

4 Information Technology in Courses

Technology gets rid of the busy work so we can do higher-level thinking and work.

—A University of Wisconsin–Madison civil engineering major

Higher education is investing substantial resources in information technologies to support student services, teaching, and learning. Much of this investment has been in administrative software, networks, and other elements of a general communications infrastructure. Increasingly, investments are being made in support of teaching and learning. What is the return on this investment in equipment, applications, and training of faculty and students? How much technology do students want? How and for what purposes do they use IT in their courses? Is IT being used well? Is the use of IT in courses improving the undergraduate learning experience? What concerns do students express about IT in their courses?

In *ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control*, we found that students preferred a moderate amount of technology in their courses and that they used it primarily for convenience, for communications, to manage their work and assignments, and to monitor their grades. Only 12.7 percent of the students reported that IT's primary benefit in courses was improved learning. Because some portion of higher education's investment in IT in courses is premised on a belief that IT will

Key Findings

- ◆ Students prefer a moderate amount of technology in courses.
- ◆ Students see IT in courses as making a positive contribution to teaching and learning.
- ◆ Seniors and older students tend to prefer more technology in courses than freshmen and the youngest students in the study.
- ◆ Engineering, business, and life sciences students prefer more technology in courses than students in other disciplines.
- ◆ Overall, students give their instructors good marks in their use of technology in courses.
- ◆ Students who perceive instructors' IT skills to be effective report being engaged increasingly in the course, being more interested in the subject matter, and understanding complex concepts better.
- ◆ Students who consider themselves more skilled in using IT than their peers also see themselves as more engaged and interested in the course and subject matter. These students also believe that they are better able to use IT to help them understand complex concepts.
- ◆ According to survey respondents, the primary benefit of technology used in courses is convenience, followed by communication with the instructor and other students (connection), management of course activities (control), and improved student learning.
- ◆ Student concerns and expectations include ready access to and reliability of information technologies, bandwidth, and online resources and services.

improve learning, we added several questions to the 2005 survey that address learning more squarely. An objective of this study is to better understand how, for whom, and under what circumstances IT in courses contributes to learning.

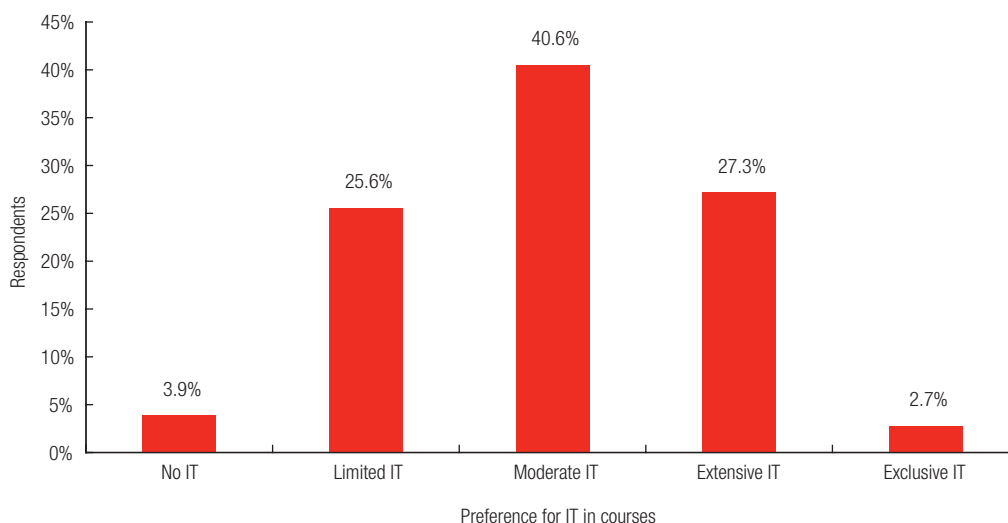
Student Preference for Technology Use in Courses

What are student preferences with respect to the use of technology in courses? We expected that college or university students who grew up with the Internet would prefer courses that make extensive use of technology. We further expected to find that demand for technology in direct support of learning is increasing. Instead, we found that students' answers to the question "How much technology do you prefer in your classes" was an almost perfect Bell curve, with a mean preference for a "moderate" use of technology in courses (see Figure 4-1). The mean (2.99), median (3.00), and mode (3) are squarely at the moderate level of preference for technology use on a scale of 1 to 5, with 1 being "I prefer taking courses that use no technology" and 5 being "I prefer taking courses that use technology exclusively." We find that 30

percent of the students prefer taking courses that use technology extensively or exclusively and an almost equal number (29.5 percent) of students prefer either limited technology or none at all in their courses. Most students (40.6 percent) prefer a moderate use of technology in courses. This overall preference distribution is very slightly lower than what we found in the 2004 study.

According to Sarah Guri-Rosenblit (2003), "Both students and academic faculty seem to like the traditional classroom encounters, even when given the opportunity of being exempt from attending a class, and provided with all the needed materials and assignments online." She refers to a University of California, Berkeley, study that found that only 16 percent of students surveyed were willing to watch lecture Webcasts entirely online instead of going to the lecture hall, and 84 percent of the students indicated that they preferred to attend the face-to-face encounters, even though they could have studied all the materials and watched the videotaped lectures at home (Harley et al., 2002). Guri-Rosenblit concludes, "It seems that many forecasts that predicted the replacement of the campus university by the new technologies have not been substantiat-

Figure 4-1.
Student Preference for Use of IT in Courses
(N = 17,856)



ed at all in reality, and the traditional styles of learning and teaching still reign dominantly in most higher-education settings.”

We expected that the youngest students in our study would have the strongest preference for IT use in courses. To our surprise, they have the least preference (mean of 2.86) (see Figure 4-2). The age group 30 to 39 has the strongest preference for the use of IT in courses (mean of 3.25). This preference by the latter group may reflect that group’s likely need to balance competing academic, employment, and family demands. The findings may also corroborate other studies (Hartman, Moskal, and Dziuban, 2005) that report older learners show more engagement (in online learning) and Net Gen learners show disappointment, perceiving “a lack of immediacy in their online courses” and feeling “that faculty response times lagged behind their expectations.”

The same pattern emerges when we look at the preferences of freshmen and seniors (see Figure 4-3). Seniors’ preferences skew more to greater use of IT in courses than freshmen’s, although we would note that their preferences are still weighted toward a moderate use of technology in courses. This

finding suggests that despite their clear comfort with core technologies such as e-mail, text messaging, IM, word processing, and so forth, and their well-reported access to broadband, Web, and video games, younger students have less exposure to IT in the classroom context, are therefore less comfortable with these technologies, and express a lower preference for them. Although freshmen arrive on campus “communication ready,” they appear not yet ready to incorporate tools like Excel, PowerPoint, and other specialized programs into their coursework.

We tried to obtain a better understanding of the factors that influence the preference for technology use in courses. We looked at the following factors: previous experience with the use of technology in courses, faculty skill using technology, number of hours students use technology weekly, respondents’ perceived comparative levels of skill using computers, institution, major, grade point average (GPA), and demographics.

We found that a student’s previous positive experience in a course that used IT is strongly associated with a preference for technology. It is not surprising that if the instructor uses

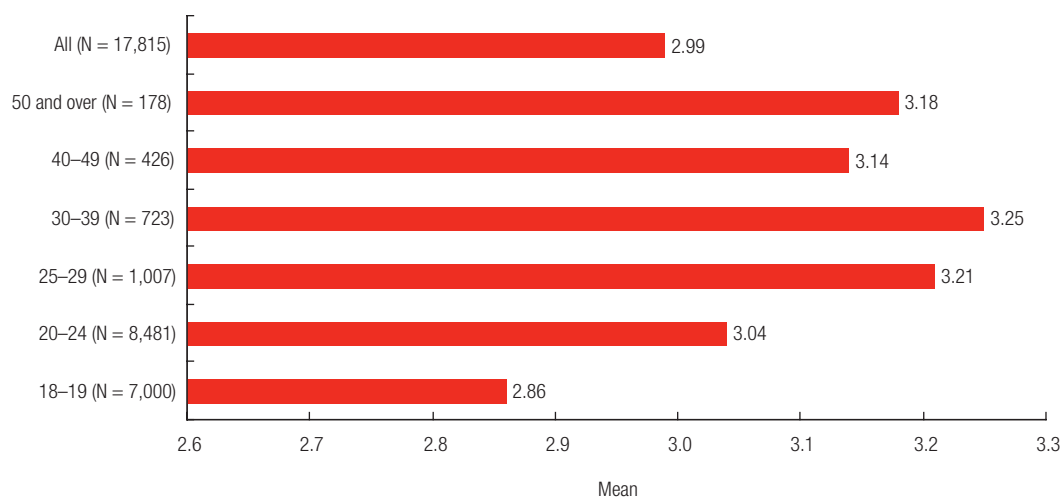
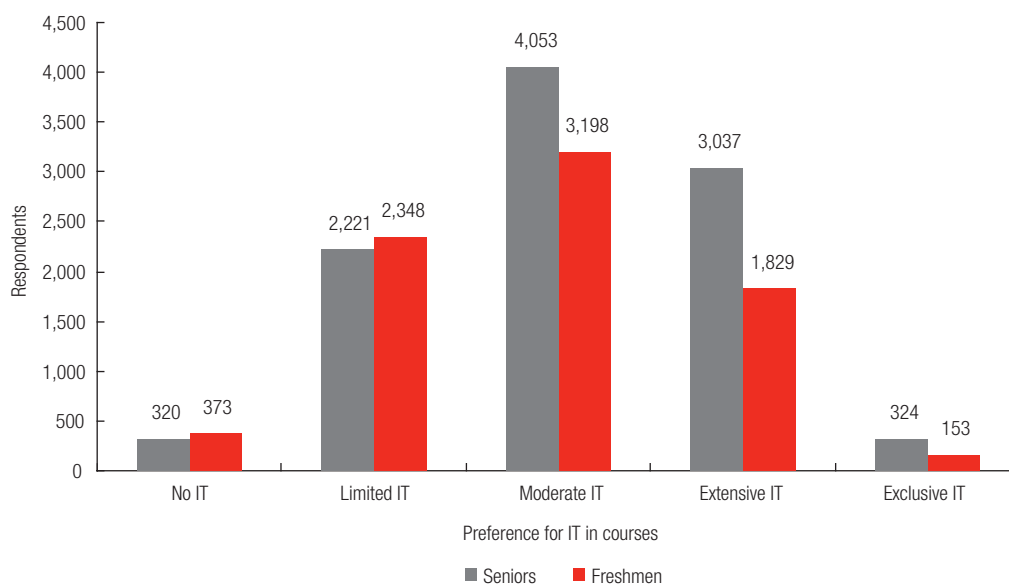


Figure 4-2.
Preference for IT
in Courses, by Age
(N = 17,815)

Scale: 1 = I prefer taking courses that use no IT, 2 = I prefer taking courses that use limited IT, 3 = I prefer taking courses that use moderate IT, 4 = I prefer taking courses that use extensive IT, 5 = I prefer taking courses that use IT exclusively

Figure 4-3.
Preference for
IT in Courses,
by Senior and
Freshman
Students



technology well, students will come to appreciate its benefits. This may explain why seniors have a higher preference level for technology use in courses than freshmen. Noteworthy, too, is the finding that a student who gets better grades in courses using technology likes those courses better. But also significant is the finding that students who feel they have more control (planning, apportioning time) over their course experience because of the use of technology also strongly prefer a high level of technology in courses. Using the scale from Figure 4-2, we found differences by gender (for males a mean of 3.08, for females 2.95), on-campus (2.89) and off-campus residency (3.08), and full-time (2.97) and part-time (3.24) students.

We did note some significant variation by Carnegie class. Students at doctoral institutions (mean of 3.07) prefer a greater use of technology than students at baccalaureate institutions (2.77). We believe some of these differences are due to the absence of engineering programs and an overweighting of fine arts and humanities majors at many baccalaureate institutions. When we exclude engineering and business students from the analysis, the differences all but disappear. Ad-

ditionally, the students at baccalaureate institutions in our sample are younger overall than those at the doctoral and MA institutions. It also seems likely that students who attend BA institutions expect more interaction with faculty and peers in small class settings.

A student's major is an important predictor of preferences for technology in courses (see Table 4-1). Engineering, business, and life sciences students have the highest preference for technology in the courses, and seniors in these majors have a higher preference for technology than their freshman counterparts. Of the eight majors identified in this study, only students in these three fields have a preference for technology in courses above a mean of 3.00, and only in engineering did a majority of the students have a preference for extensive or exclusive use of IT in courses. Humanities students have the least preference for technology in courses, with a mean of 2.73.

Assessing Technology's Impact in Courses

We asked students to evaluate the impact of technology use in their courses (see Table 4-2). Note that each impact score is above

Table 4-1. Preference for IT in Courses, by Student's Major

Discipline	N	No IT	Limited IT	Moderate IT	Extensive IT	Exclusive IT	Mean
Engineering	1,880	1.5%	11.8%	34.0%	48.4%	4.4%	3.42
Business	3,162	2.3%	18.2%	41.5%	34.2%	3.8%	3.19
Life sciences	2,698	2.8%	24.4%	41.7%	28.9%	2.2%	3.03
Physical sciences	1,330	3.7%	25.8%	43.8%	25.4%	1.4%	2.98
Education	2,483	3.3%	30.2%	43.9%	20.4%	2.2%	2.88
Social sciences	3,327	4.7%	30.4%	40.9%	22.0%	2.1%	2.86
Fine arts	1,354	6.1%	30.1%	38.1%	23.0%	2.4%	2.85
Humanities	1,934	5.7%	35.2%	40.1%	17.2%	1.4%	2.73

Table 4-2. Impact of IT in Courses

Impact	N	Mean	Std. Deviation
The use of IT in courses has helped me better communicate with my instructors.	17,947	3.89	0.868
The use of IT in courses has resulted in prompt feedback from my instructors.	17,907	3.77	0.880
The use of IT in courses has helped me better communicate and collaborate with my classmates.	17,909	3.70	0.915
I primarily use IT in courses to improve the presentation of my work.	17,910	3.56	0.902
Courses that use IT allow me to take greater control of my course activities.	17,895	3.51	0.931
The use of IT in courses has helped me better understand complex or abstract concepts.	17,942	3.23	0.922
I am more engaged in courses that require me to use technology.	17,953	3.21	1.004
The instructors' use of technology in my courses has increased my interest in the subject matter.	17,919	3.14	0.936

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

average, which indicates that students have a positive feeling about the use of IT in their courses. The highest scores are given to improved communications—communications with instructors (mean of 3.89), feedback from instructors on coursework (3.77), and communication with classmates (3.70), where the scale is 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Related to this is the ability to improve the presentation of one's work (3.56) and to take greater personal control of course activities—planning and apportionment of time (3.51). Activities related to comprehension of complex concepts (3.23), engagement (3.21), and interest in the subject matter (3.14) are positive but more neutral in respondents' perspective.

The importance of improved communications was also established in the earlier ECAR *Faculty Use of Course Management Systems* study (Morgan, 2003). Improving communications was one of the top five reasons faculty gave for using a CMS. Fifty-nine percent of faculty reported that using a CMS increased faculty-to-student communication. Also, the 2004 National Survey of Student Engagement found that 79 percent of seniors and 67 percent of first-year students used e-mail to communicate with instructors.

An interesting finding is that students overall do not feel that use of IT in courses greatly increases student engagement with course activities (3.21 mean, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). This contrasts with faculty perception reported in the earlier faculty ECAR study, where 65 percent of faculty reported that they perceived that there is more activity between student and content when IT is used in courses (Morgan, 2003). When we take into account students' perceptions of faculty skill in using technology, however, the story changes markedly. We recognize that student perceptions about

faculty technology skills may in fact reflect deeper student perceptions about faculty's choice of pedagogy, or teaching style. This deserves further research.

Notwithstanding this, perceptions of instructor skill in using IT in courses appear to make a significant difference on the student's perception of IT's impact in the courses (see Figure 4-4). Perceived instructor skill has the biggest impact on improving communications with the instructor and instructor feedback, but it also affects engagement and interest in the subject matter, and comprehension of abstract concepts. A Brandeis student notes, "I have taken economics and math courses that use modeling and simulations. For example, in a psychology class we studied sensation. It was very cool to see a Flash presentation about how an eye works. It is definitely a special occasion when something like that is used—perhaps something the professor developed himself. This professor, for example, developed a beautiful picture of an eye and wanted to share it with the class."

If we look at the difference in the means between students who rate their instructors' IT skills highest versus those who rate them lowest, we see that the perceived skill of the instructor has the greatest impact on engagement, interest in the subject matter, and understanding complex concepts, where the mean differences are greatest (see Table 4-3). Where the perceived skill of the instructor is less relevant to the activity, the mean differences are significantly lower. The greater the difference in the means, the more significant the relationship between the variables.

Note that despite a significant number of complaints about faculty IT skills in the open-ended questions, especially with respect to PowerPoint, the students give the faculty good grades when asked whether their instructors use IT well in their courses. Fewer than 15 percent are critical, 28.5 percent

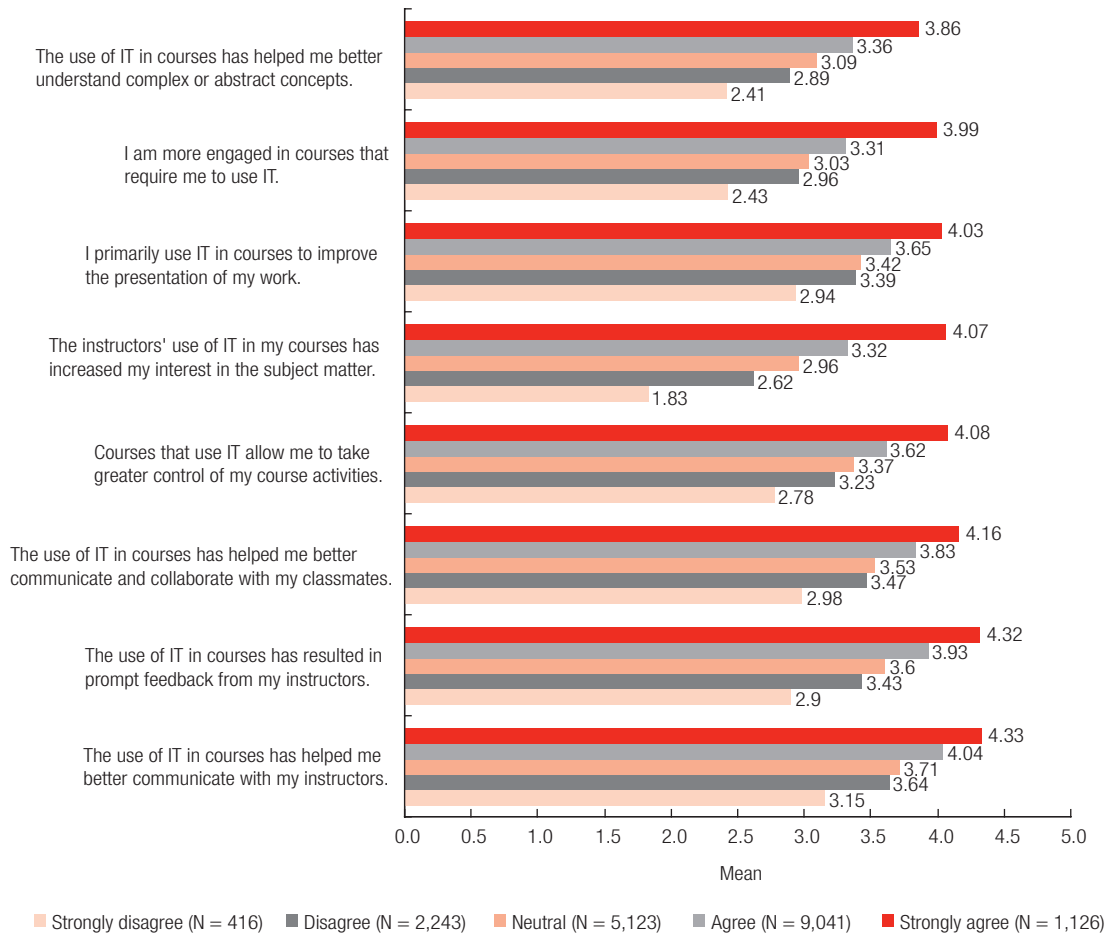


Figure 4-4.
Impact of Instructor Skill Using IT, by Impact of IT in Courses

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

Table 4-3. Impact of Instructor Skill, by Impact of IT in Courses

Instructor Skill	Mean Difference	N
The use of IT in courses has helped me better communicate with my instructors.	1.18	17,912
The use of IT in courses has resulted in prompt feedback from my instructors.	1.42	17,869
The use of IT in courses has helped me better communicate and collaborate with my classmates.	1.18	17,876
Courses that use IT allow me to take greater control of my course activities.	1.30	17,861
The instructors' use of IT in my courses has increased my interest in the subject matter.	2.24	17,890
I primarily use IT in courses to improve the presentation of my work.	1.09	17,882
I am more engaged in courses that require me to use IT.	1.56	17,925
The use of IT in courses has helped me better understand complex or abstract concepts.	1.45	17,908

are neutral, and 56.7 percent are positive or very positive. On a scale of 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree with the statement, "Overall, my instructors use information technology well in my courses,"¹ the mean score was 3.46, with a standard deviation of 0.873.

Figure 4-5 supports the earlier conclusion that students who agree and strongly agree that their instructors use IT well are much more likely to say that they are more engaged in courses that use IT. For example, we see that 40.0 percent of students who strongly agree that their instructors use IT well in courses also strongly agree that they are more engaged in courses that use IT. In contrast, of the students who strongly disagree that instructors use IT well, only 10.1 percent strongly agree that IT increases their engagement in courses. We find very similar patterns for increased interest in the subject matter (see Figure 4-6) and understanding complex concepts (see Figure 4-7).

Just as faculty skills have an impact on outcomes, so do students' IT skills, but less so (see Table 4-4). Students who consider themselves more skilled than their peers are more engaged in the course and interested in the subject matter and believe themselves to be better able to use IT to understand abstract concepts. They believe that they are more likely to use technology to improve the presentation of their work. Importantly, there is less of a difference with communications, where Chapter 3 shows all students' skill levels to be more even.

If we look at the difference in the means between students who rate their IT skills highest versus those who rate them lowest, we see that the student's perceived skill has the greatest impact on engagement in courses where the mean difference is greatest.

Where the student's skill is less relevant to the activity, the mean differences are

significantly lower. The mean differences are significantly lower for student skills than for faculty skills.

Figure 4-8 supports the earlier conclusion that students who believe that they are much more skilled than their peers are much more likely to say that they are more engaged in courses that use IT. For example, we see that 27.2 percent of students who say they are much more skilled also strongly agree that they are more engaged in courses that use IT. In contrast, of the students who consider themselves much less skilled than other students, 22.9 percent strongly disagree that IT increases their engagement in courses. We find a similar pattern for increased understanding of complex concepts (see Figure 4-9).

Students with engineering and business majors indicate that technology used in their courses increases their understanding of complex concepts and provides more opportunity for practice and reinforcement. This may suggest that these disciplines or their faculty are further ahead in the incorporation of software applications (including learning objects, tools, and simulations) for their students than faculty in other disciplines. Seniors, too, provide overall higher scores than freshmen.

We see very minor differences by gender, age, campus residency, part-time or full-time status, and Carnegie class. And surprisingly, students who indicate that they need more training in the use of IT in support of course activities score only slightly lower overall on the impact of IT in their courses. We find some minor but significant differences on engagement, interest in the subject matter, and understanding of complex concepts that relate to hardware and access difficulties. Owning older machines and having no access to broadband compromises these outcomes. Older machines affect communication activities much less.

From these data we surmise that technology use in courses serves predominantly

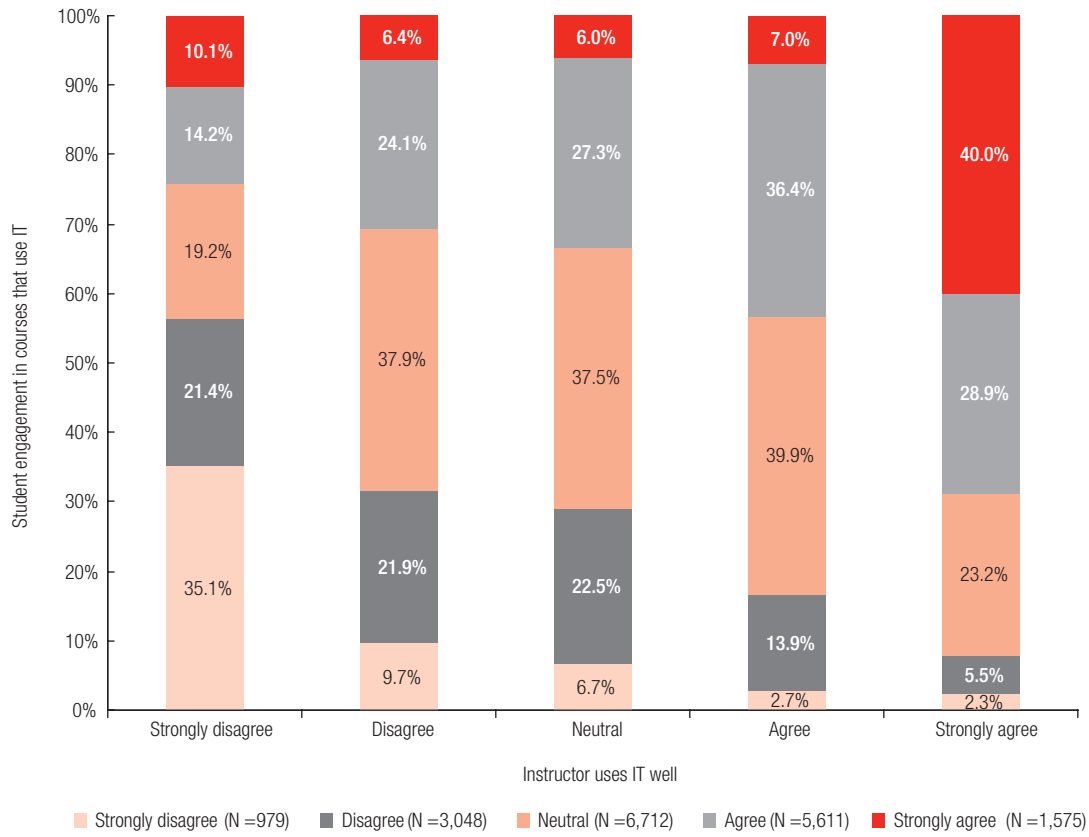


Figure 4-5. Student Engagement in Courses That Use IT, by Instructor Skill Using IT

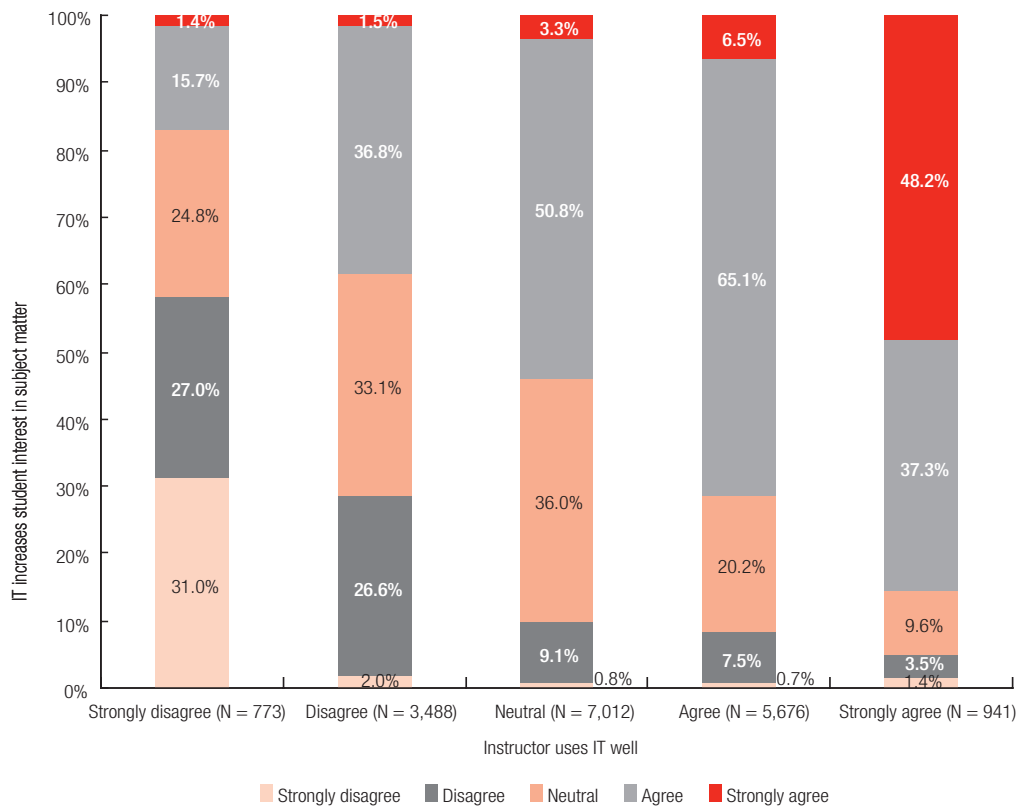


Figure 4-6. Student Interest in Subject Matter, by Instructor Skill Using IT

Figure 4-7.
Student
Understanding
of Complex
Concepts, by
Instructor Skill
Using IT

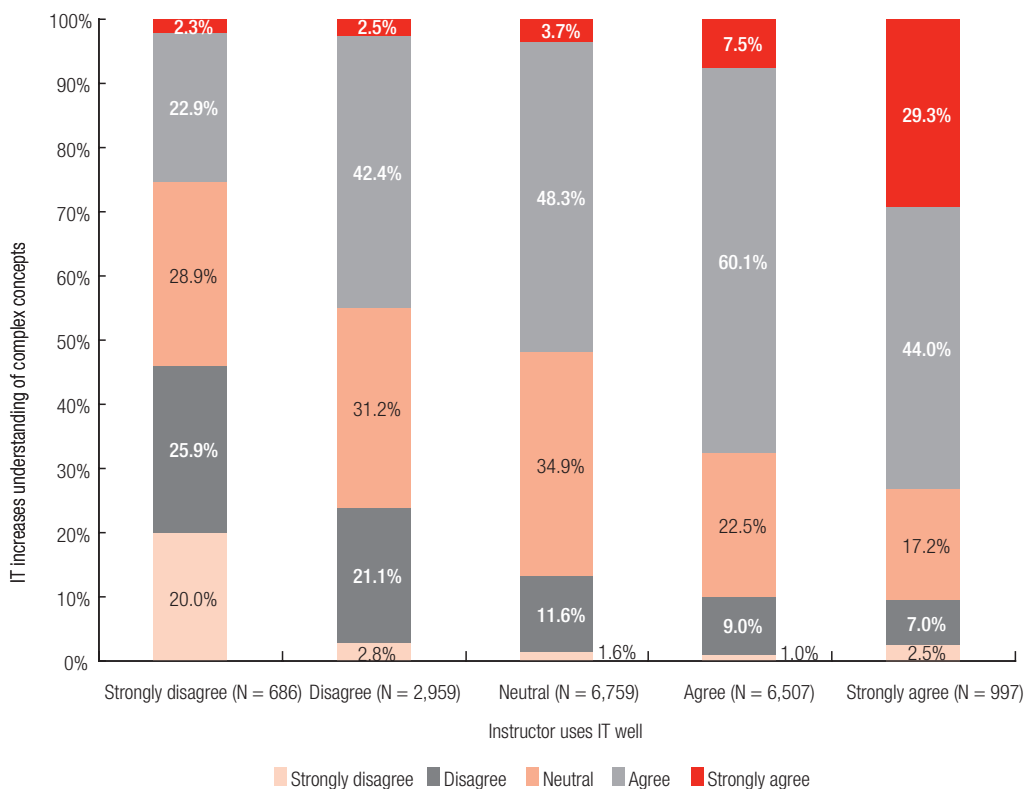
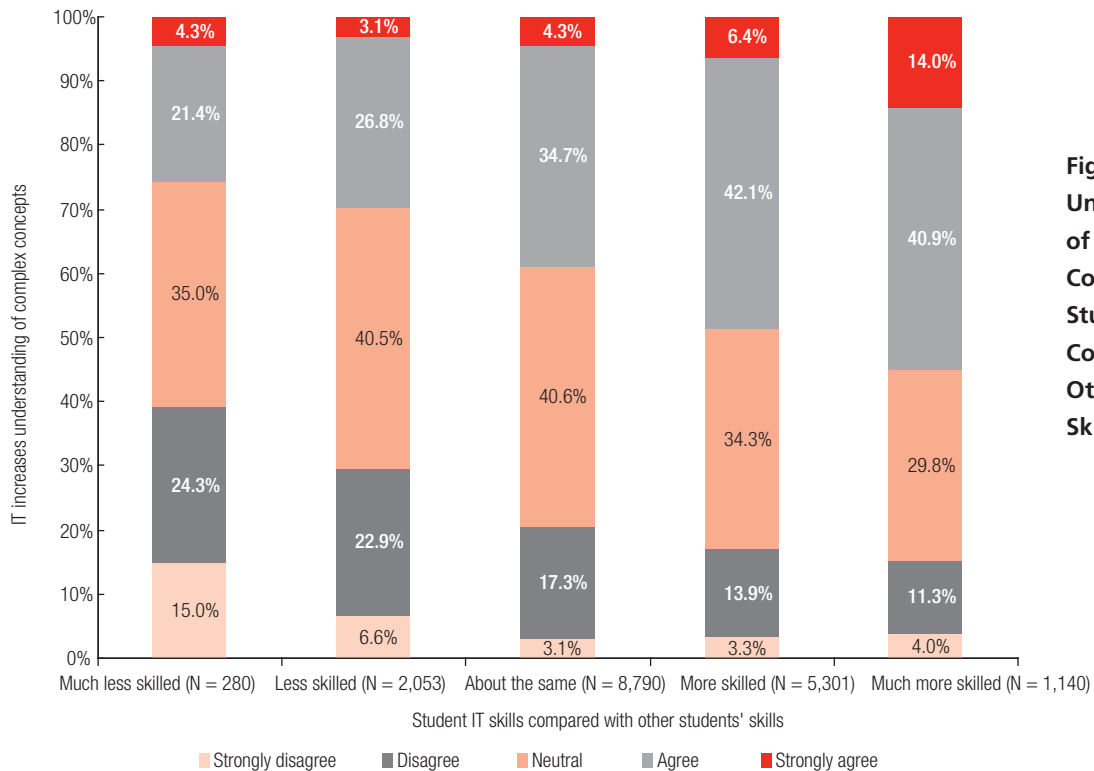
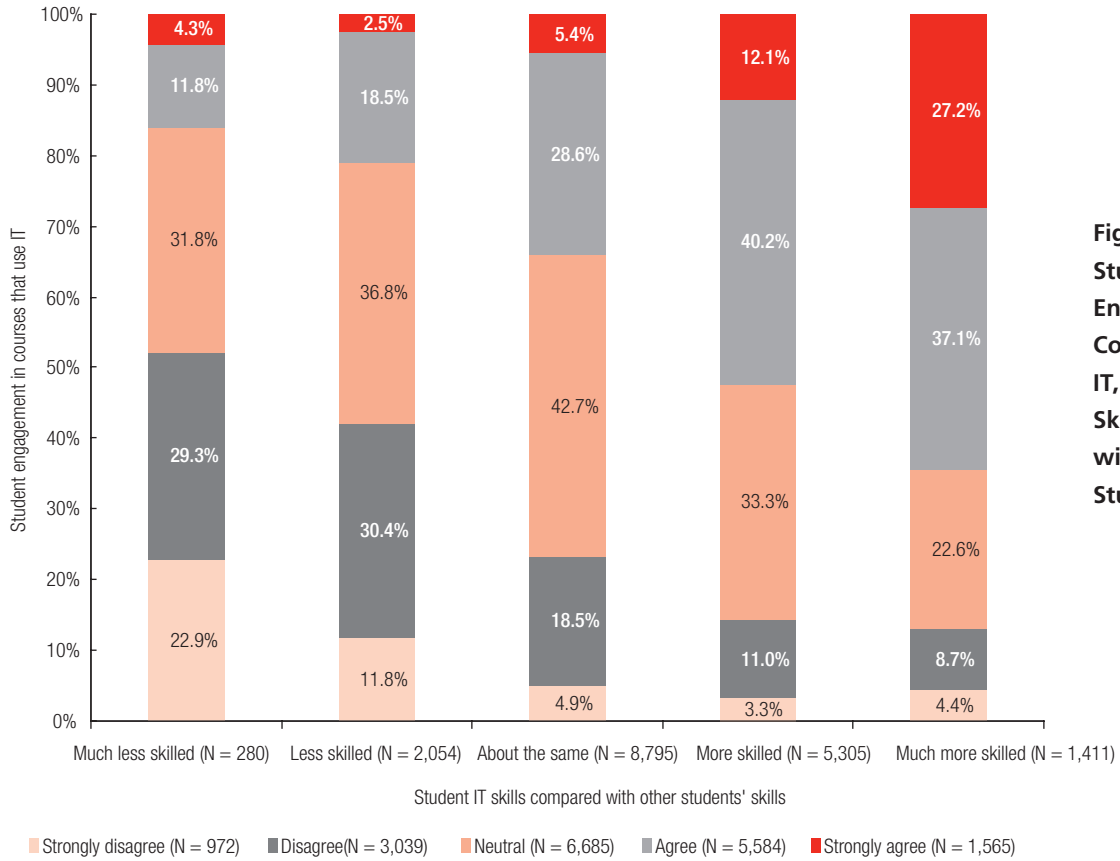


Table 4-4. Impact of Self Reported Student IT Skills Compared with Other Students' Skills on the Effectiveness of IT in Courses

Student Skills	Mean Difference	N
The use of IT in courses has helped me better communicate with my instructors.	0.47	17,839
The use of IT in courses has helped me better communicate and collaborate with my classmates.	0.60	17,802
The use of IT in courses has resulted in prompt feedback from my instructors.	0.30	17,800
I primarily use IT in courses to improve the presentation of my work.	0.71	17,804
I am more engaged in courses that require me to use technology.	1.29	17,845
The use of IT in courses has helped me better understand complex or abstract concepts.	0.74	17,834
The instructors' use of IT in my courses has increased my interest in the subject matter	0.59	17,812

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



administrative and communication purposes. Instructor and student IT skills are critical if technology is going to have a positive impact on student interest in the subject matter, engagement, and comprehension of complex and abstract concepts in courses.

The qualitative data reinforce these conclusions. According to one Franklin W. Olin Engineering College student, “Technology facilitates learning in our math class. We used MathLab to show us complicated concepts that were quite hard to figure out by hand. It gave us a better understanding about the application of mathematical problems in areas like economics or psychology. We saw how these concepts can be applied to real people in the real world—which I thought helped the learning process.” A Colgate University freshman also talks about how technology strengthens student interest in the subject matter: “In my class about inventing the atomic bomb, we used our course management system for everything. We even had a chat with our alumni—some of whom are World War II veterans and discussed their experiences.” Another Colgate student states, “For science classes, the animations help you get (information) into your head more easily than words.”

Benefits of IT in Courses: The Student's Perspective

We asked students to identify the most valuable benefit of using technology in courses (see Figure 4-10). By far the most valued benefit is convenience (50.3 percent), followed by communications (19.7 percent). Management of course activities (13.5 percent) and learning (12.7 percent) are next. Only 2.8 percent of students perceive no valuable benefit whatsoever. These findings are very nearly the same as those we found in the 2004 ECAR study. It is important to note that convenience, connection, and control all

contribute directly and indirectly to learning² (Pascarella and Terenzini, 1976, 1991).

Convenience

In both open-ended survey comments and interviews, students have much to say about the convenience that IT offers. A student at South Dakota State University reports, “Technology is definitely a convenience for students, but it’s a convenience for the professor as well. They [professors] can put materials online and use PowerPoint. We both benefit.” A senior notes, “Convenience is a big deal. PDF files online are great! I like to have access to materials at one o’clock in the morning.” Another states, “The convenience is having everything I need online so that when I have a spare minute I can access things at work. Also of major importance is being able to see grade progress at all times.”

Communications

Students feel that IT improves communication with the faculty. Technology makes it possible to have out-of-classroom contact. Via e-mail, they can set up meetings with faculty or e-mail a question and get a quick response—especially important when working on a project. One student explains, “It is much easier to e-mail assignments or ask a professor a question through e-mail than wait until class, especially when you only have one class a week with that professor.” Another student reports, “With everyone’s busy schedules, it is not always possible to meet in person. But with IT, I can send an e-mail at my convenience and they can respond at their convenience.”

Managing Course Activities

Students greatly value the ability to assume greater personal control of their activities. One student notes, “When syllabus, assignment descriptions, digital drop box, and instructor communication are all centralized on the

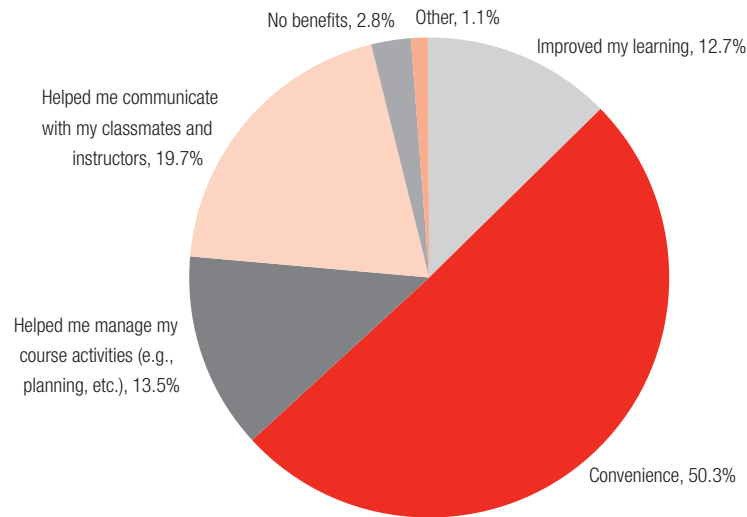


Figure 4-10.
Student
Perceptions of the
Primary Benefit
from Using IT in
Courses
(N = 17,984)

class IT site, the class becomes much easier to manage, plan, and succeed in.” Another student remarks, “It is much easier to take a test, study, or turn in assignments on my own time and on my own computer.” Another says, “It allows me to take a test when I feel ready, even if it is midnight.” Of course, the gains enabled by IT are harvested differently. One student remarks, “My course management system helped me stay up to date and on track with everything,” while another notes, “IT lets me get things done quicker.” A third respondent argues from a different perspective: “I can now go to class and not pay attention.”

Learning

While learning may not be seen as the primary benefit of IT use in courses, nearly two-thirds (64.1 percent) of the responding students perceive that IT used in courses improves their learning (see Figure 4-11). The remaining students are largely neutral (28.8 percent), and only 7.0 percent perceive that IT does not improve their learning. One student says that the use of IT to apply theory to reality improves learning: “I find that learning from theory alone results in a very limited learning experience. IT greatly enhanced my

learning.” Another student astutely observes that “No longer is education merely the transfer of knowledge from a professor to a student, but it is about the total transfer experience using all of the senses to receive and to process the information.”

Numerous students comment on how technology influences how education occurs. One student reports, “In my Physics 100 class, we use clickers. They are like little remotes, with A to H buttons that the students have. The professor puts a question up and then we all click in the answer we think is right. Then, we all see the results, and if most of the class gets it wrong, we go over it again. It helps the professor recognize if we understand the concepts, and it helps the students learn what we need to work on.”

For those students who indicate that IT in courses improves learning, without question the single most important factor is the instructor’s skill, regardless of the student’s age, gender, or major (see Figure 4-12). According to one student, “It is not the technology that improves learning; it all depends on the professor and what he is presenting.”

In the qualitative interviews, students talk about instructors’ teaching skills generally and about their use of IT in particular. One

Figure 4-11.
IT in Courses
Improves Learning
(N = 17,908)

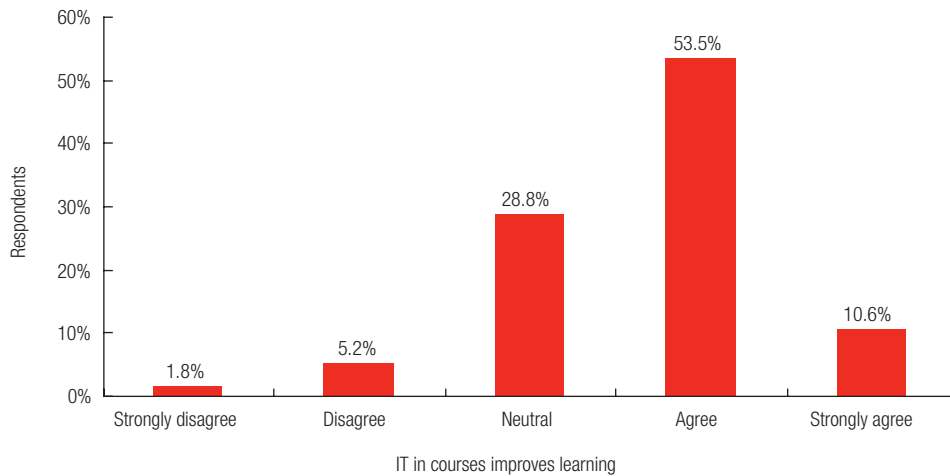
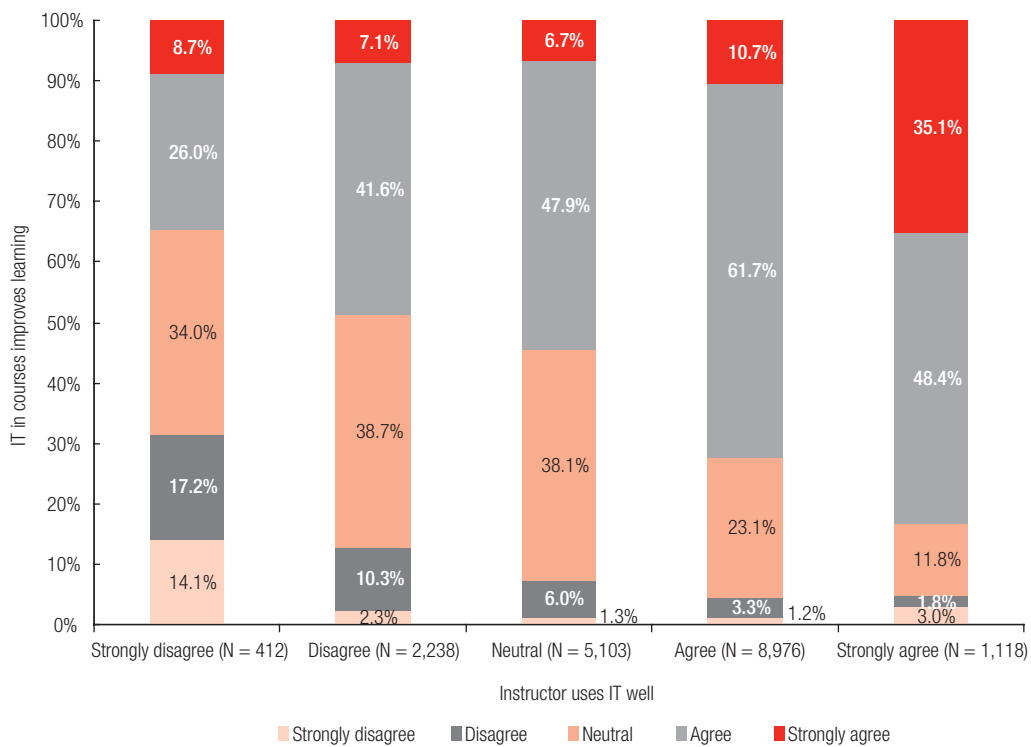


Figure 4-12.
IT Impact on
Learning, by
Instructor Skill
Using IT



Brandeis University student notes, “I have had professors who are great at making content available on the course management system, but I have seen professors who are pathologically afraid to touch a computer.” Another student echoes, “It depends on the professors. One professor is very computer illiterate. A couple of others know how to do very basic functions like e-mail. It is a mixed bag.” One undergraduate says that “Technology is great as long as the professor is smarter than the device. I have had quite a few classes cancelled or cut short because of technical difficulties.”

The most common comment from students in the qualitative interviews is that IT can help faculty present information and concepts visually, which helps students learn better. Some examples given by students include mathematical and 3D modeling. A less commonly cited factor, but one identified at several institutions, is how technology in courses gives students access to real-time and real-world data and experiences as well as to programs they will use in their professional lives. A freshman engineering student reports, “IT is very useful when done right. In my circuits class, we use technology to simu-

late circuits and then read data from the circuit into a computer program in real time. It helps you understand how things work.”

Student Technology Concerns

We asked students about their technology concerns (see Table 4-5). No issue elicited great concern among respondents. We tried to identify the students who were most concerned with certain problems and found very few differences overall. Male respondents are less concerned than female respondents with troubleshooting computers and viruses. Not surprisingly engineering students show less concern in this area than others.

Seniors are more likely to own older computers than freshmen.

Among technology concerns listed, students’ biggest concern is computer viruses, worms, and Trojan horses, followed by spam e-mail. Many students expressed frustration with the proliferation of viruses and spam on their computers. One remarked, “I feel like my computer has a lot of viruses and problems and that there is nothing I can do about it.” Another suggested that “A lot of things that we find out about viruses are things that the

Table 4-5. Student Technology Concerns

Concern	N	Mean	Std. Deviation
Computer viruses, worms, or Trojan horses	17,975	2.71	0.951
Spam	17,927	2.55	0.934
Slow or inadequate network access	17,915	2.48	1.066
My technical skill level in troubleshooting my computer	17,932	2.18	0.896
The age of my computer hardware and software	17,965	2.10	0.965
Inadequate access to printing	17,976	2.04	0.959
Inadequate technical assistance and help available to me on campus	17,954	2.04	0.927

Scale: 1 = not a concern, 2 = small concern, 3 = significant concern, 4 = major concern

antivirus programs can't fix. You have to restart in safe mode, and a lot of students don't know how to do that. They don't know how to run different types of virus scans, like going to the registry."

Regarding spam e-mail, one student lamented, "Campus mail spam is overwhelming. The filters do not work. It's easy to miss e-mails from the university and those from my professors on a regular basis."

Students are very impatient with slow and unreliable network connections. One student remarked in graphic terms, "My school relies on an archaic system and has failed to make improvements to the system other than occasional facelifts to pacify student and professor frustration. The latest result of the use of the fossil was a system access shutdown to students, by the Office of the Registrar, to allow professors to place grades online during fall 2004. With the increase in student population expected to rise to as many as 30,000 within the next 10–15 years, the current system will prove to be an absolute and totally useless piece of trash unless overhauled."

The campus network's speed and quality may be a competitive differentiator: "The Internet on this campus sucks! You all need to figure out a way for us not to get so many damn viruses and not have such a slow system. We pay too much to go to school here to not get a top-notch system. Where's all the money going? It's obviously not going towards improving our Internet situation." Speed and access are the network watchwords. According to one student, "There should be more wireless networks around the campus, and in-house wireless would be nice too. The Internet connection should also be faster for a university." Another student justly complains, "I resided in a triple [room] for the semester, and much to my dismay, we found that there were only two ports for our RJ-45 [Ethernet] networking cables. Luckily we had a hub to use, but I think all rooms

designated as a triple should have the correct amount of ports."

Some students also report their lack of IT skills at troubleshooting their computer. Says one respondent, "Students generally don't know the basics of maintaining or troubleshooting their computer." Another student adds, "Troubleshooting is not my strength. I was having all kinds of problems with my machine. I had the campus repair office fix it. Now I have the latest—Spybot. I could probably do some troubleshooting now from what I learned from my previous efforts."

The age of computer hardware and software is not a big problem from the students' perspective. Some students do, however, report frustrations. Says one student, "I am often frustrated at the slow computers. It takes me a lot longer to do my work, and often times I have to avoid using the lab if I am concerned with completing work in a timely manner." Another pleads, "If you could please save me from these archaic UNIX systems that this university stubbornly insists on sticking with, I'd be indebted to you for life. The technology is way behind, and contrary to their belief (they're really just in denial), the UNIX systems are very inefficient. Educational growth would rise exponentially if they would just let their foolish notions go."

Access—both technical and economic—to printing is a small concern overall for survey respondents. It clearly is a concern for some. One student reports, "The issue of access to printing is very heated among many of my peers. I am very glad that my school gives us an allowance to print at the school computers, but I wonder if they take into consideration that many professors also assign substantial online readings that we are expected to print out. At the halfway point for this semester, I was already out of my allowance on school computers, and I had been using that money to print out assigned readings only. I certainly hope that my school is not implying that I

ought to do my readings online and never print out a hard copy. I know some students who do this, but I feel at a distinct disadvantage when I do not have something to mark up and take with me to class.”

Finally, most students report little concern about IT support services—but this may not mean that these services function well. In fact, it is interesting to note how reviled IT support services are by some respondents. One student quipped, “We used to joke that it was not the ‘Help Desk’ but the ‘Helpless Desk.’” Some students argue that one campus hand giveth while another taketh away: “The amount of technology on this campus is great, but God forbid you have a problem with it. There need to be people ready and willing to help no matter what the problem. And how about keeping an information systems manager or staff around with the library staff? Most people don’t use and/or get computer problems from 9:00 a.m. to 4:30 p.m.” And one student says bluntly, “Overall, I would rate the information technology department as unsatisfactory.”

Conclusion

Colleges and universities have invested large sums of money in technology. Much of this investment has been in networks and other elements of a general communications infrastructure. These institutions have also invested in improving business processes that affect the student experience in particular (Kvavik and Goldstein, 2005). These investments appear to be paying off. Students seem to see these investments as contributing significantly and primarily to convenience and facilitating communications. We have made life much easier for students in the administrative area, where a great many

lines have disappeared, one-stop shopping concepts have been embraced broadly, and most of student commerce with the institution is conducted electronically.

Institutional investment in technologies that impact the course experience—like course management systems, learning objects, and simulations—have been adopted more recently and perhaps more unevenly. Some students in this study acknowledge that technology improves learning, and we suspect this occurs most frequently where there is a deliberate institutional or faculty strategy to change and improve the learning experience. As with any tools, in the end it is more about pedagogy and institutional will and less about hardware and software. Many students are using software applications such as PowerPoint, Excel, and course management systems. By themselves these tools do not create or constitute an improved learning experience. Rather, students understand that it is incumbent on the faculty member to understand these tools’ promise and performance in support of improved learning and to use them accordingly. Our data suggest that we are at best at the cusp of technologies being integrated meaningfully into pedagogy in ways designed to improve student learning.

Endnotes

1. The wording in the 2004 survey was different: “The use of technology in my classes met my expectations.” The mean of 3.54 in 2004 to this related question was not significantly higher than in 2005.
2. Pascarella and Terenzini (1976) reported that the frequency and quality of student-faculty interactions significantly predict freshman academic outcomes such as college satisfaction and attrition. Other studies point to the importance of student-student communications to academic performance, persistence, and retention.