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Mary Sumner
Southern Illinois University at Edwardsville

Dennis Hostetler
Southern Illinois University at Edwardsville

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Factors Influencing the Adoption of Technology in Teaching

Mary Sumner and Dennis Hostetler
Southern Illinois University
Edwardsville, IL 62026
Msumner@siue.edu and dhostet@siue.edu

Background:

With the current availability of instructional technology, faculty are beginning to create Web-based instructional materials, to use computer-based presentation systems in the classroom, and to design on-line courses. Northwestern offers Internet-based academic credit to high school seniors. Purdue, Ohio University, the University of Phoenix, and numerous other institutions offer on-line courses. Custom-made MBA's, intensive degree programs, and traditional academic programs are being reinforced through the innovative use of technologies, including Internet-based instructional materials, distance learning, and multimedia instructional technology.

In one campus computing survey, it was reported that 80 percent of the academic institutions either have a Web page or are developing a Web page. About six percent of the college courses surveyed utilized Web-based resources, and this number is growing. Many institutions are planning to target off-campus audiences using Web-based resources. Between 1994 and 1995, faculty use of information technology in instruction doubled, and the proportion of entering freshmen with some academic experience with computing went beyond 50 percent (Campus Computing Survey, 1995).

Yet, in spite of these opportunities, the pace of faculty adoption of the use of technology in teaching and learning is "still measured in years or decades rather than months," according to one report. Most faculty are busy and know very little about how to use information technology effectively. Faculty reward systems (tenure and promotion) give little credit for instructional innovation using technology. One of the major impediments to the use of technology in instruction is limited access to hardware, software, and technical support services, and most campuses do not have a financial plan for acquiring desktop computers on a recurring basis.

Many colleges and universities are anxious to provide incentives and opportunities for faculty to use technology in teaching, but strategies for facilitating the learning curve with respect to the use of these technologies are unclear. One of the biggest challenges is understanding what combination of face-to-face meetings, independent work, computer-mediated instruction, and on-line instructional support is needed to improve instruction. In addition, technology is not enough. The combination of technology, teaching approach, and instructional materials will have a significant impact on improving instruction.

Objectives:

The purpose of this paper is to pose some research questions relevant to the use of technology in teaching and to identify variables which are associated with the adoption of instructional technology. The paper is based upon the findings of interviews and a questionnaire which were conducted with faculty who participated in the Internet Bootcamp, a workshop designed to train faculty how to design and construct their own Web pages for instructional purposes, and in a faculty development institute in instructional technology sponsored by the University of Illinois.

Relevant Literature:

There are a number of factors associated with the adoption of innovation. These include application development factors, organizational factors, support factors, and environmental factors. Each of these factors can be applied to the process of introducing innovative uses of technology into instruction.

Application development factors:

Adoption of innovation must be consistent with an organization's capabilities and skills (Burgleman, 1983; Rogers and Shoemaker, 1971). This means that a technological infrastructure must exist (Madique and Zirger, 1984) and that the innovation itself must be compatible with the experiences and values of potential adopters (Rogers, 1983). In the case of instructional technology, the users and developers of Web-based instructional materials would need to have skills and capabilities relevant to designing such materials, as well as access to the appropriate hardware, software, and infrastructure to support its application in the classroom.

Organizational design is a factor in facilitating innovation. Organic structures which offer flexible communications, internal interaction, and networking are more likely to foster innovation. Innovation is most likely to occur in functionally differentiated, decentralized organizations (Moch and Morse, 1977), as compared with

hierarchical structures with centralized control. In the academic environment, this means that innovation is likely to be most effectively supported at the departmental and academic unit levels, rather than being super-imposed from above.

Collaboration between technical support specialists and faculty is needed to facilitate the adoption of technological innovation, and a number of models for this occur in the academic environment. Technological "leaders" among the faculty can spur innovation among their peers by providing models of innovative technology use and by mentoring their colleagues. In addition, user support specialists with discipline-specific knowledge of computing and its applications can help facilitate the efforts of faculty to introduce innovative uses of technology in the classroom.

Support factors:
Support factors include the availability of technical support as well as top management commitment (Burgleman, 1983), user participation (Madique and Zirger, 1984), and effective vendor support (Ettlie, 1986). Effective marketing of a technological innovation is also critical (Robertson and Gatignon, 1986), and champions of an innovation play a vital role in their success.

In the academic environment, all of these support factors play a role in facilitating the transfer of technology into instruction. The commitment of the senior administration, deans, and department chairs is needed to facilitate innovation and experimentation as well as to fund technology resources and professional development opportunities. Faculty participation in professional development and training opportunities is critical to their involvement in using technology in instruction, and the effective marketing of teaching technologies by "champions" and others is associated with the transfer of technology.

Environmental factors:
Finally, environmental factors often facilitate technology diffusion and use. Organizations which try to stay technologically ahead of other organizations in a particular market environment are likely to introduce innovation. The rate of adoption of an innovation bears a strong relationship to the number of organizations within the environment or industry which have already adopted the innovation (Utterback, 1974).

Within higher education, these factors undoubtedly apply. Higher education is becoming much more competitive, with more and more colleges and universities using technology-based instruction, distance learning, on-line courses, and Web-based instructional materials as a mechanism to achieve a competitive edge in the marketplace. Technological innovation in instruction is providing opportunities to address new markets, to attract non-traditional students, and to establish partnerships with business and industry which create new opportunities for students. As more and more universities offer on-line access to academic resources and Web-based courses, those universities without such offerings may put themselves at a competitive disadvantage in the marketplace.

Research Questions:
The research questions being addressed in the study and in the preliminary interviews include:

- What are you currently doing with respect to using technology in teaching?
- What factors are facilitating your efforts to achieve these objectives?
- What types of "motivators" or "incentives" can be provided to faculty to facilitate their efforts to integrate Internet resources into teaching?
- What types of "demotivators" detract from your efforts to use technology in teaching?
- What collaborative mechanisms (e.g. teams, discipline-specific work groups) might facilitate your efforts to use technology in the classroom?
- What is the importance of training and technical support in facilitating innovative uses of technology in instruction?

Methodology:
The study included two parts: (1) in-depth interviews with a representative group of faculty to gain insight into the question of what motivates faculty to integrate Internet resources into teaching; and (2) distribution of a questionnaire to a representative sample of faculty. The questionnaire was distributed to 105 faculty who either participated in an Internet Bootcamp or in a faculty development institute in instructional technology at the University of Illinois.

Findings:
Current and Future Uses of Technology:
At the current time, the majority of the faculty surveyed were exchanging e-mail with their students (94 percent) and sharing Web sites with their students (79 percent). These uses were expected to remain consistent in the future. While approximately one-third (39 percent) of the respondents reported having a syllabus on-line or additional instructional materials on-line (30 percent) at the current time, the majority of the respondents expressed plans to maintain their syllabus on-line (66 percent) or to maintain additional instructional materials on-line (74 percent).

Although web conferencing was used by a limited number of students (9 percent) at the current time, approximately half (51 percent) planned to use web conferencing in the future. While only six percent of the

respondents noted that they had created an on-line course at present, approximately one-third (31 percent) said that they planned to create an on-line course in the future. See Table 6 for uses of technology in which the faculty anticipated the greatest changes.

Many of the faculty mentioned that they used e-mail to communicate with their students, to answer questions, to give announcements, and to transmit copies of handouts. In the future, many of the faculty planned to design on-line syllabi, supplementary course materials, and to use electronic discussion groups or "chat sessions" more extensively. In most cases, faculty wanted to put more supporting materials on the Web for students.

Incentives and Barriers to Innovation:
One of the key issues being addressed by this study is the issue of incentives and barriers affecting the adoption of technology in instruction. The time and effort faculty contribute to using Internet resources in teaching, to developing Web-based instructional materials, and to designing on-line courses represents a major investment. These efforts need to be rewarded, or else faculty will not have the incentive to integrate technology and teaching.

Obviously, incentives which are consistent with the traditional faculty reward system have the greatest impact. If achievements in integrating technology in teaching are rewarded through annual evaluations and given credibility in the promotion and tenure process, then faculty will be much more likely to devote their time to these objectives. Faculty responding to the survey were asked to rank the incentives on the basis of their importance, with "1" being the "most important" incentive and "9" being the "least important" incentive. The two most significant incentives were release time and the availability of technical support. The issue of technical support may take on greater precedence because recruiting, retaining, training, and funding technical support people in higher education is becoming a difficult challenge, and successfully meeting this challenge is a success factor that must be addressed before any meaningful faculty development can occur.

A comparison was made between the tenured and non-tenured faculty to determine if these incentives appear to be any different. In terms of release time, 58% of the non-tenured faculty ranked it either first or second in importance as an "incentive," and 45% ranked it either first or second. This makes sense, given the fact that non-tenured faculty need to be more careful about allocating their time toward research and publications.

The same was true with technical support. Fifty-eight percent (58%) of the non-tenured faculty ranked technical support as either first or second in priority as an

incentive for technology development, and 54% of the tenured faculty felt the same way.

The tenured faculty ranked funded incentives for instructional development using technology the last in importance as an incentive. However, the non-tenured faculty ranked funding incentives such as mini-grants and awards for innovation relatively high in terms of importance. The support of the senior administration was not a significant factor in motivating either the tenured or non-tenured faculty to invest their time in instructional development using technology. This was particularly true for the tenured faculty.

The greatest incentives for both tenured and non-tenured faculty were release time and the availability of adequate technical support. This is consistent with previous findings that technical support is an extremely important factor in facilitating instructional development using technology.

The other big issue was training. Faculty felt that training was critical to their ability to use technology effectively. Training in presentation graphics, the use of "smart" classrooms, and the use of specific tools were all considered important factors, and the limited time and resources available to support training represented a significant barrier.

Summary:
In summary, the research showed that faculty are beginning to explore the uses of technology in teaching, but that they feel limited by such factors as insufficient release time for development activities and inadequate technical support. Some summary findings are:

- Most faculty want to pursue innovative uses of technology, including the development of on-line courses and Web-based instructional materials.
- Technology "experts" and "leaders" are more likely to share Web-based materials with their students and to use computer-based presentation graphics in instruction.
- Most faculty expressed a preference for intensive two- to three-hour training sessions.
- Uses of information technology are critical to the quality and effectiveness of instruction in many disciplines.
- The greatest incentives to using technology in instruction appear to be release time for developing instructional materials and effective technical support.
- The greatest demotivators to using technology instruction are lack of adequate technical support and lack of release time to develop such materials.

References Available Upon Request.