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Breaking Down Barriers to the Use of Technology for Teaching in Higher Education

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This chapter examines the most common technologies used for teaching on college campuses and the most common barriers to advanced uses of technology tools. Survey results consistently show that the major barriers to incorporating technology into higher education are lack of faculty time, faculty doubts about the relevancy of technology to disciplinary learning, and inadequate technical support for faculty projects and technology uses. This chapter, then, proposes several approaches developed and assessed by the Center for Research on Learning and Teaching at the University of Michigan for removing those barriers to technology uses in higher education. Although providing flexible technology training schedules and formats helps address the problem of time, offering training that combines pedagogy and technology skills clarifies the link between technology and disciplinary knowledge acquisition. Finally, the collaborative approach to technology support enables faculty to enjoy continuous and coordinated technology support for their projects and technology uses in the classroom. This chapter also provides recommendations for supporting faculty in using technology to improve their teaching and student learning.

Technologies are now widely considered as essential tools for teaching, with a strong potential for enhancing teaching and learning (Mumtaz, 2000; Steel & Hudson, 2001). Technology integration, however, doesn't always result in finding effective pedagogy and innovative learning approaches to promote student-centered teaching and learning outcomes. Various barriers

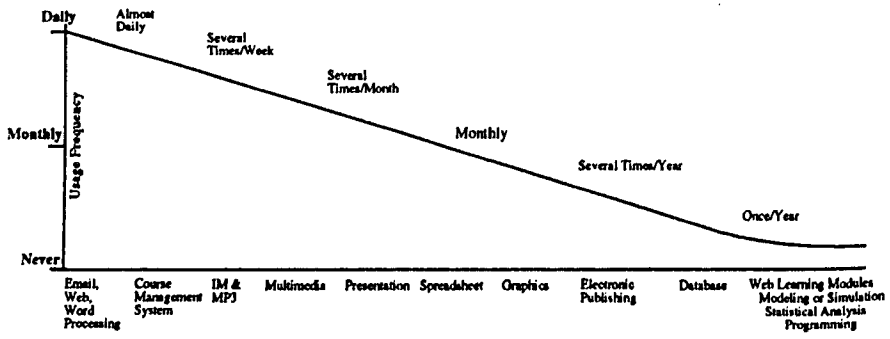
to integrating technology often prevent faculty from using it to promote knowledge construction and make changes in their teaching. This chapter reviews current technology uses in colleges and universities, identifies the major barriers that faculty members encounter when trying to integrate technology into classroom teaching, and recommends strategies that worked at the University of Michigan to effectively break down the barriers.

What Technologies Do Faculty Use in Teaching at Colleges and Universities?

Over the last decade some technology applications, such as the Internet, PowerPoint, email, word processing, and course management systems (CMSs), gained great acceptance in higher education. Faculty commonly use presentation technologies for lectures, electronically distribute lecture notes either before or after classes, manage student assignments and grades in CMSs, and communicate with students via email, discussion boards, and other communication technologies. Of all the technology tools used by faculty, communication technologies are probably the ones that faculty find most essential. Results from the Information Technology Survey at the University of Michigan (UMIT) show that most faculty believe that communication technologies keep them in close contact with students and colleagues and enable them to give students prompt feedback on their learning.

The landscape of technology use in higher education has not really changed over the years. Results from multiple years of UMIT surveys show that email, the web, word processing, presentation software, and CMSs are consistently the most frequently used applications (see Figure 20.1).

FIGURE 20.1
Technology Applications Frequently Used on College Campuses



Since the adoption of CMSs on college campuses, their use has focused on distributing information, resources, and content (Morgan, 2003). The 2005 UMIT survey revealed that the most frequently used feature in a CMS is the "Resources" function where faculty can post syllabi, readings, and links to the library. These 2005 data mirror the 2001 findings, where the most frequently used features in a CMS were "Resources" and "Assignments," and the least used features were "Discussion" and "Student Profiles." ("Resources," "Assignments," "Discussion," and "Student Profiles" are features in CTools, a CMS used at the University of Michigan.)

The pace of adopting complex features in a CMS like "Discussion," "Quiz Tools," "Gradebook," and "Wikis and Blogs" is slow. In higher education, the usage of complex and interactive technologies such as instructional games, simulations, role-plays, and interactive learning modules and objects remains low. The changing nature of technology and emerging new technologies make it difficult for faculty to keep up with new learning tools and the pedagogies for using them. No doubt, time is another underlying factor. Over the years, we have found that our faculty often do not have the time to learn technology skills and to take on the task of developing technology-based instructional materials.

Our observations are supported by the UMIT survey findings, which consistently identified time and skills, technology support, and relevance to disciplinary learning as the faculty's biggest barriers to using technology more extensively. Acquiring the skills necessary for using many types of instructional technologies, such as creating technology-mediated learning modules, takes too much time. In addition, faculty do not see clear connections between their use of technology and their students learning more content knowledge. Yet another problem faculty have encountered is insufficient technology support. Indeed, faculty training and support is fifth on the top-ten list of current IT issues in higher education (Dewey, DeBlois, & Educause Current Issues Committee, 2006).

Breaking down these barriers has become one of the biggest challenges faced by instructional and faculty development units, such as centers for teaching and learning and centers for instructional technology. But these barriers are not insurmountable. A large Midwestern research university has taken successful measures to reduce or remove the barriers faculty face when they consider using technology in their teaching.

A Matter of Time: The Enriching Scholarship and Teaching with Technology Programs

Most college and university campuses offer scheduled faculty workshops in technological skills. These workshops usually focus on training faculty to use software packages such as PowerPoint, Microsoft Word, Dreamweaver, Photoshop, and Flash at a basic, intermediate, or advanced level. They provide general rather than customized training to meet individual needs. And the workshops work well for faculty who already have ideas on how to integrate technology into teaching. This training method imitates an industrial model (Brown, 2006) that maximizes efficiency, but doesn't necessarily meet faculty's needs or suit their learning styles. Many faculty develop specific technology skills only as or just before they work on projects that require them. Standard workshops that focus on software applications fail to provide faculty with sound ways that they can use the skills in their teaching and research.

Time is another issue. The typical faculty's workload far exceeds 40 hours per week. In fact, faculty report spending an average of 57.2 hours per week on their professorial responsibilities, which include teaching, student advising, and writing internal and external grant proposals, as well as research and writing articles for scholarly publications (Cook, Wright, & Hollenshead, 2000). Juggling these many duties makes it difficult for faculty to attend fixed-schedule workshops during the regular semesters.

Finding time to attend technology workshops and to reflect on teaching with technology seems to be the most challenging tasks for faculty during the semester. Because time is always limited for teaching, research, and other immediate commitments, attending a technology workshop is often pushed down or off a faculty member's to-do list. As the UMIT surveys find, time needed to learn and use new technology is one of the biggest barriers to faculty learning technology and using it in teaching, and other studies confirm this finding (Beggs, 2000; Butler & Sellbom, 2002; Dooley & Murphy, 2001; Hagner & Schneebeck, 2001; Steeples & Jones, 2001).

The perfect time to attend technology workshops doesn't exist, but there are times when faculty members are less busy and have some time to reflect on teaching. By analyzing faculty teaching load, work patterns, and the calendar of campus events, we found that the beginning of May seems to be the most available time for faculty at our institution. This period of time usually falls between the end of the winter semester and the beginning of the spring semester, an interim period during which faculty typically remain on campus.

This insight into the best timing for faculty technology training led to the development of a weeklong program called "Enriching Scholarship," which

since 1998 has offered pedagogy training and hands-on technology sessions for faculty to explore the effective integration of technology into teaching, presenting material, conducting research, and publishing, as shown in Table 20.1.

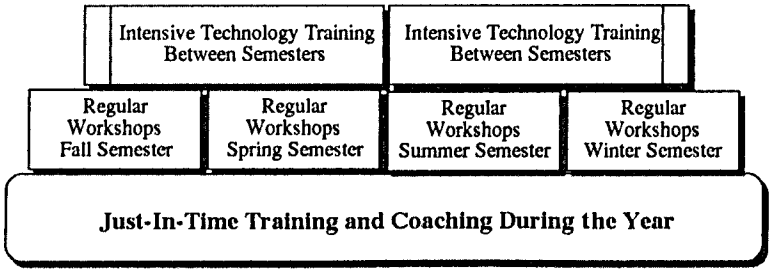
TABLE 20.1
Sample Themes and Topics for the Enriching Scholarship Programs (1998–2006)

Themes		Topics
	Teaching and Presenting	• Design/use course web site • Create multimedia presentation • Engage in media conversion • Design new courses/curriculum • Online teaching and learning • Create interactive teaching or assessment modules • Innovative ways of teaching
	Researching and Publishing	• Evaluate the use of technology for teaching and learning • Explore different strategies and pedagogies for teaching • Use and evaluate various sources of information • Learn and manage information databases • Organize and manage notes and citations • Seek grants to promote teaching and learning

The Enriching Scholarship Program, a collaborative effort from several university technology offices, succeeded in capturing faculty's attention. Since the first program in spring 1998, this annual event has drawn hundreds of faculty and graduate student instructors, and the number of training sessions has grown from about 50 in 1998 to more than 100 in 2006. The program features a keynote session each year to set the stage for faculty reflection on the potential of technology innovations to enhance teaching, learning, and research. Then the training begins as a weeklong series of intensive sessions on technology and pedagogy. For many faculty, this compressed schedule is more productive than a series of monthly fixed-schedule workshops. As a supplement to this program, we make available our "just-in-time" training and coaching services to faculty who want to get a quick start on an application or who need to follow up on their workshop training. Thus, the technology training takes a

three-tier approach: intensive technology training between semesters, regular workshop during semesters, and "just-in-time" training/coaching throughout the academic year, as shown in Figure 20.2.

FIGURE 20.2
Three-Tier Approach to Technology Skills Training



This three-tier approach creates more opportunities for faculty to learn technology skills at a time when they need those skills and have time to acquire them, thereby reducing the time barrier that inhibits faculty from learning and using technology for teaching. However, we encountered the unexpected problem of faculty attending the same workshop year after year. We wondered whether the workshop instructor had used the training time effectively and taught according to the plan. But it turned out that the faculty had not had the opportunity to implement the technology into their teaching immediately after learning it the previous year.

These returning faculty raised two issues. First, technology training may teach skills without making clear connections to disciplinary teaching and learning. Second, some faculty attend technology workshops without expecting the knowledge and skills to be relevant to their teaching. In this case, they may learn the skills for technology's sake rather than for advancing particular teaching and learning goals. Creative and innovative uses of technology in teaching and learning result from close connections between technology and disciplinary content. Providing training at a time faculty can attend is important, but its relevance to disciplinary teaching is highly pertinent to the successful integration of technology into teaching and learning.

A Question of Relevance: Connecting Technology and Disciplinary Learning

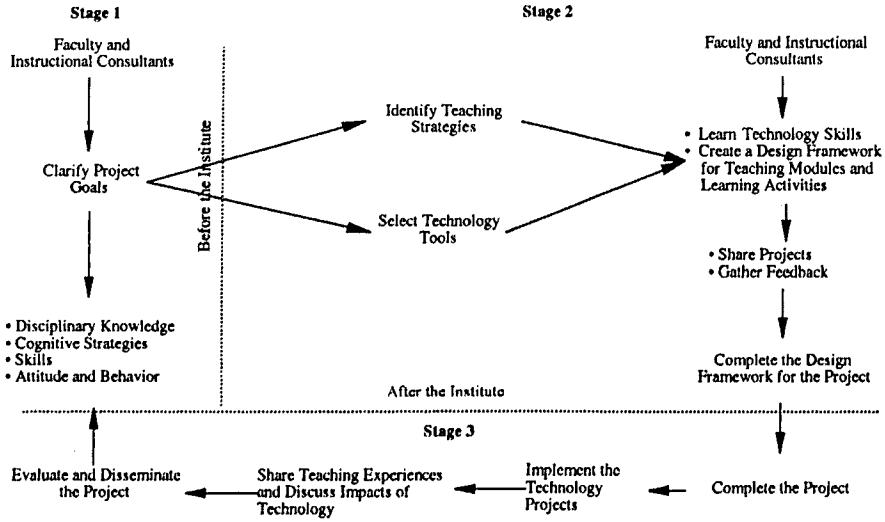
Questionable relevance has surfaced as a barrier to faculty's use of technology. Many faculty wonder whether it is worthwhile to master many of the available technologies (Butler & Sellbom, 2002). They also question whether technologies actually facilitate their students' learning of disciplinary content and skills. These concerns are not groundless. Technology can fail when carelessly planned or inappropriately used. To help faculty better appreciate technology's potential and connect it to disciplinary teaching, the Center for Research on Learning and Teaching (CRLT) established a five-day Teaching with Technology Institute that focuses on the connections among pedagogy, technology, and disciplinary learning.

Admission to the institute requires that interested faculty propose course-related technology projects. Each year, we select 10 faculty members based on such criteria as "inclusion of sound pedagogy in the plan for using technology in teaching" and "potential impact on student learning." Each participant receives a stipend of $2,500 for attending the institute and completing the project.

Institute participants define their course goals and learning objectives, design activities that assist students in meeting the learning objectives, identify technology tools that will facilitate student learning, and, finally, learn the technological skills they need. But each participant needs to be clear about what disciplinary knowledge, cognitive strategies (such as critical thinking or problem-solving skills), procedural skills, and attitudes he or she would like students to acquire in the course and what technologies may help students acquire them. A series of consultations helps the faculty identify the most relevant technologies. Of course, low-tech tools sometimes may prove useful for faculty projects as well. This approach of putting student learning first reverses the typical order of technology training, which often puts technology first. Figure 20.3 diagrams the steps through which each faculty project progresses.

As Figure 20.3 illustrates, institute faculty meet several times with CRLT instructional consultants, first to clarify project goals in terms of student learning outcomes, and then to design activities that engage students in learning content. The consultants help faculty explore a range of technology tools that can assist students to achieve the learning objectives, select the most appropriate technologies for the project, and identify ways to acquire the specific skills they need. Usually the faculty are advised to learn software applications like PowerPoint or a CMS before the institute starts, either through a "just-in-time" training service or by attending a training session if it fits his or her schedule. During the institute itself, faculty can then focus on mastering the particular features of a software application that aids in their designing teaching modules

FIGURE 20.3
Planning Stages for Faculty Technology Project



and learning activities. Participants also share their projects, discuss reasons for creating technology-based learning activities, and give and receive feedback. Most complete a framework for designing course materials, a template for teaching modules, or the actual teaching modules. Any remaining work is completed by the faculty member alone or with the help of a student assistant during the summer.

During the fall semester, participants implement their projects, teaching with either the chosen technology or the materials they created during the institute. Toward the end of the semester, they all meet to share their experiences, lessons learned, and the impacts of their technological innovations on their students' learning. Finally, they develop plans for project evaluation and dissemination.

Teaching with Technology projects range from multimedia presentations to interactive tools to web sites. For example, one professor created a multimedia and interactive PowerPoint presentation for a modern Latin American history lecture course. In his presentation, he uses images with audio and video clips, but he stops for student input in the middle, modeling a method of interactive presentation for engaging and involving an audience. Another project, "Interactive Education: Learning Pathology in the Context of the Patient," presents case histories to engage students in collaborative problem-

based learning. The web-based and graphical cases pose specific questions that require students to research issues on their own outside of class, then to send to the instructor their questions and comments about the cases. These questions and comments add focus and a sense of student ownership to the class discussions.

Faculty feedback about the institute has been very positive. Participants report gaining a more comprehensive grasp of a range of technology tools available for enhancing teaching and learning experiences. Some faculty in the social sciences and humanities also appreciate obtaining new perspectives on approaching their disciplinary materials.

In summary, the institute brings technology to faculty and connects it to teaching disciplinary knowledge. With the faculty projects deeply grounded in genuine teaching contexts and focused on disciplinary knowledge acquisition, the link between technology and the disciplines is more obvious. Therefore, learning technology skills takes on meaning and relevance to faculty.

Taking a Collaborative Approach to Technology Support

Faculty sometimes feel threatened by unexpected technology glitches, and the resulting loss of class time, when they use technologies in unfamiliar instructional settings (Berge, 1998), and they often complain about the irregular and inconsistent support they receive from technology units on campus. This kind of support impedes their uses of technology in teaching and their completion of technology projects (Berge, 1998). For example, when a faculty member creates and uses multimedia presentations or interactive learning activities for lectures, he or she may have problems in running the presentations smoothly, projecting them correctly, and getting technology to work well enough to engage students.

The support systems on most college campuses are designed to foster the earlier adopters' technology integration into teaching (Johnston & McCormack, 1996), also known as the "first wave" (Hagner, 2001). They are usually technologically savvy risk-takers and self-starters and "they will come if you build it" (Hagner, 2001). However, they do not constitute the majority of faculty at any institution. Faculty who attend technology workshops and propose projects for a technology institute may have some characteristics in common with the first wave, but they usually want to focus on teaching and learning and regard the technology as just a means to an instructional end (Hagner & Schneebeck, 2001).

Large universities usually run technology skills training out of one or more centrally supported computer labs, and at this level technology support tends to be high quality. But when faculty go back to their offices, they may find that college or departmental support staff are ill prepared to advise on using certain software in teaching.

Therefore, CRLT takes a collaborative approach to planning, organizing, and supporting projects initiated in the Teaching with Technology Institute. Collaboration is necessary for several reasons: the decentralized support structure of a large university; the high-level expertise needed to support faculty technology projects; and the impossibility that a single unit can offer expertise over as wide a range of areas as faculty development, instructional design, software training, and classroom/facility support. For instance, CRLT has expertise in faculty development, course design, and pedagogy for using technologies in teaching, and other central and departmental technology units have support staff specialized in hardware and software applications and training, as well as in network infrastructure. Neither CRLT nor the technology unit alone is able to provide comprehensive support for faculty in their uses of technology in teaching.

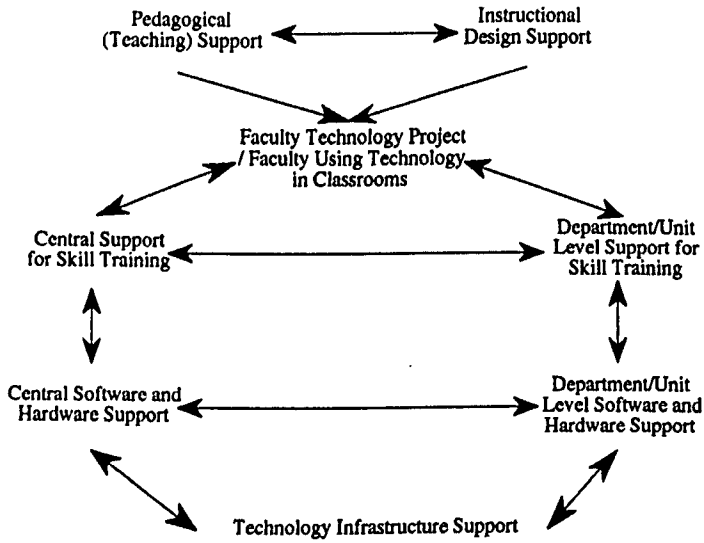
The collaborative approach enables us to introduce faculty to a community of supporters. The pedagogy specialists in faculty development get involved in the faculty technology projects first, then collaborate with technology support staff, software trainers, and hardware and classroom equipment support staff. During the development stage, the projects are already building in their future support, increasing the likelihood that they will be implemented smoothly into the classroom. For instance, with all levels of support poised to serve a given project, faculty can use multimedia instructional materials in different environments without encountering glitches. The CMS support staff will check that the system supports various video formats, the classroom support staff will ensure that appropriate equipment like a sound system and data projector are available in rooms where the course will be taught, and the infrastructure support personnel will provide instructions for configuring students' personal computers.

Sometimes faculty members use technology in their teaching without informing local technology support staff until support is actually needed. When this happens, the local support staff are in no position to give guidance and timely assistance, and both the staff and the faculty are frustrated. By involving technology support staff from various levels and informing them of the project goals, technology needs, and expected usage in all instructional settings, faculty enjoy continuous and coordinated support.

This issue may not prove so devastating in a small institution, but in a large one with thousands of faculty members, the problem snowballs if one part of the support system fails.

For instance, when a faculty member decided to make his lectures available to students, the instructional consultant discussed with the faculty the implications of podcasting for teaching and student preparation for lectures, and the classroom support staff checked the audio output on the teaching podium to ensure the system's recording capability or recommended the use of certain wireless microphones in classrooms without teaching podiums. Finally, the CMS staff created an "iTunes U," a special place in the CMS to store these lecture podcasts so that students can retrieve them from the course web site. If any of these elements were missing, the podcast project would not be successful. A collaborative support approach for faculty-driven technology projects, as described in Figure 20.4, is critical in large institutions with many decentralized colleges, schools, departments, and technology support units.

FIGURE 20.4
Collaborative Approach to Technology Support



The collaborative support model starts at the bottom of the diagram with the technology infrastructure, which interfaces with both central and departmental hardware and software support structures, as indicated by two sets of double-headed arrows. The central software and hardware support staff then

work closely with department/unit-level software/hardware support staff. Those in charge of the centralized technology training coordinate their sessions with the college and departmental trainers, and both training units assist faculty in developing their technology projects and using technology in classrooms. Faculty also receive pedagogical and instructional design support for developing new curricula and courses and for creating technology-enabled learning activities. This final layer of support directs the faculty's attention to student learning, assessment, and project evaluation.

Recommendations for Supporting Faculty in Using Technology

Based on our experience in teaching, guiding, and supporting faculty in their instructional use of technology, we recommend the following strategies to facilitate the use of technology for enhancing teaching and learning in higher education:

- Have flexible technology training schedules and formats.
- Take technology training to faculty rather than having them come to computer labs.
- Contextualize technology skills training in disciplinary knowledge acquisition.
- Focus on student learning rather than technology tools, and link technology to course goals and student learning outcomes.
- Let course goals and learning outcomes drive the selection of technology tools.
- Provide instructional design guidance for faculty technology projects.
- Integrate teaching strategies and learning theories into the use of technology tools.
- Prepare faculty to change teaching practices with the use of technology.
- Build in assessments of student learning or an evaluation plan for the technology projects.
- Take a collaborative approach to supporting faculty's technology projects.
- Ensure ongoing and continuing support for uses of technology in teaching.
- Promote the scholarship of teaching and learning with technology.

Conclusion

Claims that technology can enhance education are popular (Niemi & Gooler, 1987) and potential benefits and anecdotal success stories also abound (Massy & Zemsky, 1995), but inducing most faculty to use technology in teaching has never been easy or free of obstacles. The approaches the CRLT takes to break down the barriers have worked well at the University of Michigan, and they should export well to other contexts with some simple modifications. Integrating technology into higher education does involve skill training, but such training must be made convenient for faculty and contextualized to learning disciplinary knowledge to make it meaningful to faculty. Beyond skill acquisition, technology integration often demands changes in teaching practices and curricular design so pedagogical experts must be involved as well. Given the complexity of technology integration, we recommend enlisting a collaborative community of support staff and various experts to help faculty improve their teaching and their students' learning experiences, which is, after all, the ultimate goal of technology integration into higher education.

Author Note

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