Integrating Technology into Instruction in Higher Education

David M. Antonacci
University of Missouri-Kansas City
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Executive Summary

Introduction

Colleges and universities are making sizable investments in computer-related technologies to support and enhance instruction (Massy & Zemsky, 1996). However, many faculty simply are not using technology in their courses (Rice & Miller, 2001). This paper examines recent literature on integrating technology into instruction in a higher-education setting.

Barriers

In the literature, one important area of study examines barriers or obstacles inhibiting the integration of technology into instruction. Based on the literature and practitioner experience, Leggett & Persichitte (1998) identify five categories of barriers to technology integration: time, expertise, access, resources, and support. P. L. Rogers (2000) identifies similar barriers and develops a model for visualizing the relationships among these barriers. In this model, stakeholder attitudes and perceptions toward technology, its use in education, and institutional support determine what will be considered. Once these possibilities are established, three external barriers can slow or halt the implementation: availability and access, technical support, and stakeholder development. Also, time and funding affect these three barriers.

Self-Efficacy

Self-efficacy (Bandura, 1977), particularly computer self-efficacy, can provide a theoretical framework for understanding technology integration into instruction. Oliver & Shapiro (1993) define computer self-efficacy as "an individual's belief of their capability of using the computer (p. 81)." Responding to research linking computer self-efficacy to technology integration,

Faseyitan, Libii, & Hirschbuhl (1996) developed an in-service program to improve faculty computer self-efficacy and evaluated the effectiveness of that program. Results of the program evaluation indicated that participant computer self-efficacy improved significantly. Kagima & Hausafus (2000) studied the relationships between the computer self-efficacy of university faculty and integration of electronic communication in teaching. They found a statistically significant relationship ($p < .01$) between technology integration and computer self-efficacy, with high integrators having higher computer self-efficacy.

Change Management and Diffusion of Innovation

To better understand the integration of technology into instruction, some authors have approached the topic from change management and diffusion of innovation perspectives. Rather than introducing new technologies, Kershaw (1996) believes successful technology integration focuses on managing change effectively. Padgett & Conceicao-Runlee (2000) use the diffusion of innovation model developed by E. M. Rogers (1995) to understand faculty reaction to a development program on technology integration. In this model, adopters of an innovation are categorized into five groups based on the time they adopt: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. Understanding a teacher's location in the change process is important because each level includes its own concerns and corresponding support needs. Adams (2002) also studied technology integration from a change perspective using the Concerns Based Adoption Model (CBAM) developed by Hall, Wallace, and Dossett (1973). She found that faculty who had higher levels of technology integration had higher-level concerns about technology integration. Also, faculty with higher participation in technology training and development had higher-level concerns.

Academic Productivity

Focusing on long-term finances and economics, Massy & Zemsky (1996) introduce the idea of academic productivity related to technology integration. They describe two ways in which technology can increase productivity. The first is economies of scale, where the cost per additional student can be small after a large front-end investment. The other improvement is mass customization. They also warn that increased academic productivity without a corresponding increase in demand will require an employment reduction. Papo (2001) notes that success will require a change in the faculty work processes and their role in the institution with maximizing learning, using the most appropriate methods and technologies, as a primary goal.

Programs and Projects

Several projects and programs are described in the literature. These represent efforts to translate the abstract into the concrete. They include: Faculty Summer Institute (Bullock & Schomberg, 2000), Technology Across the Curriculum (Agee Scrivener & Holisky, 2000), Mentoring (Sprague, Kopfman, & Dorsey, 1998; Smith, 2000), Instructional Technology Center (de Vry & Hyde, 1997), and In-House Faculty Development Program (Padgett & Conceicao-Runlee, 2000).

Conclusion

Goodard (2002) vividly summarizes technology integration, "All across America blank computer screens stare out at teachers, and the teachers stare back (p. 19)." Higher educational institutions are investing heavily in technology to enhance teaching. However, this investment is too concentrated on the tangibles, such as hardware and software (Kagima & Hausafus, 2000).

Although these tangible elements are essentials pieces in the technology integration puzzle, many less tangible pieces must be considered to complete the picture: time, expertise, access, resources, and support. Without fully balancing all aspects of this process simultaneously, expensive technologies will sit unused or under-utilized. Higher education will not fully realize the promise of technology, better learning and lower costs.

Introduction

Colleges and universities are making sizable investments in computer-related technologies to support and enhance instruction (Massy & Zemsky, 1996). These investments are driven by a number of pressures including: the desire to improve learning (Faseyitan et al., 1996), a perceived need to be competitive in the higher-education marketplace (D. L. Rogers, 2000), student expectations of a technically-rich learning experience (Hecht, 2001), and business demands for technically competent graduates (Agee Scrivener & Holisky, 2000). However, many faculty simply are not using technology in their courses (Rice & Miller, 2001). Furthermore, the research on instructional technology and student achievement does not support such optimistic expectations (Lowe, 2002).

This paper examines recent literature on integrating technology into instruction in a higher-education setting. Although much information exists on this topic, the scope of this paper is limited to higher education because of potentially important differences between higher education and other educational settings, such as significant faculty responsibilities for conducting research and publishing in addition to teaching. Additionally, this paper focuses primarily on recent literature, between 2000 and 2002, because computer technologies now have widespread availability in most colleges and universities, which may have changed past expectations and needs. However, older articles are included when referenced by the recent literature and their addition elaborates on topics in the recent literature.

Barriers

In the literature, one important area of study examines barriers or obstacles inhibiting the integration of technology into instruction. Based on the literature and practitioner experience,

Leggett & Persichitte (1998) identify five categories of barriers to technology integration: time, expertise, access, resources, and support. They use the TEARS acronym to make these categories more memorable. While this acronym provides a useful mnemonic, important detail is lost in this subsumption and needs elaboration for a full understanding of these barriers.

The lack of time is at the top of their list as the obstacle most often mentioned. This includes time to plan, collaborate with peers, prepare lessons and materials, explore, practice, and evaluate, as well as develop, maintain, and expand skills. Other articles also identify time as an important barrier (Adams, 2002; Kagima & Hausafus, 2001).

Expertise is another potential barrier to technology integration. Technology training for teachers must be available. Effective technology training must be hands-on, systematic, and on-going. Additionally, a variety of models and approaches should be available to accommodate different needs, schedules, and learning styles. Adams (2002) found similar barriers related to expertise, such as limited computer training, and Kagima & Hausafus (2001) identified lack of technology competence as a barrier.

D. L. Rogers (2000) takes an even stronger position on this barrier. "The weak link in the knowledge infrastructure in most institutions is the skills and training in Information Age tools and processes for learners, faculty, staff, and other participants…. It is imperative that institutions realize that it is not only technology that is important, but also the learning methodologies utilized to employ the technology (p. 21)." She emphasizes that training focused on both technology use and effective use in instruction is necessary.

Access is the third category used by Leggett & Persichitte (1998). Teachers must have uninterrupted, on-demand access to the technologies they intend to use, both while inside and

outside of the classroom. Adams (2002) also reported hardware and software availability as a potential barrier.

Their fourth category is resources. This includes resources to purchase, maintain, and upgrade hardware and software; to provide training and support; and for auxiliary costs, such as coordinating technology access, and continuing costs, such as purchasing printer ink. They also note a relationship where time, expertise, and access are dependent on resources.

Support is their fifth barrier category, both administrative and technical. Administrative leadership and support may be the most critical factor. In addition to providing the needed financial resources, the administration can set expectations, develop a vision and plan for technology integration, and provide incentives and encouragement. Technical support not only includes the personnel for maintaining the technology, but it also includes personnel who are knowledgeable about pedagogical issues, such as appropriate instructional methods or media.

P. L. Rogers (2000) identifies similar barriers based on the literature and two studies she conducted: availability and quality of hardware and software, faculty role models, funding, institutional support, models for using technology in instruction, staff development, student learning, teacher attitudes, technical support, and time to learn to use technology. However, she organizes these barriers differently. Some barriers have an internal source, such as a teacher's attitude or perception about a technology as well as his or her competency with that technology. External barriers include: availability and accessibility of hardware and software, technical and institutional support, and stakeholder development. Time and funding barriers cross internal and external sources.

P. L. Rogers (2000) then develops a model for visualizing the relationships among these barriers. As illustrated in Figure 1, stakeholder attitudes and perceptions toward technology, its

use in education, and institutional support determine what will be considered. Once these possibilities are established, three external barriers can slow or halt the implementation: availability and access, technical support, and stakeholder development. Also, time and funding affect these three barriers.
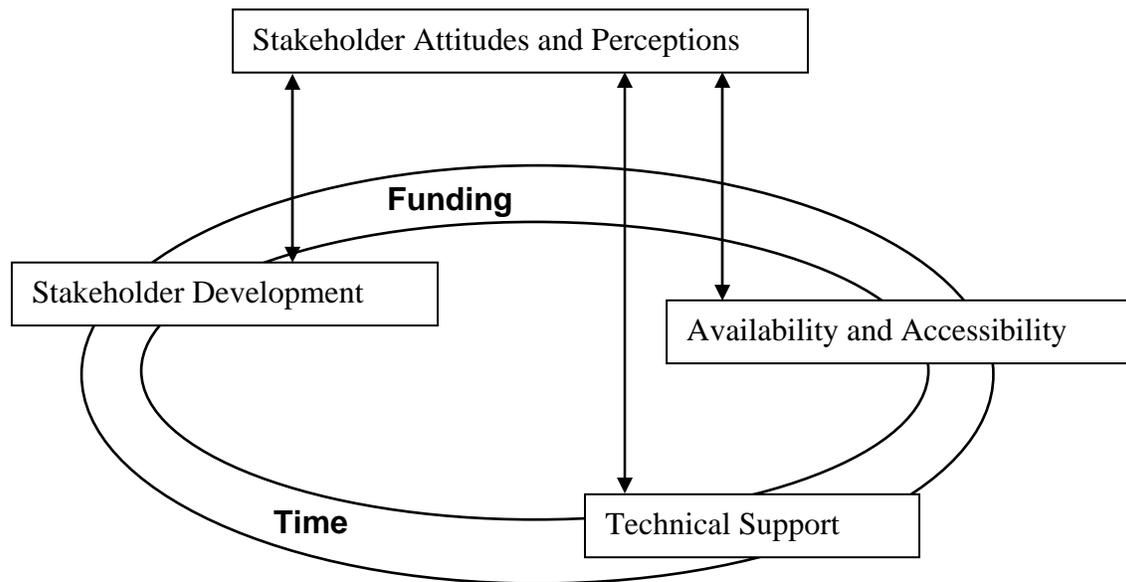

Figure 1: Relationships of Barriers to Technology Integration (P. L. Rogers, 2000)

Furthermore, P. L. Rogers (2000) makes several recommendations for technology planning based on her model. Planning should assess the level of technology adoption that currently exists to guide decisions about amounts and types of equipment and support that will be needed. Planning also should assess the attitudes of stakeholders toward instructional technology and should include strategies for changing these attitudes. The three external barrier categories— availability, support, and development—must be addressed simultaneously. And, the plan must include time and funding considerations.

Olcott & Wright (1995) report similar barriers to technology integration from a distance education perspective. These include release time, instructional and administrative support,

training, compensation, teaching load, and technical support. He also recognizes that the team approach to course development may reduce faculty autonomy and control. Furthermore, promotion and tenure concerns may be another barrier to technology integration. Kagima & Hausafus (2001) also mention career concerns, especially regarding fear of being replaced by technology and recognition and rewards, as a barrier to technology integration.

Self-Efficacy

Self-efficacy (Bandura, 1977), particularly computer self-efficacy, can provide a theoretical framework for understanding technology integration into instruction. Oliver & Shapiro (1993) define computer self-efficacy as "an individual's belief of their capability of using the computer (p. 81)."

George & Camarata (1996) examine self-efficacy as it relates to instructor cyberanxiety, which is a general anxiety about using technology. They hypothesize that increasing self-efficacy regarding technology will decrease or eliminate cyberanxiety. By using vicarious experiences through social modeling, they develop a model for understanding this process. In this model, peer modeling of technology use could initiate behavioral change in the cyberanxious instructor. This changed behavior could result in changed outcomes that would improve future outcome expectations and self-efficacy.

Responding to research linking computer self-efficacy to technology integration, Faseyitan et al. (1996) developed an in-service program to improve faculty computer self-efficacy and evaluated the effectiveness of that program.

This program was developed from the self-efficacy literature, which indicates that people use four sources of information to judge their self-efficacy: "performance attainments, vicarious

experiences of observing the performance of others, verbal persuasion that one possesses certain capabilities, and physiological states by which people judge their capability strength and vulnerability (p. 217)."

The program included showcases where faculty could demonstrate their use of technology and seminars where interested faculty could discuss issues surrounding computers in the classroom. The showcases and seminars were designed to provide verbal persuasion and vicarious experiences. The program also included hands-on workshops, developed and taught by university faculty. The workshops were intended to provide verbal persuasion and build faculty confidence through performance attainment. Enhancement money, through a proposal process, was available to faculty who completed a workshop.

Results of the program evaluation indicated that participant computer self-efficacy improved significantly. Faculty also thought the program made them more aware of available technologies and how to integrate those technologies into their instruction. And, many faculty who participated in the project planned to include computers in their teaching.

Kagima & Hausafus (2000) studied the relationships between the computer self-efficacy of university faculty and integration of electronic communication in teaching. They found a statistically significant relationship ($p < .01$) between technology integration and computer self-efficacy, with high integrators having higher computer self-efficacy. Additionally, they found significant relationships between computer self-efficacy and several factors:

- *Computer Experience:* less experienced faculty having lower computer self-efficacy.
- *Computer Applications:* faculty using only word processors and email having lower computer self-efficacy.
- *Gender:* females having lower computer self-efficacy.

- *Tenure:* tenured faculty having lower computer self-efficacy.

- *Teaching Years:* those having ten or more years of teaching experience having lower computer self-efficacy.

- *Age:* those 60 and older having lower computer self-efficacy.

- *College:* faculty from the College of Family and Consumer Science having lower computer self-efficacy than faculty in the College of Education and College of Agriculture.

They found no relationship between computer self-efficacy and educational level, access to home computer, and faculty rank.

Kagima & Hausafus (2000) conclude that understanding the factors influencing faculty computer use and integration, particularly computer self-efficacy, is important for effective integration of technology in teaching. Higher education is investing significant resources to develop information technology infrastructure without ensuring faculty use these technologies. They recommend faculty development to improve faculty self-efficacy and technology integration.

Change Management and Diffusion of Innovation

To better understand the integration of technology into instruction, some authors have approached the topic from change management and diffusion of innovation perspectives. Rather than introducing new technologies, Kershaw (1996) believes successful technology integration focuses on managing change effectively. It is about people—changing how they work and view their role in the organization. She outlines a three-step change process. This process begins with individuals understanding that change is needed. Next, individuals must understand that they

must change. And finally, the individuals actually change. She speculates that this process may take as long as five to ten years.

Kershaw (1996) also describes several strategies for managing this change process. These include "articulation of a vision, the development of a plan, the creation of appropriate organizational structures, the provision of adequate training and support, and the promotion of the use of technology for a variety of purposes (p.45)."

P. L. Rogers (2000) examines technology adoption using a five-step hierarchical model developed by Rieber & Welliver (1989) and Hooper & Reiber (1995). Understanding a teacher's location in this hierarchy is important because each level includes its own concerns and corresponding support needs.

In this model, Familiarization is the first level. It involves a light exposure to the technology, such as visiting a vendor booth or attending a short workshop. Utilization is the second level, where teachers use the technology at least once or use it for minor routine tasks. Many teachers do not progress past these first two levels due to access, expertise, and support barriers.

Integration is third level in this model. Teachers at this level select technology based on its appropriateness to the instructional task, not simply to use technology. Technology adoption often stops at this level.

Reorientation and Evolution are the fourth and fifth levels, respectively. At these deeper levels, learning is the emphasis. Technology is a part of the learning context, rather than a distinct application. Teachers are willing to change media and methods to improve learning.

Padgett & Conceicao-Runlee (2000) use the diffusion of innovation model developed by E. M. Rogers (1995) to understand faculty reaction to a development program on technology

integration. In this model, adopters of an innovation are categorized into five groups based on the time they adopt: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards.

The Innovators are the first group to adopt an innovation. Little faculty development is needed for this group as they will either train themselves or find someone to train them. Similarly, the Early Adopters, the second group to adopt an innovation, also need little faculty development. Given adequate resources, such as time and software, they will learn new technologies and apply those technologies to their instruction. The Early Adopters are an important group in the diffusion process since they are influential among their peers and can help others adopt the technology innovation.

The next adopter category is the Early Majority. They will adopt an innovation based on the recommendation of others. This group was the most responsive to technology demonstrations by Early Adopters. The Early Majority need adequate resources, but they also require rewards and incentives to adopt.

The fourth category is the Late Majority. They will learn and apply new technology but only if it is required or makes their immediate work more efficient. For example, they would learn word processing if it enhanced their current work activities. A mandate to adopt may be needed for this group.

The Laggards are the final category. They are the last to adopt the innovation. This group is not interested in the innovation, and training for this group is not effective. Because of this, targeting faculty development efforts on the Laggards is not recommended.

Adams (2002) also studied technology integration from a change perspective using the Concerns-Based Adoption Model (CBAM) developed by Hall et al. (1973). In CBAM, change is

a process that progresses through a series of stages, beginning with concerns about self and ending with higher-level concerns about the impact of the change.

Adams (2002) compared various demographic variables to the level of technology integration and concern level. She found that faculty who had high levels of technology integration also had higher-level concerns about technology integration. Also, faculty with high participation in technology training and development had higher-level concerns.

Although Adams (2002) did not include intervention in her study, CBAM includes possible intervention strategies for each stage of concern. For example, faculty at the Management stage want practical solutions to specific problems, where as those at the Consequences stage want to share information with others.

Academic Productivity

Focusing on long-term finances and economics, Massy & Zemsky (1996) introduce the idea of academic productivity related to technology integration. They describe two ways in which technology can increase productivity. The first is economies of scale, where the cost per additional student can be small after a large front-end investment. The other improvement is mass customization. This includes both individualized instruction based on student goals, learning styles, and abilities, as well delivery methods, such as with distance education.

They also identify certain subject areas as most likely to profit from technology enhancements. These courses are characterized by a high volume of students, standardized content, and well-defined outcomes. Additionally, they recognize that extensive use of technology in some subject areas will not be profitable although some technologies may enrich instruction in these areas.

They raise the concern that current technology-based academic improvements involve doing more-with-more, where greater benefit occurs at a higher unit cost. However, many higher-educational institutions do not have the expanding financial resources needed to continue in the more-with-more direction. Instead, they argue for a strategy of doing more-with-less. In this scenario, faculty will need to examine their work processes and replace some labor-intensive activities with technology-based alternatives. Since labor costs tend to increase over time and capital costs, such as technology costs, tend to decrease over time, this direction is economically feasible.

However, faculty will lose some control of the teaching process in the more-with-less scenario. Furthermore, increased academic productivity without a corresponding increase in demand will require an employment reduction.

Papo (2001) also focuses on the advantages of technology integration in large classrooms and lectures, particularly using distance education tools. New technologies have created learning opportunities outside the classroom by removing time and space dependencies. This shift can reduce the need for and expense of building space to house traditional classrooms and lecture halls. It can increase the potential audience by including students who could not easily attend campus-based classes. And, it can improve the quality of instruction by concentrating talents and efforts on developing instructional materials used by many students, rather than having numerous small development projects which duplicate efforts and include less diverse talents.

He also notes the loss of control of the teaching process as a major objection by faculty. In order to realize these potential benefits, we need to develop new teaching methods that incorporate these advantages. Additionally, success will require a change in the faculty work

processes and their role in the institution with maximizing learning, using the most appropriate methods and technologies, as a primary goal.

Twigg (2000) examines technology integration from a financial viewpoint as well. In many current implementations, where technology simply is added to existing views of classroom instruction, technology is just another cost. She argues that colleges and universities must shift their focus from improving teaching to improving student learning. "Faculty are only one of many resources that are important to student learning. Once learning becomes the central focus, the important question is how best to use all available resources—including faculty time and technology—to achieve certain learning objectives (pp. 42-43)." With this shift in focus, higher educational institutions can realize a return on their investment in technology by reducing the cost of instruction. Like others, she sees large-enrollment introductory courses as offering the best potential returns, both in terms of lower costs and higher quality.

Twigg (2000) also identifies a number of readiness criteria for success. First, an institution must want to increase academic productivity. An institution must use technology strategically for specific academic goals instead of as a general resource equally available to everyone. An institution must have an information technology organization capable of supporting faculty technology integration, including instructional design support. An institution must be committed to learner-centered education. And, an institution must view course redesign as a partnership between faculty, administrators, and support staff. These criteria not only provide a means to assess institutional readiness, but they suggest areas for development as an institution works toward realizing a return on its technology investment.

Star (2001) examined the impact of technology integration. Despite significant time, effort, and resources, she found that technology produces only superficial learning results because

faculty were simply adding technology to their teaching. However, Star (2001) goes beyond just recommending transformations based on new views of teaching and learning. She presents a model for making this change.

In traditional, classroom instruction, most class time is used to deliver content to the students through lecture. Little class time is used for higher-level processing, such as application, inquiry, or evaluation. Star (2001) proposes an alternative model where technology is used for content delivery before class. This provides more class time for processing. She then expands this model so that appropriate technology is used as needed to provide the best learning experience in a particular situation. Furthermore, she recommends using this model to deliver faculty development, so faculty can experience the same learning environment that they would like to create in their own classes.

Hecht (2001) echoes this changed emphasis. From a historical perspective, he describes the changes various technologies have had on education, beginning with the printing press through modern information technologies, including the Internet. Because these technologies have made access to information easy and inexpensive, the role of university faculty must change from solely a content expert. Universities will need instructional designers and facilitators. Universities also will need "instructional humanists—people who interact with other people to continuously remind each of us why we ask the questions, to consider the ramifications of our actions before acting, and to work to improve our lot as well as that the everyone else (p. 12)."

Programs and Projects

In the first part of this paper, four major aspects of technology integration were examined: barriers, self-efficacy, diffusion of innovation, and academic productivity. The literature provides

much to consider when integrating technology into instruction. In this section of this paper, several projects and programs are described. These represent efforts to translate the abstract into the concrete. They include problems encountered, lessons learned, and best practices.

Faculty Summer Institute

Bullock & Schomberg (2000) describe the Inter-Institutional Faculty Summer Institute on Learning Technologies (FSI), a successful summer institute on learning technologies held at the University of Illinois from 1997 to 1999. The FSI was funded by the Presidents and Chancellors of various Illinois public universities and the Illinois Board of Higher Education.

This institute grew from the recognition that educators have always sought the most beneficial ways to use innovations. However, teachers now face much more sophisticated innovations, particularly learning technologies. As a result, faculty need and want training on learning technologies. Furthermore, that training must include both the technology itself and the pedagogical issues associated with its successful implementation.

The FSI consisted of four intensive days. Each day, the morning session focused on general information about selected learning technologies, such as types, purposes, pedagogical issues, and best practices. The afternoon session followed with hands-on work teams. The participants indicated that the project-based afternoon sessions were effective for the transfer of skills from the morning session. Originally, the work teams were organized based on the discipline area of each participant. In the second year, following the suggestion of several FSI participants, some work teams were based on the technology interest of the participants while other teams remained organized around discipline. This blended approach, which continued in the third year, allowed participants to choose either a discipline specific or technology related work team.

Before attending the FSI, participants were using email and listservs for routine communications, websites for passively storing class materials such as a course syllabus, and several proprietary software packages for instructional purpose, most frequently Microsoft PowerPoint to present in-class lectures. After the institute, participants reported a broadened understanding of learning technology and had implemented the technologies highlighted in the institute. It is important to note that the technologies included in the institute were the ones most likely to be implemented by the participants.

The participants also reported that meeting people from other universities as well as their own campuses was very useful and that they had a sense of collegiality with other faculty who used technology. They also thought the off-campus location was beneficial since they would feel pressure to work in their office for part of the day if the training had occurred at their home campus.

Technology Across the Curriculum

In 1998, George Mason University began the Technology Across the Curriculum (TAC) program (Agee Scrivener & Holisky, 2000). TAC is a collaborative effort between the College of Arts and Sciences and the Division of Instructional Improvement and Instructional Technologies (DoIIIT). Its purpose is to ensure that liberal arts graduates have the information technology skills needed for today's world. This program is particularly noteworthy because of its emphasis on student learning rather than faculty use of technology.

TAC began by working with faculty and business partners to identify core technology skills that students needed. To engage a range of faculty, these skills are incorporated into the activities and content of existing courses, rather than taught as separate courses on technology. A plan

emerged to ensure systematic introduction and development of these skills with basic skills introduced in the general education courses and advanced skills developed within each major.

In this program, faculty can apply for $500 to $4000 of support for a specific project. Their proposals must indicate which technology skills are to be included in this project as well as assessment methods for measuring achievement of those skills. Additionally, the technology had to be integral to the course, not simply adding technology exercises or using technology for delivery.

Faculty receive technical and instructional design support. DoIIT has an Instructional Resource Center (IRC) where faculty have access to the facilities, equipment, resources, training, and personnel needed to develop instructional materials. The IRC is staffed with both professionals and student assistants. Student also are trained as technology assistants and provided to specific TAC projects.

An important outcome of TAC is a programmatic, rather than episodic, approach to technology integration. Previously, individual faculty members integrated technology into their classrooms with varying degrees of success, based on their individual interests, abilities, and resources. TAC not only improves faculty and student access to needed resources, but its broad-based, curricular approach allows technology skills from one class to reinforce and expand upon the skills from another class. TAC projects also have shifted technology use away from simple information delivery toward enabling and supporting more active learning. Additionally, the increased interaction between academic areas and technology units has improved the alignment of faculty technology needs and available technology resources.

Mentoring

Sprague et al. (1998) examine a course in which graduate students in instructional technology were paired one-to-one with faculty to assist the faculty member with integrating technology into his or her teaching. The developers of this approach consider the biggest obstacle to integrating technology into instruction is that faculty lack a vision about why and how to use technology in the classroom. Furthermore, they believe that one-on-one mentoring is the most effective way to support faculty technology integration efforts.

In this approach, student mentors were enrolled in a graduate-level course on faculty development in instructional technology. They studied issues about integrating technology into the curriculum and applying technology in the educational process. They also learned about the adoption of innovations and adult development.

This course included a field experience component where students were paired with faculty. Both students and faculty were interviewed about their abilities and interests to better match student mentors with faculty. During the field experience, student mentors attended class sessions to share experiences, discuss issues, and receive suggestions. Students also received help from the university's media center.

Feedback from faculty and students was mostly positive. Faculty considered student modeling of technology use to be very important. Faculty also liked the one-on-one help and direct assistance with their technology needs. Students valued the mentor experience as well, and they reported that they learned more about themselves as mentors than about using technology.

However, some problems were encountered. Scheduling conflicts were the most common problem type. The lack of needed technology resources was identified as a problem. At times, student mentors were not as knowledgeable about specific topics as faculty expected. Students

sometimes found themselves more involved with troubleshooting technical problems than with demonstrating technology integration. Finally, faculty may need more than one semester of assistance to be successful with this change.

Smith (2000) also describes and evaluates a faculty technology training program that uses graduate students as technology mentors. Although the author of this article acknowledges that many educational institutions are facilitating the use of computer technologies through improved access to hardware and software, he maintains that the lack of faculty training continues to hinder the change process. Instead of providing this training in a traditional format with a single technology course, faculty members were paired with graduate students who acted as mentors. This study is unique as it examines whether traditional graduate students could be trained on a specific technology and effectively serve as mentors on that technology.

The selected students were competent with basic computer operation and applications, but they did not have experience with Microsoft PowerPoint, the technology targeted in the study. Before beginning their mentoring experience, the students participated in a technology-training program that introduced them to basic and advanced features of PowerPoint. During their work as mentors, students had access to a trainer for technical questions and participated in a session to review questions and examine issues about their mentoring experience.

The faculty received a short, introductory training session on PowerPoint basics. The faculty then received six one-hour training sessions conducted by their student mentor. The first half of each session included a scripted lesson on PowerPoint integration, and the second half was for addressing individual faculty concerns.

As expected, faculty believed the multiple-session training format had been effective, and they liked having a technology trainer in their office. A follow-up interview showed that they had continued to use PowerPoint.

Several unexpected outcomes are worth noting. The students expressed that being a mentor had increased their own ability to integrate technology. The lack of student technical expertise had a positive impact on the mentoring as both faculty and student mentors were more comfortable with the resulting facilitative role. And, faculty began mentoring their student mentors on professional topics, not related to the technology.

Instructional Technology Center

Practical Resources for Educators Seeking Effective New Technologies (PRESENT) is a facility at the University of Delaware with a mission to "bridge the gap between gee-whiz technology and effective classroom use of technology (de Vry & Hyde, 1997, p. 45)." At one level, the PRESENT facility is a hands-on evaluation site for instructional technology where various technologies are available for learning and for use within a simulated classroom environment.

However, at a deeper level, the PRESENT staff work with faculty on their technology needs. Their focus is on the teaching process, not just solving an immediate problem. This begins with a needs assessment to select appropriate technologies based on educational goals. The assessment guides their work throughout a specific project and after initial needs have been met. The staff also provides training, consultation, and support. According to this article, "the PRESENT has become a place for the supportive exploration of alternative instructional options (p. 48)."

In-House Faculty Development Program

The Virtual Guild, a faculty development program in the School of Social Welfare at the University of Wisconsin-Milwaukee, is another response to the gap between available technology and faculty skills (Padgett & Conceicao-Runlee, 2000).

When creating the Virtual Guild, a needs assessment was first conducted to determine faculty abilities and interests. This information was then translated into hands-on training sessions for developing technical skills and demonstration sessions to present less technical topics, such as illustrating the integration of a particular technology into a course. Faculty and staff members within the school lead these sessions.

Participant evaluations have been consistently positive. Additionally, technology use at conferences and in the classroom has increased though other factors have contributed to this increase as well.

Development of the Virtual Guild was guided by E. M. Rogers (1995) work on diffusion of innovation. At the Virtual Guild, they found that little faculty development was needed for the Innovators because they would train themselves. Faculty development for the Early Adopters was straightforward. They were eager to learn and only needed to be provided with the resources to do so. Also, the Early Adopters became the trainers at the Virtual Guild. The Early Majority were very responsive to demonstrations by Early Adopters, which showed this group that new technology could be learned and used. The Late Majority were only interested in learning technology if it was required or had immediate impact. The Virtual Guild found that it was not worthwhile to target the Laggards because of their lack of interest in technology.

Comparing Approaches

Although each of these highlighted programs and projects reported success, Kaminski (2000) compared the effectiveness of three slightly different workshops. In one workshop, faculty attended weekly meetings for two semesters and received release time from one course each semester for participating. In another workshop, faculty attended a one-week intensive workshop and received a stipend and laptop computer for participating. Both these workshops were viewed as successful based on high attendance and continued use of technology by the participants.

However, she found one workshop format that was very poorly attended. It was similar to the intensive workshop, but faculty attended sessions each week for eight weeks, instead of one entire week. It also did not include release time for participants nor other incentives like the other two workshops.

Kaminski (2000) concluded that release time and incentives were important success factors. She also noted that faculty seldom used the faculty lab facility and equipment it housed. She recommended against developing such support centers and advocated for in-office and in-classroom support instead.

Conclusion

Goodard (2002) vividly summarizes technology integration, "All across America blank computer screens stare out at teachers, and the teachers stare back (p. 19)." Higher educational institutions are investing heavily in technology to enhance teaching. However, this investment is too concentrated on the tangibles, such as hardware and software (Kagima & Hausafus, 2000). Although these tangible elements are essentials pieces in the technology integration puzzle, many less tangible pieces must be considered to complete the picture: time, expertise, access,

resources, and support. Without fully balancing all aspects of this process simultaneously, expensive technologies will sit unused or under-utilized. Higher education will not fully realize the promise of technology, better learning and lower costs.

The literature on integrating technology into instruction, though always incomplete, provides important theories for understanding this process and includes a great deal of practical advice. Technology integration is a complex process. No simple formula or plan exists that ensures success. Instead, those who want to improve instruction through technology must apply what is known, research what is unknown, and engage in the daily struggle that emerges as we seek to change and improve.

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