in the relationship between students and knowledge. Indeed, students experience the profound changes in the practice of science and engineering and the nature of inquiry that cyberinfrastructure provokes.

One could create comparable vignettes to illustrate educational opportunities in constellations of fields across the sciences and social sciences. Overall, cyberinfrastructure investments will add momentum to attempts to infuse emerging media into college and university teaching.

Conclusion

In Shakespeare's *The Tempest*, Ariel sings to Ferdinand:

> *Full fathom five thy father lies;*
> *Of his bones are coral made;*
> *Those are pearls that were his eyes:*
> *Nothing of him that doth fade*
> *But doth suffer a sea-change*
> *Into something rich and strange.*

Our ways of thinking and knowing, teaching and learning are undergoing a sea change, and what is emerging seems both rich and strange. The rising tide of sophisticated information and communications technologies driving this shift will not recede, so we should try to understand the richness, to welcome the strangeness as a source of creative insight, and to fuse some synthesis combining the best of old and new. A dialogue with students, including both advocates and critics, around these survey findings is a first step toward such a goal. Another important step is sharing the results of the many small experiments instructors are individually conducting to explore the strengths and limits of emerging interactive media.

Many faculty view the shifts I describe above with deep suspicion. They fear that teaching and learning will end up as Ariel portrays Ferdinand's father to be: rich, strange, and lifeless. I have colleagues who hope to retire before the sea change forces them to confront the prospect that, as in other professions, the old ways are no longer best. Yet many more of us welcome the opportunity for renewal that advanced information and communications technologies offer and hope to serve a vital role in their development, tempering the new vistas they offer with wisdom and experience based on the strengths and limits of older educational media. Whatever one's stance—concern or hope—the results of these ECAR surveys offer much food for thought.

Endnotes

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3
Methodology and Respondent Characteristics

This is a great survey...glad to see that the school is seeking feedback! :)
—An undergraduate student

This 2007 research on undergraduates and information technology (IT) marks the fourth annual study. In 2001, ECAR fellows discussed the paucity of data and analysis of undergraduate students and their uses of, preferences for, expectations of, and experiences with IT. With the help of knowledgeable leaders, the idea of creating a new survey of students focusing on technology was hatched and given flight.[1] In 2004, the first ECAR study was launched with a baseline of 13 institutions; 63 institutions participated in 2005, 96 institutions in 2006, and 103 institutions in 2007.[2]

Methodology

The 2007 study builds on and extends previous studies and consists of the following data collection and analytical initiatives.

Literature Review

We undertook a literature review (extending the 2006 literature review) and also reviewed other relevant surveys. Previous ECAR studies on student use of IT provided additional insight for the current 2007 study.[3] The bibliography appears in Appendix E.

Web-Based Survey

A Web-based survey of college and university undergraduates supplied the quantitative data about student experiences with IT in higher education. The 2007 survey was based on the 2006 survey, with some improvements. A few questions were deleted because we found that they did not work well; others were changed with better wording or clearer definitions. We also added some questions in 2007 to address issues we learned were important in 2006. The online survey appears in Appendix B.[4]

We asked institutions to construct a sample of their students to achieve a 95 percent level of confidence with a +/– 5 percent margin of error. However, each university used a different sampling model, and some chose to include their entire freshman and senior classes. In the absence of our weighting of institutional responses, this means that we can generalize to the sampled students but not to the 103 institutions.[5]

Student Focus Groups

ECAR collected qualitative data by means of student focus groups at Middle Tennessee State University, the University of Wisconsin–Madison, the University of Wisconsin–Milwaukee, and Vanderbilt University. We strove to interview as diverse a group of students as possible. A total of 50 students participated in the focus groups, and each focus group meeting lasted for an hour. The focus group interview questions appear in Appendix C.[6]

Qualitative Analysis of Student Comments

Fully 4,752 students (17 percent of respondents) responded to an open-ended survey question. They expressed opinions on their use of and skill with IT, the state of their institution's IT support services, and their perceptions of technology use in their courses. Mark Nelson analyzed their comments, focusing on selected topic areas, using the content analysis tool SPSS Text Analysis for Surveys.[7] This provided additional insight into the substance of the qualitative data, and these findings have been incorporated into the study text.

Longitudinal Analysis

We compared the results of the 2005, 2006, and 2007 data where possible to identify any significant changes over the past three years. Where questions were consistent over the past three years, ECAR was able to use comparative data from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. Where survey questions were consistent over only the past two years, we were able to use comparative data from the 65 institutions that participated in both the 2006 and 2007 studies. However, it is important to note that this study does not attempt to follow the same students over time.

Analysis and Reporting Conventions

We observe the following conventions in analyzing the data and reporting the results:

- Some tables and figures presented in this study include fewer than 27,846 respondents. They were adjusted for missing information.
- Percentages in some charts and tables may not add up to exactly 100.0 percent due to rounding.
- The Likert scales used in the online surveys are footnoted in the tables and figures showing results for these survey questions.
- 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.

Research Team

Judith Borreson Caruso and Gail Salaway are the principal investigators. Mark R. Nelson's contribution to the study is a content analysis of student comments to an open-ended survey question. Chris Dede of the Harvard Graduate School of Education contributed the Introduction.

Chris Dede

Chris Dede is the Timothy E. Wirth Professor in Learning Technologies at the Harvard Graduate School of Education. His fields of scholarship include emerging technologies, policy, and leadership. In 2007, he was honored by Harvard University as an outstanding teacher. His co-edited book, *Scaling Up Success: Lessons Learned from Technology-Based Educational Improvement*, was published by Jossey-Bass in 2005. A second volume he edited, *Online Professional Development for Teachers: Emerging Models and Methods*, was published by the Harvard Education Press in 2006.

Judith Borreson Caruso

Judith Borreson Caruso is Director of Policy and Planning at the University of Wisconsin–Madison and has been an ECAR Fellow since July 2002. She has been in higher education IT roles for almost 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.

Mark R. Nelson

Mark R. Nelson earned his PhD in information science from the University at Albany, SUNY (1998). He is the Digital Content Specialist at the National Association of College Stores. Formerly, Nelson was Assistant Professor in management information systems and IT at the Lally School of Management and Technology at Rensselaer Polytechnic Institute. Nelson has served as an ECAR Fellow since summer 2003. In this capacity, he has contributed to major research studies including IT leadership, and he authored several research bulletins. He is a specialist in qualitative research methods and led the review and analysis of open-ended qualitative student responses to the survey undertaken for this study.

Gail Salaway

Gail Salaway earned her PhD in management of information systems from the University of California, Los Angeles (1984). She is a former Director of Administrative Computing and Communications at UCLA, where she was responsible for campus-wide administrative information systems and telecommunications services and management of academic and general computing initiatives. As an ECAR Fellow, she has been principal investigator of research studies on IT leadership, IT alignment, IT networking, and undergraduates and IT.

Participating Institutions

Participation in the study was voluntary, and each institution obtained approvals from their institutional executives and their institutional review board (IRB).[8] Therefore, the institutions participating in the study do not represent a statistical representation of U.S. higher educational diversity as a whole. Specifically, they are overwhelmingly four-year institutions (99 out of 103 institutions participating). Responses are further biased toward doctoral institutions (49.2 percent), larger institutions (70.6 percent enroll more than 8,000 students), and public institutions (79.8 percent). We therefore consider our findings to be instructive or indicative rather than conclusive of student experiences at different types of institutions.

Even considering these biases, the 103 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 (see Table 3-1). In this 2007 study, we had less participation from AA institutions—four institutions accounting for 6.6 percent of student respondents, compared with eight institutions accounting for 11.8 percent of student respondents in the 2006 study.

Respondent Characteristics

We e-mailed invitations to participate in the survey to 109,684 freshmen and 131,109 seniors at 103 four-year institutions and 18,109 students at four community colleges (see Appendix D).[9] A profile of the 27,846 students who responded appears in Table 3-2. While four-year institutions invited only seniors and freshmen, some students responded "other" when asked, "What is your class standing?" Their understanding of their own class standing differed from that of the official institutional record. Eighty-three students did not respond to this question at all.

Freshmen from four-year institutions make up 36.7 percent of the respondents, seniors from four-year institutions make up 47

Table 3-1. Profile of Participating Institutions

	Number of Institutions (N = 103)	Number of Respondents (N = 27,846)	Percentage of Respondents
Carnegie Class			
DR	45	13,711	49.2%
MA	36	10,515	37.8%
BA	14	1,532	5.5%
AA	4	1,824	6.6%
ENGR	2	96	0.3%
Other	2	168	0.6%
Student FTE Enrollment			
1–2,000	16	1,362	4.9%
2,001–4,000	13	1,731	6.2%
4,001–8,000	21	5,102	18.3%
8,001–15,000	28	9,638	34.6%
15,001–25,000	15	6,319	22.7%
More than 25,000	10	3,694	13.3%
Control			
Private	35	5,636	20.2%
Public	68	22,210	79.8%

percent of the respondents, and community college students make up 6.6 percent. Female students make up 62.1 percent of the respondents, despite the strategy of oversampling male students in the population. We emphasize again that our student respondents are weighted with so-called traditional students. The majority of respondents are under 25 years old (83.9 percent) and go to school full time (89.5 percent). Most freshmen live on campus (79.7 percent), while most seniors (77.1 percent) and community college students (97.4 percent) live off campus. The grade point averages for our respondents appear to follow a fairly normal distribution, with 70.9 percent of respondents having a B or better grade point average.

The overall student response rate in the 2007 study is 10.8 percent,[10] identical to the 2006 rate but lower than the 12.6 percent in 2005 and 23.7 percent in 2004. We noted significant variation by institution, but no sigificant difference between seniors, freshmen, and community college students. Several factors might affect the response rate. First, spam continues to proliferate, and since many spam e-mails can contain computer viruses and other forms of malware, students are increasingly cautious about responding to the e-mail invitation. Second, students receive numerous e-mails throughout the year asking them to take a survey and win a prize.

We asked respondents to identify their major (see Table 3-3). The total number of responses exceeds the overall number of respondents (N = 27,846) due to many respondents' reporting double majors (17.4 percent). Because so many respondents are freshmen, it is not surprising to find that 6.9 percent are undecided. Social sciences (19.2 percent) and business (19.0 percent) are the largest major areas of declared interest.

Table 3-2. Profile of Student Respondents

	Four-Year Institutions			Two-Year Institutions	Total
	Seniors (N = 13,057)	Freshmen (N = 10,189)	Other (N = 2,693)	All Students (N = 1,924)	All Students (N = 27,846)
Gender					
Male	38.2%	37.7%	40.3%	33.3%	37.9%
Female	61.8%	62.3%	59.7%	66.7%	62.1%
Age					
18–19	0.4%	93.5%	13.3%	40.3%	38.4%
20–24	78.5%	4.0%	56.9%	23.6%	45.5%
25–29	9.3%	1.1%	11.1%	11.0%	6.6%
30–39	6.0%	0.8%	10.3%	14.0%	5.0%
40 or older	5.7%	0.6%	8.4%	11.1%	4.5%
Residence					
On campus	22.9%	79.7%	27.1%	2.6%	42.8%
Off campus	77.1%	20.3%	72.9%	97.4%	57.2%
Full/Part-Time Status					
Full time	88.7%	97.8%	79.3%	63.4%	89.5%
Part time	11.3%	2.2%	20.7%	36.6%	10.5%
GPA					
Under 2.00	0.2%	2.6%	3.2%	1.3%	1.4%
2.00–2.49	5.0%	8.7%	8.9%	6.2%	6.7%
2.50–2.99	17.5%	18.1%	19.7%	16.3%	17.7%
3.00–3.49	36.8%	33.1%	26.1%	30.9%	34.2%
3.50–4.00	40.0%	33.0%	29.8%	40.1%	36.7%
Don't know	0.6%	4.4%	12.3%	5.2%	3.2%
Family Income					
Less than $30,000	19.1%	10.7%	18.2%	25.5%	16.4%
$30,000–$74,999	25.7%	20.9%	24.7%	31.8%	24.3%
$75,000–$149,999	20.9%	21.0%	21.7%	13.0%	20.5%
$150,000 or more	7.9%	8.5%	6.5%	2.8%	7.6%
Decline to answer	11.2%	10.8%	12.4%	9.0%	11.0%
Don't know	15.2%	28.1%	16.5%	17.8%	20.2%

Table 3-3. Student Respondents' Majors

Major	N	Percentage
Social sciences	5,340	19.2%
Business	5,294	19.0%
Other	5,006	18.0%
Life sciences, including agriculture and health sciences	4,557	16.4%
Education, including physical education	3,646	13.1%
Humanities	2,876	10.3%
Engineering	2,655	9.5%
Fine arts	2,332	8.4%
Physical sciences	2,043	7.3%
Undecided	1,925	6.9%

Endnotes

1. ECAR is indebted to Robert Albrecht (ECAR), Carole Barone (then with EDUCAUSE), Darwin Handel (University of Minnesota), Diana Oblinger (then with ECAR), and many others who consulted on this research and survey design.
2. This year ECAR included one non-U.S. institution, the University College of Dublin, as an experiment. This institution is not included in any data analysis or reports.
3. Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *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, *ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning,* (Boulder, CO: EDUCAUSE Center for Applied Research, 2005); and 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).
4. The information collected from the student respondents is confidential and no personally identifiable data is made available from the quantitative survey. Institutional review board (IRB) approval was received from every participating institution.
5. The confidence interval (margin of error) refers only to the statistical error associated with the size of a sample, assuming a representative and random sample. This is the only type of error that can be readily quantified. Note, however, that there are other potential sources of error that are non-sample related, such as the wording of the survey questions (may not be clear) and most notably nonrepresentative responses (a large percentage of the students declined to take this survey). Since the response rates in this study were lower than hoped for at several institutions, we cannot be certain 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.
6. Staff from participating institutions used various 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 IRB regulations that govern the research and their rights and the investigators' responsibility to protect their rights. Notes were taken. None of the comments made by students and cited in this study identify any individual student. In some instances, we corrected their English but made no change in meaning.
7. The qualitative analysis for this study used a simple, iterative codification analysis process. SPSS Text Analysis for Surveys (v2.0) software was used as follows: (1) terms and concepts were identified by frequency, (2) the terms were evaluated by "type," such as whether a term or combination of terms had a positive or negative tone, (3) terms and term pairings were reviewed for accuracy and greater contextual understanding than provided by the software, and (4) as needed, responses were force-coded into additional categories or reclassified as synonyms, and/or new study-specific terms were added to the software dictionary. In addition, all responses were reviewed manually for additional concepts, topics, or patterns that need to be codified within the data.

This process required multiple data reviews, as is common in grounded theory and similar approaches to qualitative data analysis.

8. Each institution required approvals from institutional executives and their institutional review board (IRB) in order to participate in the study. The approval processes, while navigated by an institutional contact, varied considerably in difficulty from institution to institution. Often, the information required for approval was different from one institution to the next. While the investigators made every attempt to provide all information required at the start of the study solicitation, additional details were added throughout the approval process to provide what each institution required. The information collected is confidential. No data from the quantitative survey are presented that would make it possible to identify a particular respondent. The data files we used for analysis have been purged of any information that would have similar consequences. The IRB applications, application dates, and approval dates are available from ECAR.
9. To encourage a larger response from the students, ECAR offered 35 $50 gift certificates and 25 $100 gift certificates to be awarded to students via lottery. We learned from other institutions' experiences that the absence of an incentive would greatly reduce the response rate.
10. One participating institution did not provide enrollment and sample information, so this data was not included in the calculation for overall response rate.

4

Student Ownership of, Use of, and Skill with IT

Sometimes we're in the same room in our apartment and my roommate and I will IM each other with things like, "hey, dude, you didn't do the dishes."
—A senior communications major

Key Findings

- Laptops continue to gain as the computer of choice. About three-fourths (73.7 percent) of respondents own them. Fully 64.0 percent of freshmen own a laptop less than one year old.
- Smartphone ownership is on the rise, with 12.0 percent of respondents owning one. Among respondents who consider themselves innovators or early adopters, 18.0 percent now own a smartphone.
- Respondents spend an average of 18.0 hours per week doing online activities for school, work, and recreation. Males spend slightly more time online (about 19.5 hours) than females (17.0 hours). Respondents who depend on dial-up Internet access spend less time online (14.3 hours).
- Use of some online activities is on the rise, including course management systems (CMS) (83.0 percent), downloading music and video (77.8 percent), and online social networking (81.6 percent). With the exception of course management systems, younger respondents are driving this increase.
- Respondents overwhelmingly (82.5 percent) prefer to use their college or university e-mail account for communication with their institution, especially younger respondents and those residing on campus.
- Most respondents have high-speed Internet (91.5 percent), with 69.7 percent using wired broadband and 21.8 percent using wireless as a first line of contact. Wireless access is growing the fastest, and dial-up is declining. However, 8.4 percent of respondents still rely on dial-up access.
- Overall, respondents report that their IT skills are relatively good. Seniors report stronger skills than freshmen in using spreadsheets and online library resources. Males report stronger skills than females in computer maintenance and video/audio software. Respondent major strongly influences which IT skills respondents develop.
- Only one-fourth of respondents (25.9 percent) agree that their institution should give them more training in the IT required for their courses; 40.2 percent disagree. Older respondents agree somewhat more than younger respondents.
- Half of respondents (50.6 percent) say they are mainstream adopters of technology, 36.0 percent say they are early adopters, and 13.5 percent say they are late adopters. Early adopters own more technology, report stronger skills, and spend more time online.

This chapter begins the study with an analysis and discussion of how students use important technologies in work, school, and recreation. We present survey data on

- what technologies students own and how that is changing,
- how students connect to and use computers and the Internet,
- how students assess their IT skills,
- why students learn IT skills,
- student preferences for communicating with their institution, and
- student technology adoption practices.

Student Ownership of Technology

A recent survey of mobile devices found that 59 percent of respondents said they couldn't imagine life without a mobile device, and 22 percent said they even take their devices to bed with them.[1] Virtually all of the 2007 ECAR student study respondents own some type of cell phone. While the great majority of these are simple cell phones (86.1 percent), more than 1 in 10 respondents (12.0 percent) claim ownership of a smartphone capable of general Web access (see Table 4-1). And smartphones are definitely on the rise.

Table 4-2 shows changes in technology ownership using longitudinal data from 40 institutions that participated in each of the past three studies.[2] Their data show that in 2005, when smartphones were new to the market, only 1.2 percent of their respondents had one.[3] Two years later, that percentage has risen to 10.1 percent, and market forecasts predict strong, possibly explosive increases in smartphone sales as prices continue to drop.

Personal digital assistants (PDAs), even though many are also Web enabled, appear to be losing ground. Among our respondents, PDA ownership in 2007 is down slightly from 2005 and 2006. This is consistent with IDC's May 2007 "Worldwide Handheld QView" report that finds handheld devices excluding smartphones have declined year-on-year for

Table 4-1. What Electronic Devices Students Own

	Males (N = 10,458)	Females (N = 17,117)	All
Type of Electronic Devices Owned			
Simple cell phone (without Web access)	85.3%	86.6%	86.1%
Personal computer—desktop	66.3%	57.0%	60.6%
Personal computer—laptop	73.1%	74.0%	73.7%
Electronic music/video device	77.0%	76.1%	76.4%
Electronic game device	73.5%	45.6%	56.3%
Personal digital assistant (PDA)	15.9%	9.4%	11.9%
Smartphone (combo cell phone/PDA)	14.9%	10.4%	12.0%
Number of Different Types of Electronic Devices Owned			
None	0.2%	0.2%	0.2%
One device	1.4%	2.0%	1.8%
Two devices	8.8%	14.3%	12.2%
Three devices	22.4%	36.3%	31.0%
Four devices	37.8%	30.3%	33.0%
Five devices or more	29.3%	17.0%	21.7%

Table 4-2. Changes in Technology Ownership from 2005 to 2007 (40 Institutions)*

Technology	2005 (N = 13,620)	2006 (N = 12,335)	2007 (N = 12,007)	Absolute Change**	Relative Change**
Personal desktop computer	62.8%	68.9%	58.1%	-4.7%	-7.5%
Personal laptop computer	52.8%	68.3%	75.8%	23.0%	43.6%
Personal digital assistant (PDA)	12.1%	14.8%	10.4%	-1.7%	-14.0%
Smartphone (combination cell phone/PDA)	1.2%	7.8%	10.1%	8.9%	741.7%
Electronic game device	–	51.8%	54.5%	–	–
Electronic music/video device (iPod, etc.)	37.0%	60.1%	74.7%	37.7%	101.9%

**Data are based on student responses from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. While institutions remain the same, the actual students responding are different each year.*

***Absolute change is the difference between the 2005 and 2007 percents. Relative change is the absolute change as a percentage of the 2005 percent.*

the past 13 consecutive quarters as the "key features that once distinguished these handheld devices can now be found commonly on converged mobile devices."[4] Whether the move to converged mobile devices proves to be revolutionary or evolutionary, institutions can expect to find more and more students using them. To date, male respondents and older respondents (see Table 4-3) lead the way in acquiring both smartphones and PDAs.

Colleges and universities are watching the maturation of converged mobile devices with keen interest. With 12 percent of respondents owning smartphones and another 9.0 percent (who don't own a smartphone) owning a PDA, a total of 21.0 percent of respondents own a handheld device that can potentially be used to access a wide variety of services at their institutions. In our interviews, students' reported use of smartphones and PDA features varied. One student commented, "I have friends that have the most expensive cell phones, but do not use the extra expensive features." Another student echoed this thought: "I own a phone that has lots of capabilities but I don't use the Web access for two reasons: I don't know how, and it's expensive—about $100 a month." Other students are regular users of Web features. A biology student commented, "I have a cell phone with Internet access—lots of capabilities. I use them. I access the Net, do IM, etcetera." Another noted, "I read all my e-mail with my phone, and have been doing this for about a year. I text, too."

Devices associated more with leisure than with academic pursuits—music/video devices and game devices—have become standard fare and are now in the hands of the majority of respondents. Most younger respondents own music/video devices (83.1 percent of respondents 18 to 19 years old), and males and females now own them equally. This is a shift from just two years ago, when a gender gap was still in effect. For institutions that participated in each of the past three years' studies, significantly more males (46.1 percent) reported ownership of music/video devices than females (32.3 percent) in their 2005 data.[5] At these same institutions, overall music/video device ownership has risen from 37.0 percent in 2005 to 74.7 percent in 2007.

Table 4-3. What Electronic Devices Students Own, by Respondent Age

	18–19 Years (N = 10,628)	20–24 Years (N = 12,556)	25–29 Years (N = 1,809)	30–39 Years (N = 1,393)	40 Years and Over (N = 1,244)	All (N = 27,630)
Simple cell phone (without Web access)	86.2%	87.3%	82.5%	82.3%	83.3%	86.1%
Personal computer —desktop	55.0%	57.4%	76.0%	85.7%	90.0%	60.6%
Personal computer —laptop	83.9%	69.5%	62.2%	61.4%	59.0%	73.7%
Electronic music/video device	83.1%	75.7%	68.4%	62.5%	49.8%	76.4%
Electronic game device	62.8%	51.3%	61.3%	58.6%	42.3%	56.3%
Personal digital assistant (PDA)	8.3%	12.1%	18.1%	20.3%	22.5%	11.9%
Smartphone (combo cell phone/PDA)	11.9%	11.0%	15.7%	17.0%	13.3%	12.0%

Now that these devices are nearly ubiquitous, gender differences are disappearing.

Males continue to be the primary gamers. Game devices, however, do not show the same level of increased ownership, probably because of the growing popularity of multiuser online games such as *World of Warcraft* and *Everquest*.

How many of these electronic devices do students collect? Almost every respondent (98.0 percent) owns at least two devices—most often some type of a cell phone and a computer. Respondents owning five or more of the devices listed in Table 4-1 are more often male (29.3 percent) than female (17.0 percent).

Personal Computers

Laptops are still gaining as the platform of choice (see Figure 4-1). Overall, 98.4 percent of respondents own a computer. A full 73.7 percent of respondents own a laptop, 60.6 percent own a desktop, and 35.7 percent own both. For the 40 institutions participating in the past three studies, laptop ownership has increased from 52.8 percent in 2005 to 75.8 percent in 2007. Overall, new computers are largely laptop computers—about one-third (34.5 percent) of laptops are less than one year old, while only 8.1 percent of desktops are less than one year old. This trend will undoubtedly continue as more powerful and less expensive laptops become available.

Since about one-third of respondents own both a laptop and a desktop, we looked at the profile of students' newest computer. The majority of student respondents (52.4 percent) own a computer less than two years old, well within recommended equipment replacement cycles. However, this still leaves one-fifth of respondents (20.4 percent) whose newest computer is at least four years old and more likely to pose reliability and performance problems.

While males more often own desktops than females, this gender distinction disappears with laptop ownership. Here again, as a technology becomes widely owned, gender no longer makes a difference. At our respondent institutions, it is becoming standard practice for freshmen—both males and females—to come to college with a new laptop in hand. Figure 4-2 shows that 64.0 percent of freshmen have a laptop less than a year old and nearly three-fourths (74.3 percent) own one less than two years

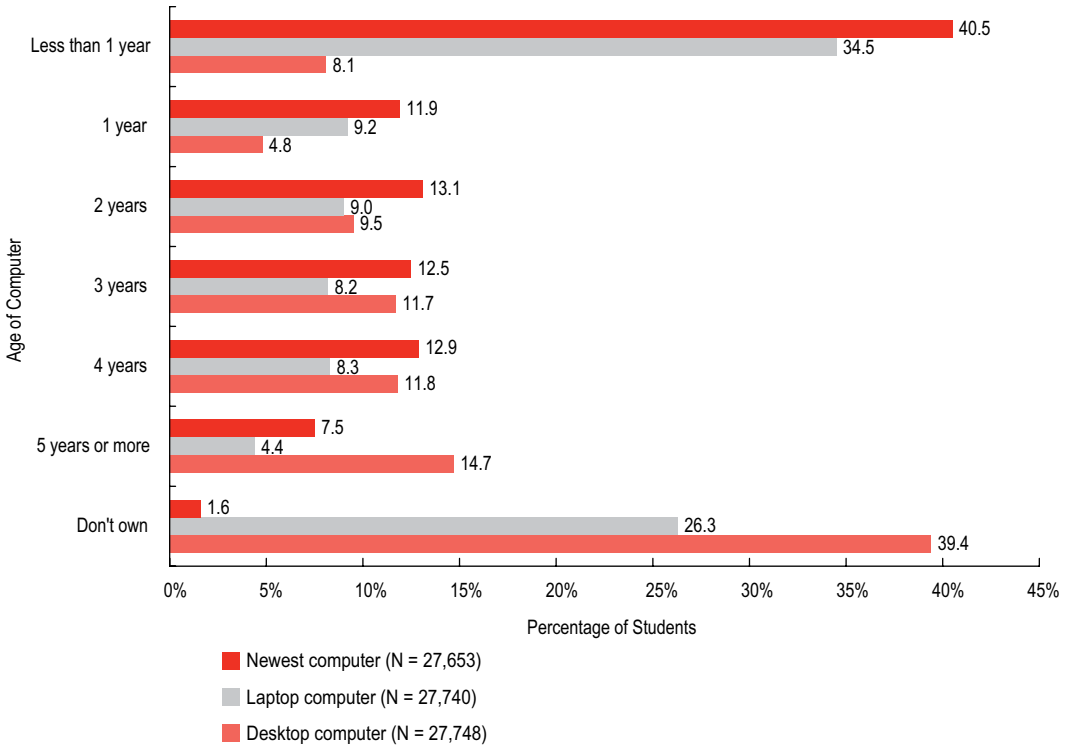


Figure 4-1. Age of Computers

old. Respondents from community colleges have a much different profile, with only 24.4 percent owning a laptop less than one year old, and almost half (46.7 percent) do not own a laptop at all. This general pattern for community colleges held true for the 2006 data as well.

In our qualitative interviews, most students said they owned a laptop. One sophomore stated, "I actually own three laptops and three desktops; two of these don't work anymore. I build them and give them to others in my family." In contrast, a student comment from our survey solicited a laptop: "If anyone ever has a laptop they don't want, I would be happy to take it off your hands. I could really benefit from one! Thanks!"

Only 1.6 percent (457 respondents) don't own a computer at all. While these respondents are dispersed across all of our demographic groups, 151 (33 percent) report a family income of $30,000 or less.[6] Respondents without their own computers also report less overall time spent doing computer work, going online, and engaging in many Internet activities. However, it is important to note that they show the same patterns of use as other respondents for the basic activities of e-mail, writing documents for class, and accessing their college or university library Web site. Even though they do not personally own computers, they do have some access to computers. Further, whether respondents are working with an old or a new computer, engagement in these fundamental activities—e-mail, writing documents for class, accessing library resources, and here even spreadsheets and presentation software—does not differ meaningfully.

Student Use of Technology

We asked students about their use of various technologies. How many hours do they spend actively online? Are they using high-speed Internet or dial-up? What, specifically, are they doing when they are on computers and online? And how do they

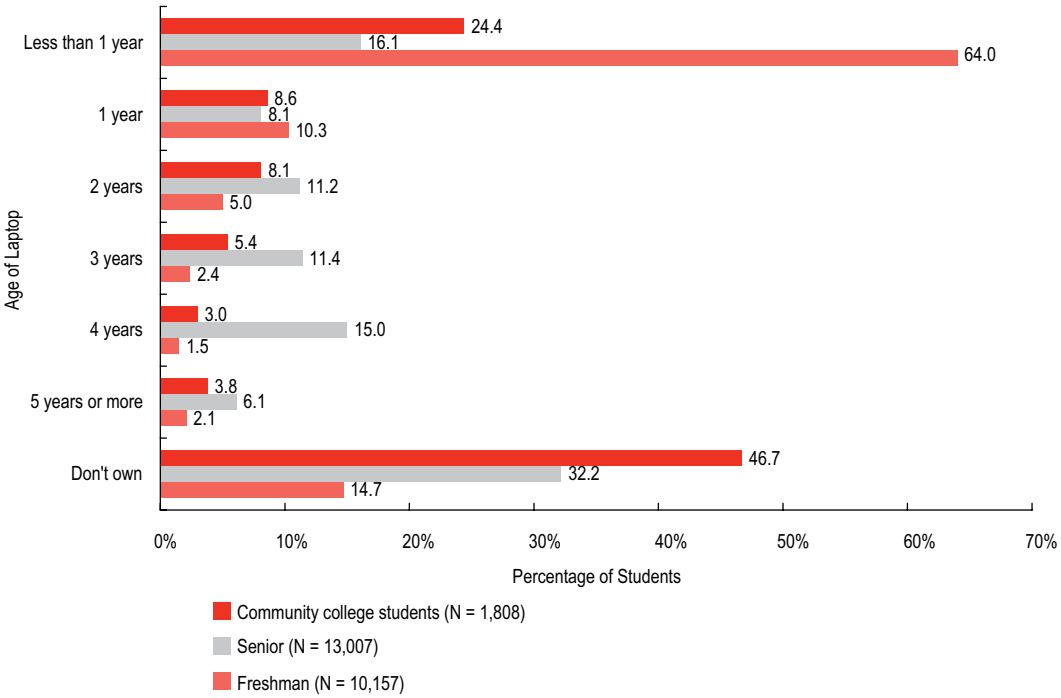


Figure 4-2. Age of Laptop, by Class Standing

like to communicate electronically with their institution? We address student responses to these questions in this section.

Hours Students Are Online

Respondents spend many hours each week doing online activities for school, work, and recreation (see Figure 4-3).[7] The most frequent answer is in the range of 6 to 10 hours per week (26.5 percent), the overall mean is 18.0 hours per week, and the median is 14 hours per week. A study (2004 to 2006) from Bridge Ratings found similar results—that young adults 15 to 24 years old spent an average of 2.35 hours per day (16.5 hours a week) on the Internet.[8] Also clearly evident is a group that spends an inordinate amount of time on the Net: 6.0 percent of respondents spend more than 40 hours a week doing online activities—in excess of what we typically consider a full-time job.

Overall, males say they spend only slightly more time online (mean of 19.5 hours per week) than females (mean of 17.0 hours per week). While this difference of 2.5 hours per week is small, it is statistically significant and consistent with a broad consensus of other research finding that men of all ages and across many contexts spend more time online than women.[9]

However, some research on teens and tweens over the past two years did not find gender differences. A study by Simmons Market Research Bureau (SMRB) in fall 2005 reported that for teens 12 to 14 years, males and females spent the same amount of time per week online.[10] Similarly, in 2006 the *Los Angeles Times* and Bloomberg did an extensive study of teens and tweens 12 to 17 years old, finding that computer and Internet use was about equal for males and females. There was one exception: Twice as many males as females fell in the largest time category (more than 5 hours per day).[11] The ECAR data also find more males than females in our largest time category of "more than 40" hours per week.

Respondents at doctoral institutions show the most hours online (mean of 19.1 hours per week), master's and bachelor's institution

respondents follow (means of 17.3 and 17.5 hours per week, respectively), and associate's institution respondents report spending the fewest hours doing online activities (mean of 13.1 hours per week). These differences can be due to several factors, possibly including the higher number of engineering students at doctoral institutions and the larger number of nontraditional students and different patterns of Internet use at associate's institutions (for example, less CMS use and higher use of dial-up access).

Time spent online also varies by major, with engineering majors showing the highest use and life sciences and education majors showing the lowest use (see Table 4-4). Again, the actual gap between the lowest- and highest-use majors does not seem large—just 6 hours per week, or less than an hour a day.

Computer and Online Activities

Respondents are quite diverse in how they spend their time using technology. Table 4-5 gives a profile of some of these activities and

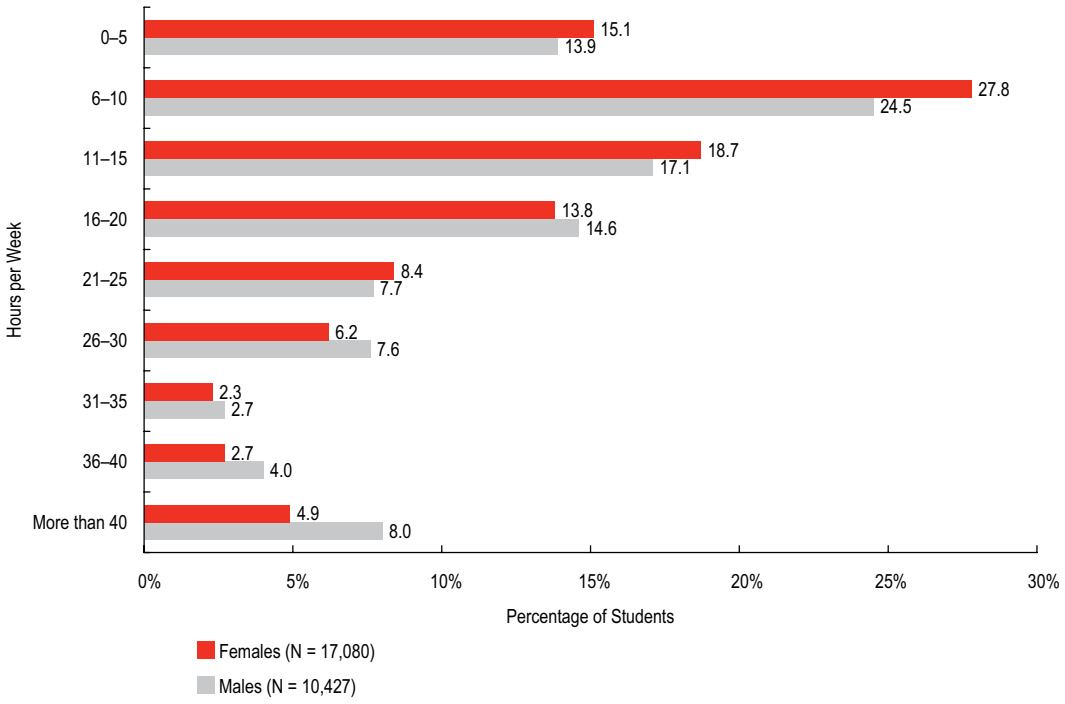


Figure 4-3. Hours per Week Doing Online Activities, by Gender

Table 4-4. Hours per Week Doing Online Activities, by Major

Major	N	Mean Hours per Week	Median Hours per Week
Engineering	2,650	21.9	16
Business	5,279	18.7	15
Humanities	2,868	18.7	15
Social sciences	5,332	17.8	15
Physical sciences	2,042	17.5	14
Fine arts	2,325	17.4	14
Life sciences	4,547	16.3	14
Education	3,638	15.9	12

Table 4-5. Student Computer and Internet Activities

	Students Engaged (N = 27,846)	Median Frequency of Use*	Associated Demographic Factor 1	Associated Demographic Factor 2
Almost All Students Engaged				
Create, read, send e-mail	99.9%	Daily	–	–
Write documents for coursework	98.6%	Several times/week	–	–
Use library on university/college Web site	94.7%	Monthly	Social sciences	Humanities
Create presentations (PowerPoint)	91.7%	Monthly	Senior	Business
Most Students Engaged				
Create spreadsheets or charts (Excel)	87.9%	Monthly	Senior	Engineering/ business
Online shopping	86.4%	Monthly	Senior	Male
Create, read, send instant messages	84.1%	Daily	Age (younger)	Reside on campus
Use course management system	83.0%	Several times/week	4-year institutions	–
Online social network (Facebook, etc.)	81.6%	Daily	Age (younger)	Reside on campus
Play computer games (online or offline)	78.3%	Weekly	Male	Age (younger)
Download Web-based music or videos	77.8%	Weekly	Age (younger)	Male
Create graphics (Photoshop, etc.)	72.3%	Monthly	Fine arts	Engineering
Some Students Engaged				
Access or use wikis	41.7%	Weekly	Male	–
Create video/audio (Director, iMovie, etc.)	32.6%	Once per quarter/semester	Male	Fine arts
Create Web pages (Dreamweaver, HTML, etc.)	29.1%	Once per quarter/semester	Male	–
Blogging	27.8%	Monthly	Fine arts	–

**The median frequency of use is calculated only for those students engaged in an activity. It is the midpoint in a series of data values; half the data values are above the median and half are below. Data values are 1 = never, 2 = once a year, 3 = once per quarter/semester, 4 = monthly, 5 = weekly, 6 = several times/week, 7 = daily.*

highlights patterns of use, noting which demographic factors are most strongly associated with each activity.[12] E-mail and writing documents for courses have become ubiquitous; a majority of respondents use e-mail daily and write documents for their courses at least several times a week. The use of the university or college library Web site is not far behind. Technology basics for coursework—spreadsheets and presentation software—are used by about 9 of every 10 respondents, most of them using these at least monthly. Even the more complex software tools needed to create Web pages and video/audio are used by a substantial number of respondents (about 1 in 3), most doing this at least once a quarter or semester. Wikis have now taken off, with 41.7 percent of respondents accessing them, most at least weekly.[13] One student claimed, "I use Wikipedia to cram right before exams in some subjects (those I expect to have extensive Wikipedia coverage). Believe it or not, this works extremely well."

Gender continues to be a factor for some computing activities. Males dominate gaming and report more use of wikis and software

to create video/audio or Web pages. And even though the data showed that males and females own video/audio devices equally, males report that they actually download music and video more frequently. Further, the 65 institutions participating in the past two years' studies show an increase in respondents who download music and video—from 70.4 percent in 2006 to 76.2 percent in 2007. With the increase in ownership of electronic music devices and music-capable cell phones and the increased availability of music services, it is not surprising that the downloading of music and video is growing. This trend is likely to continue as more and more students obtain these devices and subscribe to music services.

Fully 78.3 percent of respondents play computer games—online or offline. A male senior explained how it can be all-consuming: "Online activities kill a lot of my time. I had a roommate who never left his room. He'd spend the entire day on [*World of Warcraft*]. The only time he came out was to pay the pizza delivery man. He was actually a pretty good student." A male sophomore admitted, "I am addicted to *World of Warcraft*. I can spend 5 hours just in parts of the game. It's so huge and it has its own currency. I make money off of it." Another student quipped, "I used to play *Warcraft* until *South Park* made fun of it."

As expected, major is key to technology use. Engineering majors make more use of spreadsheets and graphics software; social sciences and humanities majors make more use of their institution's library; business majors make more use of spreadsheets and presentation software; and fine arts majors make more use of graphics and video/audio software as well as blogging. In fact, our 2007 respondents report slightly more use of graphics and video/audio software than did respondents from the 2006 study.

More than one-fourth of respondents (27.8 percent) report blogging, and a number of our interviewees told us that they have personal blogs. One student noted its importance as a place for expression: "I have a personal blog. I am opinionated and I can rant and rave on my blog. I put it all there. You also meet people you wouldn't meet in normal life." Another senior stated, "If you slam someone, they'll comment back. But, you can really get the inflection wrong and you can take things the wrong way."

The Net Generation and Technology

A great deal has been observed, conjectured, and written about the Net Generation (millennial) students and how they relate to technology in their college years. Oblinger and Oblinger provide a thoughtful review of literature about these students—born between 1982 and 1991—who are now college undergraduates roughly 18 to 25 years of age.[14] They conclude that one of the Net Geners' defining characteristics is their social nature and preference to create and participate in a wide range of ever-changing communities. They use technology extensively to facilitate their socialization and connection with others; IMing, playing multiperson Internet games together, blogging, and social networking are seamlessly integrated into their everyday life.

The ECAR data support this notion, showing that the Net Generation age group is more highly engaged than older students in technologies that enable socializing—IM, online social networking, downloading music and video, and playing computer games. Table 4-6 shows this rather dramatic pattern in more detail for IM and online social networking. Clearly, IMing is a mainstay of many younger students' communication, and online social networking has become immensely popular for this group.

In fact, overall participation in online social networking has risen dramatically just in the last year. The 40 institutions participating

Table 4-6. Use of Instant Messaging and Online Social Networking, by Age

	N	Never	Weekly or Less	Several Times per Week	Daily
Instant Messaging (IM)					
18–19	10,587	9.2%	17.5%	14.3%	58.9%
20–24	12,524	13.5%	23.4%	15.0%	48.0%
25–30	1,807	28.3%	28.1%	15.3%	28.3%
30 and over	2,636	44.7%	26.4%	11.2%	17.6%
Online Social Networking (Facebook, etc.)					
18–19	10,607	6.5%	9.8%	14.4%	69.3%
20–24	12,553	12.8%	23.0%	19.1%	45.2%
25–30	1,811	42.4%	30.1%	9.3%	18.2%
Over 30	2,633	76.5%	16.1%	3.0%	4.4%

in the past three years' studies show an increase in respondents who use online social networks from 72.3 percent in 2006 to 80.3 percent in 2007. Further, respondents who reported using social networking Web sites on a daily basis increased from 31.9 percent in 2006 to 47.7 percent in 2007. This trend is likely to continue with next year's incoming students. The Pew Internet & American Life Project conducted a survey in November 2006 and found that 48 percent of teens (12 to 17 years) visit social networking sites daily or several times a day. Of older teens (15 to 17 years), 64 percent had posted a profile to a social networking site.[15]

In our interviews, students emphasized the important role that social networking plays in connecting with others. One student noted, "I'm a heavy user of Facebook. I use it too much, one to three hours per day. It's the easiest way to send a message rather than meet face-to-face. You can also use social networking to find a date and your next wife. My sister met her husband that way. She was in Wisconsin and he was in Missouri." A freshman said, "Facebook is the cheapest way to keep in touch with old friends." But some respondents noted the pressures of the social networking environment. As one student admitted, "I'm not on Facebook because I don't know how to do graphics and music and my page would not be interesting. It would be too boring. I'd be embarrassed."

Online social networking and mobile devices are converging, with mobile social networking software (MoSoSo) and mobile GPS. For students already texting and cyberchatting on their cell phones, using smartphones for social networking will be natural.

Several respondents commented on the negative social implications of technology. The common themes were environmental impacts of technology, too much dependence on technology, and the resulting reduction in face-to-face interactions. One student admitted, "Though I use technology regularly, I continue to have this nagging feeling that most people, including me, are not responsible enough to use it, and therefore like anything else, we can abuse it. In this way we spend hours on computers, avoiding contact with others by using portable music players and cell phones. And as I type, I am listening to my iPod." Another student captured the essence of the comments, saying, "We, students across the system, are being taught that human interaction is no longer a crucial factor in our development, when in fact, it is

through this human interaction that we learn to grow as a society."

Communicating with the Institution

The debate among college and university leaders about whether e-mail accounts are best provided by the institution or the private sector has nontrivial financial, technology infrastructure, and institutional culture implications. To inform this discussion, we asked respondents if they preferred a college e-mail account or a commercial e-mail account for communication with their institution. A resounding 82.5 percent said they prefer a university account. Figure 4-4 profiles respondent e-mail account preference by age group. A full 88.0 percent of respondents 18 to 19 years old prefer communicating with their institution using their university e-mail account. This pattern shifts for older respondents. While the older respondents still generally prefer their university e-mail account, a higher percentage prefer their nonuniversity account. In addition to age, those residing on campus have a stronger preference for communication via their university account. Of respondents 18 to 19 years of age, 89.8 percent of those residing on campus prefer their university account; fewer in this age group (82.0 percent) who live off campus do so.

Another topic of discussion is whether e-mail is waning in popularity among undergraduates. Younger students often claim to prefer IM and text messaging over e-mail for their own communications, characterizing e-mail as archaic. Some speculate that these students might also prefer IM and text messaging for official university communications as well. Figure 4-5 illustrates that respondents are still solidly in favor of e-mail for campus-related communications (85.1 percent). This finding has not changed from last year's data.

This is not to say that students think there is a need for only one type of communication, especially in light of emergency situations such as 9/11, Hurricane Katrina, and the Virginia Tech shootings. Students and administrators alike are looking to text messaging, Web sites, and other modes of communication that are faster and more effective under emergency conditions. One

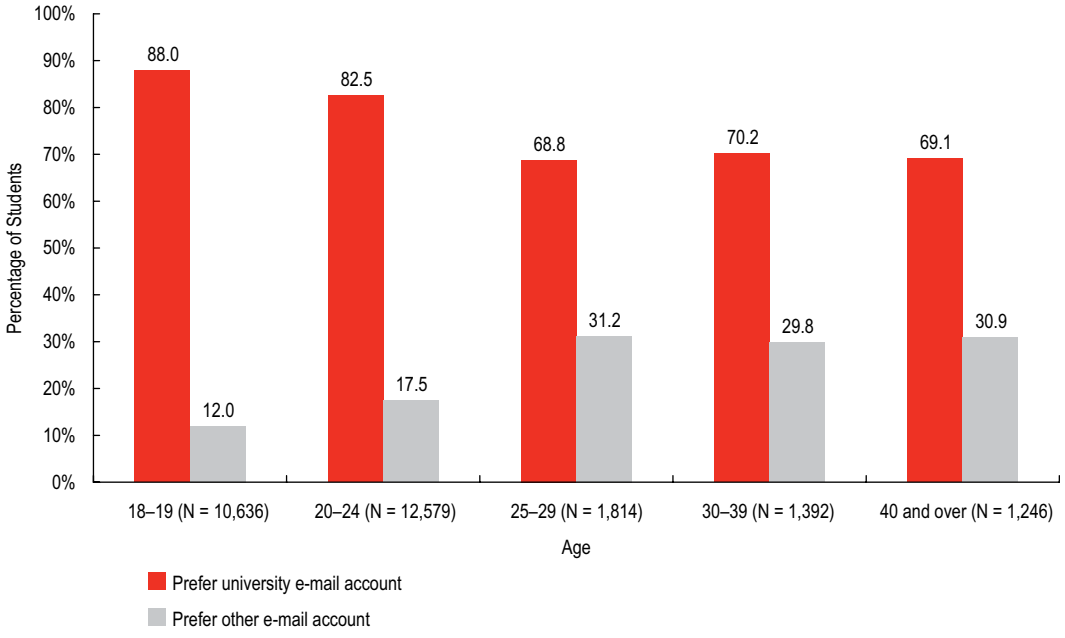


Figure 4-4. E-Mail Preference for Communication from College or University

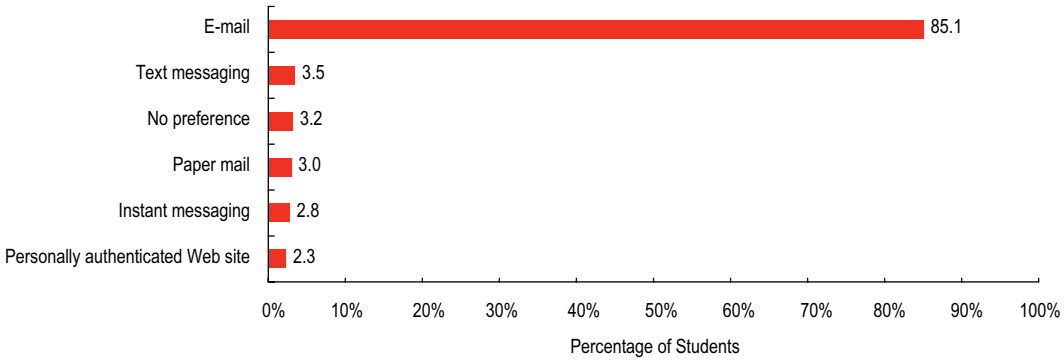


Figure 4-5. First Choice for Institutional Communication (N = 27,782)

student wrote us an e-mail the day after the Virginia Tech shootings: "I have already taken the survey, but in light of the tragic events that have occurred at Virginia Tech, I would like to add the following comment to the survey: 'I think a text-messaging system for school officials to communicate emergency information to students on their cell phones would be excellent.'" We asked about this in our focus groups, and some students did not agree, saying that they were not interested in receiving text messages from their institutions. Many college and university leaders are currently discussing with their students technology options for emergency notification.

Internet Access Method

Most respondents report having access to high-speed Internet (91.5 percent); 69.7 percent primarily use wired broadband, and 21.8 percent primarily use wireless. We note that wired broadband is often, but not necessarily, a precondition to wireless, and wireless in this analysis refers to the first line of contact. Also, since the move to laptops is in part driving the move to wireless networking, it makes sense that laptop owners show stronger use of wireless than those with desktops.

Fully 8.4 percent of respondents are still using dial-up as their most frequent method of access to the Internet. Who are these respondents? Respondents from associate's institutions report using dial-up access most often (14.3 percent), in contrast to respondents from four-year institutions (8.1 percent), as shown in Table 4-7. With respect to age, the youngest (18 to 19 years) and oldest (30 years and over) respondents are most likely to still be using dial-up. In fact, looking at the 310 respondents 50 years and older, one-fifth (19.7 percent) report using dial-up access most frequently. There are likely other reasons for dial-up use not captured by the survey, such as less broadband or wireless coverage in some rural areas.

Respondents depending on dial-up access spend less time online. Their use of the Internet (mean of 14.3 hours per week) is lower than that of respondents using wired broadband (mean of 18.6 hours per week) or that of respondents using wireless (mean of 17.4 hours per week). Specifically, dial-up users report less time on some activities (online shopping, downloading Web-based music and video, using wikis, and online social networking) but not on others (e-mail, library Web site, CMS, or blogging). This suggests that the time they do spend is focused on the core activities and technology tools needed for school or work. This is consistent with our earlier finding that respondents who do not own computers do have access to computers and show patterns of use similar to those of computer owners for these core technology tools.

Our findings are consistent with numerous national and institution-specific studies that have tracked student use of technology.

Table 4-7. Most Frequently Used Internet Access Method

	N	Broadband (wired)	Wireless	Dial-up
Laptop Ownership				
Own	20,406	66.8%	25.9%	7.4%
Don't own	7,287	78.3%	10.4%	11.3%
Gender				
Male	10,438	77.6%	16.4%	6.0%
Female	17,097	65.1%	25.1%	9.8%
Carnegie Class				
DR	13,687	69.5%	23.9%	6.6%
MA	10,499	71.5%	18.6%	9.9%
BA	1,528	67.4%	24.7%	7.9%
AA	1,817	66.3%	19.4%	14.3%
Age				
18–19	10,648	65.8%	24.2%	10.0%
20–24	12,589	71.1%	22.7%	6.2%
25–29	1,815	76.0%	16.0%	8.0%
30 and over	2,639	75.7%	11.7%	12.6%

They report a continuing trend among college students toward universal ownership, mobility, and access, while recognizing that a digital divide does currently exist and is of public concern.

Respondents are evenly split between those using commercial Internet providers and those using the Internet service provided by their institution. Of the half of ECAR respondents who live on campus, most (91.7 percent) use their university-provided Internet service. Not surprisingly, 77.4 percent of respondents from baccalaureate institutions use university-provided Internet service, in contrast to only 21.2 percent of associate's institution respondents, who often live off campus, have jobs, and attend school less than full time.

What has changed? Table 4-8 compares respondents' methods of Internet access over the past three years. A few trends emerge. Dial-up access continues to decline, from 12.1 percent in 2005 to 7.8 percent in 2007. This decline has been dramatic for respondents using commercial providers, as these providers make migration to broadband increasingly attractive and affordable. In contrast, the number of respondents reporting use of campus-provided dial-in modem pools has been stable over the past three years.

The ECAR data show that wired broadband is steadily being replaced or augmented by wireless as the first line of contact. The percentage of respondents connecting via wired broadband decreased from 75.6 percent in 2005 to 68.2 percent in 2007, and those connecting via wireless increased from 12.4 percent to 24.0 percent in the same time frame. This suggests that wired broadband users are adding wireless and that dial-up users are migrating to wireless—increasingly the connection method of choice. Indeed, students living off campus set up wireless connections and hubs for their own use, campuses push their wireless initiatives, and there are many more off-campus wireless zones in public libraries, coffee shops, and other commercial areas.

Table 4-8. Change in Internet Connection Method from 2005 to 2007 (40 Institutions)*

Connection Method	2005 (N = 13,534)	2006 (N = 12,855)	2007 (N = 12,029)	Absolute Change**	Relative Change**
Dial-up—university or college provided	5.7%	4.6%	5.4%	-0.3%	-5.3%
Dial-up—commercial provider	6.4%	4.3%	2.4%	-4.0%	-62.5%
Total Dial-up	**12.1%**	**8.9%**	**7.8%**	**-4.3%**	**-35.5%**
Broadband—university or college provided	40.9%	35.3%	32.7%	-8.2%	-20.0%
Broadband—commercial provider	34.7%	36.6%	35.5%	0.8%	2.3%
Total Broadband (Wired)	**75.6%**	**71.9%**	**68.2%**	**-7.4%**	**9.8%**
Wireless—university or college provided	7.2%	11.3%	13.7%	6.5%	90.3%
Wireless—commercial provider	5.2%	7.9%	10.3%	5.1%	98.1%
Total Wireless	**12.4%**	**19.2%**	**24.0%**	**11.6%**	**93.5%**

**Data are based on student responses from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. While institutions remain the same, the actual students responding are different each year.*

***Absolute change is the difference between the 2005 and 2007 percents. Relative change is the absolute change as a percentage of the 2005 percent.*

This study's respondents are strong advocates of the move to wireless on campus. Student comments fell into two major categories. First, students wanted more wireless. One student stated, "I like the wireless network. It would be extremely helpful to have a campus-wide wireless network, not just a few hotspots scattered throughout the campus. I should be able to open up my laptop anywhere on campus and connect to the Internet." Second, there were complaints about the wireless service. One student said, "The wireless Internet is extremely slow at times, making it hard to do research for classes." Another agreed: "The wireless Internet is very frustrating. One day it works fine and the next day it doesn't work or is very slow."

Finally, at a more granular level, we see a three-year decrease of 8.2 percent in respondents who most often use institution-provided wired broadband, and a corresponding 6.5 percent increase in respondents who use institution-provided wireless as a first line of contact. This trend is likely to continue as colleges and universities that have been providing wired broadband (for example, in residence halls) are adding wireless access. This is confirmed by the Campus Computing Project survey conducted in September and October 2006, which found that wireless networks now reach half of college classrooms, more than two-thirds of institutions have a strategic plan for deploying wireless, and three-fifths of institutions have increased their budget for wireless for this academic year.[16]

Student Technology Skills

What technology skills do incoming freshmen bring with them? To what extent is there an information literacy "digital divide"? Are students' skills strong enough to allow them to gain the most from their college experience? These and similar questions about information literacy are on the minds of both administrators and faculty as they make decisions about how to effectively deploy technology on campus and how to incorporate technology into the curriculum.

Understanding and assessing information and technology literacy within the context of the rapidly changing landscape of information resources and technology is certainly

challenging. Early on, the U.S. Department of Education Office of Educational Technology defined information literacy as "computer skills and the ability to use computers and other technology to improve learning, productivity, and performance."[17] More recently, the Partnership for 21st Century Skills defined information and communication technology (ICT) literacy as the ability to use technology to develop 21st-century content knowledge and skills in the context of learning core subjects. Students must be able to use technology to learn content and skills—so that they know *how* to learn, think critically, solve problems, use information, communicate, innovate, and collaborate.[18] The EDUCAUSE Learning Initiative and others are also doing extensive and important work to expand the scope of *information literacy* to more closely match and track the expansion of what now constitutes *information* in the context of new media.[19]

This ECAR study, too, looks at student technology knowledge and skills for a subset of technologies generally deemed important to course, job, and leisure activities. Respondents were asked to rate their skills for computer maintenance, common software applications, and use of university online library resources. We are well aware of the problems associated with self-assessment (as opposed to a true measurement of skills). The literature on self-assessment of skills suggests that students overrate their skills in general, men more so than women. Even with these cautions, we hope the data are informative and can help guide future institutional initiatives to improve campus technology use and skills.

Self-Assessment of Skills

Respondents have the most confidence in their CMS and presentation software (such as PowerPoint) skills, with mean ratings close to "very good" (see Table 4-9). Skill levels for spreadsheets, online library resources, and computer maintenance are rated somewhat lower, between "good" and "very good." Note that the standard deviation for some skills—computer maintenance, graphics, and video/audio—is high, denoting a wide range of opinions. While 23.7 percent of respondents rate their maintenance skill as "excellent," nearly one-third (29.7 percent) report their maintenance skills as "poor" or "fair." Far fewer respondents use the more esoteric software designed for creating graphics or video/audio, and

Table 4-9. Student Technology Skills

Technology	Students Using the Technology	Mean*	Std. Deviation	Associated Demographic Factor 1	Associated Demographic Factor 2
Presentation software (PowerPoint,etc.)	25,411	3.84	0.982	Age (older students)	–
Course management system	22,752	3.77	1.020	–	–
Spreadsheets (Excel, etc.)	24,250	3.47	1.088	Engineering	Business
Online library resources	25,852	3.47	1.022	Senior	Social sciences/ humanities
Computer maintenance	27,014	3.29	1.282	Male	Engineering
Graphics (Photoshop, Flash, etc.)	18,987	2.92	1.153	Fine arts	–
Video/audio (Director, iMovie, etc.)	8,584	2.82	1.176	Male	Fine arts

**Scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent*

Note: Means and standard deviation calculations include only the students who use the technology.

those respondents indicate lower skill levels—slightly less than "good."

Table 4-9 also shows the demographic factors most strongly associated with skill levels. There are some gender differences, even considering that males rate themselves higher than females. Of the seven technology skills listed in Table 4-9, males report much stronger skill in computer maintenance and moderately stronger skill using video/audio software than females. Perhaps more interesting is that males and females show similar skill ratings for the core technologies used in courses—course management systems, spreadsheets, presentation software, and use of online library resources.

Of note are the differences between majors. Fine arts majors report more skill with graphics and video/audio software; engineering majors report more skill with spreadsheets and computer maintenance; and social science and humanities majors report more skill using online library resources. Students emphasized the importance of major in our interviews. A psychology student noted, "Your major matters a lot [with technology use and skills]. A nursing student doesn't use as much technology as a computer science, graphic art, or journalism student. The degree program focuses the use of technology. But, in many areas, things are going online for everyone."

Compared with other respondents, those rating their technology skills stronger have a higher technology use profile. They tend to

- own more computers and other electronic devices,
- engage more often in many of the Internet activities we asked about, and
- spend more hours per week online.

Class Standing and Skills

We would expect that seniors rate themselves higher than freshmen when it comes to some technology skills. Our data find this is true for skills in only two areas (see Table 4-10). For online library skills, 54.3 percent of seniors report "very good" or "excellent" skills, compared with 40.3 percent of freshmen and 43.6 percent of community college respondents. For spreadsheets, 55.4 percent of seniors report "very good" or "excellent" skills, compared

Table 4-10. Student Technology Skills, by Class Standing

	Students Using the Technology	Seniors		Freshmen		Community College Students	
		Mean*	Std. Deviation	Mean*	Std. Deviation	Mean*	Std. Deviation
Seniors Report Stronger Skill Levels Than Freshmen							
Spreadsheets (Excel, etc.)	21,810	3.61	1.079	3.29	1.064	3.30	1.118
Online library resources	23,306	3.61	1.011	3.30	1.004	3.40	1.057
Seniors and Freshmen Report Similar Skill Levels							
Presentation software (PowerPoint, etc.)	22,916	3.88	0.971	3.84	0.964	3.60	1.087
Course management system	20,440	3.82	1.012	3.70	1.017	3.67	1.075
Computer maintenance	24,328	3.35	1.279	3.22	1.271	3.20	1.308
Graphics (Photoshop, Flash, etc.)	17,070	2.86	1.147	2.98	1.152	2.99	1.172
Video/audio (Director, iMovie, etc.)	7,742	2.74	1.171	2.92	1.171	2.99	1.237

**Scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent*

Note: Mean and standard deviation calculations include only the students who use the technology.

with 42.5 percent of freshmen and 41.7 percent of community college respondents. Other than for these two skills, we find no meaningful skill differences between seniors and freshmen. In part, this may be due to freshmen entering college with a stronger technology background, having had more exposure to technology in high school and in their personal lives before college. Or freshmen may not have enough experience with these technologies to be realistic about their skill levels.

In our interviews, students talked about acquiring technology skills needed for their courses. A junior business major noted, "I am much better with technology than when I started college. I respond to what demands are put on me. I pick the skills up as I need them. Without these required experiences, I wouldn't have the skills."

Institutional Technology Training

How do these relatively high marks for technology skills, especially on the core technologies commonly used in courses—library access, course management systems, spreadsheets, and presentation software—align with respondents' opinions about institutional training? Students were asked to agree or disagree with the statement, "My school needs to give me more training on the IT that I am required to use in my courses." Fully two-fifths of respondents (40.2 percent) say they do not need more training, and more than one-third are neutral (34.0 percent); only one in four respondents (25.9 percent) say they do, in fact, need more training to be provided by their institution (see Figure 4-6). There are likely many reasons for this lackluster interest in institutional training. It may be that students prefer learning from others instead of through formal training, or that they feel their institution's training is not effective, or that they don't have enough time for training.

Respondents admitting that their skills are not very good are more likely to indicate that they need more training from their institution. For example, of respondents claiming only

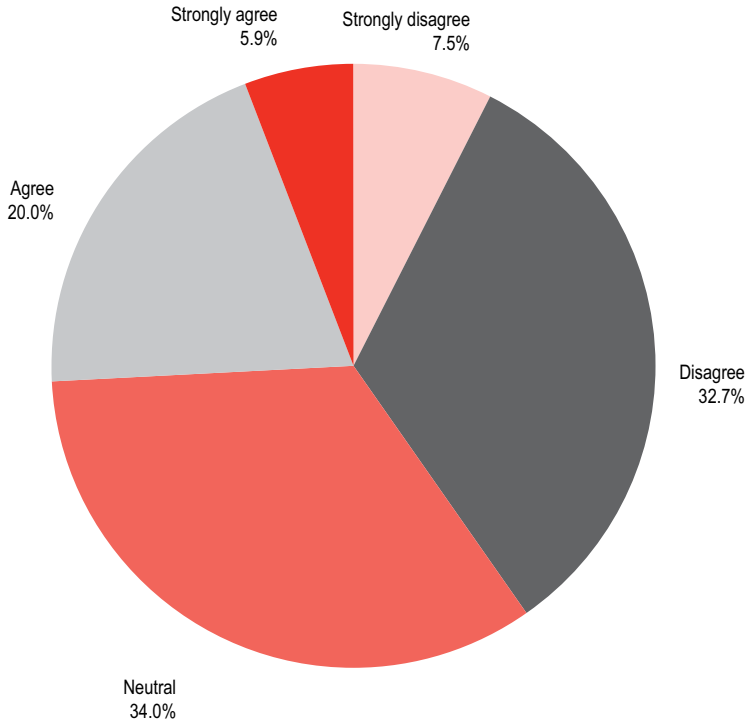


Figure 4-6. My School Needs to Give Me More Training (N = 27,722)

"poor" or "fair" skills with spreadsheets, 36.2 percent agree that their institution needs to provide more training; only 21.0 percent of those with "very good" or "excellent" skills agree.

Older respondents are more likely to feel they need training than younger respondents. One older student told us, "A significant portion of university enrollment consists of students 25 years and older. Many older students were already out of the educational setting when many technologies were implemented, so they never had the opportunity to learn how to use them." Besides this factor, there is little difference of opinion about the need for training based on class standing, major, GPA, family income, or two-year versus four-year institutions. This question has been asked in each of the last three studies, and the findings are remarkably stable.

Some institutions offer basic technology training as a required part of the curriculum. One student commented, "A lot of students breeze through the introduction class to Excel, Word, and Access and don't realize how important it is. It's important to tell students that using these programs efficiently will help them gain experience and help them find careers afterward." Another student requested a required course: "I notice that our IT people always hold classes so that students can become better acquainted with Excel, PowerPoint, etcetera. I think it's great that they offer them, but, honestly, I've never gone to one due to lack of time, class conflict, or work schedule. I think having a required class for all incoming freshmen where they could learn all the things they need would help."

Analysis of respondents' written comments surfaced three major issues about training and support. Two are focused on faculty: the need for an instructor to give students more training on technologies specifically required for a course, and the need for the faculty themselves to get more training. The third theme came from several hundred comments about the central and departmental help desks. While there were some positive comments about the helpfulness of staff in fixing technical problems, negative comments were far more frequent. These pointed most often to a lack of customer service orientation but also addressed problems with help desk availability, wait times, and fees. This suggests that the help desk function appears to be a relatively high priority for many students, and this is an important finding for IT leaders.

Why Students Learn Technologies

We queried students as to why they learned four basic software technologies (Figure 4-7). Overall, most respondents learn spreadsheet and presentation software as a course requirement. However, when we look at the data more closely, we see that age also matters. Older respondent populations, more likely to be in the workforce, often report that they have learned technology skills on the job. For spreadsheets, 54.9 percent of respondents 30 years and older say they learned spreadsheets as part of a job requirement, in contrast with just 3.8 percent of 18- to 19-year-olds. Younger respondents are much more likely to learn these basic skills as part of their course requirements.

Learning graphics and video/audio software, much less used in courses, is driven by personal interest. For respondents under 25 years, 65.2 percent said they learned video/audio software because of personal interest, while 71.6 percent of respondents 25 years or older said they learned because of personal interest. It appears that since graphics and video/audio skills are infrequently needed for coursework or jobs, students wishing to use these tools are generally left to learn them on their own. One student recommended, "I wish there were free daily seminars for learning new technology. I wish I knew how to use iMovie and all of that new multimedia software, but I don't have time to take a full semester class."

In addition, males are more likely to learn technologies out of personal interest. For example, 14.5 percent of males said they learned spreadsheet software for personal interest, whereas only 7.7 percent of females did so. And 72.7 percent of males said they learned video/audio software for personal interest, in contrast with 58.7 percent of females.

Student Technology Adoption Profile

In the 2006 study, a student's "technology adoption" profile was an important factor in his or her experience with technology. Technology ownership, use, and skill profiles were very different for students with different approaches to adopting new technologies. So, in 2007, students were again asked to describe themselves as technology adopters, using the standard scale developed by Everett Rogers.[20] Table 4-11 shows the overall profile—a fairly traditional bell-shaped curve—similar to that found in the 2006 data. This remains an important finding for institutions to consider as they are faced with providing quality educational experiences to both those who love and are on the forefront of technology and those who simply are not.

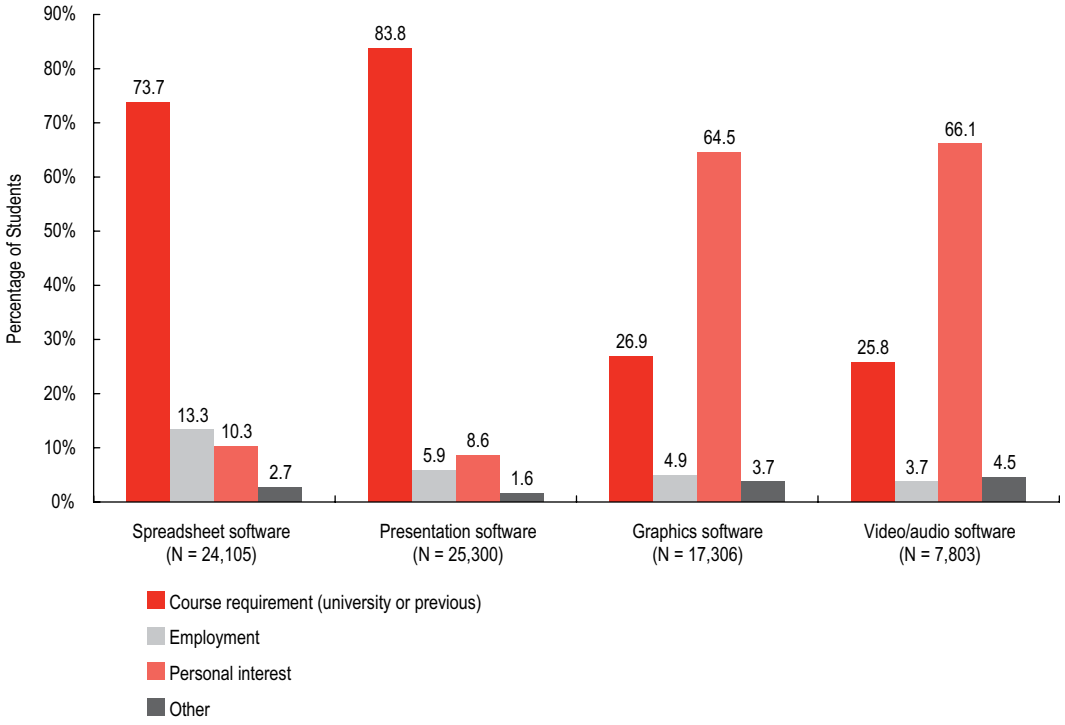


Figure 4-7. Why Students Learn Technologies*

**Students who do not use a technology are excluded.*

Table 4-11. Respondent Technology Adoption (N = 27,735)

Which best describes you?	Descriptor	Percentage
I love new technologies and am among the first to experiment with and use them.	Innovator	9.9%
I like new technologies and use them before most people I know.	Early adopter	26.1%
I usually use new technologies when most people I know do.	Mainstream adopter	50.6%
I am usually one of the last people I know to use new technologies.	Late adopter	11.3%
I am skeptical of new technologies and use them only when I have to.	Laggard	2.2%

When it comes to technology adoption, there is a very large difference between male respondents (55.4 percent) and female respondents (24.1 percent) claiming to be innovators or early adopters. Females are most likely to identify themselves as mainstream adopters (59.6 percent). Engineering students strongly identify as innovators or early adopters (60.4 percent) compared with other majors (33.4 percent).

Figure 4-8 shows other important differences related to technology adoption. While only 12.0 percent of overall respondents own smartphones (refer to Table 4-1), nearly one-fifth (18.0 percent) of those who describe themselves as innovators or early adopters already have one. So, even though overall penetration of smartphones is low, innovators and early adopters are jumping to this mobile platform, and mainstream adopters are likely to be close behind.

Innovator/early adopters also spend more time doing online activities and rate themselves higher in all of the technology skills we asked about. Three skills—spreadsheets, graphics software, and computer maintenance—are shown in Figure 4-8. Even though spreadsheets now fall in the category of the basic skills needed for work and school, only one-third (29.6 percent) of late adopters/laggards think their spreadsheet skills are very good or excellent. Computer maintenance is especially dramatic, with almost three-fourths (72.9 percent) of innovator/early adopters reporting "very good" or "excellent" skills, compared with only 16.3 percent of late adopter/laggards.

One student, who sounds like an early adopter, shared an opinion regarding technology adoption: "I hope that dinosaurs eventually die and the rest see that digitalization is the most important human advancement. It has radically changed our lives to the point where we can't go back." Another student, likely a late adopter, said the opposite: "IT use in education promotes laziness. The simple feel of paper in your hands and a writing instrument is the fundamental essence of scholarship."

Endnotes

1. Penn, Shoen & Berland Associates, "Consumers Crave Simpler Gadgets," eMarketer, http://www.emarketer.com/Article.aspx?1004730&src=dp1_home.
2. Longitudinal data is available for the years 2005, 2006, and 2007. For comparison of 2005, 2006, and 2007, the 40 institutions that participated in the student study each of these years were used. For comparison of 2006 and 2007 data, the 65

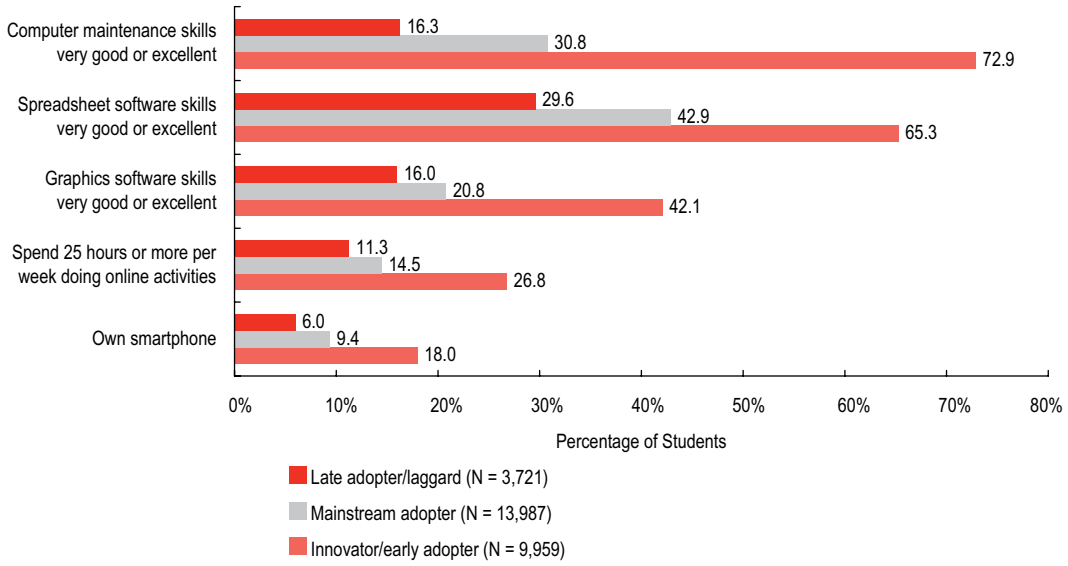


Figure 4-8. Technology Adoption Profile

institutions that participated in the student study for both of these years were used. While institutions were the same over these time periods, they survey different students each year.

3. The 2005 survey questions were in the format "Check all that apply." Therefore, all items not checked (which would include both "No" or "Missing" responses) were coded as "No" during the data preparation process. This can result in the number of "No" answers being slightly overstated. The 2006 and 2007 survey questions were in a format allowing the respondent to specify explicitly either "Yes" or "No," so we can distinguish "Missing" from "No" answers. The end result is that the change in percentages may be slightly overstated.
4. eMarketer.com, "Handheld Devices Humbled by Mobiles," http://www.emarketer.com/.
5. The 2005 survey question "Which of the following electronic devices do you own? Electronic music device (iPod, etc.)" was slightly changed in the 2006 and 2007 surveys to be "Which of the following electronic devices do you own? Electronic music/video device (iPod, etc.)."
6. The survey question was, "For the calendar year 2006, what was your total family income from all sources, before taxes?"
7. This question was changed for 2007 to limit the answer to time actually spent doing activities online rather than time using all electronic devices. The 2006 question was, "Excluding your use of cell phones, how many hours each week do you normally spend using an electronic device (computer, PDA, etc.) for school, work, or recreation?" The question for 2007 was, "How many hours each week do you spend doing online activities for school, work, and recreation?"
8. eMarketer.com, "Young Consumers Multitask at the Expense of Radio," http://www.emarketer.com/Article.aspx?1004634.
9. Eszter Hargittai and Steven Shafer, "Differences in Actual and Perceived Online Skills: The Role of Gender," *Social Science Quarterly* 87, no. 2 (June 2006): 432–48.
10. Debra Williamson, "Tweens and Teens Online: From Mario to MySpace," eMarketer.com (2006): 9–10, http://www.emarketer.com/Reports/All/Em_tweens_oct06.aspx?src=report_head_info_sitesearch.
11. Ibid.
12. Demographic factors analyzed include gender, age, family income, major, on-campus or off-campus residence, part-time versus full-time enrollment status, and class standing (senior, freshman, or community college student).
13. This number may be understated, as some respondents may not know the term "wiki." In addition, during Internet searches respondents may be directed to wikis without realizing it.
14. Diana G. Oblinger and James L. Oblinger, eds., *Educating the Net Generation* (Boulder, CO: EDUCAUSE, 2005), http://www.educause.edu/educatingthenetgen.
15. Amanda Lenhart and Mary Madden, *Social Networking Websites and Teens: An Overview* (Washington, DC: Pew Internet & American Life Project, 2007), 2–3.
16. Kenneth Green, "The Campus Computing Project," 2006, http://www.campuscomputing.net/.
17. U.S. Department of Education, "Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge, A Report to the Nation on Technology and Education" (Washington, DC: U.S. Department of Education, 1996), http://www.ed.gov/about/offices/list/os/technology/plan/national/index.html.
18. The Partnership for 21st Century Skills describes itself as the leading advocacy organization focused on infusing 21st-century skills into education. The organization brings together the business community, education leaders, and policymakers to define a powerful vision for 21st-century education to ensure every child's success as a citizen and worker in the 21st century. A one-page overview, *Framework for 21st Century Learning, 2006*, is available at http://www.21stcenturyskills.org/documents/frameworkflyer040606.pdf.
19. See the ELI Net Savvy White Paper Series at http://www.educause.edu/NewLearners/5515, and Donald J. Leu Jr. and others, "Toward a Theory of New Literacies Emerging from the Internet and Other Information and Communication Technologies," in *Theoretical Models and Processes of Reading,* ed. Robert B. Ruddell and Norman Unrau (International Reading Association, 2004), 12,16.
20. Everett M. Rogers, *Diffusion of Innovations* (New York: Simon and Schuster, 2003).

5
Student Use of IT in Courses

It's just great to e-mail a professor at 2:00 a.m. with a question about my homework and get a response at 8:00 a.m.
—An undergraduate student

Key Findings

- Fully 59.3 percent of respondents prefer a moderate amount of information technology (IT) in their courses. Older respondents, males, and engineering students prefer somewhat more IT in courses.
- Respondents who consider themselves early adopters of technology or have more technology skills prefer more technology in their courses.
- Most respondents were using a course management system (CMS), spreadsheets, course Web sites, and presentation software in their courses the quarter/semester of the survey.
- Seniors reported more use of spreadsheets and presentation software in their courses the quarter/semester of the survey; freshmen reported more use of course Web sites, online social networking, and IM in their courses the quarter/semester of the survey.
- Half of respondents (53.3 percent) say they like to learn through programs they can control, such as simulations and video games. About one-third of respondents like to learn by contributing content to Web sites or through text-based conversations such as e-mail, IM, and text messaging.
- Half of respondents (52.4 percent) who own laptops never bring them to class. One-quarter (25.0 percent) bring them to class at least weekly.
- Respondents' CMS use has increased this year, with 82 percent of respondents having taken a course using a CMS. Longitudinal analysis shows that this is a 13.2 percent increase since 2005. How often respondents use a CMS has also increased.
- Although CMS usage has changed, respondent ratings of their CMS experience and the usefulness of CMS features have not changed since 2005.
- At about half of surveyed institutions, 90 percent or more of respondents have used or are using a CMS.
- Most respondents (58.2 percent) agree that, overall, instructors use IT well in their courses, but 13.6 percent disagree. Those who report positive rather than negative CMS experiences are more likely to agree that their instructors use IT well.

Using the Chapter 4 profile of undergraduate technology ownership, use, and skill as a backdrop, this chapter takes the next step and looks at IT used in instruction. Student responses are presented about

- preferences for IT in courses,
- what technologies they are using the quarter/semester of the survey,
- how they like to learn through selected technologies,
- experience and use of course management systems, and
- instructors' use of IT in courses.

Preference for IT in Courses

How much technology do students prefer in their courses? Responses have changed little since 2004 when ECAR first asked this question.[1] Though new technologies have emerged, existing technologies have gained popularity, and old technologies have faded, respondents continue to report their desire for what they perceive as "moderate" IT in their courses (see Figure 5-1). Very few respondents prefer the extremes: only 2.0 percent prefer no IT at all in their courses, and only 2.8 percent prefer classes that use IT exclusively.

Despite this consistency over the years, we caution that these results may say more about the relative amount of technology students prefer than the absolute amount or the richness of the resources provided. As once-exotic technologies have become common and the overall digital environment has gotten increasingly dense, what once seemed like extensive use of technology may now seem more moderate. Indeed, it is possible that students take some networked resources so much for granted that they don't think of them as "IT" at all. These and other findings, however, suggest a widespread preference for IT resources that are situated in a variety of other learning modalities, such as face-to-face meetings and personal faculty interaction.

Male respondents tend to express a stronger preference for IT in courses, with 30.9 percent preferring extensive or exclusive IT in courses compared with 18.5 percent of females. Engineering and business students

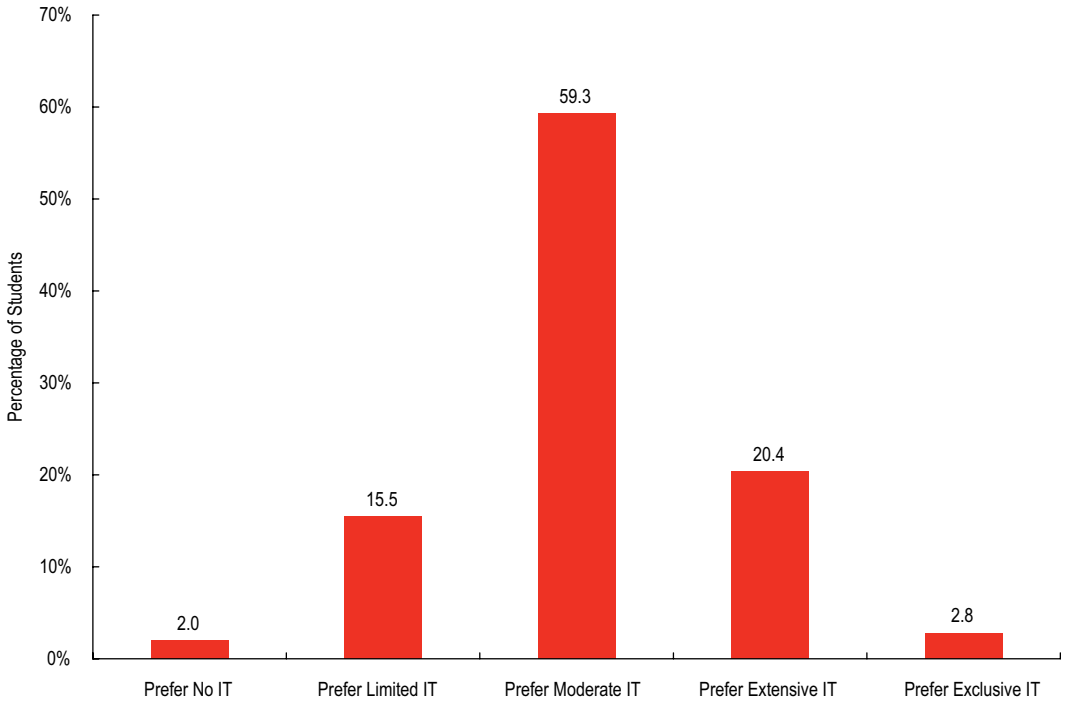


Figure 5-1. Preference for IT in Courses (N = 27,675)

also prefer somewhat more IT in courses, as do older students. These findings are generally consistent with the past three years' ECAR study results.

Previous ECAR studies have looked more closely at this association with age—older students preferring more IT and younger students preferring less. Younger respondents are coming to campus having grown up immersed in technology-mediated activities and with high expectations for their campus technology environment. It follows that these students might tell us they prefer courses that use extensive technology. This is not the case. Qualitative interviews with students by ECAR and others surface several possible reasons. Younger students generally place real value on face-to-face instruction. They often feel that faculty and instructors do not use technology in a way that meets their expectations. And some may not yet feel sufficiently comfortable or skilled with specific technologies used in courses, such as course management systems, spreadsheets, and presentation software.

Lotkowski, Robbins, and Noeth examined more than 400 studies of factors contributing to student retention and degree completion.[2] They concluded that improving student success, especially for younger students, is associated with strengthening the formal and informal contacts with the institution that develop confidence and competence in core communication skills. In sum, "face time" with faculty and peers contributes to students' feeling included and integrated into the academic environment, and ultimately contributes to their success.

Younger respondents also talked about the value they placed on the classroom. One senior told us that "From a learning standpoint, a classroom experience is important for our age group (18- to 22-year-olds). Hearing the discussions and questions is important—you don't get that from online classes. Too much technology overshadows the course content." A freshman engineering major also noted, "The class is an atmosphere. It's different than being at your home doing an online course where there may be partying going on behind you." A psychology major remarked, "I value interacting with my teachers. The student-teacher interaction is more powerful than it's given credit for."

Older respondents often told us their stronger preference for IT in courses reflects their need to balance competing academic, employment, and family demands. One student commented, "Older students definitely want more extensive or exclusive technology because of their jobs. Eighteen- to 19-year-olds don't generally have this." One commuter affirmed, "By having a computer with Internet access at home, I am not tied to the university computers, so I can do my class work at home at my convenience instead of having to drive to campus to physically hand in an assignment before a deadline. I believe that the need for 'brick and mortar' schools is in decline."

While this year's finding that younger respondents prefer less IT in courses than do older respondents is consistent with previous years, the difference is not as great. At this point, we can only speculate why. Are freshmen, using a greater variety of technology in their high school classes, now coming to college better prepared and more confident with technologies needed for their courses? Or are their first college experiences with a CMS and other course technologies more positive? Results reported in the earlier ECAR 2004 study lends strength to these ideas, finding that students who reported previous positive experience with technology in the classroom (such as high school or first-year college classes) preferred more technology in courses.[3] Future studies can help determine if this is a trend.

The ECAR 2006 study reported that three factors—technology adoption, preference for technology in courses, and self-assessment of technology skills—were highly correlated. It

makes sense that those students who most eagerly embrace new technologies would be more inclined to like technology in their academic work. Figure 5-2 shows the strength of this finding for 2007. Notice that while most innovators prefer extensive or exclusive IT and most laggards prefer limited or no IT, most of the remainder—early, mainstream, and late technology adopters—prefer moderate IT in courses.

Respondents who prefer more IT in courses report stronger technical skills overall (see Table 5-1). As might be expected, computer maintenance shows the largest skill gap (mean difference of 1.17) between those who like extensive or exclusive technology in courses and those who like limited or no IT in courses. More important is the relatively large skill gaps for spreadsheets, presentation software, and CMS skills. These core skills are becoming basic technology literacy requirements for many undergraduates, no matter how much technology a student prefers in courses. These findings highlight the challenge colleges and universities face in providing instructional technology that meets the needs of students with widely varying levels of technology interest and skills.

The desire for moderate IT in courses was evident in student comments from both survey open-ended comments and student focus groups. One student captured the essence of

Figure 5-2. Preference for IT in Courses, by Technology Adoption

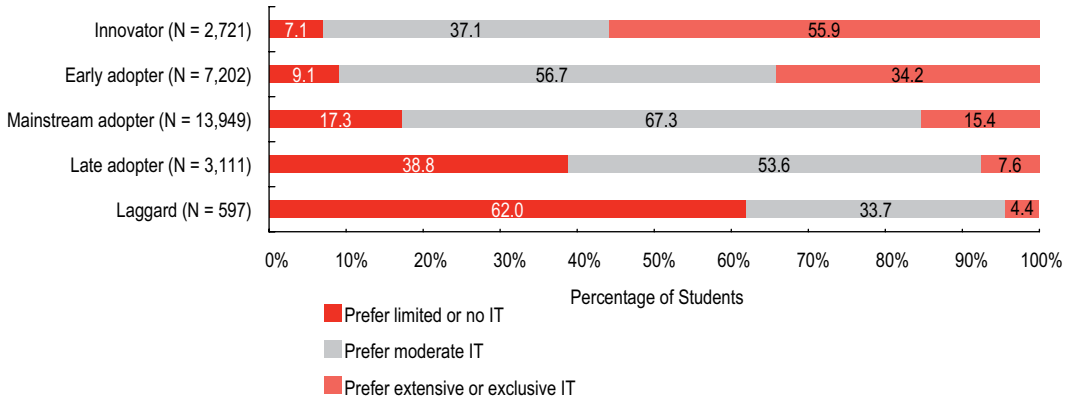


Table 5-1. Preference for IT in Courses, by Skill Level

Technology	N	Prefer Limited or No IT Mean Skill*	Prefer Moderate IT Mean Skill*	Prefer Extensive or Exclusive IT Mean Skill*	Difference in Means**
Computer maintenance	26,863	2.74	3.20	3.91	1.17
Spreadsheets (Excel, etc.)	24,113	3.02	3.43	3.87	0.85
Presentation software (PowerPoint, etc.)	25,270	3.46	3.82	4.14	0.68
Course management system	22,635	3.43	3.74	4.06	0.64
Graphics software (Photoshop, Flash, etc.)	18,880	2.67	2.84	3.22	0.55
Video/audio software (Director, iMovie, etc.)	8,529	2.65	2.72	3.06	0.41
Online library resources	25,707	3.27	3.47	3.64	0.37

**Scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent*

***Difference in means is the difference between the mean skill for "prefer limited or no IT" and the mean skill for "prefer extensive or exclusive IT."*

Note: Means and standard deviation calculations include only the students who use the technology.

these comments, saying, "I am a big fan of Internet technology, but surprisingly did not like the few online-only courses I took. On the other hand, I found Web-based resources that were included as part of 'normal' face-to-face classes to be very useful. This really is the best of both worlds."

Technologies Used the Quarter/Semester of the Survey

Respondents told us what technologies they were actively using as part of their coursework at the time of the ECAR survey (March/April 2007). Table 5-2 shows a set of core technologies used by most respondents: e-mail, course management systems, course Web sites, and software to create spreadsheets and presentations. With the exception of e-mail, seniors and freshmen do not report equal use of these core technologies. More seniors report using presentation software and spreadsheets in courses this quarter/semester, while more freshmen report using course Web sites. Community college respondents show generally less use for all of these technologies.

This usage profile aligns well with the differences between lower- and upper-division courses. Lower-division classes, often large lectures, are adequately served by course Web sites and basic CMS functions such as online quizzes, syllabi, and electronic gradebooks. Upper-division courses, smaller and focused on student major, call for more use of application software.

E-mail is by far the most widely adopted technology in courses, used by almost all respondents in the quarter/semester of the survey. Not surprisingly, student comments

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

	Senior (N = 13,038)	Freshman (N = 10,169)	Community College Students (N = 1,816)
Almost All Students Use This Quarter/Semester			
E-mail	96.9%	96.0%	89.4%
Most Students Use This Quarter/Semester			
Course management system	77.4%	78.3%	60.4%
Presentation software (e.g., PowerPoint)	77.1%	63.1%	50.4%
Course Web site	57.2%	65.7%	52.7%
Spreadsheets (e.g., Excel)	56.0%	43.9%	33.3%
Few Students Use This Quarter/Semester			
Discipline-specific IT (e.g., Matlab, Stella)	19.4%	18.2%	10.5%
Social networking software (Facebook, etc.)	16.9%	27.0%	19.0%
Graphics software (Photoshop, Flash, etc.)	13.2%	10.5%	9.9%
Instant messaging	11.4%	17.3%	13.9%
Programming languages (C++, Java, etc.)	10.9%	11.9%	7.2%
E-portfolios	9.0%	4.8%	4.4%
Blogs	7.9%	9.9%	8.3%
Video/audio software (Director, iMovie, etc.)	6.8%	6.3%	5.2%
Podcast	4.5%	6.0%	3.4%
Webcast	4.2%	4.4%	4.0%

are overwhelmingly positive about e-mail for courses. One typical response was, "The use of e-mail helps keep me in touch with professors and students, and keeps me informed about what is happening within the university." Another student commented, "Most of my teachers are available by e-mail, and this helps me with everything from not misunderstanding material to getting help with a paper. I think it would be cool if teachers had open chats at certain times to discuss subjects deeper with students also."

Most respondents were using presentation software themselves in courses during the quarter/semester of the survey (69.3 percent). However, their comments were not generally about their own use but about instructors' PowerPoint use. The primary discussion centered on what is effective versus ineffective use of PowerPoint by faculty in the lecture context. On the positive side, one student said, "Access to PowerPoint slides online is the major advantage of IT in courses. All of my professors post them online. So, if you miss a class, you can see what was missed." On the negative side, one representative student commented, "Teachers attempt to fit too many topics into each presentation and fail to explain things clearly. They should be adding to the PowerPoint presentation and enriching the lesson with additional information." One student summed up, "Professors who *know* how to use PowerPoint effectively are awesome; those who use it as a place to stuff 15 lines of vague notes are not. Professors need to be trained on when to use and *not* use PowerPoint."

Few respondents (5.0 percent) are using podcasts in their courses during the current quarter/semester, most likely because they are not widely available. Yet the student comments we received were chiefly positive, describing podcasts as an extremely helpful supplemental tool. One typical response was, "Podcasts are a very useful way to keep students updated on class. Everyone walks around campus with iPods, so listening to class lectures on your way to a test, after you have missed a class, or just to reinforce information covered would be very beneficial. Moreover, some people learn better by listening. So it would be easy and beneficial for both students and teachers to post lecture podcasts." Another undergraduate commented, "Harvard, Yale, and Berkeley all have podcasts for their classes available, and I listen to them at work!" Expressing the minority opinion, a senior said, "One of my four professors is doing podcasts. But, it's not as useful as going to class. I need to go and listen in person."

Some application software appears to be used in response to student major requirements. Engineering students are avid spreadsheet users and report more use of course Web sites in courses the quarter/semester of the survey. Engineering courses also provide students extensive experience with software specific to the engineering discipline. More than two-thirds (68.2 percent) of engineering students reported using some discipline-specific IT in courses the current quarter/semester, compared with 30.4 percent of physical science students and 12.0 percent of the combined remaining majors. Engineers are also proportionally the most active programmers, with more than one-third (36.6 percent) using a programming language for coursework during the quarter/semester of the survey. Of respondents in other majors, only 8.4 percent did so.

As expected, business majors make more use of fundamental business tools. They used presentation software more often than others (77.6 percent versus 67.3 percent) and spreadsheets more often than others (67.7 percent versus 44.9 percent) during the quarter/semester of the survey.

Fine arts students use graphics and video/audio software the most. More than a quarter of these students used graphics software (27.0 percent) in their courses the quarter/

semester surveyed, compared with only 10.4 percent for other majors. Video/audio software, although minimally used overall, was still used more (14.0 percent) by fine arts students than others (5.8 percent).

E-portfolios are a mainstay in many education departments, often used as a part of the student program to fulfill teacher education requirements. It is often a vehicle for teacher applicants to provide school district administrators with tangible evidence of the skills and understanding the applicant can bring to the classroom. It's not surprising that education student respondents reported much more use of e-portfolios (32.2 percent of seniors and 6.5 percent of freshmen) in their courses the quarter/semester of the survey than other students (4.9 percent).

While 27.8 percent of respondents said that they have done blogging (refer to Table 4-5), only 8.6 percent of respondents said they were using blogs in their courses the quarter/semester of the survey. We asked about this course-related use in our focus groups. One sophomore majoring in psychology explained what worked well: "I have a class where we look at current events from different perspectives. We'll do an Internet blog on the topic. For it to work effectively, you must have an opinion! It seems that broad topics work best." Another student supplied information in the open-ended survey question: "Setting up a blog for a specific class proved effective. Cheers to Web 2.0."

Although the survey did not collect data on the use of interactive response systems (clickers), students volunteered opinions about their benefits and problems. There were a few positive comments, such as "It keeps me engaged during lecture and lets me know if I really understand the material." Many comments were negative, however, with respondents using phrases such as "a waste of time," "ineffective and expensive," and "disruptive." Students also point to instructor overuse of clickers as problematic, with comments such as "One of my professors employs clickers poorly because he merely asks questions for us to answer but does not really *teach*."

Earlier, ECAR reported (Table 4-5) that most respondents use IM (84.1 percent) for recreation, work, or school. Far fewer respondents reported using IM in their courses in the quarter/semester of the survey (13.8 percent). The same pattern holds for online social networking, with 81.6 percent using it for recreation, work, or school and only 20.6 percent having used it the current quarter/semester in their courses. This data is consistent with what students tell us in qualitative interviews—that they think of these as tools to use with friends and they prefer that IM and online social networking remain within the scope of their private lives.[4] While a few survey comments mentioned that IM capabilities to chat with faculty or IT support staff would be helpful, these comments were outnumbered by those of students who strongly felt that the use of IM by the institution was not a good idea. One typical comment was, "I think that pressuring students to communicate through text/instant messaging is an invasion of personal space and preferences." Another student said, "I would hate it if a teacher made me use IM in a class because no one pays serious learning attention to instant messages." However, it is noteworthy that freshmen are more likely than seniors to use IM and social networking in courses; it may be that entering students are less adamant about keeping the boundary between school and personal life for these technologies. Future studies can help determine if this is a trend.

How Students Like to Learn with Technology

While ECAR focuses on technology use of college-level students, other organizations such as the Pew Internet & American Life Project study teens who will soon be entering

college, tracking teen use of existing and emerging technologies such as blogs, wikis, gaming Web sites, IM, text messaging, and so forth.[5] These studies concur that young students are great fans of such technologies in their personal lives. But do teens and undergraduates see these same technologies as learning tools for use in their courses? In the context of this discussion, Edward Dieterle, a doctoral student at Harvard Graduate School of Education, designed four questions for ECAR (see Figure 5-3).

It is not surprising that most respondents now like to learn by doing Internet searches (72.0 percent). In the open-ended question, students often mentioned the Internet, commenting on its convenience in finding information and linking that with improved learning. For example, one student gave the following example: "An excellent use of technology was Google Earth in my genetics course. We were studying the avian flu and using Google Earth to see all the outbreaks of the flu on a 3D map of the earth. It showed us how the outbreaks spread over time. I found this a very valuable addition to the lecture."

Of greater interest, though, is that about one-third of respondents like to learn through either text-based conversations (35.1 percent) or contributing to Web sites (32.6 percent). In our open-ended survey question, a number of students commented on use of wikis in courses. One student told us, "A class I took revolved around writing a wiki as an open textbook. Chapters were written and edited by groups. This was a great experience because everyone got involved with the material and we created a useful and permanent resource."

Further, the majority of respondents (53.3 percent) indicate that they like to learn through programs they can control, such as video games and simulations. Educators are currently pursuing the deployment and use of digital game-based learning (DGBL) to meet this demand. Richard Van Eck, assistant professor at the University of North Dakota, notes, "Educators have adopted three approaches for integrating games in the learning process: have students build games from scratch, have educators and/or developers build educational games from scratch to teach students, and integrate off-the-shelf games into the classroom."[6] Regardless of the games' development methods, more and more educators are considering what role DGBL will play in future educational offerings. Games that are based on learning theory and research can provide students with an immersive environment, allowing them to inhabit new roles and think, act, and talk in new ways.[7]

One in 10 respondents (10.5 percent) does not like to learn using any of these four

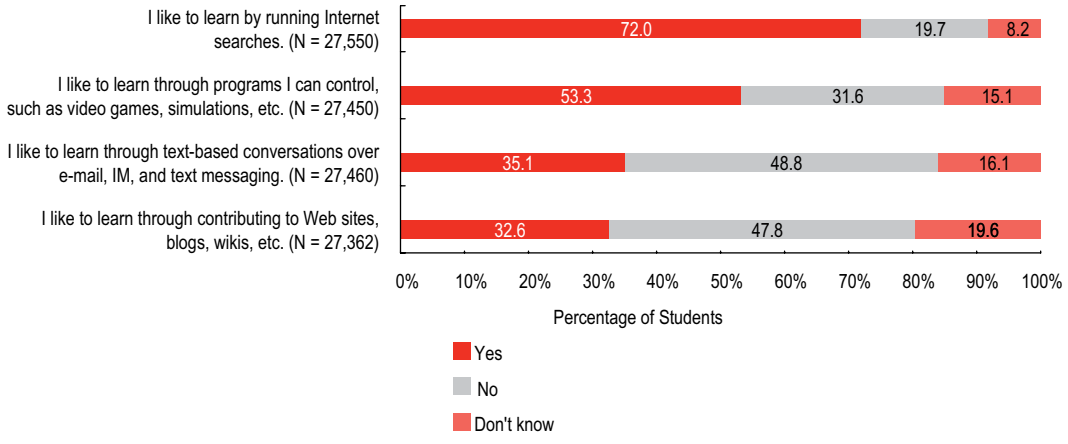


Figure 5-3. How Students Like to Learn with Technology

technology groups. At the other extreme, another 1 in 10 respondents (11.5 percent) indicates a preference for learning using all four technology groups.

Further, with the exception of learning through Internet searches, a large proportion of respondents (15 to 20 percent) do not know whether they like to learn using these technology groups. It may be that this group is not experienced enough with these modalities in a learning context, or that they are not fully aware of their individual learning preferences. In fact, younger respondents report a higher proportion of "don't know" answers than older respondents.

The data suggest that respondent behaviors are consistent with their responses about how they like to learn. Respondents who say they like to learn through a technology are, indeed, likely to use technology in both their personal and academic lives:

- Respondents who like to learn through text-based conversations (such as IM, text messaging, and e-mail) report more use of IM in their courses the quarter/semester of the survey.
- Respondents who like to learn through programs they can control report more use of discipline-specific software (such as MatLab and STELLA) in their courses the quarter/semester of the survey and play computer games more.
- Respondents who like to learn by contributing to Web sites, wikis, blogs, and so forth report more use of blogs in their courses the quarter/semester of the survey and more use of blogs and wikis in general.

Responding students who identify themselves as early technology adopters generally like to learn using these technology groups (see Figure 5-4). This pattern is especially striking for the newer technologies in the list—contributing to Web sites and using simulations and video games. Fully two-thirds (67.7 percent) of innovators and early technology adopters like to learn through programs they can control (such as DGBL environments). It follows that the very large number of mainstream technology adopters will be close behind. This suggests that additional exploration and adoption of gaming in coursework is appropriate for educators and technologists.

Bringing Laptops to Class

Although respondents are clearly choosing mobile laptops over desktops, they are not in the habit of bringing them to class. Of the 73.7 percent of responding students who own

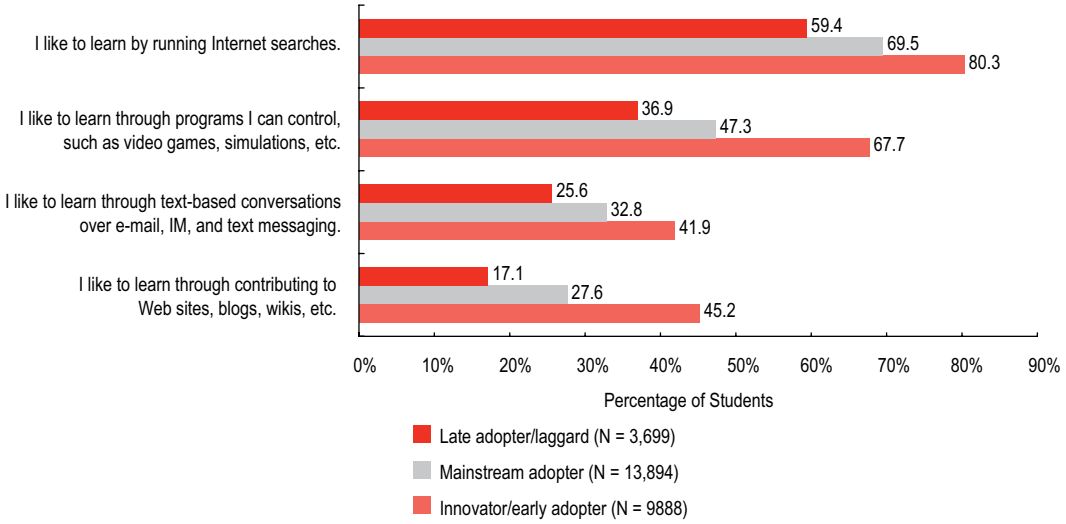


Figure 5-4. How Students Like to Learn with Technologies, by Technology Adoption

laptops, more than half (52.4 percent) never bring them to class. We find that just one-fourth (25.0 percent) generally bring them to class on at least a weekly basis (see Figure 5-5). When a University of Wisconsin–Madison survey asked "why not?" it uncovered two primary reasons: laptops are too heavy, and they are not needed.[8] One student commented, "I find laptop use in the class is unnecessary and distracting during lectures. I notice that most students that use laptops in the classroom spend their time instant messaging or playing online games."

About one-third (34.5 percent) of males who own laptops bring them to class weekly or more often, compared with 19.1 percent females. Engineering majors, regardless of gender, bring laptops to class more frequently. Doctoral institution respondents (29.6 percent) and associate's respondents (26.4 percent) are also more likely to do so than master's (18.9 percent) or bachelor's respondents (14.2 percent).

However, technology adoption is the key factor. More than half of respondents who own and bring a laptop to class at least weekly identify themselves as technology innovators or early adopters (58.2 percent); only a scant 5.4 percent of late adopters or laggards do so. Internet access method also makes a difference. It's logical that more wireless users (33.6 percent) bring their laptops to class at least weekly than others (21.8 percent). Of note is recent research at Carnegie Mellon to understand how students use their laptop computers. Researchers found that while laptops give users more flexibility in choosing where and when to study, there was no evidence that laptops improved students' work.[9]

Course Management Systems

The current year's ECAR data indicates that overall CMS use is gaining ground. Data collected directly from students, rather than from institutional leadership, indicates that both the number of respondents exposed to a CMS and the frequency with which they use a CMS have increased. Other current research corroborates this finding.

The EDUCAUSE 2007 Current Issues Survey Report recently published findings from its annual survey asking campus IT leaders to rate the most critical IT challenges facing them and their institutions. For the first time ever, course/learning management systems moved into their top-10 ranking for both "issues of strategic importance" (ranking ninth) and "potential to become more significant in the future" (ranking seventh).[10] In addition, course/learning management systems moved up in ranking for "consumption of human and/or financial resources," from eighth in

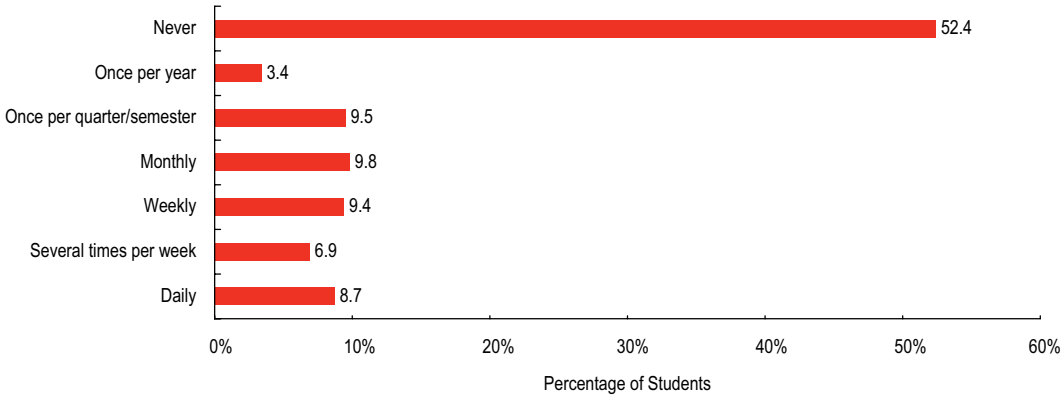


Figure 5-5. How Often Students Bring a Laptop to Class (N = 20,357)*

**Students who do not own a laptop are excluded.*

2006 to fifth in 2007. The report points to course management systems' accelerating role as a mission-critical application for teaching and learning.

Other survey research reports mild but consistent evidence of increased CMS diffusion. The 2006 EDUCAUSE Core Data Service reported an increase in faculty CMS use. While the 2005 Core Data Service found that 22.5 percent of institutions reported that faculty used a CMS in all or nearly all of the institutions' courses, that number increased to 25.6 percent in 2006.[11] In addition, the Campus Computing 2006 report finds that the percentage of courses using a course/learning management system has been steadily rising since 2000 and is now at 46.8 percent. There was an increase of about 5 percent from 2005 to 2006—a finding consistent across all higher education sectors measured. The report further states that the number of institutions having a strategic plan for course/learning management systems deployment is up from 52.4 percent in 2005 to 56.5 percent in 2006.[12]

Increasing CMS Use

Fully 82 percent of respondents have used a CMS at some time. These include vendor products such as ANGEL, WebCT, Blackboard, Desire2Learn, OnCourse, and FirstClass; open source software such as Sakai and Moodle; and homegrown systems tailored to a specific institution. Figure 5-6 shows results by class standing. Of senior respondents—who have completed most of their courses—86.8 percent have used a CMS. Freshmen, even though they have attended far fewer courses, are close behind, with 78.3 percent having used a CMS. Fewer community college students have used a CMS—consistent with last year's finding. However, since this year's data includes only four community colleges, these results should be viewed with caution.

Because course management systems are becoming so widely used and are usually

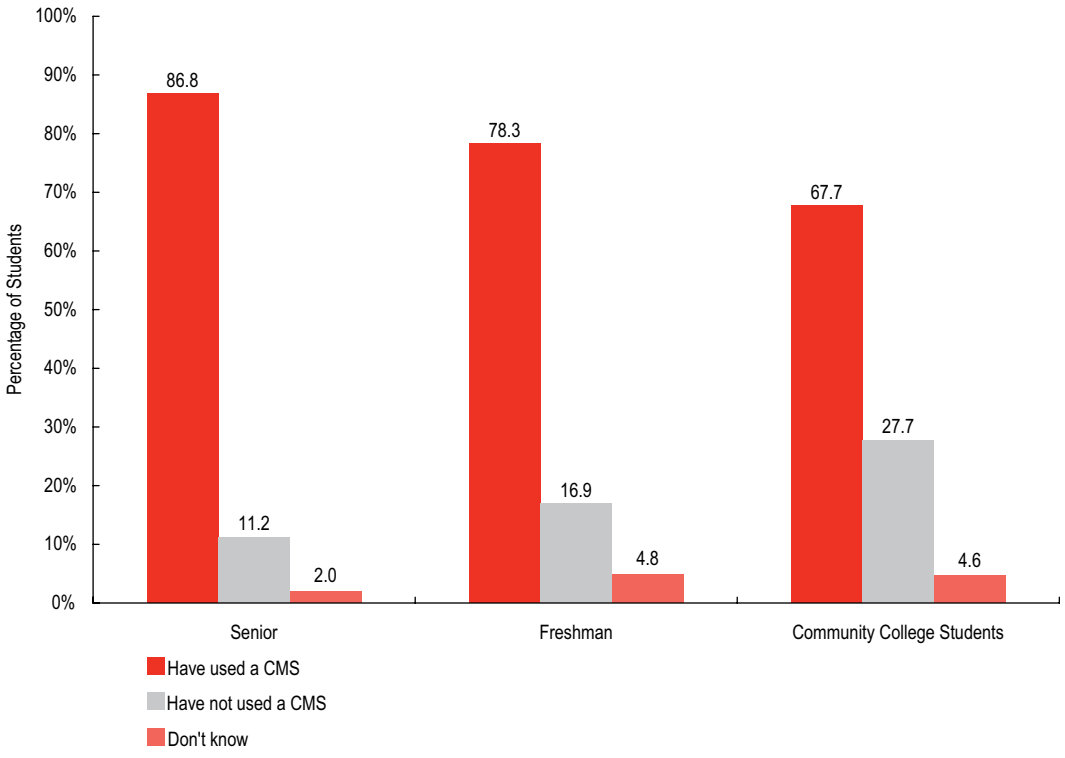


Figure 5-6. Students Who Have Used a CMS, by Class Standing (N = 25,070)

deployed as institution-wide applications, it is not surprising that no meaningful usage differences surfaced on the basis of gender, student major, place of student residence, or full-time versus part-time enrollment status.

Both the 2005 and 2006 ECAR studies reported that about 72 percent of all respondents had taken a class using a CMS. The 2007 data show a significant jump to 82.0 percent for the whole respondent population. Table 5-3 shows the changes in the percentage of respondents who have used a CMS from just the 40 institutions providing longitudinal data. While increased CMS exposure is seen for all respondents from four-year institutions, freshmen show a slightly greater increase from 2005 to 2007.

We now look at respondent exposure to a CMS at the 103 individual institutions participating in the 2007 study (see Figure 5-7). At the institution with the lowest CMS penetration, only 27.0 percent of its responding

Table 5-3. Change in Percentage of Students Who Have Used a CMS, from 2005 to 2007 (40 Institutions)*

	Report in 2005 (N = 13,620)	Report in 2006 (N = 12,387)	Report in 2007 (N = 10,221)	Absolute Change**	Relative Change**
Seniors	74.5%	77.1%	86.5%	12.0%	16.1%
Freshmen	63.5%	66.6%	78.2%	14.7%	23.1%
All students	69.7%	72.5%	82.9%	13.2%	18.9%

**Data are based on student responses from the 40 institutions that participated in each of the 2005, 2006, and 2007 studies. While institutions remain the same, the actual students responding are different each year.*

***Absolute change is the difference between the 2005 and 2007 percents. Relative change is the absolute change as a percentage of the 2005 percent.*

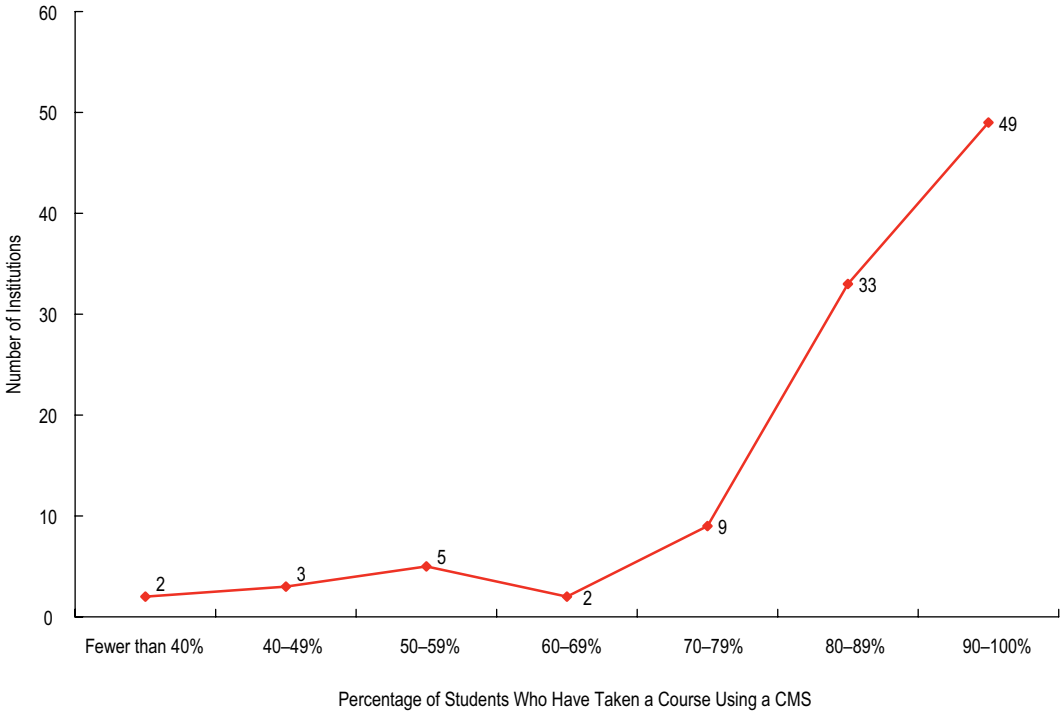


Figure 5-7. Profile of Institutional Use of Course Management Systems (N = 103)

students had used a CMS. At the institution with the highest CMS penetration, 97.1 percent of its responding students had used a CMS. In fact, almost half of the participating institutions (49 out of 103) reported that 90 percent or more of their respondents said they were exposed to a CMS. Respondent CMS exposure was below 70 percent at only 12 institutions.

There is reason to believe that institutions are still in flux implementing course management systems. About 8 percent of the institutional respondents to the 2007 IMS GLC Learning Technology Satisfaction and Trends survey indicated they plan to switch to a new CMS provider in the next 12 months, and another 8 percent say they will probably switch. In addition, more than 9 percent noted that they will implement a new CMS this year.[13]

In 2007, not only do more respondents say they have used a CMS, but they also say they use it somewhat more frequently (see Table 5-4). For the 65 institutions participating in each of the past two years, data for 2006 show that 39.6 percent of respondents from these 65 institutions reported using a CMS at least several times a week; in 2007, 46.1 percent did so.

Experience with Course Management Systems

While more respondents have used a CMS, they have not altered their opinions about their CMS experience (see Figure 5-8). Respondents still say that their overall CMS experience is positive (76.5 percent), and about one in six respondents goes so far as to say "very positive." Less than 1 in 20 respondents (4.6 percent) report a negative experience. This distribution of responses is remarkably similar to last year's. Further, whether respondents are male or female, live on or off campus, are part-time or full-time, are seniors or freshmen, are young or old, or are fine arts or engineering majors, they are consistent in their overall ratings of whether they experience course management systems as positive or negative.

Respondents are actively engaged in and expressive about their campus course management systems. The survey open-ended responses had hundreds of comments about course management systems—both positive and negative. Positive comments typically relate to the value of a CMS in helping students organize their course activities and in facilitating the exchange of information between

Table 5-4. Change in How Often Students Use a CMS, from 2006 to 2007 (65 Institutions)*

	Report in 2006 (N = 20,844)	Report in 2007 (N = 19,598)	Absolute Change**	Relative Change**
Never	23.4%	18.4%	-5.0%	-21.4%
Monthly or less	15.5%	13.3%	-2.2%	-14.2%
Weekly	21.6%	22.1%	0.5%	2.3%
Several times per week	21.7%	24.3%	2.6%	12.0%
Daily	17.9%	21.8%	3.9%	21.8%

**Data are based on student responses from the 65 institutions that participated in both the 2006 and 2007 studies. While institutions remain the same, the actual students responding are different each year.*

***Absolute change is the difference between the 2006 and 2007 percents. Relative change is the absolute change as a percentage of the 2006 percent.*

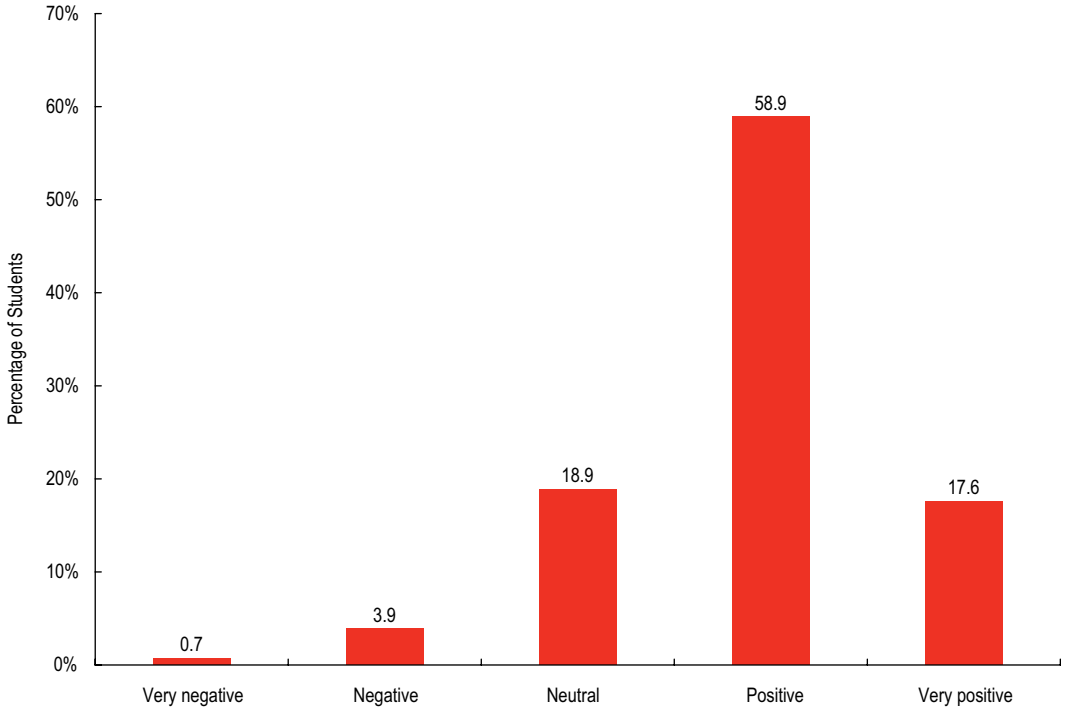


Figure 5-8. Positive/Negative Experience Using a CMS (N = 22,509)

faculty and students. One student commented, "I have been more successful in classes that use a course management system. I love being able to access all the class materials anytime I want or need to. I am lost in the classes that do not offer it, though most do."

Negative comments typically relate to difficulty in use, technical problems, or instructors' poor or inconsistent CMS use. Students complain about limited access: "It is extremely hard to access during busy times, and I have had to wake up in the middle of the night just to take a quiz before it expired." They also mentioned difficulty with downloading and uploading files and taking online tests. Some specific course management systems received more positive (or negative) comments than other systems, suggesting that from a student perspective course management systems and their implementations vary.

Consistent with last year's data, respondents reporting positive CMS experience show a stronger technical profile. They prefer more IT in their courses, are more often early technology adopters, and, especially, use a CMS frequently and are confident about their CMS skills. Table 5-5 presents the relationship between CMS usage, skill, and experience.

What CMS features have respondents used most? Figure 5-9 shows that almost all respondents (more than 95 percent) have accessed class syllabi, and readings and other text-based course materials—the CMS feature most commonly used by instructors. Also popular is keeping track of grades. Least used, although still used by about 70 percent of respondents, is getting assignments back from instructors and sharing of materials among students. This makes sense, since students have e-mail and other electronic ways available for sharing materials.

Exactly one-half of respondents who have used a CMS report that they have used all nine of the CMS features in the ECAR list, and three-quarters (76.0 percent) have used seven or more of these features. This finding corroborates our 2005 and 2006 data, with the exception that this year somewhat more students report having used online access to sample exams and quizzes.

Table 5-5. Positive/Negative Experience Using a CMS, by Skill and Frequency of Use

	N	Mean*	Std. Deviation
Skill Level			
Excellent	5,963	4.17	0.727
Very good	6,891	3.94	0.682
Good	5,648	3.73	0.717
Fair	1,613	3.54	0.779
Poor	294	3.49	0.881
Frequency of Use			
Daily	6,004	4.13	0.711
Several times per week	6,314	3.95	0.712
Weekly	5,490	3.79	0.721
Monthly	1,706	3.61	0.768
Once per quarter/semester	854	3.55	0.819
Once per year	260	3.56	0.848

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

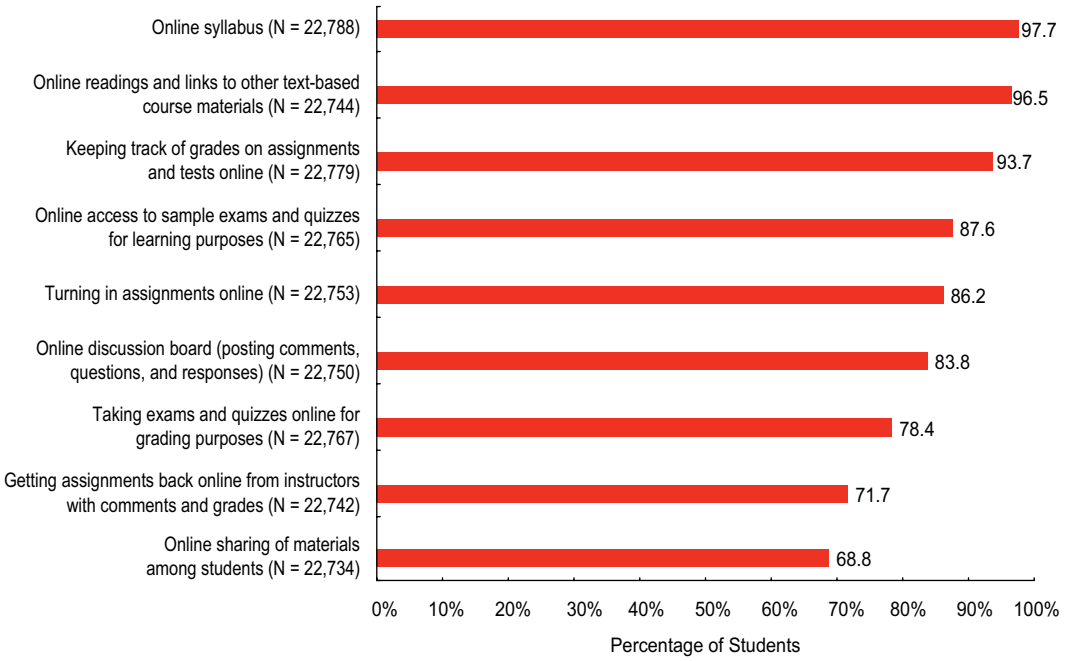


Figure 5-9. CMS Features Used by Students

Table 5-6 goes one step further, presenting respondent opinions about the usefulness of CMS features. Respondents rate all CMS features as "useful" or better. Those rated highest, with a mean usefulness above "very useful," are directly related to monitoring and improving grade performance—keeping track of grades and getting access to sample exams and quizzes. Student comments about posting grades to the CMS were positive, and one student told us it was top priority: "The CMS is only effective if the teachers use it and post grades to it so you know how you are doing throughout the semester." Student comments

Table 5-6. Usefulness of CMS Features

Feature	N	Mean*	Std. Deviation
Keeping track of grades on assignments and tests online	21,341	4.38	0.925
Online access to sample exams and quizzes for learning purposes	19,924	4.17	0.965
Online syllabus	22,254	3.98	1.034
Turning in assignments online	19,622	3.82	1.174
Online readings and links to other text-based course materials	21,949	3.81	1.056
Taking exams and quizzes online for grading purposes	17,848	3.66	1.250
Getting assignments back online from instructors with comments and grades	16,314	3.74	1.252
Online sharing of materials among students	15,643	3.50	1.221
Online discussion board (posting comments, questions, and answers)	19,075	3.13	1.291

**Scale: 1 = not useful, 2 = somewhat useful, 3 = useful, 4 = very useful, 5 = extremely useful*

Note: Students who do not use a CMS feature are excluded.

were also largely positive about the availability of syllabi and readings online.

Those CMS features rated lowest relate to student interaction—discussion boards and sharing materials among students. Again, respondent comments are consistent with the data. While they were universally positive about online grades, comments about discussion boards were more mixed, and more often negative. Students experienced them as more time-consuming and less interesting than live discussions. One psychology student admitted, "Online discussions for me personally don't work well. I don't like it because you don't have the personal interaction. It's hard to read between the lines. You can't observe how others really feel about something." A few students, however, felt it was a benefit for shy students. One noted, "For students who don't like to or don't feel comfortable speaking up in class but still want to contribute and have opinions, online discussion boards for classes are really useful."

Respondents often commented about how the CMS directly affects their grades—taking exams and turning in assignments. A typical positive comment was, "I think that being able to submit assignments online is convenient and fast. It saves paper, too. Students are forced to save their work before an upload, which reduces the chance of a teacher losing an assignment. Moreover, the number of lost assignments decreases because everything is online." However, several students complained about CMS operational problems affecting their grades. One student told us, "Because computers are so prone to malfunction, things can easily get messed up. I have already failed three quizzes, and all, yes *all*, of my English assignments got turned in late. I did speak to my teacher, and all of my assignments are now counted as on time—but the CMS marked them as late."

Faculty Use of IT in Courses

Respondents were asked whether they agreed or disagreed with the statement "Overall, instructors use IT well in my courses." Figure 5-10 shows that instructors get generally good marks: half of respondents (51.5 percent) agree, and a few (6.7 percent) even strongly agree. Of note, however, more than 1 in 10 respondents (13.6 percent) disagree. What is remarkable about this finding is its stability. No mean-

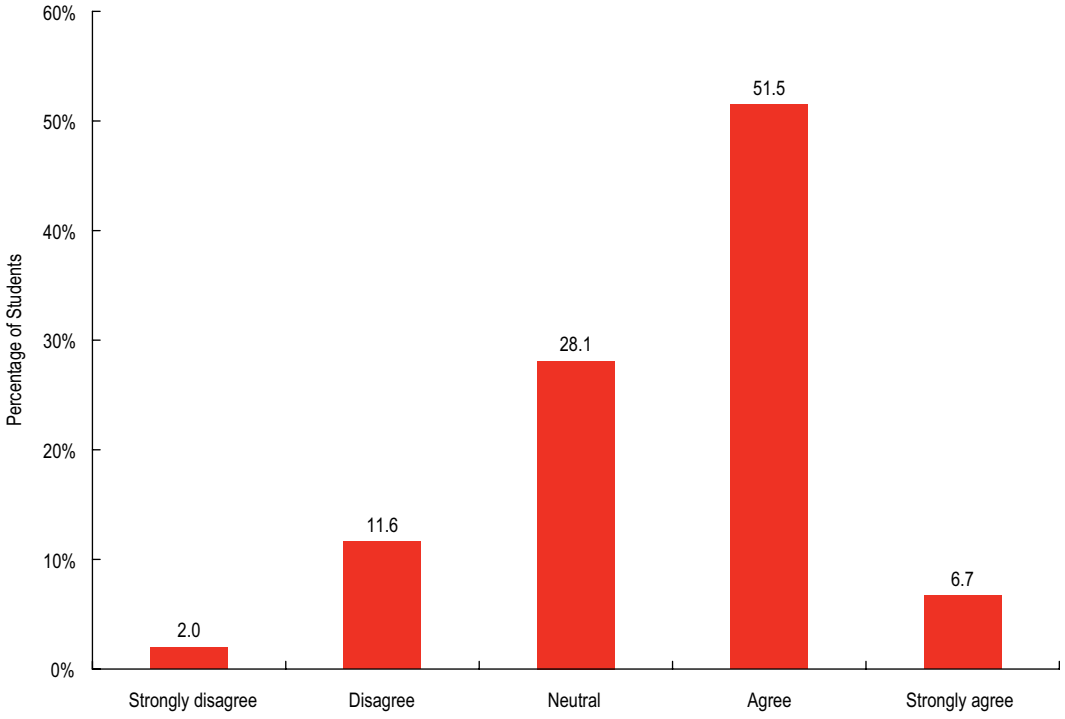


Figure 5-10. Instructors Use IT Well in My Courses (N = 27,719)

ingful differences in ratings were found among respondents on the basis of

- demographic factors of gender, class standing, major, age, grade point average, or part-time versus full-time status;
- institutional factors of Carnegie classification, institution size, or public versus private status;
- the past three years' ECAR studies (2005, 2006, and 2007) that asked this question;
- student technology adoption practice (early, mainstream, or late adopters);
- student opinion about whether their institution needs to give them more training; or
- technologies students used in their courses this quarter or semester, whether more common software (such as spreadsheets or presentation software) or more sophisticated software (such as programming languages, video/audio software, or graphics software).

What *does* make a difference? By far the strongest indicator as to how respondents rate their instructors' use of IT is how positively or negatively students rate their own overall CMS experience. It is likely that when students think about faculty use of IT, first and foremost they think about course management systems. In fact, respondents who are positive about their CMS experience rate faculty use of IT much higher than do respondents who are negative about their CMS experience (see Table 5-7). This strong association between course management systems and instructor use of IT is an important finding for institutional leaders, suggesting that the enormous amount of work done by campus IT units and their vendors to implement high-quality, easy-to-use course management systems for faculty and students may well be worth the effort.

Looking deeper into the student CMS experience, we find that two of the CMS features listed in Figure 5-9 are more strongly associated with positive ratings for faculty

Table 5-7. Instructors Use IT Well in My Courses, by Positive/Negative Experience Using a CMS

Experience Using CMS	N	Mean*	Std. Deviation
Very negative	149	2.64	1.203
Negative	878	2.99	1.044
Neutral	4,245	3.25	0.850
Positive	13,205	3.55	0.788
Very positive	3,950	3.78	0.860

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

use of IT than others. These are online access to sample exams and quizzes, and online readings and links to other course materials. For example, 63.3 percent of respondents reporting that online access to sample exams is "very" or "extremely" useful also agree that their instructors use IT well in courses. In contrast, only 12.3 percent of respondents who find access to sample exams less than "very" useful do so. This suggests that students appreciate using these particular CMS features.

While respondents agree that their instructors use IT well in courses *overall*, respondent comments from the open-ended survey question describe student experiences at the extremes. Namely, students find some of their instructors to be inspiring, some mediocre, and some dismal when it comes to integrating technology into coursework. As one student described, "In some cases, the use of IT in my classes has been very helpful and has improved the overall efficacy of the course. Yet, recently I've taken a few classes where the instructors use no IT resources whatsoever. They hand out the syllabus on the first day of class, break out the chalk, and start teaching. These classes have been very informative. I believe that IT can be extremely useful in some situations, and a complete waste of time in others, depending on the subject matter."

And finally, ECAR finds that respondents who say their instructors use IT well are much more likely to report that technology has a positive impact on their academic experience—their degree of engagement in courses, how much they learn, and the convenience afforded by technology. Because faculty use of IT in courses is such an important issue, and because so many students commented on this, ECAR conducted a qualitative analysis of student comments about this from the survey. We discuss the results in Chapter 6.

Endnotes

1. The shape of the response curve in 2007 is a near-perfect bell, as it was in the 2004, 2005, and 2006 studies (see Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *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, *ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning* [Boulder, CO: EDUCAUSE Center for Applied Research, 2005]; and 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]). In 2006 and 2007 the percentage of students choosing "moderate use of technology" was higher, possibly because the answer options in the 2004 and 2005 question provided examples of what constituted limited, moderate, and extensive and exclusive information technology in courses.
2. Veronica A. Lotkowski, Steven B. Robbins, and Richard J. Noeth, *The Role of Academic and Non-Academic Factors in Improving College Retention* (ACT, 2004), http://www.act.org/path/policy/pdf/college_retention.pdf.
3. Robert B. Kvavik, Judith B. Caruso, and Glenda Morgan, *ECAR Study of Students and Information Technology,*

2004: Convenience, Connection, and Control (Boulder, CO: EDUCAUSE Center for Applied Research, 2004).

4. These percentages for using IM and social networking may be high, as students may be reporting personal use as well as use in their courses.
5. Amanda Lenhart and Mary Madden, *Teen Content Creators and Consumers* (Washington, DC: Pew Internet & American Life Project, 2005) and Amanda Lenhart, Mary Madden, and Paul Hitlin, *Teens and Technology: Youth Are Leading the Transition to a Fully Wired and Mobile Nation* (Washington, DC: Pew Internet & American Life Project, 2005).
6. Richard Van Eck, "Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless," *EDUCAUSE Review* 41, no. 2 (March/April 2006): 20, http://www.connect.educause.edu/library/abstract/DigitalGameBasedLear/40614.
7. Diana Oblinger, "Simulations, Games, and Learning," (Boulder, CO: EDUCAUSE, 2006), http://www.connect.educause.edu/library/abstract/SimulationsGamesandL/39338.
8. Judy Caruso, "2006 UW–Madison Student Computing Survey Report," (University of Wisconsin–Madison, 2006), http://www.doit.wisc.edu/about/research/2006/DoITStudentSurveyReport06.htm.
9. Brock Read, "Laptops Change How Students Work but Do Not Improve Their Performance, Study Finds," *Chronicle of Higher Education* (November 29, 2006), http://chronicle.com/daily/2006/11/2006112901t.htm.
10. John S. Camp and Peter B. DeBlois, and the EDUCAUSE Current Issues Committee, "Current Issues Survey Report, 2007," *EDUCAUSE Quarterly* 30, no. 2 (2007), http://educause.edu/apps/eq/eqm07/eqm0723.asp.
11. EDUCAUSE, "EDUCAUSE Core Data Service (2005 and 2006)," (Boulder, CO: EDUCAUSE, 2005, 2006), http://www.educause.edu/coredata/. Finding was generated directly from the Core Data.
12. Kenneth Green, *Campus Computing 2006: The 17th National Survey of Computing and Information Technology in American Higher Education* (Encino, CA: Campus Computing, 2006), 12.
13. IMS Global Learning Consortium, "IMS GLC Learning Technology Satisfaction and Trends, North American Higher Education" (IMS Global Learning Consortium, 2007), http://www.imsglobal.org/. This survey sample included a sample of 197 institutions and claimed that "a reasonable distribution of institution types are represented in the sample of respondents as compared to the higher education industry at large."

6

Student Perceptions About IT's Impact on the Academic Experience

IT is not a substitute for good teaching. Good teachers are good with or without IT and students learn a great deal from them. Poor teachers are poor with or without IT and students learn little from them.

—An undergraduate student

Key Findings

- Respondents generally agree with six ECAR outcome statements about the impact of information technology (IT) on their coursework. This finding holds across most demographic factors.
  - About 70 percent of respondents agree IT helps students do better research for courses and results in more prompt feedback from instructors.
  - About 60 percent of respondents agree IT helps students better control course activities and communicate with classmates.
  - Three-fifths (60.9 percent) of respondents agree that IT improves their learning in courses.
  - Two-fifths (40.4 percent) of respondents agree they are more engaged in courses requiring the use of IT; 20.8 percent disagree; and the rest are neutral.
- More than half of respondents (55.5 percent) choose "convenience" as IT's chief benefit to their coursework. Respondents who have used a course management system (CMS) choose "convenience" (58.3 percent) more often than those who have not used a CMS (42.7 percent).
- Females are more likely than males to choose "communication" as the chief benefit of IT in courses, as are education, fine arts, and humanities respondents.
- Males are more likely than females to choose "improved my learning" as the most important benefit of IT in courses. Associate's institution respondents and older respondents are also more likely to choose "improved my learning."
- Males are more engaged than females in courses that require IT. Business and engineering majors are also more engaged.
- Respondents who agree IT has a positive impact on their courses are more likely to report a positive experience with a CMS and find CMS features useful. They are also more likely to prefer more IT in courses, describe themselves as innovators or early adopters of technology, and agree their instructors, overall, use IT well in courses.

This chapter presents respondent perceptions about how IT impacts students' academic experiences—course activities, course engagement, and learning. ECAR asked students their opinions about six outcome questions grounded in the "student success" literature to learn what students think about the effect of IT on their courses. Analyzing the data, we found several factors to be strongly associated with positive IT impacts. These factors are students'

- positive experiences using course management systems,
- preference for more IT in courses,
- early adoption of technology, and
- perception that their instructors use IT well in their courses.

To give these quantitative findings more depth, ECAR did a qualitative analysis of respondent comments to the open-ended survey question. Hundreds of comments touched on the relationship between instructors, technology, and learning; these will be discussed in detail. Finally, this chapter discusses what respondents say about the most valuable benefit of IT in courses.

Student Success and IT

How does higher education's use of IT impact student success? This is a bottom-line concern for higher education leaders, policymakers, and technologists everywhere. Yet the relationship between IT and the student academic experience is exceedingly complicated. Understanding the broader topic of student success alone has been an ongoing challenge for decades, and adding a technology component to the equation means factoring in tricky issues such as technology literacy, emerging technologies, and ever-evolving student technology behaviors and preferences.

Recently, the National Postsecondary Education Cooperative (NPEC) sponsored a three-year initiative on student success. Peter Ewell and Jane Wellman, in their May 2007 summary report of the project's culminating symposium, stated that "student success," at its simplest, can be understood as getting students into and through college to a degree or certificate.[1] Beyond this, they point out that "student success" is a generic label for a topic with many dimensions, ranging from *student flow* across the entire educational pipeline, to *quality and content* of learning and skills achieved as a result of going to college, to positive *educational experiences* (such as student engagement or satisfaction). The NPEC work generated a significant body of literature on all these aspects of student success.

Despite the scope and complexity of assessing student success, ECAR thinks its survey of undergraduate IT use provides an excellent opportunity to learn more about this critical area—specifically about how students perceive the impact of IT on courses. To this end, the survey solicits student responses in selected areas related to student success:

- Student engagement in courses using technology. Using the definition from the National Survey of Student Engagement, we take engagement to mean student participation in course activities that are provided for their learning and personal development.[2] Over time, student engagement has been consistently and positively linked to student success.[3]
- Support for selected course activities known to be associated with learning. These include peer communication and collaboration, instructor feedback, student control over their learning experience, and the ability to conduct course-related research.[4]
- Learning. ECAR included an overall self-assessment by students, asking them to agree or disagree with the statement "The use of IT in my courses improved my learning."

ECAR ventures into this arena with caution and explicitly acknowledges important limitations to our data and process, including

- real limits to the application of survey research and self-reported outcomes about learning and engagement,
- an unmeasured nonrespondent bias to the ECAR Web-based survey coupled with a near certainty that Web-based surveys are likely to result in somewhat inflated responses,[5] and
- unresolved questions about the interplay between institutional action and student impact.

Perhaps the most common measure of student success is grade performance. ECAR asks students for a self-reported cumulative GPA and looks at how GPA is related to other survey data. From one perspective it would seem that higher IT literacy and engagement would be associated with higher grades; from another perspective, some aspects of IT, such as gaming and downloading music and video, can be a tempting distraction from academic studies and therefore associated with lower grades. To date, our data suggest that most factors that ECAR analyzes are not strongly associated with respondent GPA.

GPA is, however, mildly associated with only one nondemographic factor in the study—frequency of use of some technologies. Respondents who report that they play computer games, download music and video, do online social networking, or IM much more frequently (especially daily) than others are more likely to report a lower GPA. ECAR controlled for gender, age, class standing, major, and family income, which are factors understood to be associated with GPA. This finding mirrors previous years' study findings and suggests that beyond certain thresholds, student socializing and recreational activities may contribute to academic underperformance.

Overview of Student Perceptions About IT's Impact

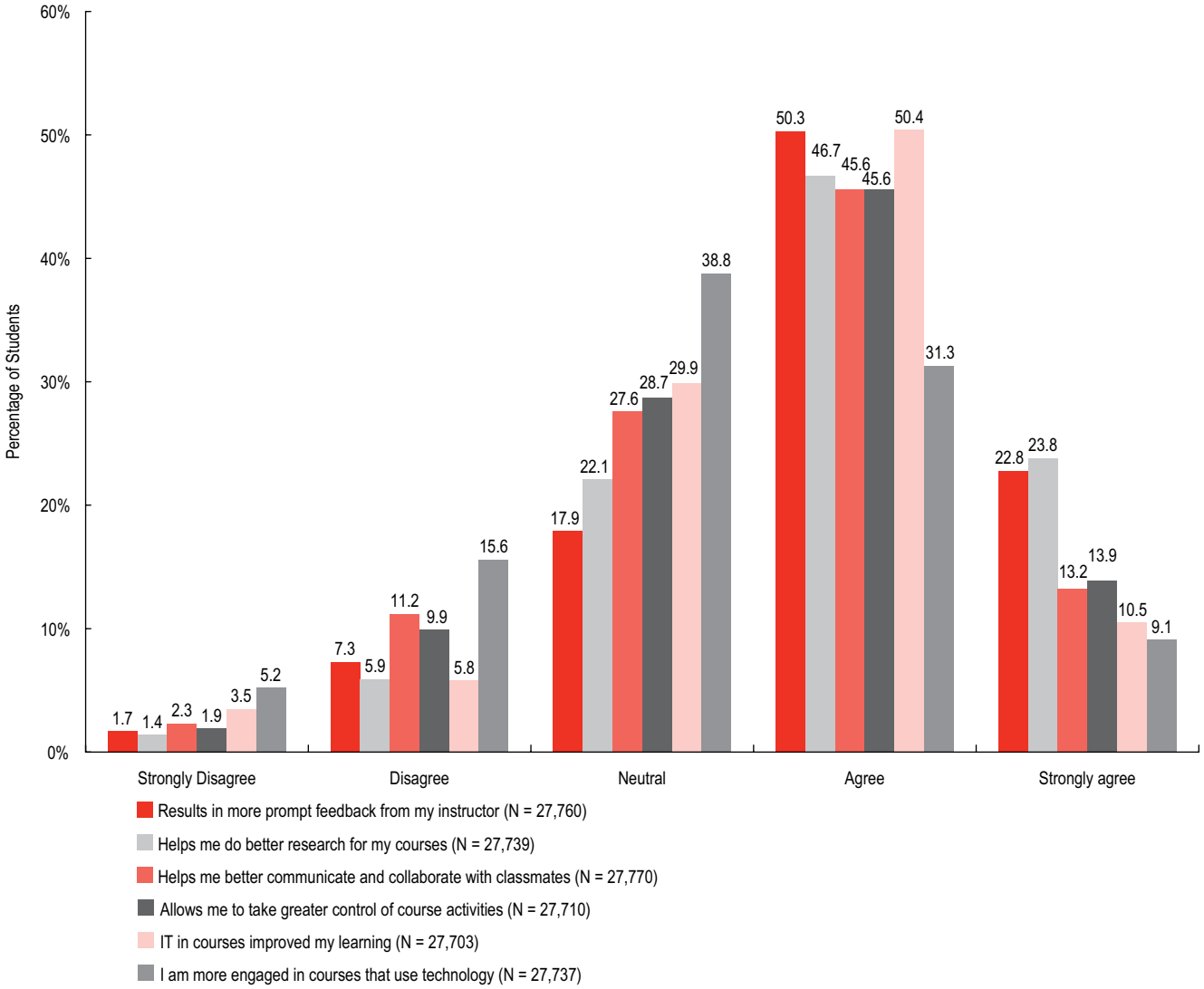
For each of the past three years, ECAR has asked respondents whether they agree or disagree with six outcome statements about technology's impact on student engagement, course activities, and learning. Table 6-1 and Figure 6-1 show that respondents for 2007 are generally positive, though not overwhelmingly so, as were respondents from the 2005 and 2006 ECAR studies.[6]

Table 6-1. Student Perceptions About IT in Courses

	N	Mean*	Std. Deviation
Support for Coursework			
Helps me do better research for my courses	27,749	3.86	0.897
Results in more prompt feedback from my instructor	27,760	3.85	0.910
Allows me to take greater control of my course activities	27,710	3.60	0.911
Helps me better communicate and collaborate with my classmates	27,770	3.56	0.935
Learning			
The use of IT in my courses has improved my learning	27,703	3.59	0.881
Student Engagement			
I am more engaged in courses that require me to use IT	27,737	3.23	0.993

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

Figure 6-1. Student Perceptions About IT in Courses



Most respondents perceive technology as an enabler of course activities—helping with peer communication, control of course activities, course research, and instructor feedback. Here, the number of agree responses outweighs the combined disagree and neutral responses. Respondents are most positive about technology's contribution to their course-related research (70.5 percent agree or strongly agree) and how IT facilitates timely feedback from instructors (73.1 percent agree or strongly agree). They also point to e-mail communication with instructors as extremely helpful. A typical comment was, "I love the instant feedback/response you can get from professors who use e-mail. I have been happily surprised to find out that more than 90 percent of my professors use e-mail as extensively as I do (and I use it a lot)."

When asked directly if "IT in courses improves my learning," half (50.4 percent) of respondents agreed and 10.5 percent strongly agreed. Students made frequent reference to IT in this context, with phrases such as "technology is valuable in assisting professors to achieve educational goals," or "computers and the Internet are invaluable tools in the learning process." However, it is important to

acknowledge that 1 in 10 respondents either disagree (5.8 percent) or strongly disagree (3.5 percent) with this opinion. Bottom line, a large number of students do not believe IT has a positive role in their learning. One student told us, "Education should consist primarily of personal and group conversation, debate, and lecture. IT has enabled some of my professors to think they do not even have to talk to their students. Technology has its place, but not in the classroom." Later in this chapter we analyze respondent comments from the open-ended survey to understand more deeply what students are thinking about the relationship between technology and learning.

Looking at the distribution of responses about IT and student engagement we see a different pattern. Here, responses form a more traditional bell-shaped curve, with only 40.4 percent agreeing that they are more engaged in courses that require use of IT. This leaves the majority of respondents unconvinced that IT in courses increases student engagement (59.6 percent are neutral or disagree). This finding is consistent with students' views that IT's primary contribution to courses is making things more convenient. For example, ECAR found previously that the most valued CMS features are those that administratively support grade performance (tracking grades and access to sample exams), and those CMS features least valued are those more related to engagement (discussion boards and sharing materials among students). Only for this outcome statement does gender make a difference. About half (49.4 percent) of males report that they are more engaged in courses requiring use of IT, in contrast with only 35.0 percent of females. This is not surprising, given the stronger technology profile of males; they prefer more IT in courses, adopt new technologies sooner, and own and use some technologies more often.

Respondent perceptions about the ECAR outcome statements hold across gender (with the exception of student engagement and IT), age, class standing, GPA, part-time versus full-time enrollment status, and Carnegie class. Responses are also consistent over the past three years' studies, with one exception. The 2006 data indicated that age mattered—older respondents were somewhat more positive than younger respondents about these outcome statements. However, the 2007 data does not show age as a differentiator. This finding is reminiscent of the Chapter 5 finding that age was less a factor this year in respondent preference for IT in courses. Future studies will continue to track trends based on age differences.

Table 6-2 shows respondents' agreement with outcome statements by student major.[7] As expected, business and engineering majors, with their stronger technical profile, report somewhat more agreement that technology has a positive impact on their academic experience. This is especially true for student engagement in courses. More than half of engineering (56.5 percent) and business (51.3 percent) students agree or strongly agree that they are more engaged in courses using IT, compared with other students (only 38.2 percent agree or strongly agree). It may be that the more project-oriented disciplines such as engineering and business find more value in IT support for collaboration and management activities; alternatively, the softer disciplines such as humanities and social sciences, involving relatively more intensive face-to-face discussion and argument, find these IT support functions less valuable. Indeed, these results likely reflect differences in disciplinary engagement. Note also that the actual differences between majors are small for outcomes about IT improving course research and facilitating prompt feedback from instructors, indicating that these IT benefits are more consistently valued across majors.

Other factors are also strongly associated with IT's impact on academic outcomes. The data show that CMS experience, preference

Table 6-2. Student Perceptions About IT in Courses, by Major

Major	N	IT in courses improved my learning*	I am more engaged in courses that use technology*	Helps me better communicate and collaborate with classmates*	Results in more prompt feedback from my instructor*	Allows me to take greater control of course activities*	Helps me do better research for my courses*
Business	5,294	3.70	3.46	3.70	3.94	3.76	3.95
Engineering	2,655	3.69	3.59	3.64	3.88	3.69	3.88
Life sciences	4,556	3.59	3.16	3.57	3.90	3.63	3.88
Physical sciences	2,043	3.56	3.22	3.49	3.84	3.55	3.84
Education	3,646	3.56	3.15	3.57	3.81	3.53	3.80
Social sciences	5,340	3.53	3.09	3.52	3.86	3.53	3.86
Humanities	2,876	3.48	2.97	3.46	3.79	3.43	3.78
Fine arts	2,332	3.47	3.05	3.44	3.79	3.45	3.80

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

for IT in courses, technology adoption profile, instructor use of IT in courses, and how students like to learn through technology are all important. These relationships are discussed in the following sections.

Course Management Systems and Outcomes

In Chapter 5, Table 5-7 reports that respondents who are positive about their CMS experience are generally more positive than others about how well their instructors use IT in courses. There is a similar association between CMS experience and perceptions about IT's impact on courses. Figure 6-2 shows a stair-step pattern illustrating this finding.[8] Respondents having a positive CMS experience generally agree with the ECAR positive outcome statements. In contrast, respondents reporting a negative CMS experience are more inclined to be neutral about IT's impact in their courses.

Positive CMS experience is most strongly associated with the outcome "IT in my courses allows me to take greater control of my course activities." This makes sense, as support for management of course activities is a key capability of CMS software and a software feature not readily available through other technologies. One student said, "I really like CMS sites used by my teachers. I found it more difficult to manage my courses where professors did not use the CMS. If using CMS became a requirement, it would really help me and my fellow students." In contrast, a student with a bad CMS experience noted, "I don't like the course management system. It can be helpful, but teachers don't manage it very well, and so it's confusing and hard to keep everything straight."

The weakest association (although still strong) is between CMS experience and the outcome "IT in courses helps me do better research for my courses." While a CMS does provide content for course-related research, it is only one of several research technologies easily available to students, including Internet searches, college and university library sites, and non-CMS course Web sites. For example, one student stated, "The online library resources have definitely been beneficial for me personally. The databases are great, the

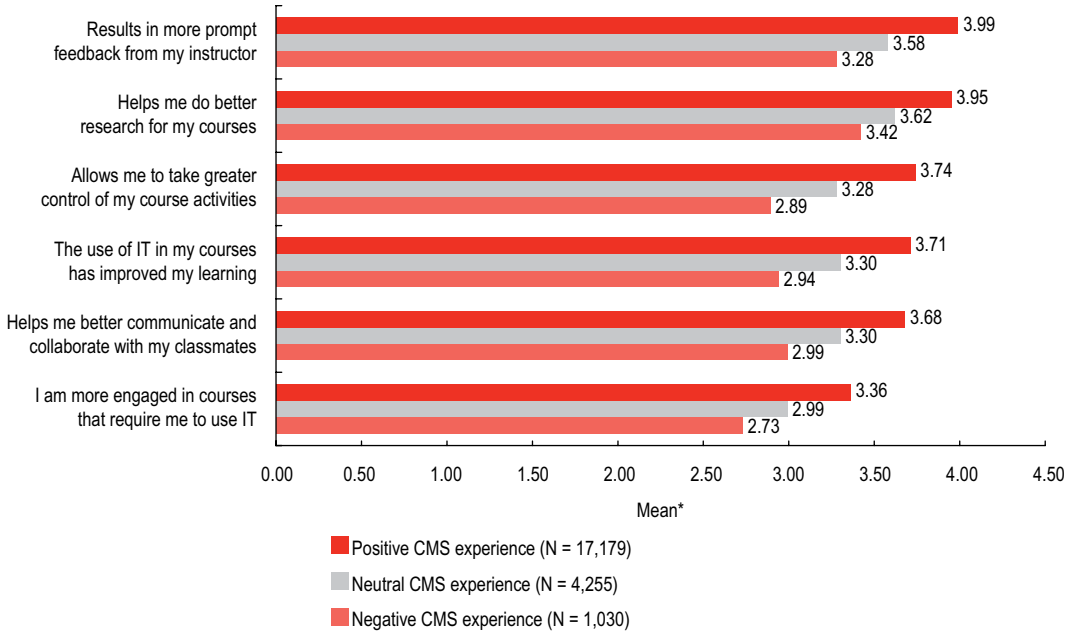


Figure 6-2. Student Perceptions About IT in Courses, by Positive/Negative Experience Using a CMS

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

online journal access amazing, and the interlibrary loan Web site superb. These resources have literally cut my research time in half."

Further, students who think that CMS features are useful—especially the capability to keep track of grades and have access to sample exams—agree more than others that IT is a benefit to their coursework. This finding is consistent with the 2006 study finding and is discussed in more detail in the 2006 study report.

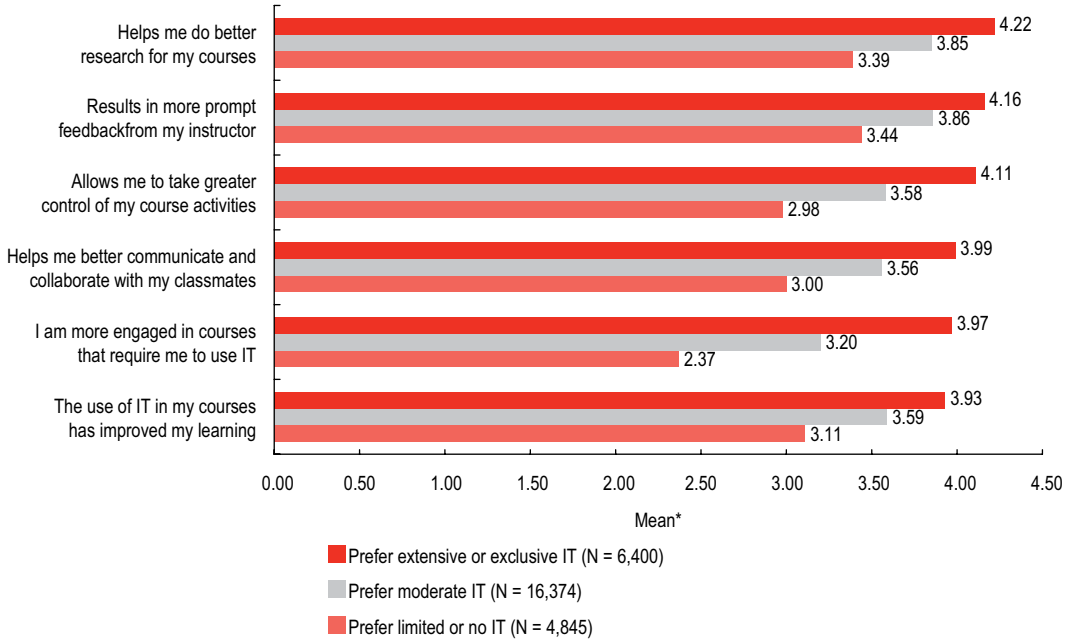
Preference for IT in Courses and Outcomes

Figure 6-3 again shows a stair-step pattern: Respondents who prefer more IT in courses agree more that IT has a positive impact on coursework. On the other hand, most respondents who do not prefer much IT in their courses generally disagree, or are at best neutral, about all of the ECAR outcome statements. For example, of respondents who prefer limited or no IT in courses, 34.4 percent agree that IT improves their learning; in contrast, 79.5 percent of respondents who prefer extensive or exclusive IT in courses agree that IT improves their learning. Recognizing the wide range of student preference for IT, 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.

The strongest relationship by far occurs for the outcome "I am more engaged in courses that require me to use IT." Three-fourths (75.4 percent) of respondents who prefer extensive to exclusive IT in courses say they are more engaged in courses that use IT. One technology-oriented student said, "When teachers incorporate visuals via computer presentations, it makes learning that much more interesting. PowerPoint, slideshows, and online activities really help me to stay focused in class and engaged in the material." In contrast, very few respondents who prefer little or no IT in courses say they are more engaged (only 10.4 percent agree). A student explained, "When a professor lectures from the black/whiteboard, I find it a much more engaging classroom experience."

The weakest relationship (although still strong) is between preference for IT in courses

Figure 6-3. 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*

and the outcome statement "IT in my courses results in more prompt feedback from my instructor." Fully 83.6 percent of respondents who prefer extensive or exclusive IT in courses agree that technology results in more prompt feedback from instructors. Still, more than half of those who prefer little or no IT also agree (56.2 percent). This is likely because e-mail is widely used and appreciated, even by those who do not like other uses of IT in courses.

Although not shown here, we find a similar stair-step pattern when looking at respondents' technology adoption practices. Respondents who are early adopters of technology are more apt to be positive about the impact of IT on courses and learning, and vice versa.[9] In addition, we find that respondents who say they like to learn by using programs they can control (such as simulations and video games) or by contributing to Web sites (such as blogs and wikis) are also more positive about the benefits of IT in courses.

These findings are consistent with the 2006 study findings and corroborate other findings in this 2007 study as well. We noted a cadre of respondents with a set of characteristics in common:

- they prefer relatively more technology in their courses,
- they like to learn by using programs they can control and by contributing to Web sites,
- they report a positive CMS experience and find CMS features useful, and
- they perceive that technology makes a positive difference in their academic experience.

Faculty Use of IT in Courses and Outcomes

It matters a great deal how well instructors use IT in courses. This theme surfaces in all of the data ECAR collected—the quantitative survey data, the student comments from the open-ended survey question, and the student focus groups. This section looks at the quantitative data results and then dives deeper into the qualitative data to better understand what is behind student perceptions about faculty, technology, and learning.

Faculty Use of IT and ECAR Outcome Questions

Figure 6-4 shows the stair-step pattern once more, this time illustrating that respondents who are more enthusiastic about instructor use of IT in courses are also more enthusiastic about the benefits of IT in courses, and vice versa.[10] This is not surprising, given the relationship between instructor competence and learning. Research about student success concludes that when instructors use effective educational practices, students have a better academic experience.[11] It follows that when instructors integrate IT into effective teaching practices, students would be more likely to perceive both that their instructors use IT well in courses and that the effect on their courses is positive. Note that the differentiator is the respondents who agree that their faculty use IT well; neutral and disagree responses are not meaningfully different in their perceptions about outcomes.

Students Speak About Faculty, Technology, and Learning

ECAR turned to 4,752 written comments from the open-ended survey question and found hundreds of responses that mentioned the link between technology and learning, either directly or indirectly. We analyzed these comments to get an in-depth understanding of what respondents were thinking when they generally agreed or disagreed with our survey outcome statement "IT in courses has improved my learning." Responses were categorized into three major themes that emerged: IT as an enabler of learning, IT as a barrier to learning, and the balance between technology and face-to-face interactions with instructors.

IT as an Enabler of Learning

Respondents identified five positive categories about technology's impact on learning.

- Technology facilitates organization and control in the learning environment.

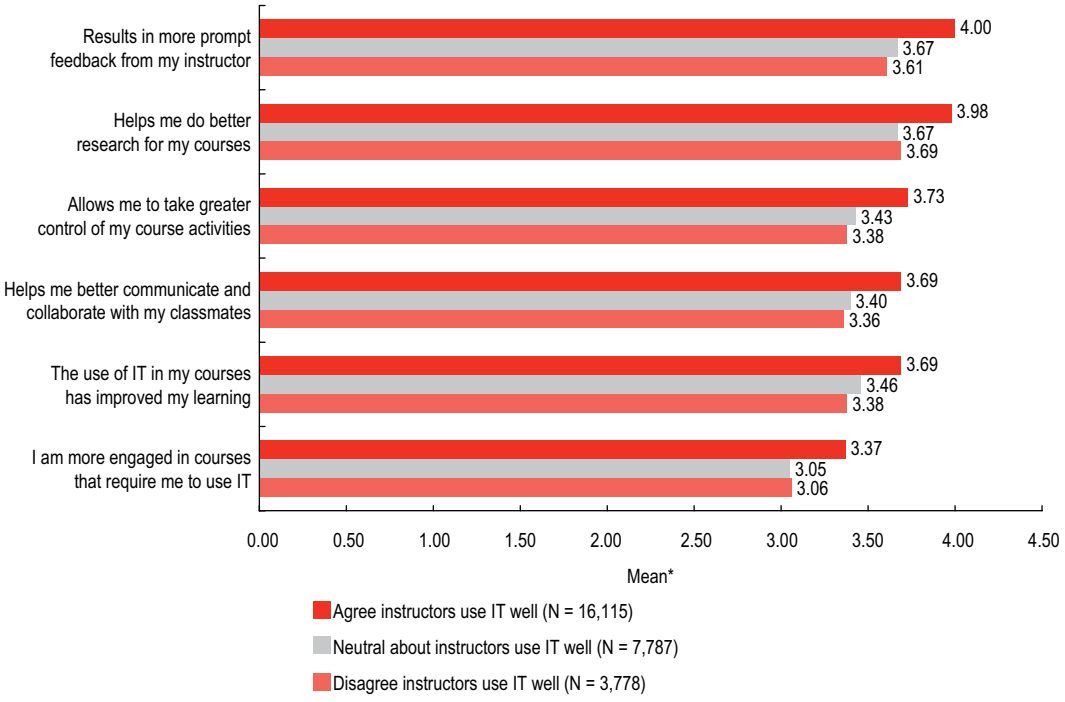


Figure 6-4. Student Perceptions About IT in Courses, by Instructors Use IT Well in My Courses

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

- Technology facilitates communication with faculty and classmates.
- Technology can make content more accessible, including class materials and Internet resources.
- Technology in courses is valuable when directly linked to applications useful to future employment.
- Technology is an enabler of learning when professors use it effectively.

The first three categories, about control, communication, and content, align nicely with the quantitative findings about the ECAR outcome statements—that respondents generally agree that IT in courses helps students control course activities, communicate with classmates, receive prompt feedback from instructors, and do better research for courses. Further, respondents explicitly identified four areas of technology most valuable in this regard. Posting grades online is considered very useful for tracking performance and correcting problems early in the term. E-mail and communication via the CMS are credited with facilitating course-related communications. Course management systems also surface in the context of helping students with class preparation and keeping assignments under control and organized. Finally, students often described the value of the Internet as a source of content useful to courses.

Respondents say they value courses using IT that is directly relevant to future employment, even though this topic was not covered in the quantitative survey. One student was pleased: "My experiences with technology at the university have prepared me for my line of work and given me an edge over other individuals when I apply for jobs."

Respondents also send a clear message that proper use of IT by instructors is critical to technology's success as a learning tool. This was the most common theme discussed; about one-third of written comments dealt in some way with how an instructor's use of IT makes a difference. One student summed up, "Using technology in high school or college all comes down to how well the professor or teacher can use technology. If they know how to use technology and they are good with it, if they know how to integrate it well in the course, then it is a useful aid in learning." Students also talked about the reverse, where an instructor's poor use of IT is seen as a barrier to learning.

IT as a Barrier to Learning

Respondents were also consistent in identifying perceived barriers to using technology for learning. In fact, more students commented on IT barriers than enablers. Barriers fell into four broad categories:

- There are problems with technologies themselves and with their institutional implementations and support.
- The proliferation of technology has created a more complex learning environment.
- Poor use of technology by faculty (underuse, overuse, inappropriate use, or overdependence) detracts from the learning experience.
- Instructors sometimes overestimate student comfort with or access to technology resources.

With respect to technical problems, respondents were adamant that they need IT services and products that are fast, easy to use, and reliable. Without basic reliability, students feel they can't count on technology when they need it most, for submitting assignments, taking exams, and communicating with classmates and instructors. They expressed frustration about networks being down, technical support being unavailable, or technology interfering with getting their coursework done. Students often complained about their CMS, saying it was "often down when I need it," "there are problems uploading files," and "there are problems with time-based assignments." Students refer to problems with technolo-

gies themselves as well as pointing to poor institutional implementation and support of IT infrastructure and applications.

Respondents also raise an interesting point—that the proliferation of technology has created a more complex learning environment for today's students. One student explained, "Professors use too much technology (PowerPoint, CMS, e-reserves, etcetera). As students, they never had to use so many sources of [electronic] information, and they don't understand how overwhelming it can be. I miss the days when I could look at my notebook and handouts and that was it. Try studying when the Internet is down, or the CMS isn't working. Professors need to ask themselves why they are using so many sources when 15 years ago they were surviving just fine without them."

Students are extremely sensitive to both how and how much technology is used in their courses—including underuse, overuse, misuse, and overdependence on technology. Many students expressed concerns that some faculty do not use available technology to post grades or improve communication, or do not do so effectively. In some cases students felt faculty use too much technology. This is complicated by the fact that each student has unique ideas about what constitutes underuse or overuse of technology. Typical comments include

- *Underuse:* "The biggest issue is that most of my professors either do not grasp the vast improvement their courses would receive by taking advantage of more IT or are not technologically savvy enough to figure it out."
- *Inappropriate use:* "IT only creates problems when professors don't know how to use the programs properly."
- *Overuse:* "Some simple classroom activities are overcomplicated by forceful addition of technology."
- *Overdependence:* "I think in many ways technology has become an obstacle to good classroom exercises and experiences, as faculty have become too dependent on it."

Respondents also questioned instructors' assumptions about student IT literacy. One comment was, "I think professors should demonstrate more use of technology. They expect that all of their students are already fluent in technology use, which is not the case." Another student agreed: "Students typically do not have time to spend many hours learning a new program. When professors merely throw a program at you and say 'learn how to do this,' and you are graded on your performance with that program, this has a negative effect on your grade."

Other students told us they were at a disadvantage because of their nontraditional or economic status. A student clarified: "As a nontraditional student, I find IT more of a challenge than traditional students who grew up in the Information Age. My IT skills are not as good, yet some instructors take it for granted that all of their students possess equal competence with technology. This has been somewhat of a handicap for me, especially when it comes to researching on the Internet and using online library sources." Another student said, "Information technology is great, but when teachers start making computer-based participation requirements it really puts poor students at a disadvantage. I do not own a computer and I should not be penalized for my inability to buy one. Teachers should not make the assumption that every student owns a computer, but unfortunately they do make that assumption."

The Balance Between IT and Face-to-Face Interaction

Many students wanted us to know that technology is not a substitute for face-to-face interaction with faculty. This is consistent with our quantitative findings that by far most students prefer only "moderate" technology in their courses (59.3 percent).

This theme was strong in all of our student focus groups as well. The sidebar provides example comments.

Learning Implications

For better or worse, students put responsibility for the answer to the question, "Does technology improve learning?" squarely on their instructors. With rare exception, students do not attribute IT-related learning problems to their own technical limitations. Instead, they comment, "Technology seems to benefit me academically only when my professors know how to properly employ the technologies afforded them" and "When instructors do not use technology efficiently, it degrades the education experience and creates disgust among students about the instructor." If the student conclusions are correct, then optimizing technology effectiveness for learning is best focused in four areas:

- developing instructor technology skill sets;
- training instructors on how to effectively integrate technology and pedagogy;
- improving the speed, reliability, and support of institutions' network and academic applications, especially course management systems; and
- increasing instructor and administrator awareness about how their students differ in technology savvy and access to technology resources.

In fact, numerous respondents explicitly mentioned the need for more formal training of instructors, especially for such common applications used in the classroom as CMS tools. The bottom line is that while technology holds promise, realizing this promise requires strong institutional support to facilitate instructor mastery of IT skills, built on a foundation of reliable, sufficiently high-performance IT infrastructure and high-quality applications.

Striking the Balance Between IT and Face-to-Face Interactions

Respondents gave various reasons why they thought technology does not replace instructors. Here are some typical comments:

- "IT adds a level of convenience to the class, and I feel it is best used for this. It cannot and should not be used in lieu of interacting with an educated professor. There is no substitute for a person that can understand his or her students and what they need to progress."
- "I find technology a useful tool. However, it easily becomes frustrating when not working properly or when an instructor uses it too much. I feel face-to-face interaction allows for students to learn how to work with others and interact with people, developing social skills needed for the work-world."
- "I worry that in many classes that faculty have gone IT crazy, sacrificing the human element in the process."
- "I feel that computers and the Internet are invaluable tools in the learning process. However, I also feel that IT isn't what helps the younger generation learn critical thinking and making decisions based on common sense."
- "I am a firm believer in getting to know people and figuring out where they are coming from. My best teachers use the CMS and e-mail to keep us posted on important information, but they are also the most personal professors on campus."
- "I have taken online courses, but I am not sure if the convenience of the online classes outweighs the learning experience of the classroom."
- "I may be old-fashioned, but I prefer to learn in class or in face-to-face conversations with students. I am really good with IT, but I prefer going to the library and pulling out some books."
- "Although all of the new technology is a great blessing as far as convenience and efficiency, nothing will replace live face-to-face interaction with the instructor."

The Most Valuable Benefit of IT

Again this year, convenience is the clear winner for the "most valuable benefit of IT in courses." More than half of respondents (55.5 percent) tell us that technology's contribution to "convenience" trumped that of technology's support for communicating with

classmates and instructors, managing course activities, or improving learning. In fact, even though 60.9 percent of respondents agreed that IT in courses improved their learning, just 1 in 10 respondents (10.3 percent) identified "improved my learning" as the most valuable benefit of IT in courses.

Figure 6-5 shows that females more often value IT most for its help in communicating and collaborating with classmates and instructors (12.4 percent) than do males (7.5 percent). ECAR also finds that respondents majoring in education, fine arts, and humanities are also more likely to value communication as the top IT benefit in courses.

What is the profile of respondents who think that technology's primary benefit is enhanced learning? Gender, age, and Carnegie class all play a role. Males are more likely to choose "improves my learning" as their most valuable benefit of IT in courses (12.6 percent) than females (8.9 percent). This makes sense, since males report more engagement in courses that require technology. Associate's institution respondents perceive a contribution to learning as the primary benefit of IT in courses (16.7 percent) more often than four-year-institution respondents (9.9 percent). This likely reflects the larger populations of older and nontraditional students at associate's institutions.[12] In fact, older respondents, regardless of the type of institution they attend, are more apt to choose "improved my learning" as the primary benefit of IT in courses. Of respondents 40 years and older, 17.8 percent chose "improved my learning," compared with only 9.5 percent of traditional-age respondents 18 to 24 years old.

Respondents using a CMS this quarter/semester are least likely to choose "improved my learning" as the most important benefit (8.9 percent). Instead, CMS users choose "convenience" most often (58.1 percent). Vendors and institutions alike would agree that course management systems are all about convenience—organizing and presenting materials, enabling interaction between faculty and students, and the like. It follows that CMS users would be more likely than non-CMS users to choose convenience as the primary benefit of IT in courses.

In fact, of all the questions asked in the survey, the strongest association with respondent choice of top IT benefit is whether they have ever taken a course using a CMS. Figure 6-6 shows that respondents who have been exposed to a CMS choose "convenience" (58.3 percent) more often than those who

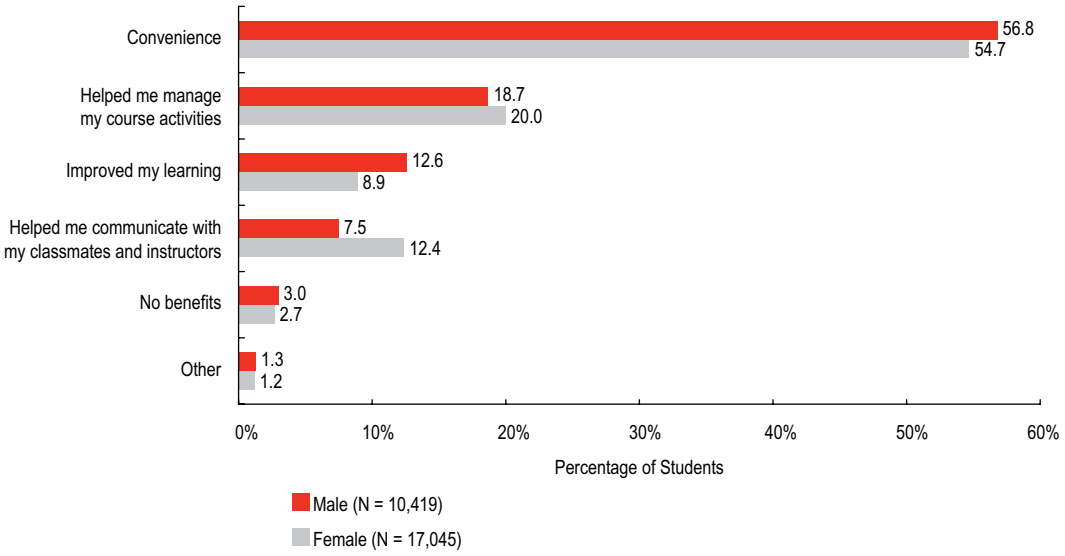


Figure 6-5. Most Valuable Benefit from Using IT in Courses, by Gender

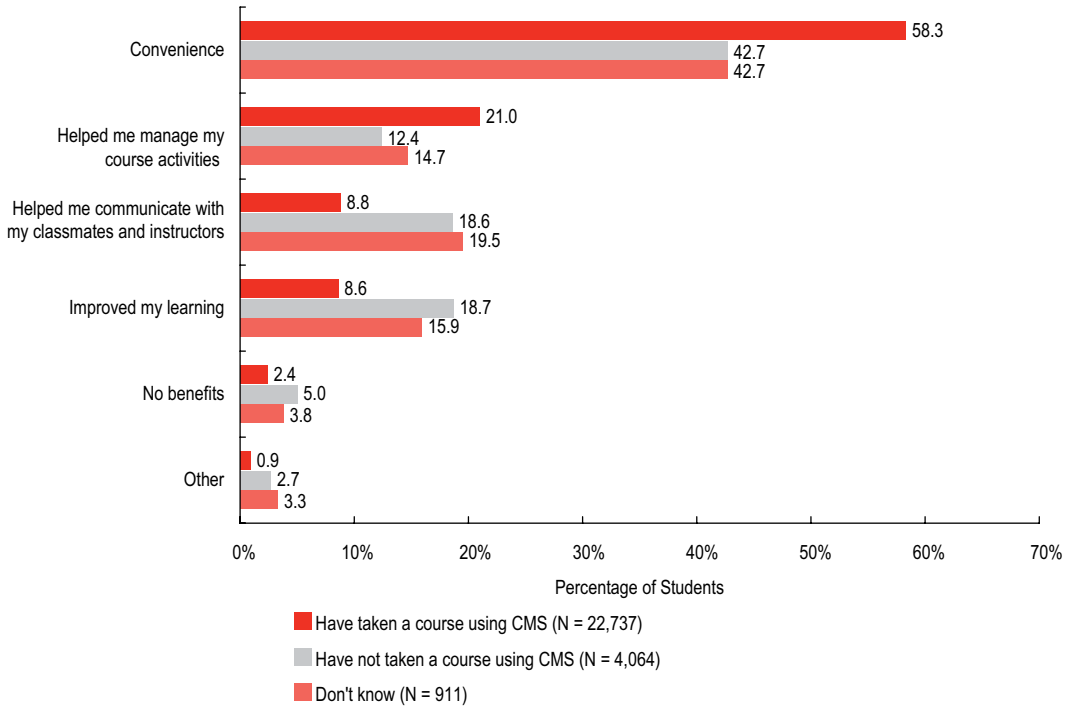


Figure 6-6. Most Valuable Benefit, by Students Who Have Taken a Course Using a CMS

have never been exposed to a CMS (42.7 percent). A typical comment was, "I am now taking classes with the course management system—the convenience factor is invaluable." In addition, respondents exposed to a CMS are also more likely to see the CMS capabilities that help them manage their course activities as the top IT benefit.

Perhaps this finding linking CMS exposure to convenience helps explain the increase in respondents who chose "convenience" as the top benefit of IT this year. For the 40 institutions that participated in all of the past three ECAR studies, the percentage of their respondents choosing "convenience" as the most valuable benefit increased from 50.0 percent in 2005 to 51.6 percent in 2006 to 56.3 percent in 2007. It makes sense that if we have more CMS users overall this year, and if CMS users more often choose "convenience" as the primary IT benefit in courses, that we would show an overall increase in respondents choosing "convenience" as well.

Endnotes

1. Peter Ewell and Jane Wellman, *Enhancing Student Success in Education: Summary Report of the NPEC Initiative and National Symposium on Postsecondary Student Success* (National Postsecondary Education Cooperative [NPEC], 2007).
2. The National Survey of Student Engagement, "Engaged Learning: Fostering Success for All Students" (NSSE, 2006), http://nsse.iub.edu/NSSE_2006_Annual_Report/docs/NSSE_2006_Annual_Report.pdf.
3. 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 [NPEC], 2006), http://nces.ed.gov/npec/pdf/Kuh_Team_Report.pdf. These themes are discussed and references are provided throughout this paper.
4. Ibid.
5. Robert Carini and others, "College Student Responses to Web and Paper Surveys: Does Mode Matter?" *Research in Higher Education* 44, no.1 (2003): 1–19.
6. The wording in the 2005 survey was slightly different from the 2006 and 2007 surveys, which included the words "… than in courses that do not

use technology" to each of the outcome statements. For example, the 2006 and 2007 survey statement was, "The use of information technology in my courses helps me better communicate and collaborate with my classmates than in courses that do not use technology." The 2005 survey statement was, "The use of information technology in my courses has helped me better communicate and collaborate with my classmates."

7. Numerous students (17.4 percent) report more than one major and will be included in all majors reported.
8. For the Student Perceptions about IT in Courses outcome questions shown in Figures 6-2, 6-3, and 6-4, the "agree" and "strongly agree" responses have been combined into "agree," and the "disagree" and "strongly disagree" responses have been combined into "disagree." Also, for the question about student experience with course management systems, the "positive" and "very positive" responses have been combined into "positive," and the "negative" and "very negative" responses have been combined into "negative."
9. 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), 80.
10. For the question "Overall, instructors use IT well in my courses," the "agree" and "strongly agree" responses have been combined into "agree," and the "disagree" and "strongly disagree" responses have been combined into "disagree" responses.
11. Arthur Chickering, *Applying the Seven Principles of Good Practice for Undergraduate Education*, ed. Zelda Gamson (San Francisco: Jossey-Bass, 1991); and George D. Kuh, *What Matters to Student Success*.
12. For the previous 2006 study, 19.3 percent of associate's institution students chose "improved my learning" as the IT benefit of most value to them. This was based on eight associate's institutions with 3,380 students responding to the survey. This year the number is 16.7 percent, based on four associate's institutions and 1,824 responding students.

Appendix A

Acknowledgments

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Aurillo, Suzanne—San Diego State University
Backscheider, Nickolas—Auburn University
Benson, Marisa—Emory University
Bianchi, Julius—California Lutheran University
Bielec, John—Drexel University
Biros, Jan—Drexel University
Brookes, Kim—Simmons College
Brum, Debra—California State University, Pomona
Bucher, John—Oberlin College
Burrell, Steven—Saint Leo University
Carr, Daryl—Monmouth College
Carr, Michael—Capital University
Caruso, Judith—University of Wisconsin–Madison
Cernock, Bob—Central Connecticut State University
Chancellor, Beth—University of Missouri–Columbia
Chester, Timothy—Pepperdine University
Chichester, Susan—SUNY College at Geneseo
Christenberry, Reid—Miami University
Chronister, Michael—Embry-Riddle Aeronautical University–Worldwide
Cleek, Dick—University of Wisconsin Colleges
Collura, Mike—The Ohio State University Mansfield
Contos, Chris—Vanderbilt University
Conway, Steven—Texas A&M University at Galveston
Cromwell, Dennis—Indiana University
Davis, William—Bridgewater State College
Deess, Perry—New Jersey Institute of Technology
Deneen, Linda—University of Minnesota Duluth
Denman, Chip—University of Maryland

Derco, Jean—The University of Tennessee
DiGangi, Sam—Arizona State University
Dinkins, Kriss—Wake Forest University
Doetkott, Curt—North Dakota State University
Draude, Barbara—Middle Tennessee State University
Dumke, David—University of Wisconsin–Stevens Point
Durso, Ann Marie—University of Wisconsin–Parkside
Eckardt, Chip—University of Wisconsin–Eau Claire
Elarde, Chris—Pace University
Elmore, Garland—Indiana University-Purdue University Indianapolis
Elwell, Cheryl—Clark University
Fisher, Paul—Seton Hall University
Foster, Susan—University of Delaware
Franke, Tom—University of New Hampshire
Frazier, Ken—University of Wisconsin–Madison
Fritz, John—University of Maryland, Baltimore County
Gonick, Lev—Case Western Reserve University
Haddaway, Carole—Towson University
Haile, Christine—University at Albany, SUNY
Hanson, Perry—Brandeis University
Helland, Patricia—Vanderbilt University
Hilton, Linda—Vermont State Colleges
Huang, Henry—University of Wisconsin–Madison
Huff, Steve—Southern Illinois University Edwardsville
Hughes, James—Trinity College
Hurley, Doug—The University of Memphis
Huskamp, Jeff—University of Maryland
Iroff, Linda—Oberlin College
Jasper, Joanne—Catawba College
Johnson, Steve—Montclair State University
Jonas, James—University of Wisconsin–Madison
Justice, Debbie—Western Carolina University
Kahle, David—Tufts University
Kalai, Bob—The Ohio State University
King, Beverly—University of North Carolina at Pembroke
King, Rebecca—Baylor University
Knaapen, Laura—University of Wisconsin–Oshkosh
Kossuth, Joanne—Franklin W. Olin College of Engineering
Krogman, John—University of Wisconsin–Platteville
Kroll, Gary—SUNY College at Plattsburgh
Kvavik, Bob—University of Minnesota
Landry, Stephen—Seton Hall University
Langeland, John—Trinity College
Lea, Lucinda—Middle Tennessee State University
Ledbetter, Phil—Embry-Riddle Aeronautical University
Lepak, Jack—University of Wisconsin–Madison
Levy, Samuel—University of St. Thomas
Lightfoot, Ed—University of Washington
Maas, Bruce—University of Wisconsin–Milwaukee
Maas, Paula—The College of New Jersey
Maurice, Mitch—University of North Carolina at Pembroke
McClelland, Kathleen—Auburn University
McDaniel, Scott—Middle Tennessee State University
Metros, Susan—The Ohio State University
Mirliss, Danielle—Seton Hall University
Moore, Anne—Virginia Tech
Morgan, Peter—Willamette University
Muly, Faye—The University of Tennessee

Nielsen, Brian—Northwestern University
O'Bryan, Cathy—University of Wisconsin–Madison
Parker, Ronald—Brazosport College
Peters, Sandra—University at Buffalo
Pflueger, Kenneth—Pomona College
Pletcher, Kathy—University of Wisconsin–Green Bay
Pokot, Elena—University of Wisconsin–Whitewater
Prudden, Laura—University of Massachusetts Lowell
Reese, Brad—Roosevelt University
Rehm, Roger—Central Michigan University
Robb, Terry—University of Missouri–Columbia
Rowe, Theresa—Oakland University
Sakai, Eric—Vermont State Colleges
Samuel, John—Indiana University-Purdue University Indianapolis
Sannier, Adrian—Arizona State University
Schaeffer, Sandy III—The University of Memphis
Schaffer, Connie—Eastern Michigan University
Seraichick, Laura—Keene State College
Siesing, Gina—Tufts University
Skidmore, Daniel—Le Moyne College
Smith, Elizabeth—University of St. Thomas
Sorensen, Roger—College of Saint Benedict/Saint John's University
Speck, Fritz—Saint Mary's University of Minnesota
Splittberger, Ken—University of Wisconsin–Oshkosh
Stack, David—University of Wisconsin–Milwaukee
Stahl, Wilson—Western Carolina University
Steed, Jay—University of Notre Dame
Steinbrenner, Karin—University of North Carolina at Charlotte
Stern, Nadine—The College of New Jersey
Strohmetz, David—Monmouth University
Suess, Jack—University of Maryland, Baltimore County
Sutton, Brett—Roosevelt University
Taylor, Bob—Northwestern University
Thompson, Jeff—University of Massachusetts Lowell
Thompson, Rebecca—New Jersey Institute of Technology
Ticknor, Don—The University of South Dakota
Tillman, John—University of Wisconsin–La Crosse
Trinko, Lynn—The Ohio State University at Lima Campus
Trubitt, Lisa—University at Albany, SUNY
Unger, Elizabeth—Kansas State University
Van Dyke, Ray—Virginia Tech
Vandever, Jennifer—Southern Illinois University Edwardsville
Veselsky, Lora—Case Western Reserve University
Vogel, Kim—Central Michigan University
Walsh, Theresa—Indiana University-Purdue University Indianapolis
Wheeler, Lisa—University of Wisconsin–River Falls
White, Marshall—University of New Hampshire
Williams, Calvin—Monmouth University
Wilson, Joshua—Brandeis University
Wishon, Gordon—University of Notre Dame
Wong, Lorna—University of Wisconsin–Whitewater
Wong, Victor—University of Michigan
Woody, Karalee—University of Washington
Wynd, Matt—Towson University
Yarborough, Bill—Presbyterian College

Appendix B

Students and Information Technology in Higher Education:

2007 Survey Questionnaire

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

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

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

Please submit your survey responses as soon as possible within the next two weeks. It should take you approximately 15 minutes to complete the survey. As thanks for your time and valuable input, each participant who provides an e-mail address will be entered in a drawing for one of 60 $50 and $100 gift certificates for Amazon.com.

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

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

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

Section 1.

We may only survey students age 18 or older.

1.1 I am 18 years old or older. <Required>

○ No <Proceed to Section 5>
○ Yes <Proceed to 1.2>

I give my consent to the following:

For this survey you were selected at random from a list of students at your institution. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

Sponsored by the EDUCAUSE Center for Applied Research, this study is being conducted by Judy Caruso of the University of Wisconsin–Madison and Dr. Gail Salaway, EDUCAUSE Center for Applied Research. EDUCAUSE is a nonprofit association whose members include information technology leaders in higher education. Its mission is to advance higher education by promoting the intelligent use of information technology.

Background Information

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

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

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

Risks and Benefits of Being in the Study

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

Compensation

We will hold a raffle for gift certificates of $50 and $100 from Amazon.com for participating in this survey. If you choose to participate in the raffle, you must include an e-mail address in the space provided at the beginning of the survey. Once the survey has closed, we will conduct a random drawing from the e-mail addresses of those who participated within four weeks of the closing of the survey.

Your e-mail address will be kept separate from the data collected in the survey. It will not be used to connect your survey responses with your name, nor will it be used for any purpose other than to contact you should you win a prize.

Confidentiality

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

Voluntary Nature of the Study

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

Contacts and Questions

You may direct any questions to Judy Caruso, 608-263-7318, judy.caruso@doit.wisc.edu, or to a representative of your institution's Institutional Review Board.

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

Statement of Consent

1.2 I have read the above information and have had the opportunity to ask questions and receive answers. I consent to participate in the study. <Required>

○ No <Proceed to Section 5>
○ Yes <Proceed to next question>

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

_____

Section 2. Your Use of Electronic Devices

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

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

2.3_2.7 Which of the following electronic devices do you own?

	No	Yes
2.3 Simple cell phone (without Web access)		
2.4 Personal digital assistant (PDA) (Palm, Blackberry, etc.)		
2.5 Smart phone (combination cell phone and PDA device) (Blackberry, etc.)		
2.6 Electronic music/video device (iPod, etc.)		
2.7 Electronic game device (Game Boy, Xbox, PlayStation, etc.)		

2.8 How often do you access your university e-mail account?

- ○ Do not have a university e-mail account
- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.9 If your institution could communicate with you in any form, what would your first choice be?

- ○ Instant messaging
- ○ E-mail
- ○ Text messaging
- ○ Personally authenticated Web site (portal)
- ○ Paper mail
- ○ No preference

2.10 How many hours each week do you normally spend doing online activities for school, work, and recreation?

<Drop-down list including Less than one, 1-168 (increments of 1)>

2.11 How often do you use an electronic device to access a library resource on an official college or university library Web site?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.12 How often do you use an electronic device for writing documents for your coursework?

○ Never
○ Once per year
○ Once per semester/quarter
○ Monthly
○ Weekly
○ Several times per week
○ Daily

2.13 How often do you create, read, and send e-mail?

○ Never
○ Once per year
○ Once per semester/quarter
○ Monthly
○ Weekly
○ Several times per week
○ Daily

2.14 How often do you create, read, and send instant messages?

○ Never
○ Once per year
○ Once per semester/quarter
○ Monthly
○ Weekly
○ Several times per week
○ Daily

2.15 How often do you play computer games?

○ Never
○ Once per year
○ Once per semester/quarter
○ Monthly
○ Weekly
○ Several times per week
○ Daily

2.16 How often do you download Web-based music or videos?

○ Never
○ Once per year
○ Once per semester/quarter
○ Monthly
○ Weekly
○ Several times per week
○ Daily

2.17 How often are you doing online shopping?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.18 How often are you doing online gaming (partypoker.com, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.19 How often are you blogging?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.20 How often do you participate in online social networks (thefacebook.com, friendster.com, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.21 How often do you use an electronic device for creating spreadsheets or charts (Excel, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.22 How often do you use an electronic device for creating presentations (PowerPoint, Keynote, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.23 How often do you use an electronic device for creating graphics (Photoshop, Flash, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.24 How often do you create audio/video (Director, iMovie, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.25 How often do you create Web pages (Dreamweaver, FrontPage, HTML, XML, Java, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.26 How often do you access a course management system (ANGEL, WebCT, Blackboard, Desire2Learn, FirstClass, Moodle, Sakai, OnCourse, etc.)?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

2.27_2.33 What is your skill level using the following computer technologies and applications?

	Poor	Fair	Good	Very good	Excellent	Do not use
2.27 Spreadsheets (Excel, etc.)						
2.28 Presentation software (PowerPoint, etc.)						
2.29 Graphics software (Photoshop, Flash, etc.)						
2.30 Video/audio software (Director, iMovie, etc.)						
2.31 Online library resources						
2.32 Computer maintenance (downloading software updates, installing additional memory, organizing files, etc.)						
2.33 Course management system (ANGEL, WebCT, Blackboard, Desire2Learn, FirstClass, Moodle, Sakai, OnCourse, etc.)						

2.34 Why did you learn spreadsheet software (Excel, etc.)?

- ○ College or university course requirement
- ○ High school or previous course requirement
- ○ Personal interest
- ○ Job requirement or to enhance job opportunities
- ○ Other
- ○ Do not use

2.35 Why did you learn presentation software (PowerPoint, Keynote, etc.)?

- ○ College or university course requirement
- ○ High school or previous course requirement
- ○ Personal interest
- ○ Job requirement or to enhance job opportunities
- ○ Other
- ○ Do not use

2.36 Why did you learn graphics software (Photoshop, Flash, etc.)?

- ○ College or university course requirement
- ○ High school or previous course requirement
- ○ Personal interest
- ○ Job requirement or to enhance job opportunities
- ○ Other
- ○ Do not use

2.37 Why did you learn video/audio software (Director, iMovie, etc.)?

- ○ College or university course requirement
- ○ High school or previous course requirement
- ○ Personal interest
- ○ Job requirement or to enhance job opportunities
- ○ Other
- ○ Do not use

2.38 During the academic year, what is your most frequently used method for access to the Internet?

- ○ Commercial dial-up modem service (AOL, EarthLink, etc.)
- ○ College- or university-operated dial-up modem service
- ○ Commercial broadband service (DSL modem, cable modem, etc.)
- ○ College- or university-operated wired broadband service
- ○ Commercial wireless network
- ○ College- or university-operated wireless network
- ○ I do not access the Internet

Section 3. Your Use of Technology in Courses

3.1 Which of the following best describes your preference with regard to the use of information technology in your courses?

- ○ 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

3.2_3.16 Are any of the following technologies used in your courses during the current semester or quarter?

	Not using this semester/ quarter	Using this semester/ quarter
3.2 E-mail		
3.3 Instant messaging		
3.4 Presentation software (PowerPoint, Keynote, etc.)		
3.5 Course management system (ANGEL, WebCT, Blackboard, Desire2Learn, Moodle, Sakai, OnCourse, FirstClass, etc.)		
3.6 Course Web site		
3.7 Programming languages (C++, Java, etc.)		
3.8 Graphics software (e.g. Photoshop, Flash, etc.)		
3.9 Video/audio software (Director, iMovie, etc.)		
3.10 Podcast		
3.11 Webcast		
3.12 Blogs		
3.13 Online social networks (thefacebook.com, etc.)		
3.14 E-portfolios		
3.15 Spreadsheets (Excel, etc.)		
3.16 Discipline-specific technologies (Mathematica, Matlab, AutoCAD, Stella, etc.)		

3.17_3.19 Please give us your opinion about the following statements regarding your experiences with in your courses.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.17 I am more engaged in courses that require me to use technology than in courses that do not use technology.					
3.18 Overall, my instructors use information technology well in my courses.					
3.19 My school needs to give me more training on the information technology that I am required to use in my courses.					

3.20_3.23 The use of information technology in my courses:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.20 Helps me better communicate and collaborate with my classmates than in courses that do not use technology.					
3.21 Results in more prompt feedback from my instructor than in courses that do not use technology.					
3.22 Allows me to take greater control of my course activities than in courses that do not use technology.					
3.23 Helps me do better research for my courses than in courses that do not use technology.					

3.24 Have you ever taken a course that used a course management system (e.g., ANGEL, WebCT, Blackboard, Desire2Learn, Moodle, Sakai, OnCourse, FirstClass)? <Required>

- ○ No <Proceed to 3.35>
- ○ Yes <Proceed to 3.25>
- ○ Don't know <Proceed to 3.35>

3.25 How would you describe your own overall experience using a course management system?

- ○ Very negative
- ○ Negative
- ○ Neutral
- ○ Positive
- ○ Very positive

3.26_3.34 How useful did you find the following course management system features?

	Not useful	Somewhat useful	Useful	Very useful	Extremely useful	Did not use
3.26 Online syllabus						
3.27 Online readings and links to other text-based course materials						
3.28 Online discussion board (posting comments, questions, and responses)						
3.29 Online access to sample exams and quizzes for learning purposes						
3.30 Taking exams and quizzes online for grading purposes						
3.31 Turning in assignments online						
3.32 Getting assignments back online from instructors with comments and grades						
3.33 Online sharing of materials among students						
3.34 Keeping track of grades on assignments and tests online						

3.35 Which of the following benefits from using information technology in your courses was the most valuable to you?

- ○ Improved my learning
- ○ Convenience
- ○ Helped me manage my course activities (planning, apportioning time, noting success and failure, etc.)
- ○ Helped me communicate with my classmates and instructors
- ○ No benefits
- ○ Other

3.36 The use of information technology in my courses has improved my learning.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly agree

3.37 How often do you bring your laptop to class?

- ○ Never
- ○ Once per year
- ○ Once per semester/quarter
- ○ Monthly
- ○ Weekly
- ○ Several times per week
- ○ Daily

3.38 Which of the following best describes you?

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

3.39 How do you learn best?

- ○ I learn best working alone
- ○ I learn best working with others
- ○ I learn equally well working alone or working with others
- ○ Don't know

3.40_3.43 How do you like to learn?

	No	Yes	Don't Know
3.40 I like to learn through text-based conversations over e-mail, IM and text messaging			
3.41 I like to learn through programs I can control such as video games, simulations, etc.			
3.42 I like to learn through contributing to websites, blogs, wikis, etc.			

Section 4. Information About You

4.1 What is your gender?

- ○ Male
- ○ Female

4.2 What is your age?

<Drop down menu with ages from 18 to 99 >

4.3 What is your cumulative grade point average (GPA)?

- ○ Under 2.00
- ○ 2.00–2.24
- ○ 2.25–2.49
- ○ 2.50–2.74
- ○ 2.75-2.99
- ○ 3.00–3.24
- ○ 3.25–3.49
- ○ 3.50–3.74
- ○ 3.75–4.00
- ○ Don't know

4.4 What is your class standing?

- ○ Senior at a four-year institution
- ○ Freshman at a four-year institution
- ○ Student at a two-year institution
- ○ Other

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

- ○ Full-time
- ○ Part-time

4.6 Do you reside on campus or off campus?

- ○ On campus
- ○ Off campus

4.7_4.16 What disciplines are you majoring in? Check all that apply.

- ○ **4.7 Social sciences**
- ○ **4.8 Humanities**
- ○ **4.9 Fine arts**
- ○ **4.10 Life sciences, including agriculture and health sciences**
- ○ **4.11 Physical sciences**
- ○ **4.12 Education, including physical education**
- ○ **4.13 Engineering**
- ○ **4.14 Business**
- ○ **4.15 Other**
- ○ **4.16 Undecided**

4.17 In 2006, what was your total family income from all sources, before taxes?

- ○ Less than $30,000
- ○ $30,000 to $74,999
- ○ $75,000 to $149,999
- ○ $150,000 or more
- ○ Decline to answer
- ○ Don't know

4.18 Which institution are you attending? <Required> <Drop-down list of institutions>

Before proceeding, please confirm that the name of your institution appears in box 4.18.

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

_____

Section 5. Thank You.

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

Appendix C

Qualitative Interview Questions

Questions for Student Focus Groups

1. Background

1.1 Student information: age, gender, senior/freshman, full/part-time, on/off campus, discipline, ethnicity

1.2 How many computers do you own? What kinds? How long have you owned them?

1.3 What other technologies do you own? Do you own a smartphone?

2. Skill and use

2.1 How skilled are you at using computer technology to do work required for your classes?

2.2 Much is being said and written about the current generation of students being good at using technology and being tech savvy. Do you think this statement is true of yourself? Of your friends?

2.3 What kinds of technology skills do you have? (Last year's students reported being good at communications and Web surfing but less skilled at technologies like creating Web pages, graphics, video.)

2.4 What kinds of technology skills are you weak in?

2.5 What kinds of technology skills do you think students in general are weak in?

2.6 How good do you think students are at dealing with changes in technology (e.g., when you get a new course management system, such as WebCT or Learn@UW, a new set of programs, or when technologies you use are not available)?

2.7 Do you use computers and the Internet for entertainment? If so, what kinds of activities do you engage in for entertainment?

2.8 What impact do you think a student's major has on his or her use and skills with technology?

2.9 Tell me about your use of social networking (Facebook, etc.), IM, blogs, and wikis?

3. Your use of technology in courses

3.1 Do you think that the skills you may acquire in using the Internet for entertainment transfer to your school work? If so, what are the components of those skills? If not, why not?

3.2 How have instructors used technology in the courses you have taken thus far? Have you used wikis, blogs, podcasts, etc.?

3.3 What are the major advantages that you see in the use of technology in your courses?

3.4 What is the major disadvantage that you see in the use of technology in your courses?

3.5 Do you think that the use of technology in your courses has helped you in your learning?

- 3.5.1 If so, how?
- 3.5.2 If not, why not?

3.6 Do you think that in general your instructors are skilled in the use of technology in teaching?

3.7 What are the major obstacles that you see to more effective use of computers and information technology in your courses?

3.8 In last year's study, students indicated that technology in their classes was about convenience, communication, and control of the learning experience. While improved learning was also mentioned, it seemed to play a lesser role. Can you please comment on this?

3.9 If there was one thing your professors could do or not do with respect to technology in your course, what would it be?

4. Future

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

5. Other Comments

Appendix D

Participating Institutions and Survey Response Rates

Four-Year Institutions

	Carnegie Classification	Freshmen and Senior Enrollment	Freshmen and Senior Sample	Sample Percentage of Enrollment	Student Respondents	Response Rate
Arizona State University	DR EXT	23,653	5,913	25.0%	732	12.4%
Auburn University	DR EXT	11,187	2,800	25.0%	385	13.8%
Baylor University	DR INT	5,607	1,550	27.6%	186	12.0%
Brandeis University	DR EXT	1,617	1,617	100.0%	444	27.5%
Bridgewater State College	MA I	3,744	3,744	100.0%	230	6.1%
California Lutheran University	MA I	887	444	50.1%	21	4.7%
California State Polytechnic University, Pomona	MA I	11,433	11,433	100.0%	340	3.0%
Capital University	MA II	1,158	289	25.0%	47	16.3%
Case Western Reserve University	DR EXT	1,891	473	25.0%	105	22.2%
Castleton State College	MA II	826	826	100.0%	46	5.6%
Catawba College	BA GEN	470	470	100.0%	71	15.1%
Central Connecticut State University	MA I	3,870	2,780	71.8%	165	5.9%
Central Michigan University	DR INT	9,611	8,789	91.4%	1,090	12.4%
Clark University	DR INT	1,131	1,131	100.0%	176	15.6%
The College of New Jersey	MA I	2,973	2,973	100.0%	358	12.0%
College of Saint Benedict/Saint John's University	BA LA	2,090	2,090	100.0%	277	13.3%
Drexel University	DR INT	5,961	5,961	100.0%	497	8.3%
Eastern Michigan University	MA I	2,608	6,522	250.1%	721	11.1%
Embry-Riddle Aeronautical University	OTHER	2,303	1,173	50.9%	168	14.3%
Embry-Riddle Aeronautical–Prescott Campus	MA I	850	432	50.8%	83	19.2%
Embry-Riddle Aeronautical University–Worldwide		9,243	2,247	24.3%	204	9.1%
Emory University	DR EXT	3,495	2,400	68.7%	176	7.3%
Franklin W. Olin College of Engineering	ENGR	159	159	100.0%	49	30.8%
Indiana University	DR EXT	16,969	700	4.1%	75	10.7%
Indiana University-Purdue University Indianapolis	DR INT	11,373	700	6.2%	100	14.3%
Johnson State College	MA I	529	529	100.0%	41	7.8%
Kansas State University	DR EXT	10,762	2,700	25.1%	233	8.6%
Keene State College	MA II	2,291	2,291	100.0%	322	14.1%
Le Moyne College	MA II	1,131	1,131	100.0%	261	23.1%

Lyndon State College	BA GEN	514	604	117.5%	60	9.9%
Miami University	DR INT	7,535	1,995	26.5%	200	10.0%
Middle Tennessee State University	DR INT	11,179	3,012	26.9%	270	9.0%
Monmouth College (Illinois)	BA LA	665	665	100.0%	232	34.9%
Monmouth University	MA I	2,030	1,033	50.9%	146	14.1%
Montclair State University	MA I	6,274	6,091	97.1%	597	9.8%
New Jersey Institute of Technology	DR INT	2,574	1,597	62.0%	162	10.1%
North Dakota State University	DR INT	5,789	1,850	32.0%	115	6.2%
Northwestern University	DR EXT	4,269	1,000	23.4%	256	25.6%
Oakland University	DR INT	6,217	6,217	100.0%	788	12.7%
Oberlin College	BA LA	1,221	600	49.1%	186	31.0%
The Ohio State University	DR EXT	19,078	5,535	29.0%	369	6.7%
The Ohio State University at Lima Campus	BA AA	712	712	100.0%	37	5.2%
The Ohio State University Mansfield	BA AA	758	758	100.0%	93	12.3%
Pace University	MA I	4,106	4,106	100.0%	172	4.2%
Pepperdine University	DR INT	1,564	393	25.1%	56	14.2%
Pomona College	BA LA	761	761	100.0%	112	14.7%
Presbyterian College	BA LA	569	569	100.0%	118	20.7%
Roosevelt University	MA I	1,952	1,400	71.7%	138	9.9%
Saint Leo University (FL)	MA II	8,550	8,550	100.0%	321	3.8%
Saint Mary's University of Minnesota	MA I	623	623	100.0%	90	14.4%
San Diego State University	DR INT	14,978	4,025	26.9%	422	10.5%
Seton Hall University	DR INT	1,933	410	21.2%	76	18.5%
Simmons College	MA I	1,018	255	25.0%	63	24.7%
South Dakota State University	DR INT	4,970	1,200	24.1%	261	21.8%
Southern Illinois University Edwardsville	MA I	6,200	1,700	27.4%	97	5.7%
SUNY College at Geneseo	MA I	2,803	1,141	40.7%	323	28.3%
SUNY College at Plattsburgh	MA I	2,641	2,641	100.0%	258	9.8%
Texas A&M University at Galveston	BA LA	724	724	100.0%	69	9.5%
Towson University	MA I	7,200	4,137	57.5%	581	14.0%
Trinity College	BA LA	986	282	28.6%	59	20.9%
Tufts University	DR EXT	2,565	2,565	100.0%	293	11.4%
University at Albany, SUNY	DR EXT	5,368	2,000	37.3%	93	4.7%
University at Buffalo	DR EXT	8,306	3,000	36.1%	324	10.8%
University of Delaware	DR EXT	7,932	7,932	100.0%	925	11.7%
University of Maryland	DR EXT	11,588	4,000	34.5%	413	10.3%
University of Maryland, Baltimore County	DR EXT	1,971	1,971	100.0%	251	12.7%
University of Massachusetts Lowell	DR INT	3,084	3,084	100.0%	232	7.5%
The University of Memphis	DR EXT	7,702	7,702	100.0%	465	6.0%
University of Michigan–Ann Arbor	DR EXT	12,697	2,000	15.8%	141	7.1%
University of Minnesota–Duluth	MA I	4,168	1,000	24.0%	83	8.3%
University of Minnesota–Crookston	BA GEN	516	516	100.0%	66	12.8%
University of Minnesota–Morris	BA LA	787	621	78.9%	103	16.6%
University of Missouri–Columbia	DR EXT	11,743	2,936	25.0%	281	9.6%
University of New Hampshire	DR EXT	5,684	2,000	35.2%	251	12.6%
University of North Carolina at Charlotte	DR INT	7,507	7,432	99.0%	602	8.1%
University of North Carolina at Pembroke	MA I	2,315	577	24.9%	46	8.0%
University of Notre Dame	DR EXT	4,200	900	21.4%	129	14.3%
The University of South Dakota	DR INT	2,888	722	25.0%	93	12.9%

University of St. Thomas	DR INT	2,535	1,100	43.4%	165	15.0%
The University of Tennessee	DR EXT	9,872	9,872	100.0%	657	6.7%
University of Washington	DR EXT	12,654	1,100	8.7%	55	5.0%
University of Wisconsin–Eau Claire	MA I	4,961	1,600	32.3%	209	13.1%
University of Wisconsin–Green Bay	MA II	2,556	2,556	100.0%	539	21.1%
University of Wisconsin–La Crosse	MA I	4,079	4,079	100.0%	1,233	30.2%
University of Wisconsin–Madison	DR EXT	13,381	2,000	14.9%	353	17.7%
University of Wisconsin–Milwaukee	DR EXT	11,025	1,600	14.5%	127	7.9%
University of Wisconsin–Oshkosh	MA I	5,679	1,705	30.0%	184	10.8%
University of Wisconsin–Parkside	MA II	2,989	2,989	100.0%	291	9.7%
University of Wisconsin–Platteville	MA I	2,913	2,913	100.0%	501	17.2%
University of Wisconsin–River Falls	MA I	2,909	2,909	100.0%	454	15.6%
University of Wisconsin–Stevens Point	MA I	4,977	4,977	100.0%	674	13.5%
University of Wisconsin–Superior	MA I	1,444	1,444	100.0%	345	23.9%
University of Wisconsin–Whitewater	MA I	4,377	1,000	22.8%	247	24.7%
Vanderbilt University	DR EXT	525	525	100.0%	101	19.2%
Vermont Technical College	ENGR	513	513	100.0%	47	9.2%
Virginia Tech	DR EXT	10,950	3,833	35.0%	477	12.4%
Wake Forest University	DR INT	2,000	500	25.0%	107	21.4%
Western Carolina University	MA I	3,526	3,526	100.0%	83	2.4%
Willamette University	BA LA	965	242	25.1%	49	20.2%

Associate's Institutions

	Carnegie	AA Enrollment	AA Sample	Sample Percentage of Enrollment	Student Respondents	Response rate
Brazosport College	AA				14	
Community College of Rhode Island	AA	15,060	7,509	49.9%	756	10.1%
Community College of Vermont	AA	2,431	2,431	100.0%	109	4.5%
University of Wisconsin Colleges	AA	8,169	8,169	100.0%	945	11.6%

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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