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Teaching for Learning with Technology:

A Faculty Development Initiative at a Research University

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Abstract

This paper reviews recent literature addressing the state of technology in higher education as a backdrop for a faculty development program offered annually at Northwestern. First, we will present the state of technology related to teaching in three areas: (1) the varied institutional interest in technology, (2) the variance in faculty engagement with technology, and (3) factors that influence faculty acceptance of technology. Next, we will introduce Northwestern's response to the need for faculty development related to technology, the 5-day Teaching and Learning with Technology workshop. Finally, we will present data gathered over two years that demonstrates how pedagogically-driven technology training can enhance teaching and encourage faculty to embrace technology in teaching to accomplish pedagogically-based learning objectives.

Teaching for Learning with Technology:

A Faculty Development Initiative at a Research University

A review of recent literature indicates the following main points about the state of technology in higher education: (1) There is a wide range of institutional commitment to technology, (2) Faculty engagement with technology varies considerably, and (3) Multiple factors influence faculty acceptance of technology in the classroom. Understanding the multi-faceted nature of institutional acceptance of technology in education will help academic technology specialists to design context specific programs and services. The design of the current faculty development program was grounded in and informed by past research and related literature. This article will (1) review recent literature related to technology in higher education, (2) describe the Teaching and Learning with Technology (TLT) faculty development program, and (3) provide an assessment of the program's effectiveness.

The state of technology in education

There is a wide range of institutional commitment to technology.

The wide range of institutional commitment to technology is reflected in the literature. Kontos (2001) provides an example of what is arguably the highest level of commitment, the "laptop university." Laptop universities have fully embraced the computer as an integral part of learning. Although the details of the laptop university vary (from "required but not provided" to "provided in full"), the essential component is the plan (be it actualized or envisioned) for all students to have a personal laptop computer they carry with them to classes.

A more modest implementation of technology embeds "technology intensive" (TI) curriculum after the popular "writing enhanced" curriculum already in place. The idea is to designate some courses as TI to help students become “fluent” in technology skills the way writing intensive courses function in relation to language skills. In one example, professional development is carried out by graduate students who conduct workshops for faculty. This technology mentoring also sees graduate students and faculty members paired off and assigned the task of redesigning one course to be TI (Fulford & Ho, 2002).

An even more modest approach is a faculty development training program. University support entails the provision of funds and release time for individual faculty to integrate technology into classes (Roberts et al, 2002).

Some argue now, perhaps because cutting edge technology is an essential commodity in the world market and a national agenda item, it is finally a topic of institutional interest (Cooley & Johnston, 2001; Kontos, 2001). The reasons for the array of technology implementation could be as diverse as the 3500 post-secondary institutions in the United States.

Faculty engagement with technology varies considerably.

Another perspective is that institutional interest is historically dictated by faculty, and without a high level of faculty interest, it will predictably stutter. Although we can look to laptop universities, for example, to show how engaged faculty can potentially be, at most institutions, faculty involvement with technology is considerably less. Lan (2001) identified faculty knowledge and skill as important variables in technology infusion. Perhaps this explains the wide acceptance by faculty of technology as a facilitator of communication (Searle-White, 2002); email and Internet use has become the norm rather than the exception as faculty have developed sufficient knowledge and skill in these areas as a function of cultural membership. Indeed, other authors have also found that faculty engage with technology in fairly low-level ways: for email, posting information, and literature searches (Vodanovich et al, 2001). There is a growing number of faculty engaging in what has been labeled a hybrid model, where face-to-face instruction is supplemented with online virtual discussions (both synchronous and asynchronous), whereby faculty facilitate knowledge construction by monitoring (scaffolding) information in debates on line (MacDonald & Caverly, 2001).

Multiple factors influence faculty acceptance of technology in the classroom.

When asked about making PowerPoint slides available to students online, faculty typically respond with either grave or smug concern. The basic rationale is that students would not come to class. That sentiment is either housed in a deep, genuine concern for students missing out on the benefits of class attendance, or in a condescending "I must be out to lunch" tone which implies students would be able to get away with skipping out. Either way, the concern seems reasonable, but it is not supported by recent research. Frey & Birnbaum (2002) conducted a quantitative study of student perceptions of PowerPoint. They found that most students liked it, and that few said they would not go to class if slides were available online, a finding that seems to contradict the fears of many faculty. Exploring student interest in technology one step further, Winer & Cooperstock (2002) documented the efforts of one university to create "Intelligent Classrooms[1]," in which much of the technology is automated, thus freeing professors to concentrate on the lecture, and not the technology. Survey data from

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[1] In the intelligent classrooms studied at McGill, "Many components are integrated to perform control of the classroom, including programmed sensors for the VCR, document camera, digital tablet, and electronic whiteboard. A central program receives messages from the various sensors and in response, configures the equipment appropriately. For example, when a document is placed under the document camera, the room lights are adjusted, the projector turned on with the document camera input made active, and the screen lowered. In addition, the room responds to and learns from simple manual override commands and provides feedback as to which devices are currently active." (Source: http://www.cim.mcgill.ca/research/1999AnnualReport/html/node95.html. Viewed December 10, 2003).

90 students indicated that students responded very positively to the “smart classroom” instructional context.

If it is the case that students view technology in education favorably, and they would not skip classes specifically because the information was made available online, then what is keeping faculty from embracing technology in education?

An early attempt to understand the hesitancy relates phobias such as denial and resistance as the source of resistance to technology (Bailey & Tweed, 1994). However, it seems probable that the source is not an unknown psychological factor, but rather, a practical and deliberate decision that reflects realistic awareness of the higher education environment. The resistance may stem from rigid reward systems that are not open to accommodating tech efforts. The reward structure doesn't recognize tech efforts in questions of promotion and tenure (Sandham, 2001; Hughes, 2002). Hughes (2002) offers three reasons for faculty resistance: The sharp learning curve associated with tech infusion, the difficulties of assessing the benefits of technology use, and the current reality that such efforts do not help professional advancement. Goldfield (2001) stresses the interconnectivity between administrative, pedagogical, and historical problems with faculty tech development. The present authors would like to look more closely at the issue of pedagogy.

Some argue that faculty resistance to technology is an overt and deliberate effort to put pedagogy first, and faculty are suspicious of technology efforts that do not seem grounded in sound pedagogy (Kontos, 2001; Lan, 2001; Cooley & Johnston, 2001; Fulford & Ho, 2002). Learning the technology as independent tools and tricks, without careful consideration of specific pedagogical foundations, may discourage faculty from engaging with technology altogether.

An example is found in Lumpkin (2001), who recounts the technology infusion in a school of education in Georgia without any mention of active engagement with pedagogical issues even though 'enhanced classroom pedagogy' is identified as one of 5 critical areas by the Georgia Department of Education.

To summarize, in order to successfully infuse technology into the educational process, several factors must come together: institutional interest, faculty willingness, and appropriate faculty development programs. These factors interrelate. Faculty development initiatives are often undervalued, but because of the importance of technology-fluency, it has become a national agenda item, and so finally a topic of institutional interest (Cooley & Johnston, 2001). Once it is on the institutional agenda, faculty need to buy into it. Before this will happen, it must be contextualized in appropriate pedagogy, and built into the institutional reward structure. With these pieces in place, there must be appropriate faculty development programs to make it happen.

Understanding Pedagogical Approach

Reviews of faculty development programs in higher education indicate a range of goals that include the development of specific skills, the increased ability to reflect on teaching practice, and the development of self-confidence (Gilbert & Gibbs, 1999; Coffey & Gibbs, 2001). In recent years, research on how teachers in higher education understand or conceive of their teaching practice (Kember 1997; Prosser & Trigwell 1999; Ho, Watkins, & Kelly 2001; Trigwell, 2003) has inspired programs which include among their primary goals changes in faculty conceptions of teaching (Light & Cox, 2001). While there are some differences in the specific descriptions, conceptions of teaching can be categorized under two broad orientations focused on qualitatively different ways in which teachers understand and approach their teaching. Kember (1997) describes the two orientations as teacher centered/content oriented and student centered/learning oriented. Prosser and Trigwell (1999) describe them as teacher focused/information transmission and student focused/conceptual change. Both distinguish between faculty who are concerned with teaching as essentially an organization of the content of the teacher's knowledge for transmission to the students and those who regard teaching as facilitating students' personal construction of knowledge. In addition to faculty conceptions of teaching, research on faculty approaches to teaching find similar qualitatively different patterns in how teachers approached their teaching. Approaches to teaching are constituted primarily in terms of the teacher's intentions and strategies. Trigwell, Prosser & Taylor (1994) identify five approaches which may be subsumed under two main categories.

Research on faculty and their students indicates an important relationship between faculty approaches to teaching and the ways in which students approach their learning. In a study that explored the relationship between teaching approach and learning approach, Trigwell & Prosser (1996) found a correlation between information transmission/teacher focused approaches to teaching and surface approaches to learning. Students taking surface approaches to learning tended to be concerned with reproducing content, often through memorization strategies, without any particular strategy other than coping. In contrast, conceptual change/student focused teaching approaches, with the intention of effecting conceptual change in the student's learning, correlated more strongly with deeper approaches to learning by students. Students employing deep approaches to learning were concerned with understanding the subject in a manner that was personally meaningful to them, making connections to their own experience and previous knowledge.

One of the key overall pedagogical goals of the faculty development program was to initiate a change process in the ways in which the participating faculty approach their teaching for the potential impact on their students' approaches to an understanding of learning in their classes.

Teaching, Learning and Technology: Northwestern's answer

The workshop planning committee was comprised of staff from technology services and the faculty development office. Committee members had a variety of concerns. The technology staff recognized that faculty with interest in expanding technology in their teaching held strong reservations about the time commitment required. Faculty committed to providing top flight learning experiences for their students expressed fears that they could not infuse technology into their presentation or student homework unless assured that the execution would be flawless. In the experience of the technology staff, this attitude often prevents faculty from experimenting altogether, as learning new computing skills typically does not come without considerable trial and error.

The staff from the faculty development office had a different list of faculty issues. In their experience, motivating faculty to examine their own pedagogical approaches was unlikely to engage them without concrete examples of how they could use the information in their own teaching. It was important to provide faculty participants experiences that allowed them to transform new ideas and approaches into practice.

In each of the two years under investigation, the workshop planning committee met bi-weekly from April through July and weekly through August to prepare for the workshop, held in early September. The general format of the workshop included demonstrations by workshop instructors, application discussion lead by a guest faculty lecturer, and independent work time for participants to develop projects and practice with the technology.

Workshop agenda and physical space

Year 1

In the first year of the pilot program, planners identified five specific technologies which they included during the workshop: a course management system, web authoring, PowerPoint, media streaming, and Macromedia Flash. Instructors briefly demonstrated these technologies on the first day of the workshop, and participants then set individual learning goals for the week. Each participant developed a technology-based teaching project with the goal of building a technology-based element for an upcoming course, and presenting the project to the other participants on the final afternoon of the workshop. The environment for the workshop was two classrooms in the university library. One was a traditional classroom and the other was a computer laboratory. Participants met in the classroom for faculty demonstrations and lectures, and they spent the rest of the time in the lab, working on individual projects.

Year 2

During the second year of the workshop, the planning committee made minor revisions to improve the workshop structure, carefully alternating sessions on pedagogical theory with demonstration sessions that integrated the pedagogical content into successful teaching and learning tools, executed by participants' peers (other university faculty). We designed the technology training sessions of the workshop to engage the participants in hands-on experiential activities, and we scheduled these technology sessions to correspond with the daily faculty demonstrations. (See Table 1 for details.)

The environment for the workshop was a 16-seat microcomputer lab that offered very ample desk space, an aisle in the middle of the room that made for easy access to each participant's work area by support staff, and a large ceiling-mounted projector for displaying computer images. An additional "smart" seminar room, offering both a large seminar tables and a computer-equipped podium with projector, was available nearby for some of the pedagogy discussions, lunches, and breaks.

Workshop instructors used a course management system as an organizing aid for the week. As a tool, it provided schedules, handouts, an electronic discussion forum, and a means to conduct end-of-day feedback evaluations. This offered participants the opportunity to experience the system from a student's point of view.

METHOD

Participants

During the two years of the workshop, 23 faculty participated. Two people dropped out in each year. The 19 remaining faculty represented the sciences, medicine, engineering, social sciences, and the humanities. More men than women participated, with 4:5 and 4:6 women:men ratios in the two years. All participants attended at least 90% of the sessions and gave a final presentation on a teaching project. Participants were paid a $250 stipend.

Materials

Approaches to Teaching Inventory (ATI)[2]. Developed by Prosser and Trigwell (1999), this 16-item, Likert-scale response inventory measures divided equally into two sub-scales that correspond to two teaching orientations: Information Transmission/Teacher-Focused (ITTF) and Conceptual Change/Student-Focused (CCSF). See Appendix A for a copy of the ATI instrument.

[2] Although the ATI has drawn some criticism (see Meyer & Eley, 2003), Trigwell and Prosser have responded with a paper which describes the development of the instrument and reviews recent research in which the ATI was used. They conclude that the instrument “has statistical, construct and face validity as a relational instrument for measuring variation in the ways teachers see and approach teaching” (Trigwell & Prosser, 2004).

Follow-up Protocol. This self-made protocol contained 20 Likert-scale questions and 10 open-ended questions. Additionally, it prompted participants to report on prior, current, and aspirant use of 11 specific technology tools (see Appendix B).

Procedure

Workshop participants completed the ATI before the workshop began (ATI Pretest). The workshop ran Monday through Friday for one week. On those days, participants experienced didactic instruction, peer presentations, and one-on-one tutorials. At the end of the last day, participants completed a second ATI (ATI Posttest). We contacted participants six months following each workshop. From the first year's group, six of ten agreed to meet privately for a follow-up interview and completed another ATI (ATI Delayed posttest). From the second year's group, nine of ten participated in the delayed testing ATI and interview.

Results

ATI Data

Years 1 and 2 Pre- and Post-ATI data were combined. Subscales were considered separately.

Information Transmission/Teacher-Focus Scale. The means for the pre and post measure (2.84 and 2.64, respectively) were important for two reasons. First, the difference in mean scores (Mean difference = -.20) was statistically significant ($n=19$, $t=2.23$, $p=.039$). Second, the difference was in the desired direction, indicating a shift away from this approach.

Conceptual Change/Student-Focus Scale. The mean difference between pre- and post-scores (.16) was not statistically significant ($n=19$, $t=1.68$, $p=.111$), but the shift in mean scores from 3.47 to 3.64 was in the desired direction.

We examined effect sizes to determine if there was a change in ATI responses that might suggest practical significance. According to the criterion set by Cohen (1988)[3], the obtained effect sizes of 0.34 for each scale indicate a shift in participant responses from pre- to post-workshop responses in the small-to-medium range.

Follow-up Protocol Data

Participants responded to Likert-scale items on a 1-5 point scale, in which a "1" is associated with positive values (true, strongly agree, extremely characteristic of me) and a "5" is associated with negative values (false, strongly disagree, extremely uncharacteristic of me). The first 10 questions queried participants on what they recalled thinking and feeling prior to participation in the workshop. The results were not surprising. There were only small differences between the means for most questions. Ranking them according to mean response, "I spent time considering how pedagogy relates to learning" ranked highest (M=1.14, SD=.38), followed closely by "I thought technology could enhance my teaching" (M=1.29, SD=.49). The item that ranked lowest was "I thought it would look good on my cv" (M=4.71, SD=.49).

The next several questions asked them to recall how they felt during the workshop. Responses indicated the workshop, "Caused (faculty) to see new possibilities regarding technology in teaching" (M=1.6, SD=1), and "Gave (them) interesting ideas" (M=1.79, SD=.81). Interestingly, responses were much more mixed to the prompt, "Made me more comfortable with technology in teaching" (M=2.5, SD=1.38).

The last set of prompts measured attitudes about workshop participation six months after workshop completion. Mean scores were very high, indicating very favorable responses. Again,

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[3] Cohen (1988) concluded an effect size of .2 is considered "small," an effect size of .5 is considered "medium," and an effect size of .8 is considered "large."

the “I spend time considering how pedagogy relates to learning” prompted the highest ranked mean (M=1.14, SD=.38) while “I want to learn more about putting technology into teaching” ranked the lowest (M=2.14, SD=1.46).

Conclusions

The results of the analysis are encouraging. In both scales of faculty approach/conception of teaching, the results were in the desired direction, one reaching statistical significance. The second scale, which approached statistical significance, probably failed to reach statistical significance because of the low statistical power associated with the relatively small sample size. This is impressive given that the change was measured over a very short time period during which the primary focus was on developing faculty technological skills.

A limitation of the study was our failure to include an untreated control group. We cannot say with certainty that it was the program that brought people from one point of teaching approach to another, although the correlation would seem to warrant further investigation.

An important follow up to this study (currently being undertaken) looks at long-term impact. While it was not possible to do a randomized controlled study of the efficacy of the faculty development program, these results provide positive indications of the efficacy of the program with respect to one of its central goals, the improvement of teaching in higher education in terms of faculty approaches to teaching.

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Table 1. Schedule of workshop days.

Session:	Monday	Tuesday	Wednesday	Thursday	Friday
Pedagogy	How to engage students	Cognitive Science applied to Student Learning	The how’s and why’s of integrating technology into teaching	Course design: Designing & Aligning Learning Outcomes	Assessment of learning: High Tech and Low Tech Options
Faculty Demonstration	Interactive PowerPoint in a science course	Video programming in foreign language	Flash & Dreamweaver in Music	??	Blackboard?
Technology Tutorial	PowerPoint	Dreamweaver & Streaming media	Flash	??	Blackboard?