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AUTHOR	Ebersole, Samuel; Vorndam, Marge
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ABSTRACT

Qualitative data collected from 24 lead faculty members at a regional comprehensive university were analyzed to discover barriers and incentives to the adoption of educational technology. Leading barriers to adoption of educational technology are: time, resources, and lack of confidence in the benefit of educational technology. Incentives that were mentioned included: because it is the right thing to do, personal satisfaction, and student demand. The effect of mentor role models, modeled use of educational technology, and other exposure to educational technology methodology are also discussed. (Author)

Adoption of Computer-Based Instructional Methodologies: A Case Study

Samuel Ebersole, Ph.D.
Instructional Technology Center
University of Southern Colorado
ebersole@uscolo.edu

Marge Vorndam, M.S.
Instructional Technology Center
University of Southern Colorado
mvorndam@uscolo.edu

Abstract: Qualitative data collected from 24 lead faculty members at a regional comprehensive university were analyzed to discover barriers and incentives to the adoption of educational technology. Leading barriers to adoption of educational technology are; time, resources, and lack of confidence in the benefit of educational technology. Incentives that were mentioned included; because it's the right thing to do, personal satisfaction, and student demand. The effect of mentor role models, modeled use of educational technology, and other exposure to educational technology methodology is also discussed.

Introduction

One of the challenges for implementing technology-based learning on college campuses is providing support for instructors who are already motivated to engage in new approaches to teaching and learning. Another challenge is to provide the initial motivation that will convince faculty that the time and effort required by these new approaches is justified. The University of Southern Colorado1 in Pueblo, Colorado is a regional comprehensive institution that has begun to address both of these challenges with an innovative program which supports faculty who are early adopters with the time and resources necessary to develop showcase projects. These projects in turn will be used to attract and recruit other faculty within their colleges, hopefully inspiring them to take the plunge into the world of technology-enhanced teaching and learning.

The use of educational technology on the USC campus has been, until recently, determined on an individual basis, or departmentally. In 2000, Blackboard course management software was installed on campus. In the same year, the University developed a strategic plan that recognized the importance of educational technology to teaching and learning. And most recently, the faculty handbook was modified to include appropriate use of educational technology as a criterion on which faculty performance is evaluated.

A national survey found that almost 47% of classes were taught utilizing web page supplementation nationwide at public universities (Green, 2001). Currently, approximately 33% of the University of Southem Colorado's classes employ web pages as adjunct information for student use. At 55% of participating universities, including USC, on-line course management tools, e.g., Blackboard, WebCT, or e-education, are provided. On other campuses with course management capabilities, 22% of classes were offered using these tools, whereas, at USC

[1] The University of Southem Colorado is a member of the Colorado State University System. During the 2001-2002 academic year, the University enrolled 4,000 students in twenty-nine undergraduate and six graduate programs with approximately 500 full-time faculty and staff. The University has been an Hispanic Serving Institution since 1998, and is accredited at the bachelor's and master's levels by the Commission on Institutions of Higher Education of the North Central Association of Colleges and Schools.

approximately 18% of all courses utilized the on-line supplemental interface. Nationwide, 34% of all faculty members have their own web pages, whereas at USC less than 20% of faculty members do so. USC is among those institutions that; require all students to take a mandatory introductory computer class, offers supportive instructional training for faculty, and provides computer access for every faculty member. The comparative results would suggest that USC shares the number one challenge highlighted by the national participants, that "assisting faculty to integrate technology into instruction is the single most important Instructional Technology issue confronting their campuses over the next two to three years" (Kenneth Green, personal communication, November, 26, 2001).

It is in this context that the University received a $1.6 million Title III grant from the U.S. Department of Education to create the Instructional Technology Center (ITC)—a facility charged with faculty training in education technology methodologies. A major goal is to increase faculty use of educational technology for the purpose of enhancing student performance and academic success. To accomplish this goal, the grant enables the creation of an environment on campus where faculty leaders or "champions" are empowered—through training, release time, and access to current technology—to develop discipline-specific projects that will supplement traditional avenues of student learning through the appropriate use of educational technology. At the same time, these projects will serve as incentive models for other faculty members in their departments, colleges, and in the university at large. According to Horgan (1998), "Using faculty more proficient with the technology to support their less knowledgeable or more reluctant peers is another way to focus on teaching rather than just the technology. A faculty mentor program, with release time or other special incentives, is often an excellent way to jump-start innovation."

As part of this mission, the ITC conducted a survey in the autumn of 2001 of representative faculty members from each department to establish a base of information on attitudes toward educational technology, current use patterns, philosophies of education related to computer-assisted education and factors affecting the adoption of technology by faculty members.

Theoretical Foundation

The adoption or "diffusion of innovation" curve developed by Rogers (1995) illustrates the way that an innovation is first adopted by a few members of a community, and how, over time, other members join in and begin to use or deploy the innovation. According to Rogers, an innovation is a concept or practice that is perceived as new by an individual, and diffusion is the process by which the innovation moves through the system. Members of a community who are more receptive to the innovation and who lead the other members are labeled "innovators" and "early adopters." These are followed by the "early majority," the "late majority" and, finally, the "laggards."

One of the ways that innovation spreads through a community is via interpersonal communication and information sharing. Personal contact with an esteemed colleague, often including a personal demonstration, is key to the diffusion process in higher-education settings (Hutchinson & Huberman, 1993). Perceived leaders who adopt an innovation are particularly instrumental in the promotion of a new idea or practice. According to one study of mid-sized to large research universities, chemistry and mathematics professors favor different dissemination approaches depending on their current level of understanding and exposure (Foertsch, et. al., 1997). The same study, however, indicated that in most cases personal contact with an esteemed colleague was strongly preferred by the adoptee.

It has been posited that university faculty who fit the "innovator" model are self-motivated and, given the appropriate infrastructure, will integrate instructional technology even when incentives or rewards are absent (Jacobsen, 1998). With the sense that innovators are already "on board," proponents of change have often focused on those in the early adopter and early majority categories because of a perception that they hold the most promise for advancement with the investment of the limited resources at hand. In contrast, those predisposed to the other end of the scale are oftentimes viewed as a poor investment in terms of the time and energy that is required to move them towards adoption.

Kurt Lewin's (1951) "field theory" also provides a framework to analyze incentives ("driving forces") and barriers ("restraining forces") that faculty encounter. Identification of barriers to adoption is the first step in the process. Once barriers to change are identified, it is possible to remove the barriers or give the faculty the tools or resources that they need to overcome them.

Methodology

Full-time faculty from 24 campus departments were interviewed to elicit responses to closed and open-ended questions about their use of educational technology. For the purpose of this study, educational technology was defined as, "recent developments in computer-based technologies (hardware and software) used to facilitate learning." The survey garnered responses from one representative within each department, with three exceptions where representatives could not be reached and did not return telephone calls or e-mail contacts. By interviewing a population of 24 (representing 11.8%) of the 204 full-time faculty, the researchers obtained a significant cross-section of opinion which is believed to be representative of general campus sentiment among faculty.

Results

Faculty interviewees were assigned a category of educational technology use based on their response to three questions. The first question asked them to self-evaluate their personal level of use on a five-part scale. The second question asked them to identify the educational technology that they used in their teaching. And the third question asked them the frequency of their use of educational technology. Based on their responses to these three questions each of the 24 respondents was assigned to one of three categories; below average (n=8), average (n=11), and above average (n=5).

Incentives

Next, respondents were asked to identify factors that convinced them to become (and remain) users of educational technology. Five choices were offered, along with the opportunity to name additional factors. The five choices were; personal satisfaction (selected by 58.3% of respondents), support from administration (selected by 16.6% of respondents), required by administration (selected by 4.2% of respondents), student demand (selected by 37.5% of respondents), and, because it's the right thing to do (selected by 62.5% of respondents)[2]. Respondents were also asked to indicate which of the factors was the most important factor for them. The most common response was "because it's the right thing to do" (n=6), followed by "student demand" (n=2). Other factors mentioned as being influential in adoption of the use of educational technology are:

- more student friendly*
- efficiency and efficient use of class time*
- convenience*
- good source of info and students have access to it*
- it raises student achievement*
- immediacy of communication*, sense of teamwork with students and between students
- I'm hoping that after I've been through it once, that my updating of material will be easier
- I think it's the right thing to do to familiarize students with resources
- richness and convenience of resources*
- kinds of material that can be accessed*
- found that students were gaining employable skills, need for visuals to provide relief...they are so visually oriented, students have to be at cutting edge of technology*
- students learn many different ways, and this type of technology allows you to use all three areas (visual, auditory, kinesthetic) and it enhances student learning*
- accommodating various student learning styles and achieving the desired learning outcome* I think it made me a better teacher.
- personal decision*

*Note: * indicates factors that were considered to be the "most important" factor for the respondent's choice to adopt educational technology*

When considering the response to this question in relation to the faculty member's designation as a below average, average, or above average user, it is interesting to note that, with one exception, the "below average"

[2] Multiple responses were allowed, resulting in total in excess of 100%.

users selected as their most important factor either "personal satisfaction" or another response that focused on student or instructor convenience. In contrast, all of the "above average" users selected either "because it's the right thing to do" or a responses that focused on student outcomes, e.g., "it enhances student learning." This sense of almost a moral obligation to provide the best possible experience for the learner is consistent with the belief that educational technology can accommodate a wider range of learning styles and can result in higher levels of student achievement.

Barriers

In an attempt to better understand what respondents perceived to be impediments to their adoption of educational technology, we asked them to list three barriers and the one that they considered the greatest barrier. Because of the wide range of responses, we attempted to group the responses into three main categories; time constraints, resource restraints, and questions about effectiveness. Responses that fit into the first category are:

- time to learn technology
- time to develop, time required
- too busy*
- planning time*
- time constraints on prep time*
- time constraints within class itself
- time to do it*
- because it wastes time
- time to experiment and discipline to learn the techniques that I don't know*
- time to prepare*
- time it takes to find out what's out there, find out what's most effective and time to integrate it into what you do*

*Note: * indicates factors that were considered to be the "most important" barrier to adoption of educational technology*

A sense that resources are not available to support development and implementation of educational technology is also an issue as indicated by the following responses:

- cost/availability of equipment
- resources
- lack of knowledge
- training/knowledge
- access*
- convenience of access*
- cost of purchase
- lack of hardware and facility*
- cost*
- funding
- lack of access
- shortage of classrooms that are equipped
- lack of help/facilitators
- money to purchase it*
- there was no one to provide assistance (when I got started)*

*Note: * indicates factors that were considered to be the "most important" barrier to adoption of educational technology*

There continues to be concern that educational technology does not deliver on its promise or that its usefulness is still to be proven. The following statements reflect these views:

- doesn't see how it always benefits students*
- not significant
- not so important to me...my current methods still work
- it doesn't help*

- part of the technology would be harmful to my pedagogy...some of the technologies out there, e.g., PowerPoint, are used poorly. Something is lost when you get away from FTF interaction
- technology in general has not always been accommodating for people in the visual arts...a lot of the technology is not image friendly*
- wondering if this is legitimate and achieving the desired outcomes
- not convinced of its usefulness*

*Note: * indicates factors that were considered to be the "most important" barrier to adoption of educational technology*

And finally, there are additional barriers that do not fit into the above categories. The following statements reflect these concerns:

- apprehension
- doesn't always work
- comfort level*
- obsolescence
- difficulty of planning
- inertia
- difficulty of use
- copyright problems have created access problems

*Note: * indicates factors that were considered to be the "most important" barrier to adoption of educational technology*

Role Models

When faculty were asked if a mentor had used technology, and whether that experience had contributed to their use of technology, those in the "below average use" group generally stated "no", even if the mentor had used technology. In the "average use" group, there was equal indication that mentors had or had not used technology. Among the faculty who were mentored by technology users, more faculty indicated that they used technology as a result, in part, of the mentor model. In the "high use" group, a majority of respondents enjoyed the tutelage of mentor users, and indicated that this influence was a strong encouragement for them to model. Statements regarding mentor influences included:

- everything I've done is because of my mentor...since he has left I've backed away from it somewhat
- my mentor created positive attitude toward technology
- positive modeling of use
- that particular person led me to make that a large part of my doctoral dissertation and although the technology has changed, it has had long lasting effects
- I had two wonderful mentors were I was before, and that's why I became interested in technology...it made all the difference for me

Other Influences

Faculty were queried on their observation of technology use in other venues, such as at conferences, and if that experience affected their personal view and use of technology. All responders indicated that they had seen technology, such as PowerPoint, employed. However, the "below average" and "average" user categories indicated more reservations about the effectiveness of technology as it was experienced. More "below average" users indicated complete dissatisfaction with the experience than did "average" users. Also, more "below average" users indicated that they did not use this technology, or used it with reservations, than did "average" users. In contrast to these two groups, the "above average" users unanimously indicated a positive experience, and that the use had favorably impacted their own use of technology. Respondents offered the following comments about viewing the use of technology by others, and its effectiveness:

- Sometimes it was good, but talking heads w/slides are also present so quality may be questionable
- it made me more committed not to use it
- limited helpfulness
- some are and some are not...I've really grown to dislike PowerPoint.

- If person is not organized, presentation can reflect this
- as long as the technology worked
- inspired me
- I've gotten ideas from people...usually through discussion groups or looking at their web sites
- generally not...I've run into dull PowerPoint presentations
- that is where I get ideas about what to try. I belong to the ASEE (American Society of Engineering Educators) and they talk a lot about instructional topics

Faculty exposure to articles and on-line sources of information related to technology in education was also explored. Faculty were asked if they had viewed such content, and if so, how had it influenced their use of technology. Most respondents indicated that they had read about technology and issues related to its use, and had found the information helpful. Most faculty responded favorably when asked about the positive model that such material presented. Comments included:

- I refer students to tech resources that I find
- it opens up so many sources and resources for information, e.g., on the Internet
- it puzzles me
- it has made me see the value and importance of it
- those discussions are ongoing in our field...effective vs. non-effective uses for my discipline. One thing that you get from these public discussions is a sense of the value of the choices
- provided ideas for newsletter, forms
- hearing other faculty present ideas
- distance learning techniques (Chronicle of Higher Ed)
- it influenced me to a part that it has convinced me that it is a very important tool...even though I cannot keep up with the innovation
- reference again to papers at conferences. I like to see how others do things and then incorporate them in my classes.
- garnered some info, but not very persuasive
- ideas on what it does and how it works
- minimally, articles on teaching & pedagogy, not major input
- journals like Syllabus and others give me ideas about hardware and ideas about use, e.g., using handheld devices for education
- not really
- reading those sorts of things gives you an idea of what's going on in the rest of the country. Being involved in TLTR , Steve Gilbert, etc. they encourage one to use technology when it is appropriate, because it will add value if used appropriately.

Participants were also asked their opinion about the level of educational technology use and implementation on the USC campus as compared to other institutions of comparable size and mission. There was clearly a correlation between users' own use of educational technology and their perception of where the university in general was in relation to peer institutions. Using a scale of 1-3, with 1 being "behind", 2 being "equal to", and 3 being "ahead", faculty members in the "below average" user group thought that USC was ahead of peer institutions (mean = 2.67), while faculty in the "average" group thought that USC was "average" as compared to similar institutions (mean = 1.94), and faculty in the "above average" user group believed USC to be behind similar institutions in terms of use and implementation of educational technology.

Discussion

University faculty members enjoy a high degree of autonomy and self-determination. Change in behavior is seldom achieved by the use of top-down approaches (Noblitt, 1997). Rather, change is usually the result of the removal of barriers and the presence of incentives. Identification of barriers is one possible starting point for adoption and diffusion research. Interviews with faculty leaders on our campus suggest that the leading barriers to adoption of educational technology are; time, resources, and lack of confidence in the benefit of educational technology. Our grant allows us to directly address the first barrier by providing 6 credit-hours of release time and a summer stipend for faculty who successfully propose a project that uses educational technology to enhance teaching and learning. The second barrier, perceived limitations of resources, is one that the University

has been addressing and continues to address using a variety of means. Campus computing infrastructure is currently being enhanced both in terms of functionality and performance. The decision to purchase Blackboard as our course management software has resulted in a growth from zero to 165 courses that utilize Blackboard in just the first year of use. A student-supported technology fee generates approximately $220,000 each year for technology infrastructure that directly affects students. All of these efforts are attempts to address concerns by faculty that their working environment is supportive of their efforts to acquire, create and deploy technology-enhanced resources. Perhaps the last barrier, faculty members' concerns about the effectiveness of educational technology, is the one area where much of the work remains to be done. This is an area where effective modeling by peers and respected colleagues shows promise for attitude changes that can lead to changes in behavior. Jacobsen (1998) found that faculty members prefer to receive help and instruction from colleagues on campus. While responses to our question suggests that demonstrations of successful use of educational technology by a respected peer early in one's career is a positive influence, it may also be that those who are early adopters of educational technology are more likely to recall such experiences. Other types of exposure to educational technology seem to send mixed messages. Exposure to use of educational technology in external settings and in academic and scholarly publications was as often as not seen as a disincentive. Dull or poorly executed PowerPoint-enhanced presentations were noted by several respondents.

And finally, the presence of incentives for faculty to adopt and deploy educational technology is an area where both resources and faculty development play a role. As mentioned earlier, stipends are being offered to faculty whose projects are supported by the Instructional Technology Center on campus. Other faculty mentioned the convenience and efficiency that educational technology affords. But more often than not, the incentives that respondents mentioned were the benefits that they believed were accrued by their students. The belief that technology-enhanced instruction supported a wider variety of learning styles, and that students were learning both course content and picking up employable skills at the same time, were cited as incentives. While this study is exploratory in nature, it appears to support the idea that adoption of innovation, in this case the decision to employ educational technology, is multi-faceted and efforts to increase participation by faculty members must take an equally multi-faceted approach if it is to be successful.

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