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Information Technology in the Classroom

Information technology is just a tool. Like all tools, if used properly it can be an asset. If it is used improperly, it can become an obstacle to achieving its intended purpose. Never is it a panacea.

—Computer science major

I think universities should ease up on pushing information technology. I have an associate's degree in computer science, and yes, I am a Luddite.

—Senior respondent, ECAR survey

As the first student quoted above so astutely observed, technology in the classroom is not a panacea. It must be properly used. Then students will perceive it to be extremely beneficial and effective. As one enthusiastic student commented, "I love information technology. It has helped me to grow tremendously academically this year, and it strengthened my relationships with teachers, classmates, and friends." For others, Luddite or not, it is problematic, undermining face-to-face contact and having little impact on their learning. One student said, "I feel like I have lost part of the vital student-teacher connection." Another noted that technology made faculty seem more detached. For some, it appears to be a Luddite ambivalence about machines, although this is more often a student's perception of the faculty.

What the above contradictory comments suggest is that realizing IT's potential contribution to student learning requires careful thought and effort among faculty and students alike.

Chickering and Gamson identify seven principles that contribute to good practice in teaching and learning:

- ◆ encourage student faculty contact,
- ◆ encourage student cooperation,

- ◆ encourage active learning,
- ◆ encourage prompt feedback,
- ◆ emphasize time on task,
- ◆ communicate high expectations, and
- ◆ respect diverse talents and ways of learning.¹

Building on Chickering and Gamson's work, Chickering and Ehrmann identify ways to use technology in the classroom as a lever to implement these seven principles in undergraduate education.² For example, they propose the use of e-mail and other forms of technology to dramatically improve student-faculty contact. Publishing student work on the Internet makes it more visible and thus communicates higher expectations. And technology use can help better accommodate diverse learning styles by catering to visual learners and facilitating learning at different speeds. By using technology in such ways, they contend, technology can start realizing its potential to improve learning.

Similarly, Colleen Carmean and Jeremy Haefner identify five categories of learning principles that technology can support and thereby foster an engaging and student-centered experience:

- ◆ *Social.* Technology facilitates communication between students and faculty and among students, and it permits rich and timely feedback from faculty.

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- ◆ *Active.* Students engage with real-world data and issues, faculty employ active learning techniques, and curricula emphasize exploration, practice, and reinforcement.
- ◆ *Contextual.* Students come to class with an existing knowledge base and preexisting conceptual frameworks.
- ◆ *Engaging.* Technology permits accommodating different learning styles, communicating high expectations, and providing a high-challenge, low-threat environment.
- ◆ *Student owned.* Students organize materials and take control of planning for their work.³

These researchers guide our analysis of how technology contributes to the undergraduate learning experience. Do students believe that technology use at their campus improves learning? Do they acknowledge faculty's adherence to best practices and recognize technology's impact on their learning? In this chapter we pay particular attention to student use of and preference for technology in the classroom. We focus on several aspects:

- ◆ *Communication.* Is technology being used in the classroom to facilitate communication and collaboration between students and faculty as well as among students?
- ◆ *Active learning.* Is technology being used to facilitate active learning by introducing real-world data or problems, with an emphasis on exploration, practice, and reinforcement?
- ◆ *Feedback.* Are faculty using technology to provide more feedback to their students? Do students believe this feedback contributes to their learning and their undergraduate experience?
- ◆ *Time on task.* Is technology use increasing the amount of time students spend on course-related work?
- ◆ *Student control.* Is technology use contributing to students' greater control of their progress in their classes?

In analyzing the students' responses to our survey, we also contrast faculty responses to similar questions found in the ECAR study on faculty use of course management systems at the University of Wisconsin System's institutions.⁴

Student Preference for Classroom IT

What are student preferences with respect to technology use in the classroom? We expected that the millennial student would prefer classes that use technology and increasingly demand technology in support of learning. What we find instead is a bell curve with a preference for moderate classroom technology use (see Figure 4-1). The mean (3.07), median (3.00), and mode (3) were squarely at the moderate level of preference on a scale of 1 to 5, with 1 being "I do not prefer the use of technology" to 5 being "I prefer taking courses that are taken totally online." We found that 30.8 percent of students preferred taking courses that use extensive levels of technology. Least preferred (2.2 percent) were courses delivered entirely online. Nevertheless, 25.6 percent of the students preferred limited or no use of technology in the classroom.

A Pennsylvania State University survey found a similar distribution of preferences: 47.0 percent of students surveyed would prefer to take a course that makes significant use of technology, and 46.0 percent preferred a traditional classroom setting.⁵

We also used a two-box ratio to illustrate student preferences. To do this we delete the neutral group from the analysis and compare the ratio of students with the strongest and weakest preferences for classroom technology. What we find is a rather weak ratio in favor of technology: 1.4 to 1.1.

To better understand what factors influence the preference for classroom technology use, we clustered the factors as follows:

previous experience with classroom technology use; faculty skill using technology, hours students use technology, and respondents' perceived skill levels using computers; institution; and major, GPA, and demographics.

We found that a student's previous positive classroom experiences had a beneficial impact on the preference for classroom technology. Not surprisingly, if the instructor uses technology well, students will come to appreciate its benefits. This may explain why seniors had a higher preference level for classroom technology use than freshmen. Noteworthy, too, is the finding that a student who gets better grades in classrooms using technologies likes those classes better. But also significant was the finding that students who feel they have more control (planning, apportioning time) over their classroom experience because of technology use also strongly preferred a high level of classroom technology use.

The qualitative findings revealed students' strong feeling that faculty use technology poorly. Many students commented on their

instructors' lack of skill. One Colgate University undergraduate said, "Faculty skills are across the board from very skilled to clueless." Another noted, "Most faculty use of technology is fairly bad. Many want to use it but are scared because students know more [than they do], and they get embarrassed." Other students complained about having to waste class time while faculty tried to get the technology to work. "Web sites are helpful, but faculty use of technology can be more of a pain than it's worth if they spend the first 15 minutes of class trying to get a projector to work." Other problems mentioned include faculty's lack of awareness of the technology options available to them. Especially noteworthy was the unskilled use of PowerPoint and course management systems.

Faculty, though, have a different perception of their technology use. Sixteen percent of faculty who participated in ECAR's *Faculty Use of Course Management Systems* study reported having decreased their CMS use because students found the system difficult

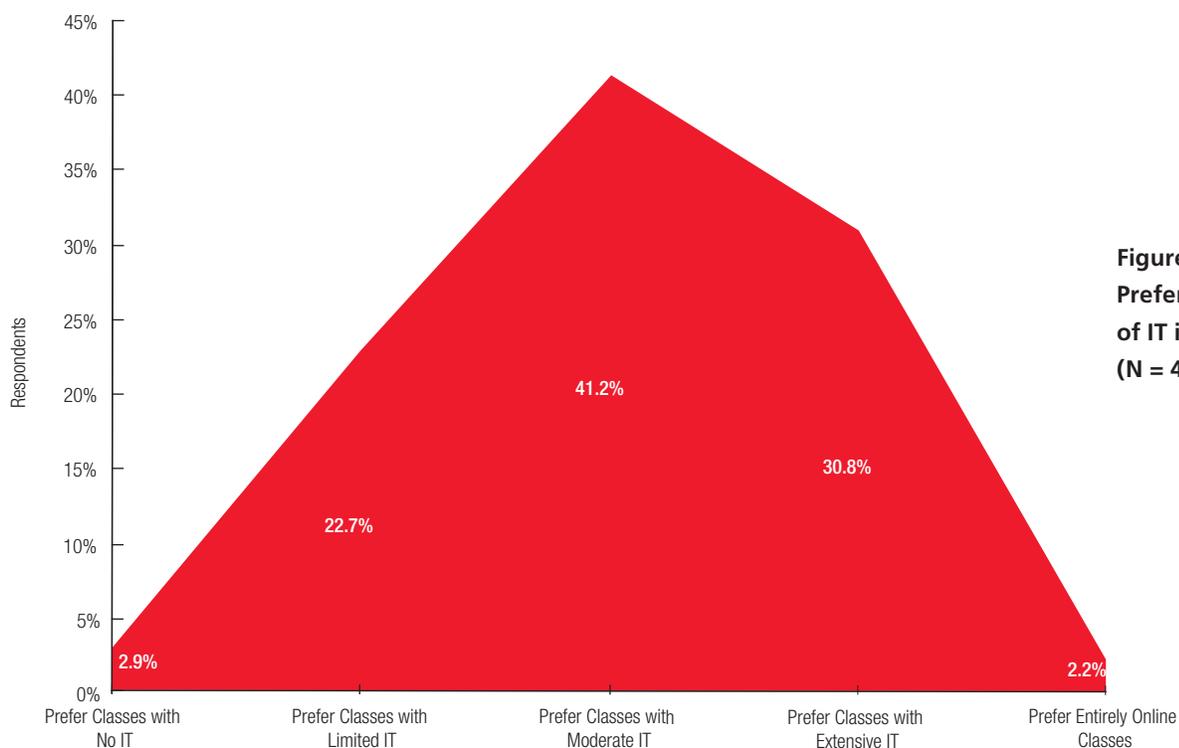


Figure 4-1. Student Preference for Use of IT in Classes (N = 4,363)

to use.⁶ Student technology difficulties included access problems, lack of technology skills, students' lack of motivation to use a CMS, and students' lower preference for online materials.

A student's major was also an important predictor of preferences for classroom technology (see Table 4-1). Engineering students,

followed by business students, had the highest preference for technology in the classroom, and seniors in these two majors had a higher preference for technology than their freshman counterparts.

We noted some institutional differences (Table 4-2), but these were minor and found to be statistically insignificant. Research uni-

Table 4-1. Preferences for Technology by Major

Discipline	Prefer No Technology	Prefer Limited Technology	Prefer Extensive Technology
Engineering	4.8%	24.4%	67.8%
Business	1.3%	28.2%	64.3%
Life sciences	4.8%	35.3%	56.3%
Physical sciences	5.7%	40.9%	51.8%
Social sciences	7.9%	44.4%	44.2%
Education	3.5%	47.9%	42.9%
Humanities	7.7%	47.9%	40.2%
Fine arts	9.0%	46.9%	39.3%

Table 4-2. Preference for Technology by Institution

Institution	Mean*	N	Std. Deviation
University of Wisconsin–Madison	3.21	456	0.819
University of Wisconsin–Stout	3.20	302	0.841
University of California, San Diego	3.16	242	0.874
University of Minnesota, Crookston	3.16	190	0.790
Drexel University	3.15	511	0.908
University of Minnesota, Twin Cities	3.14	329	0.929
University of Wisconsin–Milwaukee	3.06	331	0.914
University of Wisconsin–Whitewater	3.05	233	0.916
University of Wisconsin–Oshkosh	3.03	374	0.872
University of Wisconsin–Eau Claire	3.00	631	0.779
University of Wisconsin–La Crosse	3.00	387	0.816
Colgate University	2.73	327	0.777
Mean for the total sample	3.07	4,362	0.859

*Scale = 1 (I prefer taking classes that use no information technology) to 5 (I prefer taking classes that are totally online)

versity and laptop institution students ranked similarly in their preference for classroom technology use. The Wisconsin master's-degree-granting universities' students had less of a preference for technology use. What surprised us was the score at Colgate University, whose students report that they are highly skilled in the use of technology and use their computers a great deal on a weekly basis. If we compare Colgate University students' preferences with the strongest and weakest preferences, 40.9 percent prefer little or no technology in the classroom, compared with 25.6 percent at all institutions. But this may relate to the absence of business and engineering majors, and also to the importance of seminars and small group discussions in the liberal arts collegiate environment.

We also queried whether the number of hours spent doing various activities on a computer affected preferences for classroom technology. The best predictor was the use of course management systems. We will return to the impact of course management systems in the next chapter. Looking at the perceived skill level with each software application

produced a similar result. Basically, students who are more comfortable and skilled at using classroom technologies prefer having them available.

We also found minor gender differences. Males prefer slightly more classroom technology use (see Figure 4-2).

We found a similar but weaker pattern when comparing seniors and freshmen, with seniors showing a greater preference for technology use than freshmen. This finding surprised us; it contradicts what we would expect of the younger millennial students in our study. We can only surmise some level of ambivalence among the freshmen. It may also lend strength to the earlier finding that previous and positive experience with classroom technology is significant. Also, freshmen are unlikely to come to college knowing Excel and PowerPoint. They generally know e-mail, instant messaging, and video games.

When we analyzed students' preferences for classes using technology, we found that a student's GPA was not a significant factor. Students with lower GPAs preferred classes using technology equally with those students having

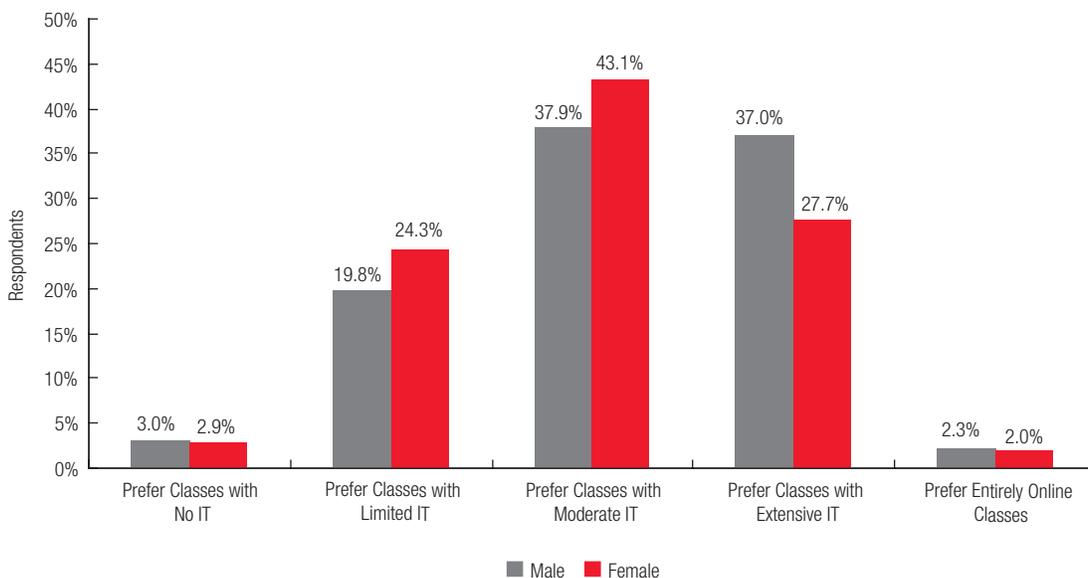


Figure 4-2. Student Preference for Classroom IT Use, by Gender

higher GPAs. An exception was that students with the highest GPAs (3.51–4.00) modestly preferred less classroom technology.

We thought that a preferred learning style would influence a student's preference for technology (see Table 4-3). The literature we discussed in Chapter 3 on the millennial generation suggests a preference for teamwork. This expectation was not corroborated.

Technology's Impact in the Classroom

We asked students to evaluate the impact of classroom technology use (see Table 4-4). They clearly gave the highest scores to improved communications—with classmates and faculty and through feedback on course work. They also highly rated the related ability to improve the presentation of their work. Ranked almost as high were classroom management activities: more time for practice and reinforcement, and greater control of classroom activities (planning, time apportionment, and self assessment). Activities related to comprehension of classroom materials (complex concepts), time on task, interest levels, and grading outcomes appear more neutral from respondents' perspectives.

The earlier ECAR course management study also established the importance of

improved communications.⁷ Improving communications was one of the top five reasons for using a CMS.⁸ Fifty-nine percent of faculty reported that using a CMS increased faculty-to-student communication.

An interesting finding is that students do not feel that classroom IT use greatly increases the amount of time engaged with course activities (3.22 mean).⁹ This directly contrasts with the earlier ECAR study's results, where 65 percent of faculty reported that they perceived that students spend more time engaged with course materials when IT is used in the classroom.

Engineering and business students indicated that classroom technology did better their understanding of complex concepts and provided more opportunities for practice and reinforcement. This may suggest that these disciplines or their faculty are further ahead in the development of software applications for their students. Seniors, too, provided overall higher scores than freshmen.

We again saw some gender difference: women looked for more training from the faculty and spent less time than their male counterparts in classes that required technology.

We surmise from these initial findings that faculty and students alike use classroom technology heavily for administrative and com-

Table 4-3. Student Learning Styles

Learning Style	Frequency	Percentage
I learn best by working alone and thinking through concepts by myself.	631	14.5%
I learn better by working alone in some situations.	1,090	25.0%
I learn equally well by working alone and by discussing problems and concepts with others.	1,631	37.4%
I learn better by discussing concepts and problems with others in some situations.	689	15.8%
I learn best by collaborating with others and discussing problems and concepts with them.	321	7.4%

munication purposes, and applications that support new and innovative ways to learn aren't nearly as visible to students.

The qualitative data corroborate this finding. Most students interviewed described classroom technology use as fairly narrow, and where it was used, these uses tended to be somewhat staid.

IT's Perceived Benefits

We asked students about the perceived benefits of using technology in the classroom (see Figure 4-3). By far the most cited benefit was convenience (48.5 percent). When combined with saving time, the percentage increases to 64.6 percent. Only 12.7 percent said the most valuable benefit was improved learning, and only 3.7 percent perceived no

benefit whatsoever. These findings compare favorably with those of a study done by Douglas Havelka at the University of Miami in Oxford, Ohio. He found that IT's top five benefits were that it improves work efficiency, affects how people behave, improves communications, makes life more convenient, and can be used to save time. The sixth-ranked benefit was that it improved students' ability to learn.¹⁰

We looked for factors that might explain differences in the perceived primary benefit of technology in the classroom. Gender, class (senior/freshman), GPA, and major had little impact, but we saw some notable differences by institution. The University of Minnesota, Crookston, stood out in terms of the number of respondents who indicated that technology had improved learning (20.6 percent), versus,

Table 4-4. Perceived Impact of Classroom Technology, by Activity

Activity	N	Mean*	Std. Deviation
The use of IT in classes has helped me to better communicate with the instructor.	4,358	3.85	0.845
The use of IT in courses has resulted in prompt feedback from the instructor.	4,351	3.84	0.813
The use of IT in courses has helped me communicate and collaborate with my classmates.	4,343	3.64	0.893
I primarily use IT in courses to improve the presentation of my work.	4,353	3.61	0.872
The use of IT in courses provides more opportunities for practice and reinforcement.	4,345	3.58	0.803
The use of technology in my classes met my expectations.	4,358	3.54	0.747
Classes that use IT allow me to take greater control of my class activities.	4,346	3.45	0.923
The use of IT in classes has helped me better understand complex or abstract concepts.	4,358	3.38	0.854
The instructors' use of technology in my classes has increased my interest in the subject matter.	4,347	3.25	0.906
Classes that use IT are more likely to focus on real-world tasks and examples.	4,347	3.23	0.884
I spend more time engaged in course activities in those courses that require me to use technology.	4,362	3.22	0.928
I get better grades in courses that use IT.	4,356	3.19	0.925
Faculty members need to give us more in-class training for IT used in the class.	4,361	3.04	0.976

*Scale = 1 (strongly disagree) to 5 (strongly agree)

for example, Colgate University at 9.5 percent. In contrast, Colgate University students (64.2 percent), followed by the University of California, San Diego, students (56.0 percent), gave the highest scores to convenience. And all University of Minnesota and Wisconsin campuses tended to give a higher score to management of classroom activities (approximately 19 percent, on average).

The qualitative data and open-ended survey responses reinforce these findings. We group the students' comments by category of perceived benefit.

Convenience

In the survey's open-ended comments, 134 students voluntarily identified convenience as one of the primary benefits of using IT in classes. Student comments included

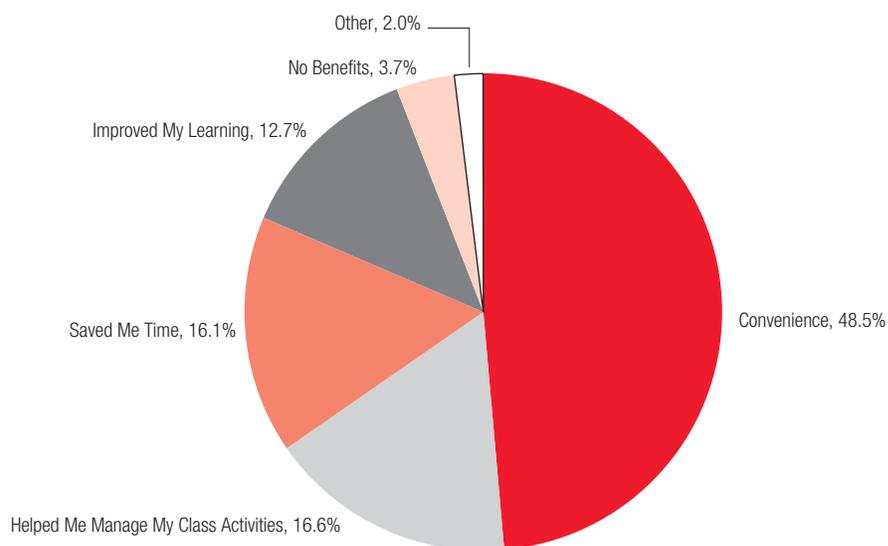
- ◆ "I don't need to go to the library very often."
- ◆ "I could work full-time while taking classes."
- ◆ "Reading materials were posted online, so I could print out a chapter as needed for class instead of buying the entire book."

- ◆ "My chemistry class has assignments and exam answers online—very convenient."
- ◆ "The availability of information technologies around campus has helped me save time in an already hectic schedule. I am able to go online at any number of places and access pertinent documents, which saves me time."
- ◆ "I feel technology is a benefit to everyone because of its increased convenience and speed."

Management of Class Activities

The students also emphasized the ability to manage time and information. They found faculty's use of PowerPoint to be very helpful, especially when faculty made their notes available for download. The students described PowerPoint as a way to organize information and really appreciated that they no longer had to decipher faculty handwriting. They also stated that it makes their notes far more accurate. A University of Wisconsin–Milwaukee student stated, "I know that I haven't misheard something or misspelled it. If I lose

Figure 4-3. Student Perceptions of Benefits of Classroom IT Use



or damage my notes, there is a copy that I can get back—or if I miss a day, I can get a good copy of the notes and not have to rely on the notes of someone else in the class.”

Learning

Although students strongly emphasized the convenience factor of classroom IT use, they also consistently stated that good use of technology helps them learn. The most common comment we heard in the qualitative interviews was that technology helped faculty present information and concepts more visually, and this helped students learn better and more effectively. Examples students described included mathematical and 3D modeling in chemistry and geology. A less commonly cited factor, but one identified at several institutions, was how classroom technology gave students access to real-world data and experiences as well as to programs they might use in their professional life after graduation.

Students appreciated the different kinds of information that technology gave them access to. One student noted that while he was generally not satisfied with classes that used technology, using technology had helped him. “I can go to the Internet and find stuff out. For example, in a class on nanotechnology I went online and found pictures that portrayed nanotech, which was really helpful in understanding the concept.” Other comments illustrating how students value technology’s use in support of learning included, “Technology doesn’t increase learning, though it does depend on the class and the type of learner. Some people might need to see things to learn. Also, if technology brings in different types of information, then it does increase the class experience; it can give you a more complete look. Plus you can get good background information—for example, ‘Googling’ a speaker to find out more about him, or getting survey data from

South Africa. I am learning so much more on my own because of the Internet.”

Students described how PowerPoint helped their faculty to be more organized, and they said that having more accurate and easier-to-use notes definitely helped their learning. “Online notes help you follow along a little better and help you see what the professor is focused on.” Another commented, “If they put the notes up ahead of time, you can see what you don’t understand. Plus we are such a visual culture, and it gives you something to look at, a visual cue.” However, one student astutely noted that the effective use of PowerPoint depends on faculty teaching skills: “PowerPoint presentations and online lecture notes won’t replace the teaching ability of the professor.”

One downside to this use of technology is that many students recognize that it can make them lazy or passive and encourage them to skip class. The same student from the University of Wisconsin–Milwaukee quoted above said one of his professors advised students not to download the PowerPoint as a handout but to take their own notes and then compare them to the PowerPoint slides.

Although most students positively viewed faculty use of PowerPoint as an organizational tool that indirectly contributes to learning, some students were critical about the poor manner in which faculty used the tool. “Faculty use of technology is okay. But it hasn’t made leaps and bounds. With a chalkboard, at least the lights were on and you didn’t fall asleep. Some use videos and music and this is cool, but the majority are taking their lectures and just putting them on PowerPoint.” Students complained that faculty would often read their PowerPoint slides out loud (instead of teaching from them) and frequently moved too quickly through the material. “PowerPoint can be too fast. It is possible to get too much information and then you end up not paying attention to the professor and you’re not as

involved in the class. You need to think about the material.” Students also described how faculty PowerPoint use made class a little too structured and inflexible and could distance faculty from students, especially when the faculty relied on it too much. “PowerPoint takes away from interaction.”

The students’ perception of the benefits of IT use agrees with the faculty’s view as reported in the ECAR study *Faculty Use of Course Management Systems*. Asked about their perception of how course management systems accommodated diverse learning styles, 70 percent of faculty surveyed reported that using a CMS provided opportunities for students to work at their own pace. More than 60 percent noted that a CMS let them distribute course materials in a wide variety of formats. They perceived that this increased student learning and helped students learn at their own pace.¹¹

Communications

Students felt that technology improved communication with the faculty. Technology made it possible to have out-of-classroom contact—for example, setting up meetings with faculty by e-mail or e-mailing a question and getting a quick response, especially valuable when working on a project. “E-mail makes it easier to communicate. For example, e-mailing a question to a professor about something that you wouldn’t quite go to office hours for but you still want an answer for.” Similarly, “Hours are an issue. Faculty don’t keep the same hours as students do, and so e-mail helps you ask a question when it occurs to you, though it can lead to your being very impatient—‘Why hasn’t he e-mailed me back, it’s been 10 minutes?’” Students also reported that e-mail helped break down barriers between students and faculty, resulting in less formal, more relaxed interaction. “E-mail makes you more comfortable with the faculty. You can e-mail them before

meeting with them, it can help cut down on formality, they sign with their first name or write a fairly relaxed note. It makes you feel less intimidated.” Another perceived benefit was saving class time for teaching instead of housekeeping tasks. “You can save class time by doing things outside of class. And it means faculty can get news to students.”

Others were less positive. Sometimes technology made learning impersonal and decreased personal contact with professors. “Students don’t go speak to faculty members that much. They generally shoot them an e-mail. This cuts down on personal contact—but it does increase out-of-class contact.” Similarly, “One of the disadvantages of the use of technology is a little more disconnection between faculty and students. They don’t talk or meet, but rather exchange e-mail.”

Presentation of Work

Contrary to the quantitative data, the qualitative interviews didn’t find that students assigned an especially high priority to using technology to improve the presentation of their work. The students interviewed placed far more emphasis on faculty’s using technology to improve their presentation, as described above. Students, however, are using technology such as Photoshop and graphic applications in natural and physical science classes for this purpose, though some describe struggling with them. Illustrative comments include

- ◆ “Information technology helps make my work look clear and precise.”
- ◆ “Information technology allows my work to be neat and organized, which generally results in a better grade.”
- ◆ “Information technology allows me to better demonstrate my work.”
- ◆ “Information technology has helped me to better communicate my presentations to my classmates, thereby helping them to learn from me and vice versa.”

Barriers to IT Use

We asked students whether they perceived barriers to their use of technology in the classroom and offered them a list of possible barriers (see Table 4-5). We found that more than half thought they faced barriers to technology use (54.3 percent), but they didn't see the barriers we listed as major problems. Most problematic on our list were, feels like extra work (16.7 percent), applications not running on their computer (14.1 percent), lack of access to printers (13.4 percent), and lack of technical support (9.7 percent). These findings were reinforced by how many times students mentioned them in an open-ended survey question.

We let students identify barriers they perceived to be problems through an open-ended survey question. What surprised us was the large number of students who took the time to vent their concerns. We can cluster their concerns into several categories.

Technology Problems

Students reported problems—with hardware, software, and computer viruses—with both personally owned and university equip-

ment. Many students complained about their personal computers, including their being too old and having battery-life problems. Students using university resources showed little patience with servers going down on occasion and disrupting their work patterns. Printers were also identified as a problem; old equipment breaks down. Some students complained of software problems and the cost of software applications. They also noted that some applications don't work on their machines. Some students were also unhappy about the multitude of viruses and the difficulties in getting their machines working again after being compromised.

Institutional Support

Students reported that lack of institutional support for operating systems such as Macintosh OS X and Microsoft Windows made using technology in their classes difficult.

Instructor Problems

Many students complained about their instructors' ability to use course management systems and other applications. In the open-ended comments in the quantitative survey,

Table 4-5. Barriers to IT Use (N = 4,374)

Potential Barrier	Not a Barrier	A Barrier
I have to set up and troubleshoot too many browser variations.	95.5%	4.5%
I don't have sufficient access to a computer.	95.0%	5.0%
I don't have the necessary skills.	91.3%	8.7%
It is too expensive.	91.2%	8.8%
I have trouble connecting to the Internet from my place of residence (I don't have reliable access to the Internet).	90.7%	9.3%
I don't have the technical support I need.	90.3%	9.7%
I don't have sufficient access to a printer.	86.6%	13.4%
The applications don't run on my computer.	85.9%	14.1%
It feels like extra work with little connection to the course.	83.3%	16.7%
There are no barriers.	54.3%	45.7%

more than 30 students noted that instructors don't understand how to use technology. One student commented, "A lot of the frustrations I encounter with information technology are caused by the fact that while we students are quick at picking up on these techniques, the teachers are often confused and make mistakes or errors that confuse the students. It's mostly the lack of technological education on the professor's part that is the trouble."

Students resent technology being used to create "busy work," which doesn't contribute to learning. One Colgate University student stated, "Faculty sometimes see technology as a medium for delivery and not so much a way of broadening what (or improving how) you learn." Further, they "just throw stuff in and don't really use it." Students also complained about spending too much time learning to use software rather than engaging with the course's subject matter. A German major described how many of her classmates complained that they spend too much time doing computer-related tasks and not enough time doing German.

In ECAR's *Faculty Use of Course Management Systems* study, faculty members were asked what caused them to decrease their use of a CMS.¹² Twenty-five percent reported that it was too time-consuming. They focused on two different aspects: the time it takes to get their course ready for a CMS and the time it takes to load the materials into the CMS. Only 10 percent reported that they decreased CMS use because they found it difficult to use. Hanson found that 53.1 percent of the faculty had little difficulty with the system, 27.8 percent thought some features were obvious but others were difficult to figure out and use, and only 5.7 percent said they needed considerable help to use the system.¹³

Course Management Systems

Students reported that discussion sections do not work well with a CMS. Online quizzes

caused some concern among the students because the tests are timed and students can't skip a question and go back. Also, computers can freeze, making it impossible for them to complete the quiz within the allocated time.

Personal Technology Skills

Some students were candid about their lack of computer skills. "I do not understand many of the applications on my computer. Also, I sometimes don't even realize what I can do with my computer or online unless someone else shows me how." Some students reported that they had Web-site navigation difficulties.

Faculty also view students' technology skills as a barrier to classroom IT use. In ECAR's *Faculty Use of Course Management Systems* study, faculty and staff noted that students had poor technology skills and that this slowed down or discouraged faculty from using a CMS. Some faculty reported that primarily older, nontraditional students lacked the technology skills to comfortably use a CMS, though numerous other respondents said that all students, regardless of age or standing, ran into similar problems.¹⁴

Access Problems

While access didn't pose a significant barrier to classroom technology use for most students, off-campus students more often identified this as a barrier. Many students who use the Internet at home via modem report that service is slow and downloading large files is annoying and time-consuming. One student noted that since he had no broadband at home, he had to come to school to do online work. Students also complained about trouble getting access because of password and logon problems.

In the *Faculty Use of Course Management Systems* study, 16 percent of the faculty who reduced their CMS use did so because students had difficulty getting access to the

needed technology. Faculty reported that many students didn't have reliable computer or Internet access at home.¹⁵

What we find, then, is a wide array of problems, none of which are significant for a majority of students. Combined, however, these difficulties cause problems for many students. Fortunately, much of what they've identified can be fixed or ameliorated.

Conclusion

Universities have invested enormous sums of money in technology. Students 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 revolution has occurred both culturally and in service delivery. The jury is out on IT's impact on learning and the learning experience.

Clearly, some students acknowledge that technology has improved learning, and we suspect this occurs where there is a deliberate institutional or faculty strategy to change and improve the learning experience. Software applications such as PowerPoint and Excel are tools, as is a CMS, but by themselves they do not contribute to an improved learning experience. It is incumbent on the faculty member to understand the promise and performance of these tools in support of improved learning and to use them accordingly. Our data suggest that we are, at best, at the cusp of employing technologies to improve learning.

Endnotes

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2. A. W. Chickering and S. C. Ehrmann, "Implementing the Seven Principles: Technology as Lever," *AAHE Bulletin*, Vol. 49, No. 2, 1996, p. 3.
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5. *FAAC Student Survey 2002*, The Pennsylvania State University, 2002, p. 2, <<http://tlt.its.psu.edu/surveys/fall2002/student2002.html>>.
6. Morgan, op. cit., p. 49.
7. Ibid., p. 64.
8. Ibid., p. 64.
9. The scale for this question was 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.
10. D. Havelka, "Students Beliefs and Attitudes toward Information Technology," *Information Systems Education Journal*, Vol. 1, No. 40, 2003, p. 3, <<http://isedj.org/isecon/2003/2434/ISECON.2003.Havelka.pdf>>.
11. Morgan, op. cit., p. 65.
12. Ibid., p. 48.
13. P. Hanson, "Project CMS@WBW.edu Pilot Study Report," October 2003, p. 7, <http://web.brandeis.edu/pub/Teaching/WbwInfo/cmswbw_report.pdf>.
14. Morgan, op. cit., p. 49.
15. Ibid., p. 49.