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

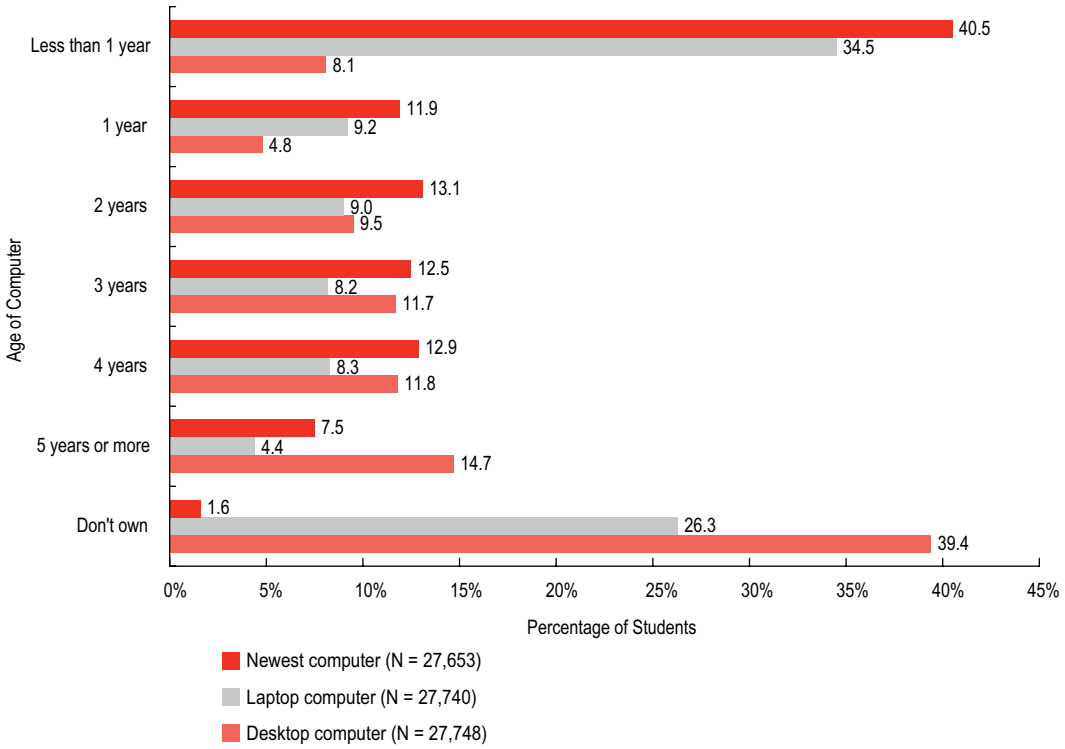

Figure 4-1. Age of Computers

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

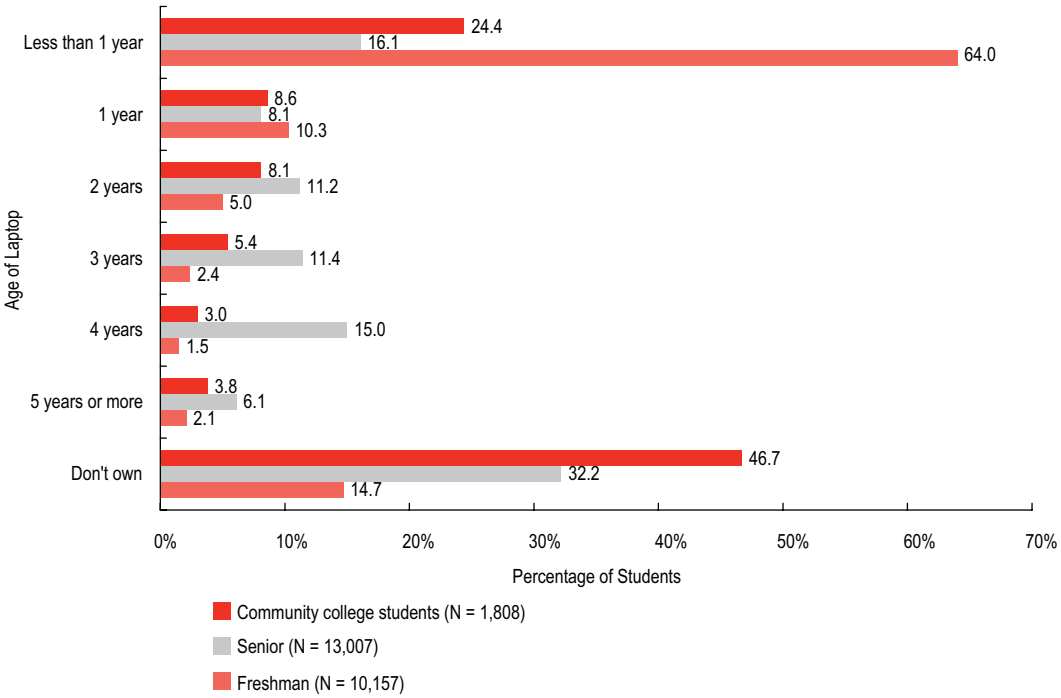

Figure 4-2. Age of Laptop, by Class Standing

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

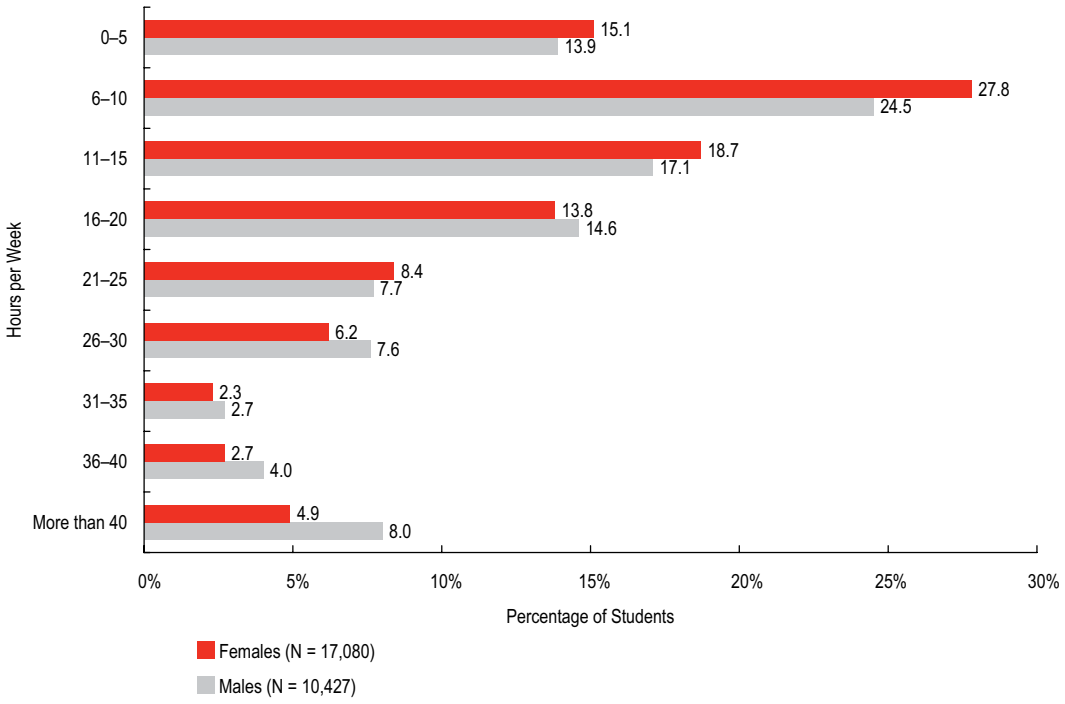

Figure 4-3. Hours per Week Doing Online Activities, by Gender

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

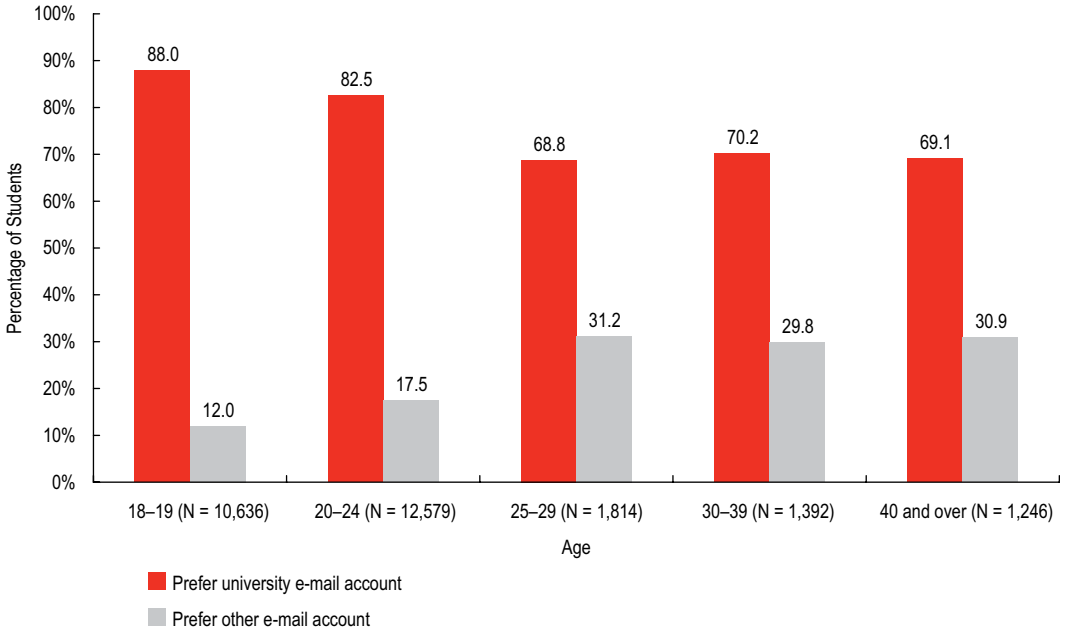

Figure 4-4. E-Mail Preference for Communication from College or University

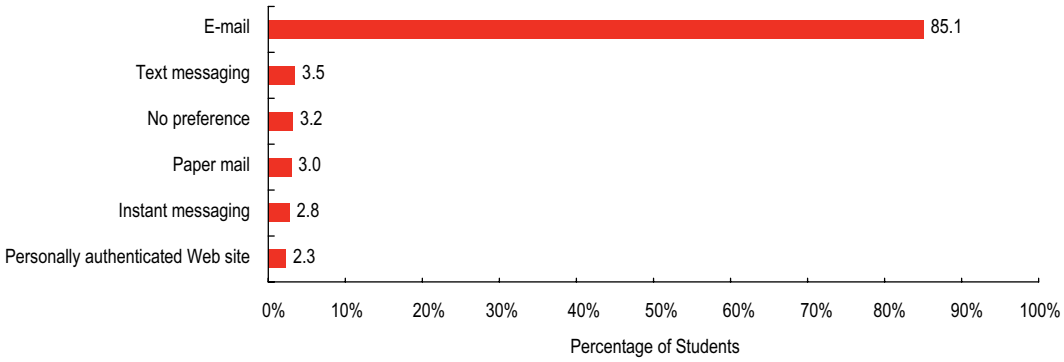

Figure 4-5. First Choice for Institutional Communication (N = 27,782)

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

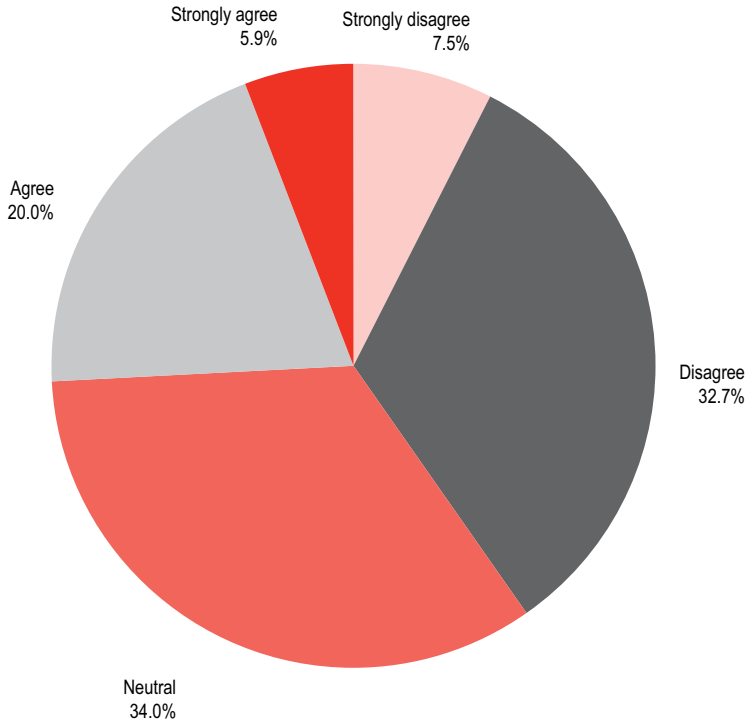

Figure 4-6. My School Needs to Give Me More Training (N = 27,722)

"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.

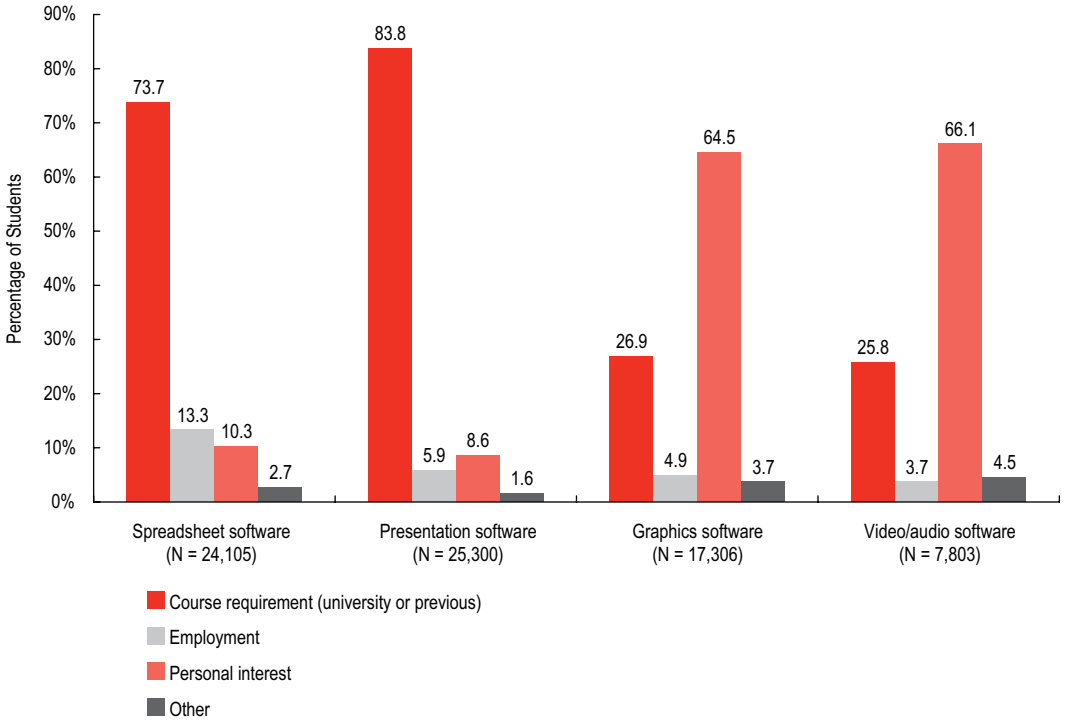

Figure 4-7. Why Students Learn Technologies*

**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

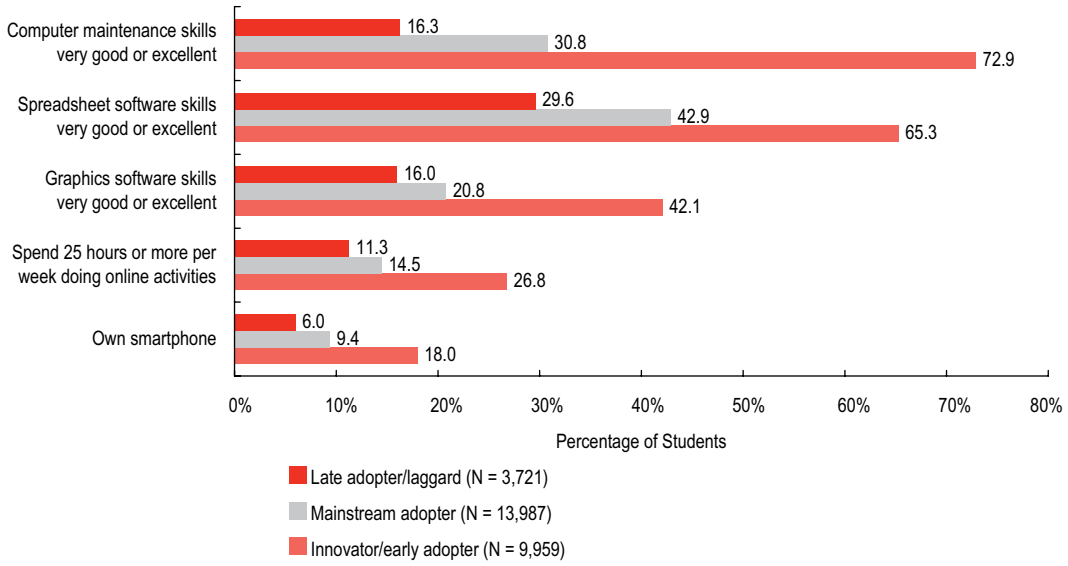

Figure 4-8. Technology Adoption Profile

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).