

**Adopting Information  
Technologies  
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*Siva Kumari*

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Siva Kumari  
University of Houston

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## **INTRODUCTION**

The introduction of new information technologies has created a turbulent environment for change in higher education; this has caused institutions, faculty and administrators to rethink their roles, teaching venues, and delivery options in markedly new ways than those currently available. The promise that accompanies any such remarkable change also brings with it some realities as these ideas are tested, implemented and adopted. Neal (1998), an outspoken critic of the unbridled enthusiasm of technology, advocates investigating experiences of individual faculty members since they are the end-of-the-line implementers of technology in higher education. He says that their opinions about the benefits of technology should be of ultimate value in discovering useful and effective strategies that have the capacity for long-term survival.

This case study presents a synthesis of data derived from interviews with six faculty members in an urban public institution of higher learning. These innovators, who have been implementing information technologies in their teaching, provide valuable information about the possibilities and the restrictions, and discuss support structures that are needed to advance the adoption of this innovation on a larger scale. This chapter addresses four core areas of concern relating to the integration of IT in higher education. The first is to understand the factors that led faculty to adopt IT in their teaching. The second is to explore the interplay between particular technologies and teaching practice. The third to ascertain the relationship between teaching architectures and learning outcomes.

## **CASE QUESTIONS**

- What factors influence the early adoption of technology by faculty?
- How can technology be used to create student-centered learning environments?
- What are the unintended consequences of using technology in teaching and learning?
- What are the rewards for using technology in the classroom environment? Does it reduce or increase the amount of time spent?

## **BACKGROUND**

Urban Public University (UPU) is a state-supported public university located in a large urban city in the southern part of the United States that prides itself for its capacity to enroll and

educate a diverse student body. It is a doctoral degree-granting institution, the largest in a system that includes three other universities. It offers 103 bachelor's degree programs, 119 master's degree programs, 53 doctoral degree programs and three professional degree programs through its 14 colleges. The teaching faculty in this university consists of 856 ranked faculty.

Six faculty members at this university were interviewed to address issues of integrating technology in higher education at a public university. They were identified through a search of the university's Web site for faculty who had won teaching awards, through Internet courses, from personal knowledge about those who have a reputation for innovation, and from recommendations of other faculty.

The faculty members interviewed for this chapter represent diversity in terms of academic disciplines and professional rank. To preserve confidentiality, only collective descriptions of the group are provided. These members include two associate deans of colleges who continue to teach. The other four include one tenured associate professor, one assistant professor seeking tenure in the year 2000, and two visiting assistant professors, one of whom has been recently promoted to an associate professor.

These faculty have been employed at this institution between four to 17 years and represent the winners of a number of teaching and distance learning awards. Many of these faculty members are also involved in an informal group, formed in 1994, that meets regularly to discuss and showcase integration of information technology (IT) into education. Those who do not teach entirely online are involved in integrating information technologies consistently into their courses. Some have participated in funded projects that resulted in technology-enriched learning resources. One faculty member is the editor of a journal that focuses on the integration of technology in his discipline. Four of the six have participated in Interactive Television (ITV) courses. Only one has never taught a completely online course.

Excerpts from the interviews are intertwined throughout this chapter. Each excerpt is preceded by FM1 (Faculty Member 1), FM2 (Faculty Member 2) to represent the person from whom that quote originated so that readers, if they wish to do so, can easily decipher whether or not the excerpts emanate from the same individual.

### **Factors that Led to the Adoption of Information Technology for Teaching**

One of the much-touted benefits of IT is the potential for implementing new and highly flexible combinations of technologies to serve specific teaching needs of the instructor. The sophistication and level of IT implementation depends both on prior expertise with technologies, the operant teaching philosophy, unfulfilled teaching needs, and expressed student needs. This section explores these issues and "technology readiness" as a factor that prompted faculty to integrate IT into their teaching. Although "readiness" was inherent in these early adopters, this issue needs to be understood in context as institutions create support systems for other faculty. It is presented here to instigate a discussion about how to create effective systems of support for those who may not be "technologically ready" or "inclined."

A background in, facility with, and interest in computing were factors that led them to be poised and ready to adopt IT in their teaching. Five out of the six faculty members indicated a history of computing that formed the basis for and propelled them to use these newer information technologies. When technology teaching innovations arose in their own disciplines, they had an affinity to the technology and developed practical experience with implementation in teaching. The focus of the implementation was always how to use the technology as a teaching tool.

One faculty member described himself as a “tinkerer” and as someone who has a natural curiosity about the use of technology in the classroom. He recalled his history of implementing technologies incrementally that led him to use IT and continue the pattern of experimentation in three formats: face-to-face classroom, Interactive Television (ITV) and online teaching.

Another faculty member, whose expertise is educational technology, indicated that she was inspired by a colleague’s presentation that demonstrated the use of Internet resources in teaching. This demonstration sparked an interest in and contemplation about how IT would serve her teaching needs. She recounted her path of experimentation that started by creating hyperlinks which eventually transformed into a full-fledged online course that has been offered several times.

Consistently, this group indicated that creating elaborate, technology-rich teaching resources for the benefit of their students was one of the main reasons that led them to implement IT. Since the majority of students are commuters and hold jobs outside the university, the fundamental benefit of IT to serve “anytime, anywhere” access to learning resources is valuable. In response to the learning needs of their students, they hosted lecture notes, in-class presentations, and links to additional content-related resources. Some aids were created to assist students in terms of the perceived deficiencies in learning skills essential to the effective consumption of curricular content:

**FM5:** Many of my students lack certain skills. They don’t know how to take notes in a lecture. They need that to help figure out what was important and what was not important. And online resources can help do that.

The creation of Web resources enabled one faculty member to change the dynamics of her face-to-face classes by enriching the teacher-student interaction:

**FM6:** I always want to cover too much material. We have three hours of class once a week.... I found myself lecturing, imparting that knowledge... Now I can ask them to read that (material) on their own. I can ask them to explore topics that are interesting to them. And I can spend my time in class in a more dialogue kind of interaction rather than me talk, you listen, you write.

To summarize, the factors that led these faculty to adopt technology were a predisposition to using technology and a need to address teaching and student learning needs for which IT was a logical solution.

### **Use of Information Technology and Implications for Teaching**

The experiences of these faculty members shed some light on the variables that need to be considered in iterative refinements when using particular technologies. A single technology implemented and employed with subtle variations could produce different outcomes. Pedagogy plays as important a role as the technology itself. One faculty member, for instance, might employ the pedagogical strategy of using students as moderators in Web-based conferencing and may observe dramatically increased volume of interaction in course communications among students. Another faculty member who self-moderates the Web-based conferencing may observe that course communications have remained similar to those in a traditional classroom. This section will present issues relating the manner and use of individual technologies that these faculty have adopted and their observations about the effects on teaching practices.

### **Email and Other Asynchronous Communications**

Email continues to be a popular technology on college campuses and is relatively easy to implement in teaching environments as attested by the annual Campus Computing Project (Green, 1998). There is a continuous rise in the percentage of college courses using email. This percentage of use estimated at 54 percent in 1999, was 44 percent in 1998, 33 percent in 1997, 25 percent in 1996 and just eight percent in 1994. Email can be used to foster communication between the teacher and the student in relation to administrative and educational issues about the course.

One faculty member used asynchronous communications between face-to-face sessions as a means of providing the students with material to discuss between classes. The ensuing student-to-student dialogue formed the basis of further discussion during the next in-class session. Thus, out-of-class communication was used as an extension and a stimulant for in-class discussion. Others used email to engender communication where there was none before and/or to change the culture of student-teacher interaction:

**FM5:** For commuter students, first of all, it means communication with faculty. I can hold office hours for most semesters and basically for the whole semester never see a student. ... And electronic technology can build a bridge that's important.

One faculty member used this "bridge" to gain more usable knowledge about her students:

**FM6:** It's much easier to stay connected to your students. That's because we use the online hypergroups. And they know that I'm much easier to access. And I know that they are much easier to access.... And I guess knowing the students and knowing about whether they do understand the material has improved a lot.

Another employed asynchronous communications deliberately to increase the ability of students to use modern technologies in their learning activities and thus acquire the skills of communicating electronically:

**FM2:** I've made it a point to encourage and in fact require students to use technology like email and to .....submit papers electronically.... I have encouraged, bribed, required them to become at least somewhat familiar with communication technologies and hopefully use them. So that every student that comes to my class has to have an active email account.

Other faculty used this technology to overcome the perceived lack of interaction when they taught Interactive Television (ITV) courses. Typically in these ITV settings, the students are in remote locations and view live broadcasts of the lecture. Students also have the option of watching taped broadcasts through the public television channel or through the library. After using email with ITV students, one faculty member suggested distance education students should be given email accounts and follow protocols that require them to check their email every so often. This would change the course and increase the communication with faculty:

**FM5:** Without that, it's a correspondence course....We need to be very careful about maintaining academic quality. And I think the only way we can do that is with interactive communications.

Another faculty member, whose students typically view taped broadcasts of courses, made it a personal course policy that required students to use electronic communications:

**FM2:** And so those folks (ITV students) then... the only communication I have with them is using the electronic medium. Those people do email and are expected to submit assignments and to raise questions using the technology.

Thus these faculty used email to encourage communications between them and their students where there were none before, to increase the quality of in-class discussion, and to encourage students to use email. The effect of increased communication while using IT has been elaborated upon by many.

### **Increased Communication and Use of Technology Requires Increased Time Commitment**

Although communications have enormous value, there are indications that there is an analogous increase in the amount of time required to monitor, respond to, sustain, and manage incoming and outgoing course communications:

**FM3:** They (colleagues) haven't a clue that I've spent far more time reading and responding to email messages than I would have spent on a lecturing course.

Rowntree (1995) refers to the potential negative effect that these time implications have to cause "tutor overload." Some aspects of this increased time commitment was validated by several faculty:

**FM6:** There's an enormous amount of time commitment both on the part of the student as well as the faculty... You need to make it very clear that you will be online when you can be online. So I feel that pull on me to be there— to just live in cyberspace.

Another indicated that setting expectations in the course about reply-time, adhering to those policies, and resisting the temptation to reply to every message, is one way of countering the overload:

**FM6:** I am online a lot. But I tell students I won't be online everyday and I won't reply 20 minutes later every time they send me an email or a post. They still expect it. But if you give it to them, they will expect it even more. They will be times when I get an email and I will let it sit just so that I am not reinforcing instant feedback.

However, conferencing technologies do have the potential of increasing the quality of teaching and learning. They allow students to share the deliberation process contemporaneously with fellow students and the faculty member in a manner that is impossible without these technologies. Traditional face-to-face interactions, in most instances, only allow the faculty member (and not fellow students) to see the product of the knowledge-negotiation process. However, when information is presented and circulated among fellow students, it promotes Socratic dialogues (Couples, 1996). Lippert (1997) termed such occurrences as the building of the learning agora. As this

faculty member indicates, the results of such facilitation result in an increase in quality of student communication:

**FM1:** They are more in-depth, they are richer. Students are able to participate more fully, more broadly, deeper ... they have more time to do research before they participate.

However, the technological skill level of the student should also be considered as a factor that could add to the faculty time load and as one that could potentially divert attention from the main content of the course. A faculty member in the humanities has reservations about re-teaching online following his first attempt:

**FM5:** Students who took this course were not students who were fluent in technology. They were students who didn't know much about technology but wanted to learn.... I had to teach them much about their computer, much about downloading files, much about everything. ...each of these people would demand so many hours of my time, it was impossible...those 10 (students) took more time than 200 students.

Another faculty member reinforced this notion of increased time load on a per-student basis:

**FM6:** I would not go back to not using technology but I wouldn't tell anybody— ... use this and it'll make your life easier. It doesn't. It's astonishingly complicated—keeping up with the needs of all these students.

One technique that could be used to disperse the traditional unidirectional flow of communication patterns (students to teacher) and thus share the workload is to establish a structure for student-to-student communications. This discourages the student-to-teacher paradigm and deflects a certain amount of responsibility to the students themselves:

**FM6:** If they ask a question I will not be the first one to respond. And that if somebody posts a help question, needs some help, or asks for an idea, they (students) should respond. And when they realize that I am serious—don't jump in there and rush to be the guide—then it really changes the class.

To guide the occurrence of useful information exchange between students, it is important to set guidelines for participation at the outset, concerning the content of these messages. Posting guidelines for discussion in detail is only the beginning:

**FM1:** I have found that if I do not give parameters of what kind of posting they should make, they would love to listen to themselves think. And nobody else does. And they don't have a lot to contribute, quite frankly. ...But when you give them parameters—which I do—I say that you should be referencing something with an authority, you should be referring people to a Web page, you should be telling us something about and giving us a citation. Then the quality explodes. It is so rich and so deep that people feel overloaded with so much—including me.

Setting clear expectations about email assignments prevents students from forming undue expectations. One faculty member requested that students send email after complet-



ing the assigned reading for the week. The students, however, not knowing that the faculty member was not going to respond to each of these assignments, were offended, a situation that could have been avoided by setting parameters.

Besides setting guidelines, managing the increased volume of communications, and reserving time to sustain these communications, there are time loads involved with creating other content-related online resources (Brahler et al., 1999). The following statements from two faculty members who have taught an online course between two and five times each sheds some light on the recurring time investment in modifying courses:

**FM2:** I don't see the return on investment yet. Increasing rewards for time spent. Because I am very much in the development mode.

**FM6:** It's a huge amount of time to begin with. But I think people are deceived by thinking that once you get it done then it's over. There are a lot of things I want to add... compared to face-to-face, week to week about twice as much. It's not fair to say it's a huge amount of time to begin with because that would depend on how much material you already had before you started.

Additionally, faculty teaching course loads are a factor. One tenured faculty member indicated that his course load—three in the spring and in the fall—was a big hindrance to finding the time to develop additional course materials. Without institutional commitment to provide course-release time, it requires greater personal time commitment to create and teach with integrated resources. Others cautioned against any misperceptions about low time commitments in the production of IT-based learning environments.

**FM3:** I think some professors are beginning to jump on to this kind of technology thinking it's going to free them up and get them out of these large lecture classes. They might be looking at this thing as a way to give them more time. They are going to be in for a real shock when they discover the amount of time that's just involved putting all of this stuff together.

These faculty are investing their time to create new and different kinds of learning environments that capitalize on the abundant information resources for use in education. This requires them to gather, evaluate, and incorporate such resources into their teaching practices. However, the limiting factor here appears to be support that will allow these faculty to invest more time in creating refined iterations of their current courses, disseminate information of effective practices, and engage in creating other technology-enhanced learning architectures without having to expend personal time.

Students, in order to participate efficiently in these learning environments, need to possess a repertoire of basic skills. These include the ability to navigate the Internet, productively research information, judge the validity of sources, and effectively manage the retrieved information. Additional skills should include an awareness of ethical issues such as plagiarism and copyright violations. The common misconception in most institutions is the assumption that all students possess these skills. When students enter learning environments without these prerequisite skills, faculty will have to teach the technology as well as the content. This adds to the time required to maintain and teach these courses:

**FM2:** I'm fielding a lot of basic questions on email, on Web access, on stuff like that—that I assume, or mistakenly assume, that they should have the basic competency in.



**FM3:** Searching the Internet is a topic that we really ought to address in some of the classes or at the library. They (students) waste a lot of time... If they spend 20 minutes learning how to do it effectively, they will save hours and hours of time.

### **Teaching Architectures and Learning Outcomes**

Another main question that comes to the surface is to determine faculty perceptions of how technology has influenced their specific teaching and learning goals. It is important to look at both the positive outcomes of using IT as well as some of the drawbacks. Has IT enabled them to explore new teaching methodologies or learning outcomes? What, if any, are the incidental outcomes of teaching with technology.

One faculty member initially thought of IT as an extension, a technology for delivery and dissemination. Once the experimentation with this iteration was completed, however, the path of integration led to more complex questions. These questions led to the heart of the process of building nontraditional learning environments that are structured to engage students. How does one make the best use of the medium? These are questions that truly require rethinking the course and the events that occur within it in different ways. The interview excerpts below provide glimpses of some of the paradigm shifts that occur as a result of these questions:

**FM2:** Initially it was a way of providing more information more easily or more information visually or more information without having to draw it on the blackboard each time... But as I get more into it, it's become less of an extension of a traditional classroom and more of a challenge to think of different ways of doing things and ...restructuring the learning process.

**FM6:** I am pressured more to make that knowledge that they want. So I'm under more pressure to directly relate the knowledge to whom they are so that they'll want to use it and make it their own knowledge.

**FM5:** That's where I think we have cutting edges, not delivery, not how can we deliver this course over the Internet, but rather a new kind of project that we literally could not do in the past.

Each course will require distinctive course architectures that include content, student activities, and communication processes to attain the intended course outcomes that are best suited for that course:

**FM6:** The organizing... in the online class, I'm responsible for organizing that information for everybody (students) regardless of their learning style or who they are or background or what they want out of it. And, that's a lot of work—to anticipate what potential problems there might be and how they go through those. How... the technology fades away and the material comes to the front .... And revising it when it doesn't work.

Administrators focus on scalable models of technology implementation. While such models are necessary for large-scale cost-effective implementations, it is necessary to conceive newer teaching architectures for individual courses rather than merely converting existing materials to online formats. Teaching architectures, as used here, refer to the use of IT as an embedded resource in a course. It refers to the technical, instructional design and pedagogical elements incorporated in the learning environment (Chrisman & Harvey, 1998).

The number of students within a course also has an impact on the kind of teaching architectures one would use. One faculty member in the humanities who deals with classes of up to 592 students indicated that technology integration can be a rather complex undertaking with such large numbers. IT can be implemented through the creation of individual learning modules on core concepts that students can use to enhance their understanding. However, the same faculty member indicated that for courses where the student numbers were smaller, IT can play a role in equalizing access to original sources of information. Such access is a forgone conclusion in colleges with abundant resources, but a problem in an institution with limited resources for faculty to duplicate original documents for their students. Informational technologies can bridge that divide:

**FM5:** Active learning. We want them (students) to take charge of their education, and this, if we do it creatively, can happen.

Access to computing or the lack of it may be an issue. Statistics are not available on how many students at this institution report Internet access at their homes or the least common denominator in computer hardware. Some of the colleges host their own computing laboratories for their students. In general there are 26 labs available for students in this institution. Some labs are limited to students within that particular college.

Student computing capabilities have an impact on the teaching architecture that is implemented. For instance, streaming media is not a viable option if the majority of students connect through low-bandwidth modems:

**FM1:** I had a student literally in the middle of a jungle in Indonesia last summer. ... he was connecting at about 8K half the time on Net-Meeting.

Online communication between students enables students to learn from each other as well and get to know their fellow students, thus forming the basis for an electronic learning community:

**FM1:** And what students tend to appreciate is that they get to know people very well online. Which is an odd concept for a lot of people who have never been online or worked in this arena. But they establish rapport and get to know people in a way that they never would have time to in class.

The same faculty member continues about the learning benefits of these interactions that transform every student into a potential resource for information, a colleague and a critic—a closer emulation of the real world:

**FM1:** And I think it is because they are learning so much from each other in Web-board postings because there is so much more there than you ever get in a classroom.

Sharing the content production aspect of the teaching architecture, some of the faculty mentioned incorporating the consistently proliferating information on Web sites into their courses:

**FM2:** The textbook that I'm using has an online, publisher-supported, end-of-chapter quiz ... They (students) quickly discover that they can take the end-of-

chapter quiz in about two minutes. So it is painless for them. And their grades get emailed to me.

Others discussed new relationships with the publishers of textbooks to develop content. One faculty member used the content of the Web site that was associated with the textbook. Textbooks are increasingly including CDs and informational resources in their contents. Although this can be beneficial, one possible downside is “information overload.” As a reviewer of textbooks for publishers, one faculty member indicated that the links were far too many and too overwhelming in some instances as opposed to a set of “magnet sites” or sites that host concentrated ranked information.

## **ANALYSIS**

The use of information technology (IT) in higher education has transformative potential. Within an amazingly short period of time, IT has gone from the speculative revolutionary potential to transform universities to one that is increasingly devoted to discussing the realities and results of implementing these new technologies. Early in this “revolution,” Noam (1995) and Tehranian (1996) argued that the inevitable and widespread adoption of IT will result in profound changes in the traditional structures and operational modes of the university. Currently predominant models of education require students to physically aggregate at the university to partake in an educational process in what some have referred as the “credit for contact model” (Dede, 1996).

Distributed IT systems, by contrast, will radically alter the direction of information flow and thus eliminate the need for the student to consider physical location or a particular university as a factor while selecting educational opportunities (Noam, 1995; Tehranian, 1996). This paradigm shift in access to education—to “anytime, anyplace learning”—requires a fundamental re-conceptualization of both the teaching and learning at the university (Brown & Duguid, 1995) and the business of operating a university (Denning, 1996; Eustis et al., 1998). Additionally, competitive new players, such as the frequently cited Microsoft University and McGraw Hill University, are challenging the sanctioned role of universities as providers of education (Anson, 1999). Such developments have incited calls for a re-engineering of the role of the faculty member by outsourcing some duties, such as production of learning environments (Chellappa et al., 1997; Couples, 1996; Young, 1997). Statements such as “former practices and roles have to give way to the digital juggernaut” exemplify sentiments that consistently reverberate through current educational literature in many disciplines (Taylor, 1998).

Much has been written about the process of integrating technology into higher education practices, the potential for change in pedagogy and learning environments (Berge, 1997; Boettcher, 1997; Boettcher & Cartwright, 1997; Bourne et al., 1997). By studying early adopters, we can begin to make preliminary observations about those issues. However, technology in and of itself does not produce invigorated learning environments, but it can be creatively employed to answer educational needs (Burbules, 1997; Chen, 1997; Clark, 1994).

## **CONCLUSION**

From these interviews it is clear that Web-based technologies provide an infrastructure in which to implement new models of teaching and learning environments,

and that innovators in a state-supported public institution are able to experiment with and without institutional support. It is also evident from the reports provided by faculty members who have experimented with these technologies that their use has made some of the more moderate prophecies for revolutionary change come true. The Web provides the faculty member with a means by which to create student-centered learning environments while eliminating the need for time and space barriers. It also appears from the perceptions of these faculty members that formal structures of support, both in technical terms and in the form of incentives, are needed if this innovation is to reach further into the fabric of this institution. Institutions need to consider renegotiating their financial paradigms, roles, and support structures to enable faculty to experiment with and successfully integrate these technologies that have the potential to result in evolved and sophisticated learning environments for students. While pockets of innovation are necessary and are welcome, some of the configurations of technology-enriched learning environments could be implemented elsewhere in the institution with minimal support. The following sentiment expressed by one of the faculty members in this sample succinctly expresses the frustration of innovators when their efforts are not formally rewarded and sustained:

**FM1:** The innovators are being evaluated by the resisters in the tenure review process.

## DISCUSSION QUESTIONS

1. In what ways does technology substitute for or supplant prior forms of communication (e.g., online office hours rather than face-to-face office hours), and in what ways does technology create new mechanisms?
2. This case describes the use of technology at an urban, public university. What different sorts of challenges and opportunities would be found at a private institution, or at a university in a non-urban setting?
3. This chapter described the experiences of faculty who had employed IT in their teaching. What might be the concerns of other faculty who do not use IT in their classrooms?
4. How could the impact of the introduction of technology be measured and assessed?

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