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Technology use by a college of education faculty and factors influencing integration of technology in an undergraduate teacher preparation program

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TECHNOLOGY USE BY A COLLEGE OF EDUCATION FACULTY AND FACTORS INFLUENCING INTEGRATION OF TECHNOLOGY IN AN UNDERGRADUATE TEACHER PREPARATION PROGRAM

by

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ABSTRACT

Technology Use by a College of Education Faculty and Factors Influencing Integration of Technology in an Undergraduate Teacher Preparation Program

by

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This study describes current levels of technology use by a College of Education (COE) faculty and use of technology in teaching classes. In addition, the formation of a systematic plan for integrating technology throughout the teacher preparation programs was explored. Both quantitative and qualitative methods were used in this two-phase study.

Phase I survey results suggested that although 93% of faculty believed technology in teacher education was very important or somewhat important, use of technology in teaching was limited. Consistent with previous findings on university faculty use of technology, COE faculty rated themselves as having high levels of knowledge and skill with using various computer-based technologies (i.e., word processing, computer spreadsheets, statistical computing, e-mail, educational software, presentation software, Internet/World

Wide Web, and multimedia). However, this confidence did not necessarily transfer to use of technology in teaching. Over 50% of tenured/tenure-track faculty reported use of technology in teaching at least once during the Spring 1997 semester while no more than 30% of affiliate faculty reported using it in teaching.

Phase II case study data were collected from interviews, observations, and documents. Data were examined using the framework developed by Fullan and Hargreaves (1996): (a) teacher's purpose, (b) teacher as person, (c) context of teaching, and (d) culture of teaching.

Findings describe the manner in which case study participants used technology in their teaching as an add-on, a communication medium, a resource, and a teaching/learning tool. Commitment, a factor within "teacher as person," was found to be a critical element in adopting use of technology in teaching regardless of an individual's technology expertise. Efforts to plan for systematic integration of technology throughout the COE teacher preparation programs were met by resistance due to the issue of academic freedom and more pressing concerns such as reorganization of the COE

Although findings of this study are limited to one COE setting, a complex variety of factors influencing the integration of technology in teacher education are described, and the importance of support personnel is reinforced. Recommendations for other colleges of education attempting to integrate technology into teacher education programs are included.

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To my family, friends, and doctoral committee,
all of whom helped me as I
pursued my dream.

CHAPTER I

INTRODUCTION

Purpose of the Study

This study describes current levels of technology use by College of Education (COE) faculty and implementation of technology in required undergraduate teacher preparation courses in a state-funded university in the southwest United States. In addition, the formation of a systematic plan for integrating technology throughout the teacher preparation program was explored.

Background

The Need to Integrate Technology in Teacher Preparation Programs

Colleges of education have a pivotal role in preparing teachers who are able to teach with technology. In Teachers and Technology: Making the Connection (U.S. Congress, 1995) teachers reported feeling inadequately prepared to teach with technology. This is not a surprising situation, given that in most colleges of education, "technology is not central to the teacher preparation experience" (p. 165). This study examined the extent to which technology was being used by a COE faculty in the undergraduate teacher education programs.

Willis and Mehlinger (1996) summarized the topic of technology in preservice education: "Most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology" (p. 978). Thomas (1992) argued that technology must become "an essential part of America's teacher preparation programs" if it is to be an integral part of K-12 education (p. 9). Thomas was instrumental in the formation of technology standards developed by the International Society for Technology in Education (ISTE) which were approved by the National Council for Accreditation of Teacher Education (NCATE). ISTE's Foundation Technology Standards for All Teachers (Appendix A) incorporate 13 technology competencies that all teachers are expected to acquire, and because the standards are linked to the NCATE accreditation process, they are more likely to have an impact on teacher education (Willis & Mehlinger, 1996).

In an attempt to prepare technology proficient teachers, some colleges of education have implemented stand-alone educational computer courses while others have tried to integrate technology into foundations and methods courses (Willis & Mehlinger, 1996). One widely proposed model for fulfilling the ISTE/NCATE technology guidelines includes a combination of three main components: (a) a core computer course, (b) modeling of technology by education faculty in methods classes, and (c) experiences with technology in student teaching (Handler, 1993; Novak & Berger, 1991; Schrum, 1994; Wetzel, 1993). This study focused on the second component, the modeling of

technology by education faculty at an institution that has a required core computer course.

Faculty Use of Technology

Expectations for technology knowledge and use are not restricted to preservice and inservice classroom teachers but extend to teacher education faculty. NCATE's 1995 Standards, Procedures, and Policies for the Accreditation of Professional Education Units included a new indicator under faculty qualifications which states that "faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship" (p. 24). COE faculty use of technology in teaching, efforts to formulate a systematic plan to integrate technology in the teacher education program, and faculty willingness to use technology in required undergraduate teacher education classes are described in this study.

Discussing college faculty and staff development, Willis and Mehlinger (1996) pointed out that further education beyond the doctoral degree was traditionally up to the individual. Generally, during undergraduate or graduate work, college faculty were not trained to use technology, nor did they see it modeled. Now, demand to integrate technology in preservice education programs has created a situation in which many faculty members need training and support in the use of new methods and new media (Carr, Novak, & Berger, 1992). This study provided the needed training and support for faculty, with the researcher in the role of participant observer.

Vagle (1995) examined preservice teacher programs that were considered to be exemplary in providing instruction in technology. Nominations for exemplary programs were made by 184 individuals who either presented sessions on technology and teacher education at professional conferences, were members of editorial review boards for various technology in education journals, or were members of boards of directors for professional organizations such as ISTE. Through the use of surveys from 36 exemplary and 33 comparison institutions, Vagle looked at the integration of technology into education methods courses. Both exemplary and comparison institutions reported extensive use of the computer and VCR for delivery of instruction, but use of other technologies such as telecommunications or CD-ROM was minimal.

Vagle (1995) discussed causes of faculty resistance to educational technologies. First, the required technology course for preservice teachers came too late in the program, leaving education methods instructors to teach basic technology skills as well as content and application of technology. Second, maintaining a high level of expertise in content fields while meeting demands to develop technological expertise was a problem. Third, hardware and software access for instructors of education methods classes was a concern.

Effective use and integration of technology throughout the teacher education program is dependent on the instructors of the teaching methods courses. The technology courses must help prepare classroom teachers who

are capable and competent in utilizing a multitude of learning resources--technological and traditional (Vagle, 1995, p. 242). This study focused on instructors' resistance as factors influencing integration of technology in teaching, based on survey data and interviews.

Encouragement of technology use among faculty in teacher preparation programs is also an important issue. Topp, Mortenson, and Grandgenett (1995) identified three key elements necessary for increased use of technology in teacher education institutions to occur: (a) equipment, (b) training, and (c) expectations. The first two, equipment and training, have been discussed in many articles as critical elements for successful use of technology in education (Johnson & Harlow, 1993; Novak & Berger, 1991; Wetzel, 1993). Expectations, which offers a new perspective on what is important for increased use of technology, has been given less attention. At the University of Nebraska at Omaha, expectations and encouragement came from the College of Education Dean's Office in four ways: (a) identifying educational technology as one of the two major goals of the college; (b) expending college funds to purchase educational technology; (c) supporting faculty engaged in advancing the use of educational technology; and (d) strengthening educational technology through grants and other outside funding sources (Topp et al., 1995, p. 13). In addition, technology use was encouraged within college departments, technology was discussed at departmental meetings, and technology expertise was a factor in the hiring of new professors. This study examined factors which encourage COE faculty use of technology.

Discussing the challenge of integrating technology into K-12 schools, Sheingold (1991) stated, "technology is not likely to have a qualitative impact on education unless it is deeply integrated" (p. 20). Similar arguments have been made regarding the need for integration of technology at the college level to prepare new teachers with confidence and competence in teaching with technology (U.S. Congress, 1995). Demands for classroom technology expertise continue to increase, with school district administrators, parents, and students all expecting technology to be used (Novak & Berger, 1991). Reports that describe successful integration efforts across teacher education programs are limited in number, which can be "an indication of just how difficult that task is" (Willis & Mehlinger, 1996, p. 1000). This study investigated the implementation of a technology plan in undergraduate education classes.

The Setting: A University in the Southwest

The state-funded university of approximately 20,000 students is located in a rapidly growing city in the southwest United States. College of Education (COE) enrollment for the Fall 1996 semester included 1,806 undergraduate students and 849 graduate students. During the 1995-96 academic year, 310 undergraduate and 266 graduate degrees were conferred by the COE. Sixty-five full-time faculty and approximately 100 affiliate faculty taught in the college. Reorganization of the COE was in progress, but at the beginning of the Spring 1997 semester, academic departments included:

(a) Instructional and Curricular Studies, (b) Educational Psychology, (c) Special Education, and (d) Educational Leadership. The departments most directly involved with teacher education programs were Instructional and Curricular Studies and Special Education.

Undergraduate students in teacher preparation receive degrees in elementary education, secondary education, or special education. Within the elementary program of study, educational foundations and methods courses are taken during the junior and senior years. Students in the secondary education degree program specialize in a content area and then complete educational foundations and methods courses related to their content areas.

Graduate degrees offered in the Department of Special Education and the Department of Instructional and Curricular Studies include Doctor of Education (Ed.D.), Specialist in Education (Ed.S.), Master of Science (M.S.), and Master of Education (M.Ed.). Recently, a Doctor of Philosophy (Ph.D.) degree became an option in the Department of Instructional and Curricular Studies. An alternative licensure program provided the opportunity for students to complete a Master's Degree while becoming certified to teach in the state.

Integration of technology in the COE has been an ongoing process, beginning with the 1989 hiring of a full-time faculty member for a tenure-track technology position. Gradually, this job description evolved to include the role of Computer Coordinator for the COE. The option of educational computing as a graduate program emphasis was created about the same time. A second technology faculty position was filled in 1991. Hardware and software resources

in the COE have increased over the last five years and faculty access to technology included a networked computer in each faculty office (with the exception of two faculty members who did not want computers). At the time of this study, a teaching lab in the COE was updated with 35 Power Macintosh computers and an education file server was added to the network. A ceiling-mounted projection unit was purchased to replace the large-screen demonstration monitor. A smaller lab of 22 Macintosh computers with a large-screen demonstration monitor could be reserved by faculty, and a second demonstration classroom was being planned. In addition, a portable multimedia station containing a Power Macintosh computer, a portable harddrive, a VCR, and an active matrix projector could be transported to classrooms for instructor or student use. A university lab housed in the COE building contained 20 networked Macintosh computers for student use.

NCATE's Standards, Procedures, and Policies for the Accreditation of Professional Education Units (1995) specify that teacher candidates develop expertise in the use of educational technology. A required survey course on computers in education provided students in the teacher education programs with the basics of working with computers, integrated applications software, educational courseware, multimedia, and telecommunications. Although they are very similar, both elementary education and secondary education computer survey courses were offered. Single course approaches, however, may not be enough to develop a vision of technology in education and to utilize technology in teaching (Wetzel, 1993). Although some professors model the use of

technology in their teaching, a systematic plan for technology integration throughout the teacher preparation programs had not been developed.

Significance of the Study

This research project provides insight into the influences of teacher's purpose, teacher as person, the context of teaching, and the COE culture of teaching relative to faculty willingness to integrate technology into Spring, 1997 teacher education classes. Description of how these influences impact integration of technology in one COE may have value for other educational institutions.

Practical significance of the study includes a description of current use of technology by COE faculty, the initial formation of a technology integration plan, and an examination of factors influencing technology use in required teacher preparation courses. An implementation matrix (Handler & Strudler, 1997) aligned with ISTE/NCATE technology standards for all teachers was used to plan ways in which faculty could incorporate technology in educational foundations and methods courses. Research results will benefit the COE in NCATE reports, in planning for future needs regarding technology integration in teacher education, and in informing other colleges and universities as they develop technology integration plans.

Theoretical Framework

This study was grounded in a theoretical framework of teacher development and educational change developed by Fullan and Hargreaves (1992). Four main elements of the framework include: (a) teacher's purpose, (b) teacher as a person, (c) real world context in which teachers work, and (d) the culture of teaching. The first three elements, teacher's purpose, teacher as a person, and context of teaching relate to the total teacher while the fourth element, the culture of teaching, relates to the total school. The elements are defined as follows:

> Teacher's purpose: the concept of teaching as a moral craft, things that teachers value and want to accomplish in their teaching.
>
> Teacher as person: factors such as age, stage of career, life experiences, and gender, each capable of affecting interest in and response to innovation.
>
> Real world context: physical and social contexts such as grade levels, school location, degree of curriculum mandating, and social aspects of teaching.
>
> Culture of teaching: the working relationship that teachers have with their colleagues (Fullan & Hargreaves, 1992, pp. 5-6).

Fullan and Hargreaves (1992) proposed that the culture of teaching and the culture of schools are emerging as central to teacher development and to educational change:

> It has become clear that previous assumptions about linking staff development and effective change confined to specific innovations were too limited. We now begin to see that comprehensive career-long teacher development, and institutional reforms in faculties of education and school systems is the real agenda (p. 8).

Fullan and Hargreaves (1992) designed their framework with K-12 teachers in mind while this study explored the influence of teacher's purpose, the teacher as person, the context of teaching, and the culture of teaching as they apply to college faculty involved with planning for and implementing use of technology in their courses. This study examined the integration of technology in teacher preparation courses from the viewpoint of faculty at various stages of their careers, reflecting one element of teacher as person. Career stages included: (a) doctoral student, (b) assistant professor, (c) associate professor, and (d) full professor.

Questions Guiding the Study

This study sought to answer the following research questions:

1. How is technology currently being used by College of Education faculty?
2. What factors influence the integration of technology in undergraduate teacher education?
3. What are the outcomes of a technology integration planning process?

CHAPTER 2

REVIEW OF RELATED LITERATURE

An overview of preservice teacher education and technology is presented first. This is followed by sections on (a) barriers to technology use, (b) innovation and educational change, (c) school culture and change, and (d) teacher educators.

Preservice Teacher Education and Technology

School district administrators, parents, and students all expect that teachers use technology. But often, the teacher education programs have not prepared teachers to teach with technology and school districts may have provided little inservice training and support (Novak & Berger, 1991). Teacher preparation programs vary greatly in their approaches to including technology. Some programs offer intensive instruction in computer operation, related technology, and integration of technology in teaching and learning, while others provide only minimal instruction in computer applications and uses of technology in teaching. According to the published report of the U.S. Congress, Office of Technology Assessment (OTA), "The most direct and cost-effective way to educate teachers about technology is through the preservice education they receive in colleges of education or other institutions" (1995, pp. 166-167).

New teachers feel inadequately prepared to use technology in the classroom (Strudler, Quinn, McKinney, & Jones, 1995; Topp, Thompson, & Schmidt, 1994; U.S. Congress, 1995). According to Brooks and Kopp (1989), "If first-year teachers are expected to be creative and facile with technology, they deserve systematic exposure to technological enhancements at all levels of a coherent, interrelated preservice curriculum" (p. 4). A national survey of recent graduates who had been teaching an average of 2.8 years found that over 50% felt unprepared or poorly prepared to teach with information technology (Colon, J. Willis, D. Willis, & Austin, 1995). In their teacher education programs, it was not typical for faculty to model teaching with information technology.

Bitter and Yohe (1989) distinguished between processes and products in technology training. The products of technology are represented by a teacher's ability to apply technical skills to produce a desired result. Two types of product categories for teachers to master include technology as an instructional tool, and technology as it relates to the delivery of instruction. Process, on the other hand, refers to the theoretical investigations. "The conceptual skills teachers must understand are the limits, extensions, and future of technology" (p. 23). An understanding of the processes facilitates the ability to apply technology despite the changes in products.

Callister and Burbules (1990) argued against the traditional computer literacy course found in many preservice education programs, stating that it should be eliminated completely. They claimed computers as a separate

subject does not help students see specific ways of using computers in their classrooms. In its place, it was suggested the information be integrated into content area courses. With such a philosophy, integration of technology rather than the training aspect becomes the focus.

Southern Illinois University created a computer-intensive curriculum emphasizing a philosophy that views computer technology "as an essential element in the process of education" (Nelson, Andris, & Keefe, 1991, p. 4). Of particular interest in the Southern Illinois University model was the teaching of general computer skills through all introductory education courses, even courses such as Foundations of Education, and Educational Psychology, not usually associated with computer applications. Discipline-specific techniques and software were taught in methods courses. The Introduction to Education course included instruction in computer literacy issues and integrated applications software, topics covered in eight hours of direct instruction. In the Educational Psychology course, issues regarding learning with computers, computer-based testing, and grading were discussed. Interactive video simulations of classroom procedures were explored and computer-assisted instructional software programs were analyzed in relation to principles of learning. Application of skills and techniques were applied during student teaching.

Todd (1993) designed an innovation configuration curriculum model for the integration of technology. Innovation configuration as defined by Hall and Hord (1987) emphasizes a vision of what the change will look like when it has

been achieved, and focuses on describing the operational forms of an innovation. Todd worked within a framework of four components: (a) existing course content objectives, (b) computer-based technology practices detailed by Sheingold and Hadley (1990), (c) ISTE Technology Standards, and (d) an evaluation item. Course instructors reached agreement on component variations with the help of an *ad hoc computer curriculum committee.* A review of course syllabi was conducted and the project was organized into four main phases. First, faculty were interviewed to determine how content objectives "might be facilitated with a computer activity," and a database of possible computing applications was developed. Second, agreement was reached on a minimum of two specific objectives for each course using Sheingold and Hadley's (1990) practices framework to establish a basis for the range of practices included. Third, ISTE (1992) guidelines were identified for each course, and revisions were made in the model to ensure inclusion of all ISTE guidelines and ranges of practice. Fourth, formal faculty adoption of the model and budget authorization was sought. Specific hardware and software needs were identified and faculty instructional development assistance was targeted.

In contrast to the fully integrated approach supported by Callister and Burbules (1990), Wetzel (1993) argued in favor of keeping the core computer applications course as the first of three program components in preparing teachers to teach with technology. By means of the core course, six of the thirteen ISTE/NCATE standards were met, faculty time and experience were effectively used, and course content was relevant to preservice students

regardless of their subject area. A second component incorporated technology into the methods courses, encouraging education faculty to model technology use. Field experiences rich in technology comprised the third component in preparing teachers to teach with technology. Wetzel's model included replacing separate content and methods courses with an integrated course taught on-site at an elementary school. In the process, the two-fold plan was to "model the use of technology for undergraduates and to help professors learn to teach with technology" (p. 335).

Handler (1993) offered further support of the three component preservice model. She found that few first year teachers had the opportunity during their preservice experience to practice teaching a lesson using technology to enhance the instructional process. In a survey of 133 education graduates, Handler collected information regarding perceptions of the purpose of intentional preservice computer experiences, the value of these experiences, and use of computers in their classrooms after graduation. Additional data included qualitative responses of experiences that added to a sense of preparedness, and recommendations of experiences for future preservice students. Of the 133 graduates, only a small group was identified as feeling prepared. Factors that contributed to feeling prepared to use technology in the classroom included: (a) the value of a separate course on the introduction to computers in education, (b) the degree to which computers were used during the methods blocks, (c) the observation of and use of computers during the student teaching field experience (p. 149).

Barriers to Technology Use

Lack of hardware and software has been an obstruction to technology use in preservice teacher education programs, but according to Wiburg (1991) an additional obstruction has been a lack of shared educational models. Wiburg argued that education should be reconceptualized in view of new needs and tools, and that a vision of learning in technology-rich classrooms must be presented to students. This vision included not only curriculum content but also the context, with student teachers utilizing technology at the school site. "Central to this approach to teacher education is the presence of education professors in classrooms as active instructional leaders and users of technology themselves" (p. 120).

Wetzel (1993) assessed the extent of technology integration, willingness, and obstacles through a survey of education faculty at Arizona State University West Campus. Most of the faculty fell into two groups: those using computers, and those interested in using them although not using them presently. Major obstacles to use included (a) lack of information, (b) time, and (c) lack of software or equipment. He found that personal use of the computer by the faculty was greater than their use of computer technology in teaching. Barron and Goldman (1994) surveyed 70 teacher education faculty and administrators at two technology conferences held at Vanderbilt. Barriers to use of technology included "lack of time to learn about the equipment and to prepare to use new materials in class" (p. 102). Other barriers noted by Barron and Goldman were lack of technical support and inadequate staff development opportunities.

Strudler, McKinney, & Jones (1995) also examined impediments to technology implementation at the university level. Results of the exploratory case studies involving two professors suggested that many impediments to technology implementation had been reduced. Advances in amount and quality of hardware and software and smoother network operations allowed the faculty involved in the studies to more effectively integrate technology into their courses. Time to learn about and use technology, however, remained a problem.

As with the OTA findings (U.S. Congress, 1995), Schrum (1994) suggested that focusing on the purchase of hardware while ignoring instruction, curriculum development, and professional growth was a mistake. The undergraduate teacher education program was redesigned, making technology a "foundational experience" (p. 12). Schrum determined that the combination of a specific course and integration of technology throughout the program were necessary to influence student behavior. An initial step in the process was to make technology accessible to the education faculty. A needs assessment of the faculty targeted areas for development including word processing, presentation software, and telecommunications. Technology-related brown bag lunches were developed to enable faculty to see demonstrations of software. In addition, an electronic classroom was created which housed multimedia hardware and software. An objective of the program was to ensure every teacher education student would have experience using technology for management, professional development, curricular activities, and personal use.

"Each student will have worked with technology, seen it in his/her methods classes, designed materials for students, and used telecommunications for curricular, research, and collegial interaction" (p. 13).

A national survey commissioned by the Office of Technology Assessment was sent to a random sample of U. S. teacher education faculty (J. Willis, D. Willis, Austin, & Colon, 1995). Because the usable return was only 20%, the researchers cautioned that data must not be over-interpreted. Nevertheless, some interesting findings included attitudes, perceived barriers, and patterns of use. Education faculty rated technology in teacher education, both now and in ten years, as "Very Important" or "Extremely Important" (p. 797). Barriers to technology use included limited resources such as hardware and software, but also time, training and support, and rewards. Patterns of use revealed that most of the faculty viewed themselves as competent in using information technology, but not in teaching with it.

Innovation and Educational Change

A broad research foundation on diffusion of innovations has developed over the last fifty years with approximately 4000 diffusion publications (Rogers, 1995). Rogers synthesized much of the research findings to develop a diffusion model, and more recently, updated and revised the diffusion model he developed over thirty years ago.

In studying diffusion of innovations, Rogers (1995) examined the innovation-decision period, the process through which individuals or organizations pass as they determine whether to adopt or reject an innovation.

He theorized that the innovation-decision process is made up of five stages: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation. Rogers identified three main types of innovation-decisions:

1. Optional innovation-decisions are choices made by an individual to adopt or reject an innovation, independent of the decisions of other members of the system.
2. Collective innovation-decisions reflect choices made by consensus among the members of a system.
3. Authority innovation-decisions are made by one or more individuals in a system who have status, power, or technical expertise (p. 37).

Rogers included a fourth category, contingent innovation-decisions. This type of innovation-decision is a combination of two or more of the first three innovation-decisions, with choices to adopt or reject made after other innovation-decisions. For example, an authority innovation-decision may be required to purchase materials or equipment before an individual has the choice of adopting or rejecting an innovation.

In exploring the rate of adoption, Rogers (1995) conceptualized five adopter categories based on the time it takes individuals to adopt a new innovation. He described the adoption rate using a normal frequency distribution: (a) innovators (2.5%), (b) early adopters (13.5%), (c) early majority (34%), (d) late majority (34%), and (e) laggards (16%). According to Rogers, attributes of people in these adopter categories range from venturesome to traditional.

Rogers (1995) described the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" (p. 22). He found that for most innovations, the cumulative frequency of individuals adopting over time resulted in a distribution that is an S-shaped curve. Generally, only a few innovators adopt an innovation at first, but the diffusion curve climbs as more individuals adopt in each of the time periods. Finally, as fewer people remain who have not adopted the innovation, the trajectory of adoption levels off.

Geoghegan (1994) discussed use of technology at the college level relative to Roger's adoption model. He cautioned that differences between mainstream faculty and early adopters must be recognized. Early adopters tend to be more self-sufficient with technology and are often risk-takers. The mainstream is made up of early majority who want some proof of successes before adopting, and the late majority who tend to wait for an innovation to become solidly established before adopting it. According to Geoghegan, success in working with the mainstream can be fostered by offering applications of technology that have compelling value.

Educational innovations have come and gone over the history of education, sometimes because implementing a change is more difficult than anticipated (Fullan, 1991). Houston (1996) stated "Educators often describe change but do not change" (p. ix).

Fullan (1991) simplified three broad, commonly recognized phases of the change process to include initiation, implementation, and continuation. He

added a forth phase of his own, outcome. Initiation, also referred to as mobilization or adoption, involves the process leading up to and including the decision to adopt a change. Variables for initiation include the question of who initiates the change and the scope of change. Implementation or initial use encompasses putting a reform or idea into practice. Continuation, also called routinization, incorporation, or institutionalization, is the phase in which a change becomes ongoing. Outcome can involve several types of results including "the degree of school improvement in relation to a given criteria" (Fullan, 1991, p. 48). Numerous factors operate at each phase and the process is not necessarily linear.

Two methods of implementation form a system of variables: key factors and key themes (Fullan, 1991). Individually, each can serve as a mode of analysis in the implementation process. Key factors include three main categories: (a) characteristics of change, (b) local characteristics, and (c) external factors. Characteristics of change include perceived need, which is further complicated by conflicting or competing needs. In addition, needs are not always clear until the implementation is actually occurring. Huberman and Miles (1984) noted that complexity, the difficulty and extent of change required, also affects implementation.

Sub-processes of school change were described by Hord and Hall (1986). Their cyclical and interactive phases included assessment, initiation, implementation, and institutionalization. Once a need for improvement has been established through assessment, an innovation is chosen as a response.

Initiation is the phase often ushered in with enthusiasm in the effort to stimulate user commitment. "There appear to be available many more examples of initiating change in schools than there are of implementing (and institutionalizing) the change" (p. 6). Implementation, a critical phase according to Hord and Hall, requires that assistance such as skill training and one-on-one support be provided. Institutionalization, the goal of educational change, is difficult to measure.

School Culture and Change

Sarason (1995) has written about school as a culture since 1965, and from the beginning, made a basic assumption:

> In approaching the problem of change, I am making an assumption that the school is a subculture in our society since it has traditions, goals, dynamics, organization, and materials which set it apart from other settings in our society (p. 69).

In Sarason's recent book, Revisiting "The Culture of the School and the Problem of Change" (1996) which included the 1982 second edition of The Culture of the School and the Problem of Change, Sarason questioned whether departments and colleges of education should be regarded "as a part of a school system, or rather as another system that interacts with school systems" (p. 10). He criticized the university culture for resisting change and blamed elaborate organizational structure of faculty and administration for slowing and diluting change. Sarason's description of the change process involved three assumptions regarding social relationships: "those among professionals within the school setting, those among the professionals and pupils, and those among

the professionals and the different parts of the larger society" (p. 59).

Rudduck (1992) characterized change as a cultural problem rather than a technical problem, one that "requires attention to context and to the creation of shared meaning within working groups in schools" (p. 201). Similarly, Sikes (1992) described the cultures of teaching as a concept "crucial to any consideration of change because it is through these cultures that change is mediated (p. 43).

Rossman, Corbett, and Firestone (1988) claimed that change efforts generally focus on behavioral change rather than "the fit between those behaviors and the normative core of the school's culture" (p. 18). They proposed that a cultural perspective on the change process involves two issues: (a) nature of teacher resistance; and (b) relationship between planned change and effectiveness.

Hargreaves (1992) proposed that to understand what teachers do and why they do it requires an understanding of the teaching community. "Culture carries the community's historically generated and collectively shared solutions to its new and inexperienced membership. It forms a framework for occupational learning" (p. 217).

Teacher Educators

Ducharme (1993) commented on the scarcity of literature on teacher educators: "Education faculty are rarely the subject of sustained study, teacher education faculty even more rarely so" (p. 2). He interviewed 34 teacher education faculty members, and used the information to describe teacher

educators. When participants in Ducharme's study were asked why they left public-school teaching to become teacher educators, reasons included "isolation, low autonomy, poor intellectual climate, fear of becoming boring to students, and lack of personal time" (p. 52). Overall, Ducharme found education faculty at various ages and levels of experience expressed feelings of satisfaction with life and work.

Richert (1995) wrote about her belief that learning is important to teaching. "If teacher educators see themselves as learners, and reveal to their students a reflective-learning stance towards their practice, they will engender more broadly a positive disposition towards teacher learning in the teaching profession" (p. 6). She went on to argue that change makes all of us beginners.

Research on teacher development and educational change has been more frequent at the K-12 level, some of which may be applicable to the professional development of teacher education faculty at the college level. Fullan and Hargreaves (1992), for example, divided research on teacher development and educational change into two phases, the innovation-focused period, and the total teacher and the total school. The researchers described the 1984 work of Huberman and Miles and others as contributing new insights about educational change which included:

> ...the universal presence of early implementation problems in all cases of success, the role of pressure and support, the way in which change in practice frequently preceded change in beliefs and understanding, and the time-line of two or more years of active assistance during implementation (p. 2).

While crediting the successes of various innovation-focused projects, Fullan and Hargreaves (1992) proposed what they considered to be a more comprehensive framework for understanding teacher development, a framework which included the total teacher and the total school. The four main elements to be taken into account included: (a) the teacher's purpose (b) the teacher as a person (c) the real world context in which teachers work; and (d) the culture of teaching (p. 5). Teacher's purpose incorporates the concept of teaching as a moral craft, things that teachers value and want to accomplish in their teaching. Teacher as person can be related to age, stage of career, and life experiences, each capable of affecting interest in and response to innovation. Context encompasses grade levels, school location, degree of curriculum mandating, and social aspects of teaching. The culture of teaching (defined as the working relationship that teachers have with their colleagues inside and outside the school) and the culture of schools are emerging as central to teacher development, and to educational change.

CHAPTER 3

METHODS

Research Design

This study employed a two-phase design model (Creswell, 1994). Phase I was quantitative and Phase II was qualitative. Methods for implementing Phase I and Phase II are described separately in this chapter including the *design of the research, descriptions of the setting and participants, procedures* for data collection, and plans for data analysis. A timeline for the project was developed (see Appendix B) and the Human Subjects protocol for the study was reviewed and approved by the university Office of Sponsored Programs (see Appendix C).

Phase I

Phase I of the study employed a technology survey to collect data concerning (a) faculty knowledge about technology, (b) level of use of technology by faculty, (c) how technology was being used by faculty in teaching, and (d) faculty perceptions of the importance of technology in teacher education. Results of the survey provided baseline data to describe the overall use of technology in a College of Education (COE).

Subjects

The sample for the survey included COE tenured/tenure-track faculty (n = 66) along with affiliate faculty (n = 80). Departments within the COE at the time of the survey were (a) Instructional and Curricular Studies, (b) Educational Leadership, (c) Educational Psychology, and (d) Special Education. A list tenured/tenure-track faculty was obtained from the Dean's office and lists of affiliate faculty were acquired from each department. Faculty who taught educational technology classes in the computer lab were eliminated from the sample except for three tenured/tenure-track faculty members who also taught other courses in addition to the technology classes.

Instrumentation and Procedures

A survey (see Appendix D) was designed by the researcher with assistance from a research specialist in the university's Center for Survey Research. Drawing from research by Spotts and Bowman (1995), Vagle (1995), and Wetzel (1993) current issues regarding college/university faculty use of technology were included in the survey. Two faculty members with expertise in survey research reviewed it, and the survey was tested for item clarity with doctoral students in a seminar class. Two additional faculty members with expertise in educational technology reviewed the survey and the final version was examined and approved by the survey research specialist.

The survey and a cover letter (see Appendix E) were distributed to tenured/tenure-track and affiliate faculty in January 1997 (with the exception of

faculty who taught educational technology classes). Surveys were coded and numbers were checked against a master list to determine which faculty members needed reminder cards (see Appendix F) two weeks after initial distribution of the survey. To assure anonymity, original code numbers were removed from completed surveys and new numbers were assigned for data input purposes.

Phase I had one main research question: How is technology currently being used by College of Education faculty? Specifically, the following six sub-questions were addressed:

1. What are the current levels of faculty knowledge and skills regarding specific types of technology?
2. Which technologies do faculty use in preparing for and in teaching classes?
3. What factors inhibit faculty use of technology in teaching?
4. What level of importance do faculty give to technology in teacher education?
5. What are the primary concerns of faculty in using technology in teacher education?
6. What assistance do faculty perceive is needed to facilitate integration of technology in their teaching?

Data Analysis

Descriptive statistics provided baseline data concerning faculty knowledge, skill, and use of technology in preparing for and in teaching class.

Data were analyzed with mean, median, and mode calculated for appropriate items, and graphs were constructed for visual comparison of information gleaned from selected survey items. Narrative answers to the three open-ended Items from the survey were categorized. Survey item 12, "When you think about the integration of technology into teacher education, what are your concerns?" was based on the open-ended Stages of Concern (SoC) format designed by Hall and Hord (1987). Responses were categorized according to the seven SoC levels ranging from 0 to 6: (a) Awareness = 0, (b) Informational = 1, (c) Personal = 2, (d) Management = 3, (e) Consequence = 4, (f) Collaboration = 5, and (g) Refocusing = 6 (see Appendix G). Item 7a involved rating the importance of technology in teacher education followed by a narrative item requesting reasons for the rating. The reasons were coded based on types of responses such as "technology is necessary for future jobs" or " technology is a powerful tool for students and teachers." Rating reliability was established by having a doctoral peer also code the responses. Survey item 11 asked faculty what type of assistance was needed to help them integrate technology into their teaching. Responses such as "classrooms equipped with technology," would be coded as a hardware issue while "help with learning how to model the use of technology in teaching" would be coded as faculty development. Information such as years of teaching at the university level, current position, and years of computer experience allowed a search for patterns relative to use of technology in teaching. For example, did COE faculty with one to five years of teaching experience at the university level use technology in teaching more than others?

Phase II

Phase II was a descriptive case study employing an embedded, single-case design that involved "more than one unit of analysis" (Yin, 1994, p. 41). Case study as defined by Merriam (1988) is "an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (p. 21). In Merriam's definition, emphasis is on how people make sense of their lives, their experiences, and their interpretations of these experiences.

A pilot case study was conducted in the Spring, 1996 semester. The focus of the pilot study was on the concerns of participants (Hall & Hord, 1987) as they integrated computer activities into existing classes.

In this study the case included full-time tenured/tenure-track faculty members and full-time doctoral students teaching required undergraduate education courses in the Department of Instructional and Curricular Studies and the Department of Special Education during the Spring 1997 semester. Field study findings were expected to illuminate and possibly confirm trends found in Phase I of the study (Miles & Huberman, 1994), as well as providing a more detailed picture of technology integration from the viewpoint of individual college faculty.

Purpose

The purpose of the case study was (a) to provide descriptive information regarding faculty use of technology in required undergraduate teacher preparation courses, (b) to examine factors which influenced the integration of

technology in undergraduate teacher education, and (c) to explore the formation of a systematic plan for integrating technology throughout the undergraduate teacher preparation program. Considering the viewpoint of instructors at different stages of their professional careers, ranging from doctoral students as emerging professors to full professors, the study explored factors which influence faculty willingness to adopt technology use in their teaching. Three research questions guiding Phase II follow.

1. How is technology currently being used by College of Education faculty?
2. What factors influence the integration of technology in teacher education?
3. What are the outcomes of a technology integration planning process?

Participants

The importance of demonstrating the use of technology throughout teacher preparation programs, particularly methods courses has been well documented (Bitter & Yohe, 1989; Novak & Berger, 1991; U.S. Congress,1995). Potential participants were therefore identified from lists of undergraduate required education courses in the Department of Instructional and Curricular Studies and the Department of Special Education (see Appendix H) that were taught by full-time, tenured/tenure-track faculty members and full-time doctoral students in the Spring 1997 semester. Selecting from full-time, tenured/tenure-track faculty and full-time doctoral students rather than including affiliate faculty

allowed for increased interaction between participants and the researcher. Faculty who taught computer survey courses were excluded as were those who participated in a pilot study during the Spring 1996 semester. The decision to eliminate the pilot study participants was arbitrary, based on the fact that they had worked closely with the researcher the previous year. Instructors in the 200-level courses were also excluded from the lists.

Eight participants were included in the case study. Purposeful sampling (McMillan & Schumacher, 1997) was employed to select two participants, an assistant professor and a full professor, who were collaborating on a new teaching venture with plans to include a technology component during the Spring 1997 semester. Neither had previous experience with using computer-based technology in their teaching. The other six participants were selected from the population of COE faculty teaching required courses in the undergraduate teacher preparation programs during the Spring 1997 semester.

Stratification for participant selection was based on four categories: (a) professor, (b) associate professor, (c) assistant professor, and (d) doctoral student. Including two participants from each stage of career (Fullan & Hargreaves, 1992, 1996) provided the opportunity to compare and contrast experiences within the categories while at the same time assuring a manageable number of participants in the overall case study. Also, a limited number of potential participants existed in some of the stage of career categories (e.g., there were few full professors who taught required undergraduate teacher preparation courses). In addition to the two participants

selected by purposeful sampling, six other participants were randomly selected from the appropriate categories to provide a total of eight participants. They were given pseudonyms and all references to participants in the study are in the masculine form to further guard anonymity.

Participation in the case study was voluntary. Informed consent agreements (see Appendix I) were signed by the participants and the researcher, a copy was given to each participant and originals were stored.

The Researcher

The researcher, a graduate assistant and full-time doctoral student, was in the role of participant-observer with the assigned job 20 hours per week of facilitating (a) faculty use of technology for professional productivity, (b) integration of technology into teacher education classes, and (c) the use of technology in teaching. Faculty workshops and one-on-one technology tutorials provided the predominant means of increasing faculty skills and knowledge. Technology demonstrations in content area classes were also provided by the researcher upon request. The researcher had opportunities for informal exchanges, knowledge of the setting, and an ongoing, working relationship with the participants.

Data Collection

Data collection included a combination of interviews, participant observation and document analysis (Janesick, 1994). Seven types of data were collected for the study.

1. An initial semistructured interview (Borg & Gall, 1989) was conducted with each participant near the beginning of the Spring 1997 semester (see Appendix J). This initial interview was designed to elicit information about teaching experience, personal background with technology, and perceptions of the COE culture of teaching.
2. A second semistructured interview was conducted near the end of the Spring 1997 semester as an exit interview (see Appendix K). It was created to gather additional information related to technology use during the semester, the influence of the COE culture of teaching on technology use, and the perceived importance of technology in teacher education.
3. A semistructured interview was conducted with the COE dean near the end of the Spring 1997 semester to provide an administrative perspective on integration of technology in the COE (see Appendix L).
4. Informal interviews with participants and other faculty members (McMillan & Schumacher, 1997) took place throughout the Spring 1997 semester. Sometimes these informal interviews were initiated with a question such as "How is the PowerPoint presentation coming along?" Informal interviews were included in field notes.
5. Two types of observations were employed in this study, direct observation and participant-observation (Yin, 1994). Direct observation provided data regarding participant and student use of

technology during specific class sessions. Participant-observation allowed the researcher to "participate in the events being studied" (p. 87), such as working one-on-one with participants as they learned new software programs, conducting hands-on computer sessions as a guest lecturer, or taking part in faculty interest group and college meetings. Observation data were recorded in field notes.

6. Documents were examined to furnish details and confirm data from other sources (Yin, 1994) Agendas and minutes of faculty interest group meetings, department meetings, and COE meetings were collected as well as course syllabi. Other documents of interest included matrices involved in the planning process for systematic technology integration (Handler & Strudler, 1997), and various items created by participants (i.e., a sign-up sheet for student use of a digital camera).
7. E-mail correspondence was used as data when it pertained to use of computer-based technology. Some of the participants sent e-mail messages to the researcher with specific comments and reflections about technology. Occasionally these e-mail messages were prompted by researcher questions, but most often they were voluntary.

Formation of a Technology Integration Plan

It was proposed to faculty that a systematic plan was needed to ensure that technology experiences were integrated throughout the teacher education

curriculum. A technology integration matrix (Handler & Strudler, 1997) was used by the researcher as a tool to facilitate planning. This matrix (see Appendix M) was introduced at faculty interest group meetings in the Department of Instructional and Curricular Studies. Samples of the matrix and of ISTE's Foundation Technology Standards for All Teachers (see Appendix A) were distributed to faculty at interest group meetings, and the researcher explained the rationale of creating a systematic plan for technology integration throughout the teacher education programs.

On a more individual basis, the researcher and each of the eight case study participants determined uses of technology that complemented or enhanced course goals and objectives. Student experiences and faculty modeling with technology were planned relative to the course syllabi.

Data Analysis

Interviews were recorded and the text transcribed verbatim. Text from the interviews and observational data first were coded into categories reflecting the elements of Fullan and Hargreaves' theoretical framework: (a) teacher's purpose, (b) teacher as person, (c) context of teaching, and (d) culture of teaching (1992, 1996). Additional categories of "technology use" and "change" were added and sub-categories were developed to refine the coding. Initially, a process of repeated reading and highlighting of printed copies of data was employed.

Digital versions of the files were also coded using Q.S.R. NUD*IST (1995), qualitative analysis computer software that allows hierarchical coding. The software facilitated exploration of the data by category or by keywords, and data explorations could be saved as separate files. Lines or segments of text could also be coded into multiple categories. Constant comparison analysis (*LeCompte & Preissle, 1993*) was used to identify emerging patterns, beginning as the data were first collected and continuing throughout the study.

Trustworthiness

Merriam (1988) cautions that researchers and others need to be able to trust the results of educational inquiry, suggesting appropriate standards for assessing reliability and validity need to be used. Three issues of trustworthiness are (a) internal validity, (b) reliability, and (c) external validity. Lincoln and Guba (1985) recommend alternative terms, using truth value for validity, consistency for reliability, and transferability for external validity.

Internal validity is concerned with the match between a researcher's findings and reality. Basic strategies for addressing internal validity are triangulation of data through multiple data collection methods, member checks, and clarification of researcher's biases (Merriam, 1988).

Reliability deals with replication. Since qualitative research "seeks to describe and explain the world as those in the world interpret it" (Merriam, 1988, p. 170), reliability in the traditional sense is not possible. Results of a replicated qualitative study would not be expected to be the same as the original study.

Adding to the difficulty of establishing reliability, study results can be interpreted in more than one way. Instead, Lincoln and Guba (1985) focus on dependability of results, stressing the importance of results that make sense with the data collected. Techniques to support dependability of results are (a) describing the researcher's position relative to the study participants; (b) triangulation of multiple data sources; and (c) describing methods in detail, including data collection, analysis, and decisions made during the study.

External validity refers to generalizability, which is not a goal of qualitative research. Janesick (1994) argues that "the value of the case study is its uniqueness; consequently, reliability in the traditional sense of replicability is pointless" (p. 217). Merriam (1988) suggests that external validity can be thought of "in terms of the reader or user of the study" (p. 177). In other words, the reader determines a study's generalizability to another setting or situation.

In this study, triangulation included ongoing review of the data from the multiple collection approaches. For example, field notes might verify interview information, and informal questions could be used to confirm observation notes. A semistructured interview with the College of Education Dean provided another source of data. Member checking, defined by Stake (1995) as presenting draft materials to participants for confirmation and feedback, was used to give participants opportunity to comment on selected portions of interview transcripts and drafts of the writing.

CHAPTER 4

RESULTS

This study examined current levels of technology use by College of Education (COE) faculty, examined implementation of technology in required undergraduate teacher preparation courses, and explored the formation of a systematic plan for integrating technology throughout the teacher preparation program of a state-funded university in the Southwest United States. Research was conducted in two stages. Phase I was a technology survey of COE faculty and Phase II was a case study involving eight participants who taught undergraduate required courses in regular education and special education teacher preparation programs. Three research questions guided the study:

1. How is technology currently being used by College of Education faculty?
2. What factors influence the integration of technology in undergraduate teacher education?
3. What are the outcomes of a technology integration planning process?

Results of Phase I and Phase II are described separately in this chapter.

Phase I: Survey Results

A technology survey (see Appendix D) collected baseline data concerning COE faculty use of computer-based technology. The survey was designed by the researcher with assistance from a specialist in the university's Center for Survey Research. Survey research conducted by Spotts and Bowman (1995), Vagle (1995), and Wetzel (1993) provided insight on current issues regarding college/university faculty use of technology. These surveys provided some ideas for content and structure of items included in the COE technology survey.

The survey and a cover letter (see Appendix E) were distributed in January 1997 to full-time, tenured/tenure-track faculty (n = 66) and to affiliate faculty including part-time faculty and lecturers who were not in tenure track positions (n = 80). Faculty who taught educational technology classes (two full-time faculty and ten affiliate faculty) were excluded from survey participation and were not included in the reported number of faculty surveyed. The number of completed surveys returned was 87 for an overall return rate of 59.6%. The percent of surveys returned by full-time, tenured/tenure-track faculty was 75.8%, and the percent of surveys returned by affiliate faculty was 46.3%.

Baseline data gathered from the survey served to answer research Question 1: How is technology currently being used by COE faculty? Specifically, the following six sub-questions were addressed:

1. What are the current levels of faculty knowledge and skills regarding specific types of technology?

2. Which technologies do faculty use in preparing for and in teaching classes?
3. What factors inhibit faculty use of technology in teaching?
4. What level of importance do faculty give to technology in teacher education?
5. What are the primary concerns of faculty in using technology in teacher education?
6. What assistance do faculty perceive is needed to facilitate integration of technology in their teaching?

Descriptive statistics were compiled from the survey data using the computer software Statistical Product and Service Solutions (SPSS, 1995). Crosstab summaries, tables that display information comparing two variables, provided a means to search for patterns in the data. For example, a crosstab summary could show reported ratings of the importance of technology in teacher education in columns and stage of career (i.e., full professor, associate professor, assistant professor, or doctoral student) in rows.

General Characteristics of Respondents

Table 1 contains demographic information obtained from the survey. Respondents included 47 females (54.0%) and 40 males (46.0%) with 44 faculty members (50.6%) falling within the age range of 41 to 50 years. Nineteen faculty (21.8%) were in the age range of 51 to 60 years, 11 faculty (12.6%) were over 60 years old, and 11 faculty (12.6%) were 31 to 40 years old. Two faculty members (2.3%) were in the age range of 21 to 30 years.

Twenty-nine faculty (33.3%) indicated one to five years of university teaching experience, 20 faculty (23.0%) reported six to ten years of experience, 9 faculty (10.3%) had eleven to fifteen years of experience, 10 faculty (11.5%) had sixteen to twenty years experience, and 19 faculty (21.8%) indicated more than 20 years of university teaching experience.

Fifty-three respondents (59.8%) were in the Department of Instructional and Curricular Studies which had the largest number of full-time faculty and affiliate faculty in the COE. Thirteen respondents (14.9%) were in the Department of Educational Leadership, 12 respondents (13.8%) were in the Department of Educational Psychology, and 9 respondents (10.3%) were in the Department of Special Education.

Of the survey participants, 9 were assistant professors (10.3%), 25 were associate professors (28.7%), 16 were professors (18.4%), and 23 described themselves as affiliate faculty (26.4%). Some confusion existed on the survey item regarding current position, however. Four people selected "other" without explanation and 10 marked "instructor/lecturer." Since only five COE lecturer positions existed in the Spring 1997 semester, some of the respondents may not have understood the categories and should have selected "affiliate faculty." The categories were collapsed into "tenured/tenure-track faculty" (i.e., professor, associate professor, assistant professor) and "affiliate faculty" (i.e., lecturer, part-time faculty) resulting in 50 respondents (57.5%) and 37 respondents (42.5%) respectively.

Forty-five respondents (51.7%) indicated they had used computers for

personal and academic use for more than ten years, 17 respondents (19.5%) reported seven to nine years of computer use, 20 respondents (19.5%) indicated four to six years of computer use, and 4 respondents (4.6%) reported one to three years. Only 1 respondent (1.1%) indicated less than one year of computer experience.

Faculty Knowledge Level, Skill Level, and Use of Technology

The first four items of the technology survey gathered data about faculty knowledge, skill levels, and use of computer-based technologies in preparing for and in teaching classes. Knowledge level and skill level were not assumed to be the same since an individual might have knowledge of a particular technology but not feel skilled with actually using that technology. Likewise, it was expected that faculty use of various types of technologies in preparing for classes would be greater than their use of technologies in teaching classes.

In item one, levels of faculty knowledge, technologies included: (a) word processing, (b) computer spreadsheets, (c) statistical computing, (d) e-mail, (e) educational software, (f) presentation software, (g) Internet/World Wide Web, (h) multimedia, and (i) distance education. Technologies listed in items two through four, faculty skill levels, use in preparing for class, and use in teaching class, paralleled those in item one except that distance education was excluded. The rationale for omitting distance education hinged on insufficient number of faculty involved in distance education during the Spring 1997 semester. While most of the categories such as multimedia or educational

Table 1

Frequency and Percent of Selected Demographic Characteristics of Survey Participants

Characteristics	Frequency	Percent of Respondents (n = 87)
Sex		
Female	47	54.0
Male	40	46.0
Age		
21-30 years	2	2.3
31-40 years	11	12.6
41-50 years	44	50.6
51-60 years	19	21.8
Over 60 years	11	12.6
Years of University Teaching		
1-5 years	29	33.3
6-10 years	20	23.0
11-15 years	9	10.3
16-20 years	10	11.5
Over 20 years	19	21.8
College of Education Department		
Educational Leadership	13	14.9
Educational Psychology	12	13.8
Instructional and Curricular Studies	53	60.9
Special Education	9	10.3
Current Position		
Instructor/Lecturer	10	11.5
Assistant Professor	9	10.3
Associate Professor	25	28.7
Professor	16	18.4
Affiliate Faculty	23	26.4
Other	4	4.6
Type of Position		
Tenured/tenure-track	50	57.5
Non-tenure	37	42.5
Length of Time Using a Computer		
Less than one year	1	1.1
1-3 years	4	4.6
4-6 years	20	23.0
7-9 years	17	19.5
Over 10 years	45	51.7

software were non-specific, spreadsheets and statistical computing were included because these tools were used by several faculty members. Means were calculated for each technology listed in survey items one through four.

Current Levels of Faculty Knowledge and Skill

On the first survey item faculty rated themselves on knowledge of each type of technology using a Likert-type scale from 1 to 4. Faculty selected from the following terms: (a) no knowledge = 1, (b) very little knowledge = 2, (c) some knowledge = 3, or (d) extensive knowledge = 4. Most faculty rated themselves as having some knowledge or extensive knowledge in each of the categories with the exception of distance education. Knowledge levels for word processing (M=3.55) and e-mail (M=3.24) were highest, followed by educational software (M=2.87) and Internet/World Wide Web (M=2.76). Table 2 displays the complete data set for faculty knowledge about technologies.

On survey item two, faculty were asked to rate skill levels with using the same technologies as listed in item one, but with distance education omitted. The Likert-type scale provided the following terms: (a) none = 1, (b) little = 2, (c) moderate = 3, or (d) high = 4. Skill levels in item two were similar to knowledge levels in item one, with word processing (M=3.53) and e-mail (M=3.21) having the highest means, followed by Internet/World Wide Web (M=2.66) and educational software (M=2.63). Table 3 displays the complete data set for faculty skill levels with using technologies .

Table 2

Faculty Knowledge about Various Technologies

Item 1: How knowledgeable would you rate yourself with respect to the following technologies?

	1 No Knowledge	2 Very Little Knowledge	3 Some Knowledge	4 Extensive Knowledge	M
Word Processing	1 (1.1%)	2 (2.3%)	32 (36.8%)	52 (59.8%)	3.55
E-mail	4 (4.5%)	9 (10.3%)	36 (41.4%)	38 (43.7%)	3.24
Educational Software	6 (6.9%)	17 (19.5%)	46 (52.9%)	18 (20.7%)	2.87
Internet/World Wide Web	11 (12.6%)	15 (17.2%)	45 (51.7%)	16 (18.4%)	2.76
Statistical Computing	14 (16.1%)	25 (28.7%)	33 (37.9%)	15 (17.2%)	2.56
Computer Spreadsheets	12 (13.8%)	24 (27.6%)	42 (48.3%)	9 (10.3%)	2.55
Presentation Software	17 (19.5%)	21 (24.1%)	36 (41.4%)	12 (13.8%)	2.50
Multimedia	16 (18.4%)	26 (29.9%)	34 (39.1%)	11 (12.6%)	2.46
Distance Education	25 (28.7%)	29 (33.3%)	26 (29.9%)	7 (8.0%)	2.17

Note. (n = 87)

Table 3

Faculty Skill Level with Using Technologies

Item 2: How would you rate your skill level with using the following technologies?

	1 None	2 Little	3 Moderate	4 High	M
Word Processing	1 (1.1%)	3 (3.4%)	32 (36.8%)	51 (58.6%)	3.53
E-mail	4 (4.6%)	8 (9.2%)	41 (47.1%)	34 (39.1%)	3.21
Internet/World Wide Web	13 (14.9%)	20 (23.0%)	36 (41.4%)	17 (19.5%)	2.66
Educational Software	10 (11.5%)	26 (29.9%)	37 (42.5%)	14 (16.1%)	2.63
Computer Spreadsheets	18 (20.7%)	29 (33.3%)	32 (36.8%)	8 (9.2%)	2.35
Statistical Computing	20 (23.0%)	28 (32.2%)	30 (34.5%)	9 (10.3%)	2.32
Presentation Software	23 (26.4%)	26 (29.9%)	25 (28.7%)	13 (14.9%)	2.32
Multimedia	21 (24.1%)	32 (36.8%)	26 (29.9%)	8 (9.2%)	2.24

Note. ($n = 87$)

Faculty Use of Technologies in Preparing for and in Teaching Classes

Faculty use of technology in teaching was of particular interest in this study. Therefore, items three and four, involving use of technology, were constructed to differentiate use of technology in preparing for class from use of technology in teaching class. Monthly or weekly use in item number four would suggest that technology was more than a one-time demonstration.

Item three on the survey asked faculty to indicate frequency of use of technologies in preparing for class. Choices on item three were (a) not at all = 1, (b) once during semester = 2, (c) monthly = 3, or (d) weekly = 4. In preparing for class, means were greatest for word processing (M=3.84) and for e-mail (M=2.78). Seventy-nine faculty members (90.8%) indicated word processing was used weekly, and 37 faculty (42.5%) reported weekly use of e-mail in preparing for class. Table 4 summarizes item three data.

Table 4

Frequency of Technology Use in Preparing for Class

Item 3: How frequently do you use the following technologies in preparing for class?

	1 Not at all	2 Once during Semester	3 Monthly	4 Weekly	M
Word Processing	2 (2.3%)	2 (2.3%)	4 (4.6%)	79 (90.8%)	3.84
E-mail	26 (29.9%)	4 (4.6%)	20 (23.0%)	37 (42.5%)	2.78
Internet/World Wide Web	31 (35.6%)	14 (16.1%)	27 (31.0%)	15 (17.2%)	2.30
Presentation Software	37 (42.5%)	23 (26.4%)	10 (11.5%)	17 (19.5%)	2.08
Educational Software	29 (33.3%)	34 (39.1%)	17 (19.5%)	7 (8.0%)	2.02
Computer Spreadsheets	36 (41.4%)	22 (25.3%)	23 (26.4%)	6 (6.9%)	1.99
Multimedia	53 (60.9%)	15 (17.2%)	12 (13.8%)	7 (8.0%)	1.69
Statistical Computing	54 (62.1%)	17 (19.5%)	11 (12.6%)	5 (5.7%)	1.62

Note. (n = 87)

On item number four, more than half the faculty indicated that they never use any of the technologies on the list while teaching class. Choices for frequency of use in teaching class were (a) not at all = 1, (b) once during semester = 2, (c) monthly = 3 , or (d) weekly = 4. Means were highest for use of educational software (M=1.68) and for use of presentation software (M=1.68). Fifteen faculty (17.2%) reported monthly or weekly use of educational software and 18 faculty (20.7%) reported monthly or weekly use of presentation software. Although use of technology in teaching was infrequent, educational software was used once during the semester by 26 faculty (29.9%), and the Internet/World Wide Web was used once during the semester by 25 faculty (28.7%). The complete data set for item four is displayed in Table 5.

Means for ratings of skill levels for using technology as reported by faculty were only slightly lower than means for their ratings of knowledge levels. Figure 1 represents faculty estimates of their knowledge about various computer-based technologies (i.e., word processing, computer spreadsheets, statistical computing, e-mail, educational software, presentation software, Internet/World Wide Web, and multimedia) and their reported skill with using those technologies. Means shown in Figure 2 depict frequency of technology use in preparing for class and in teaching class. Faculty rated their knowledge and skill levels highest with word processing and e-mail, and indicated those two technologies were used most frequently in preparing for class. However, the frequency of use of word processing or e-mail in teaching class was lower. Means for each of the other technologies reflected little use in teaching.

Table 5

Frequency of Technology Use in Teaching Class

Item 4: How frequently do you demonstrate the use of the following technologies while teaching class?

	1 Not at all	2 Once during Semester	3 Monthly	4 Weekly	M
Educational Software	46 (52.9%)	26 (29.9%)	12 (13.8%)	3 (3.4%)	1.68
Presentation Software	56 (64.4%)	13 (14.9%)	8 (9.2%)	10 (11.5%)	1.68
E-mail	59 (67.8%)	12 (13.8%)	7 (8.0%)	9 (10.3%)	1.61
Word Processing	62 (71.3%)	10 (11.5%)	3 (3.4%)	12 (13.8%)	1.60
Internet/World Wide Web	53 (60.9%)	25 (28.7%)	8 (9.2%)	1 (1.1%)	1.51
Multimedia	62 (71.3%)	15 (17.2%)	7 (8.0%)	3 (3.4%)	1.44
Statistical Computing	71 (81.6%)	8 (9.2%)	4 (4.6%)	4 (4.6%)	1.32
Computer Spreadsheets	74 (85.1%)	7 (8.0%)	5 (5.7%)	1 (1.1%)	1.23

Note. (n = 87)

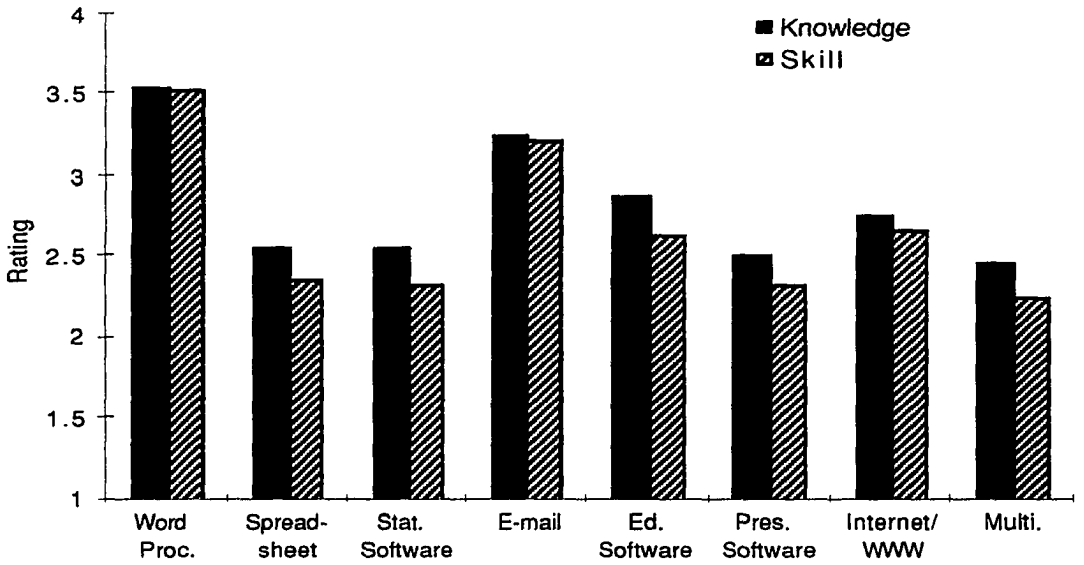

Figure 1. Knowledge Level and Skill Level Means for Various Technologies
(1) No Knowledge, (2) Very Little Knowledge, (3) Some Knowledge, (4) Extensive Knowledge

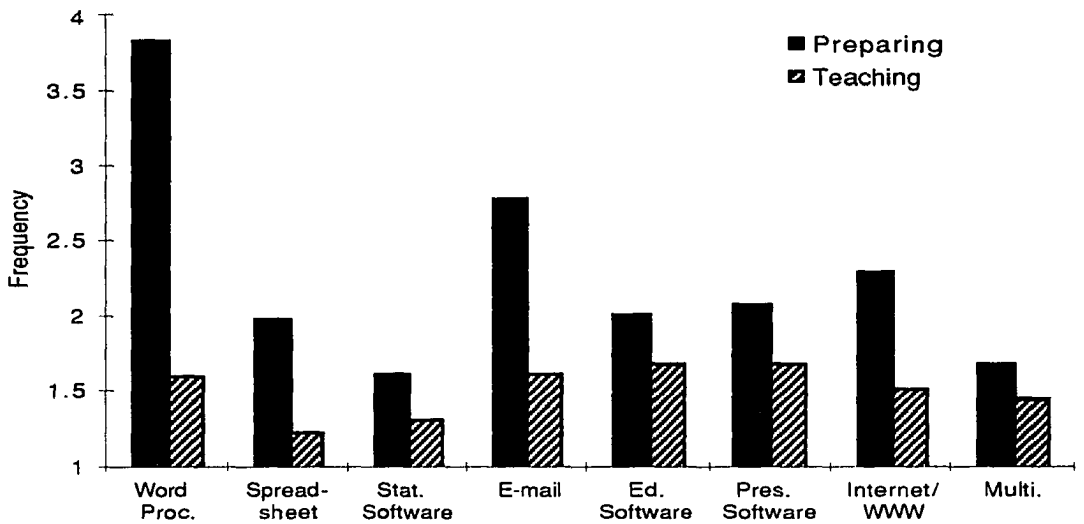

Figure 2. Means for Use of Technologies in Preparing for and in Teaching Class
(1) Not at all, (2) Once during Semester, (3) Monthly, (4) Weekly

Tenured/Tenure-Track Faculty and Affiliate

Faculty Use of Technology

Data from survey items three and four, use of technologies in preparing for class and use of technologies in teaching class, were separated into tenured/tenure-track faculty and affiliate faculty categories, with weekly use representing the highest level. While weekly use of word processing and e-mail in preparing for class was reported frequently, weekly use of other technologies was reported less frequently. Word processing was used weekly by 48 tenured/tenure-track faculty (96.0%) and by 31 affiliate faculty (83.8%). Twenty-five tenured/tenure-track faculty (50.0%) indicated weekly use of e-mail in preparing for class while 12 affiliate faculty (32.4%) reported weekly use of it. Weekly use of presentation software and the Internet/World Wide Web in preparing for class were indicated by 12 tenured/tenure-track faculty (24.0%) for each category. Five affiliate faculty (13.5%) reported weekly use of presentation software and three affiliate faculty (8.1%) reported weekly use of the Internet/World Wide Web. Eleven tenured/tenure-track faculty (22.0%) and 20 affiliate faculty (54.1%) indicated no use of the Internet/World Wide Web in preparing for class. Table 6 shows the use of technology in preparing for class by tenured/tenure-track faculty and affiliate faculty.

Technology use in teaching class was reported infrequently for both tenured/tenure-track faculty and affiliate faculty, with over 70.0% of the affiliate faculty indicating no use of the various technologies in teaching. E-mail was used monthly or weekly in teaching by 12 tenured/tenure-track faculty (24.0%)

Table 6

Frequency of Technology Use in Preparing for Class by Tenured/Tenure-Track Faculty and Affiliate Faculty

Item 3: How frequently do you use the following technologies in preparing for class?

	Tenured & Tenure-Track Faculty (n=50)				Affiliate Faculty (n=37)			
	1	2	3	4	1	2	3	4
Word Processing	2 (4.0%)	0 --	0 --	48 (96.0%)	0 --	2 (5.4%)	4 (10.8%)	31 (83.8%)
Computer Spreadsheets	23 (46.0%)	15 (30.0%)	7 (14.0%)	5 (10.0%)	13 (35.1%)	7 (18.9%)	16 (43.2%)	1 (2.7%)
Statistical Computing	29 (58.0%)	10 (20.0%)	8 (16.0%)	3 (6.0%)	25 (67.6%)	7 (18.9%)	3 (8.1%)	2 (5.4%)
E-mail	12 (24.0%)	3 (6.0%)	10 (20.0%)	25 (50.0%)	14 (37.8%)	1 (2.7%)	10 (27.0%)	12 (32.4%)
Educational Software	14 (28.0%)	21 (42.0%)	9 (18.0%)	6 (12.0%)	15 (40.5%)	13 (35.1%)	8 (21.6%)	1 (2.7%)
Presentation Software	20 (40.0%)	11 (22.0%)	7 (14.0%)	12 (24.0%)	18 (48.6%)	11 (29.7%)	3 (8.1%)	5 (13.5%)
Internet/World Wide Web	11 (22.0%)	10 (20.0%)	17 (34.0%)	12 (24.0%)	20 (54.1%)	4 (10.8%)	10 (27.0%)	3 (8.1%)
Multimedia	29 (58.0%)	12 (24.0%)	5 (10.0%)	4 (8.0%)	24 (64.9%)	3 (8.1%)	7 (18.9%)	3 (8.1%)

Note. Use of technologies: (1) Not at all, (2) Once during Semester, (3) Monthly, (4) Weekly

and by 4 affiliate faculty (10.8%). Presentation software was used monthly or weekly by 12 tenured/tenure-track faculty (24.0%) and by 6 affiliate faculty (16.2%). Monthly or weekly use of the Internet/World Wide Web was reported by 6 tenured/tenure-track faculty (12.0%) and by 3 affiliate faculty (8.1%). Table 7 displays the data for technology use in teaching.

Table 7

Frequency of Technology Use in Teaching by Tenured/Tenure-Track Faculty and Affiliate Faculty

Item 4: How frequently do you demonstrate the use of the following technologies while teaching class?

	Tenured & Tenure-Track Faculty (n=50)				Affiliate Faculty (n=37)			
	1	2	3	4	1	2	3	4
Word Processing	34 (68.0%)	8 (16.0%)	2 (4.0%)	6 (12.0%)	28 (75.7%)	2 (5.4%)	1 (2.7%)	6 (16.2%)
Computer Spreadsheets	41 (82.0%)	6 (12.0%)	2 (4.0%)	1 (2.0%)	33 (89.2%)	1 (2.7%)	3 (8.1%)	0 --
Statistical Computing	38 (76.0%)	7 (14.0%)	2 (4.0%)	3 (6.0%)	33 (89.2%)	1 (2.7%)	2 (5.4%)	1 (2.7%)
E-mail	30 (60.0%)	8 (16.0%)	4 (8.0%)	8 (16.0%)	29 (78.4%)	4 (10.8%)	3 (8.1%)	1 (2.7%)
Educational Software	18 (36.0%)	22 (44.0%)	7 (14.0%)	3 (6.0%)	28 (75.7%)	4 (10.8%)	5 (13.5%)	0 --
Presentation Software	29 (58.0%)	9 (18.0%)	5 (10.0%)	7 (14.0%)	27 (73.0%)	4 (10.8%)	3 (8.1%)	3 (8.1%)
Internet/World Wide Web	27 (54.0%)	17 (34.0%)	5 (10.0%)	1 (2.0%)	26 (70.3%)	8 (21.6%)	3 (8.1%)	0 --
Multimedia	34 (68.0%)	12 (24.0%)	2 (4.0%)	2 (4.0%)	28 (75.7%)	3 (8.1%)	5 (13.5%)	1 (2.7%)

Note. Use of technologies: (1) Not at all, (2) Once during Semester, (3) Monthly, (4) Weekly

Home Access

On survey item number five, data were collected regarding home use of computers, modems, and the World Wide Web. Forty-four tenured/tenure-track faculty (88.0%) and 36 affiliate faculty (97.3%) reported using a computer at home. Use of a modem at home was indicated by 35 tenured/tenure-track

faculty (70.0%) and 28 affiliate faculty (75.7%). Over half the faculty in each group reported having World Wide Web browser software at home. Table 8 displays data on frequency of selected items used at home by tenured/tenure-track faculty and affiliate faculty.

Table 8

Frequency of Selected Items Used at Home by Tenured/Tenure-Track Faculty and Affiliate Faculty

Item 5: Which of the following do you use at home?

	Tenured & Tenure-Track Faculty (n=50)	Affiliate Faculty (n=37)	Total Respondents (n=87)
Computer	44 (88.0%)	36 (97.3%)	80 (92.0%)
Modem	35 (70.0%)	28 (75.7%)	63 (72.4%)
World Wide Web Browser Software	26 (52.0%)	21 (56.8%)	47 (54.0%)
None of the Items	6 (12.0%)	1 (2.7%)	7 (8.0%)

Factors Which Restrict or Constrain Faculty Use of Technology in Teaching

On survey item number six respondents were asked to select factors which inhibited their use of technology in teaching. "Time to learn new programs" was the overwhelming factor selected by 22 tenured/tenure-track faculty (44.0%) and by 9 affiliate faculty (24.3%). "Obtaining equipment for use

during instruction" was selected as the primary factor by 9 tenured/tenure-track faculty (18.0%) and by 10 affiliate faculty (27.0%) "I am not aware of the technology resources available" was the primary restricting factor for only 2 tenured/tenure-track faculty (4.0%) and for 6 affiliate faculty (16.2%). Seven tenured/tenure-track faculty (14.0%) indicated "No factors restrict my use of technology in teaching" and 5 affiliate faculty (13.5%) selected that response. Table 9 displays data from item six.

Importance of Technology in Teacher Education

When faculty were asked to rate the importance of technology in teacher education, responses for tenured/tenure-track faculty and affiliate faculty were similar. Rating terms were (a) not at all important = 1, (b) not too important = 2, (c) somewhat important = 3, or (d) very important = 4. Of the 87 total responses, 57 faculty (65.5%) indicated that technology in teacher education was very important and 24 faculty (27.6%) felt it was somewhat important. Only six faculty members (6.9%) indicated that technology was not important. The rating mean (M= 3.59) suggested faculty placed importance on the integration of technology in teacher education. Table 10 shows the frequencies for each importance level by tenured/tenure-track faculty, affiliate faculty, and in combination.

After rating the importance of technology in teacher education, faculty were asked to expand on reasons for their ratings in an open-ended survey item. Categories were created for coding the open-ended responses (see Appendix N). Responses sometimes fit more than one category and were coded

Table 9

Frequency of Factors Constraining Faculty Use of Technology in Teaching

Item 6: Which factor do you consider the primary factor restricting or constraining your use of technology in teaching?

Factor	Tenured & Tenure-Track Faculty (n = 50)	Affiliate Faculty (n = 37)
Time to learn new programs	22 (44.0%)	9 (24.3%)
Obtaining equipment for use during instruction	9 (18.0%)	10 (27.0%)
No factors restrict my use of technology in teaching	7 (14.0%)	5 (13.5%)
I am not aware of the technology resources available	2 (4.0%)	6 (16.2%)
Something else	6 (12.0%)	1 (2.7%)
Technology will not enhance my subject area	1 (2.0%)	3 (8.1%)
The COE does not have the software I need	2 (4.0%)	0 –
Hardware/software changes are too rapid to keep current	1 (2.0%)	1 (2.7%)
I find technology frustrating to use	0 –	2 (5.4%)
Keyboarding skills are a problem for me	0 –	0 –

Table 10

Frequency of Ratings of the Importance of Integrating Technology in Teacher Education

Item 7a: How would you rate the importance of integrating technology in teacher education?

Rating	Tenured & Tenure-Track Faculty (n = 50)	Affiliate Faculty (n = 37)	Total Respondents (n = 87)
(4) Very Important	32 (64.0%)	25 (67.6%)	57 (65.5%)
(3) Somewhat Important	14 (28.0%)	10 (27.0%)	24 (27.6%)
(2) Not too Important	4 (8.0%)	2 (5.4%)	6 (6.9%)
(1) Not at all Important	0 –	0 –	0 –

as both, therefore, the totals for expanded reasons were greater than the number of participants. For example, the following response would be coded as "modern world/future" and "modeling."

> Technology continues to be an important part of life (it's not a fad that will go away). If we expect teachers to use it we must demonstrate its usefulness at this level.

The researcher and a doctoral student peer each coded the responses independently. Intercoder reliability was calculated using [number of agreements / (total number of agreements + disagreements)] (Miles & Huberman, 1994). Percent of agreement for item 7b was 90.8%.

Thirty-one of the responses of survey participants (28.7%) supported the importance of technology in teacher education with a statement reflecting the idea that technology is a part of the modern world or important to the future. Fourteen tenured/tenure-track faculty responses (23.0%) and 17 affiliate faculty responses (36.2%) were coded in that category, indicating that a greater number of affiliate faculty responses related the importance of technology in teacher education to being a part of the modern world or important to the future. A focus on technology as a teaching and/or learning tool was expressed in 11 tenured/tenure-track faculty responses (18.0%) and by 6 affiliate faculty (12.8%). The importance of modeling technology use in teacher education was reflected in the statements of 6 tenured/tenure-track faculty (9.8%) and by statements of 6 affiliate faculty (12.8%). Eight tenured/tenure-track faculty responses (13.1%) related importance of technology in teacher education to the "Information Age" while only two affiliate faculty responses (4.2%) made reference to it. The category of "other" included responses that did not explain the importance rating such as "It is important and I need to do it." The open-ended item was left blank by 17.6% of the respondents. Table 11 summarizes response categories.

Professional Development

On survey item nine, faculty selected workshop topics that would be helpful to them. The list included statistical computing, advanced e-mail, educational software, presentation software, Internet/World Wide Web, multimedia equipment, multimedia authoring software, World Wide Web page

Table 11

Frequency of Expanded Reasons for Importance of Technology in Teacher Education

Item 7b: Please expand on your reasons for your selection in 7a (the rating of the importance of integrating technology in teacher education).

Category	Responses of Tenured & Tenure-Track Faculty (n = 61)	Responses of Affiliate Faculty (n = 47)	Total Responses (n = 108)
Modern world/future	14 (23.0%)	17 (36.2%)	31 (28.7%)
No response	10 (16.4%)	9 (19.1%)	19 (17.6%)
Teaching/learning tool	11 (18.0%)	6 (12.8%)	17 (15.7%)
Other	9 (14.8%)	4 (8.5%)	13 (12.0%)
Modeling	6 (9.8%)	6 (12.8%)	12 (11.1%)
Information/Communication Age	8 (13.1%)	2 (4.2%)	10 (9.3%)
Social/economic issues	1 (1.6%)	3 (6.4%)	4 (3.7%)
Research	2 (3.3%)	0 –	2 (1.9%)

Note. Total responses were greater than the number of faculty.

creation, distance education, and "other." Faculty could make multiple selections and their selections indicated interest in each of the nine workshop topics. Presentation software was the topic of greatest interest to 26 tenured/tenure-track faculty (52.0%), followed by multimedia equipment and distance education, each selected by 22 tenured/tenure-track faculty (44.0%). The workshop topic of greatest interest to affiliate faculty was the Internet/World Wide Web which was selected by 23 affiliate faculty (62.2%). Twenty-one affiliate faculty (56.8%) indicated interest in a workshop on educational software. Advanced e-mail and presentation software were each topics of interest to 18 affiliate faculty (48.6%). Table 12 displays the complete data set for workshop topics selected by tenured/tenure-track faculty and affiliate faculty.

Item ten of the survey asked participants to rank order preferred arrangements for learning new things about technology. Selections were (a) figuring things out by yourself, (b) one-on-one assistance, (c) workshops, (d) using manuals or other published materials, and (e) other. One-on-one assistance was ranked as the first choice by both faculty groups, with 26 tenured/tenure-track faculty (52.0%) and 18 affiliate faculty (48.7%) indicating a preference for that arrangement. "Figuring things out alone" was ranked as a preferred arrangement by 13 tenured/tenure-track faculty (26.0%) and by 6 affiliate faculty (16.2%). Workshops were ranked as first choice by 7 tenured/tenure-track faculty (14.0%) and by 11 affiliate faculty (29.7%). Very few faculty members indicated manuals or other published materials as a preferred arrangement, but 4 tenured/tenure-track faculty (8.0%) and 2 affiliate faculty

Table 12

Frequency of Workshop Topics Selected by Tenured/Tenure-Track Faculty and Affiliate Faculty

Item 9 Which of the following workshop topics would be helpful to you? (Please circle all that apply)

Topic	Tenured & Tenure-Track Faculty (n=50)	Affiliate Faculty (n=37)	Total Respondents (n=87)
Presentation software	26 (52.0%)	18 (48.6%)	44 (50.6%)
Internet/World Wide Web	19 (38.0%)	23 (62.2%)	42 (48.3%)
Educational software	20 (40.0%)	21 (56.8%)	41 (47.1%)
Advanced E-mail	20 (40.0%)	18 (48.6%)	38 (43.7%)
Multimedia equipment	22 (44.0%)	16 (43.2%)	38 (43.7%)
Distance education	22 (44.0%)	14 (37.8%)	36 (41.4%)
Creating a WWW page	20 (40.0%)	13 (35.1%)	33 (37.9%)
Statistical computing	15 (30.0%)	16 (43.2%)	31 (35.6%)
Multimedia authoring software	18 (36.0%)	11 (29.7%)	29 (33.3%)
Other topics	1 (2.0%)	0 –	1 (1.1%)

Note. Percents for each topic were calculated independently.

(5.4%) declared that preference. Table 13 shows frequency of preferred arrangement for learning new things about technology.

Table 13

Frequency of Preferred Arrangement for Learning New Things about Technology

Item 10: Which of the following arrangements works best for you when learning new things about technology?

Arrangement	Tenured & Tenure-Track Faculty (n=50)	Affiliate Faculty (n=37)	Total Respondents (n=87)
One-on-one assistance	26 (52.0%)	18 (48.7%)	44 (50.6%)
Figuring things out alone	13 (26.0%)	6 (16.2%)	19 (21.8%)
Workshops	7 (14.0%)	11 (29.7%)	18 (20.7%)
Using manuals or other published materials	4 (8.0%)	2 (5.4%)	6 (6.9%)

Assistance Needed for Integrating Technology into Teaching

Faculty were asked to explain in an open-ended item what type of assistance they needed to help them integrate technology into their teaching. Some responses encompassed more than one category. For example, "Time and the equipment available" was coded both as "time" and "equipment." Coding categories (see Appendix O) were developed and responses were coded independently by the researcher and a doctoral student peer. Intercoder reliability was calculated using [number of agreements / (total number of

agreements + disagreements)] (Miles & Huberman, 1994). Percent of Agreement for item 11 was 91.5%.

Percentage of faculty indicating a need for each type of assistance was calculated. A need for assistance through professional development was indicated by 13 tenured/tenure-track faculty (26.0%) and by 14 affiliate faculty (37.8%). Equipment included availability, access, or updating needs and was noted in responses of 12 tenured/tenure-track faculty (24.0%) and 11 affiliate faculty (29.7%). This paralleled the responses in survey item 6 showing that "Obtaining equipment for use during instruction is a problem" was considered the primary factor restricting use of technology in teaching by a total of 19 faculty members (21.8%). Eleven tenured/tenure-track faculty (22.0%) and 8 affiliate faculty (21.6%) did not respond to the open-ended item. Table 14 displays the complete data set for assistance needed by faculty to integrate technology into teaching.

Faculty Concerns about Technology Integration

Survey item 12 elicited faculty concerns about the integration of technology in teacher education. The open-ended item, "When you think about the integration of technology into teacher education, what are your concerns?" was based on the Stages of Concern (SoC) model of Hall and Hord (1987). Responses were categorized according to the seven SoC levels ranging from 0 to 6: (a) Awareness = 0, (b) Informational = 1, (c) Personal = 2, (d) Management = 3, (e) Consequence = 4, (f) Collaboration = 5, and

Table 14

Assistance Needed for Faculty to Integrate Technology into Teaching

Item 11: What type of assistance do you need in helping you integrate technology into your teaching?

Category	Tenured & Tenure-Track (n = 50)	Affiliate (n = 37)	Total Respondents (n = 87)
Professional development	13 (26.0%)	14 (37.8%)	27 (31.0%)
Equipment	12 (24.0%)	11 (29.7%)	23 (26.4%)
No response	11 (22.0%)	8 (21.6%)	19 (21.8%)
Software	8 (16.0%)	5 (13.5%)	13 (14.9%)
List of resources	4 (8.0%)	6 (16.2%)	10 (11.5%)
Time	5 (10.0%)	4 (10.8%)	9 (10.3%)
Unsure	2 (4.0%)	2 (5.4%)	4 (4.6%)
Compensation	2 (4.0%)	1 (2.7%)	3 (3.4%)
None	3 (6.0%)	0 –	3 (3.4%)
Other	2 (4.0%)	1 (2.7%)	3 (3.4%)

Note. Percents for each type of assistance were calculated independently.

(g) Refocusing = 6 (see Appendix G). The SoC model was designed to help analyze concerns experienced by teachers as an innovation is being adopted, thereby increasing the likelihood of providing appropriate assistance or reassurance to alleviate those concerns.

With the SoC model, teachers often focus on self concern dimensions during the early phases of implementing an innovation. These self concerns (stages 0-2) include awareness, informational, and personal stages. Awareness relates to having little concern or involvement with the innovation. Informational concerns reflect wanting to know what the innovation involves, what training or support will be available, how the program will work, the basis of the program, and other general information. Personal concerns relate to wondering about personal ability to implement the innovation and fears about failures.

The second dimension, management (stage 3), is typified by concerns about how to cover objectives, provide instruction for differing abilities in students, and gather materials together. Management concerns include issues about resources, access, efficiency, organizing, managing, scheduling, and time demands.

The third dimension, impact, includes consequence, collaboration and refocusing (stages 4-6). Consequence concerns focus on how students are affected by the innovation, while collaboration relates to working with others to improve the outcomes of the innovation. The last stage, refocusing, involves wanting to find better ways to use the innovation to teach students.

On the survey, some COE faculty responses reflected concerns that corresponded to more than one stage and they were coded into multiple categories. Each coding was counted as a separate response, making the total number of responses (n = 99) greater than the number of faculty (n = 87). Percents were calculated by comparing the number of responses in each category to the total number of responses. Items were coded independently by the researcher and by a doctoral student peer, and intercoder reliability was calculated using [number of agreements / (total number of agreements + disagreements)] (Miles & Huberman, 1994). Intercoder reliability was 94.0%.

Statements reflecting little concern or involvement with technology in teacher education were coded as awareness, and blank responses were included in this stage. Twenty concerns (20.2%) were categorized at the awareness stage. Informational concerns were expressed by only 1 response (1.1%), and personal concerns were reflected by 12 statements (12.1%). Concerns at the self concern level totaled 33, representing a third of the concerns expressed on this survey item.

Concerns at the management stage were frequent with 33 responses (33.3%) revealing management concerns. This was consistent with the responses to survey item 6 dealing with factors inhibiting use of technology in teaching.

Consequence, collaboration, and refocusing concerns are grouped at the impact level because they look beyond personal concerns and equipment concerns (Hall & Hord, 1987). Concerns at the consequence stage were

expressed in 24 responses (24.2%). Collaboration concerns were not indicated in responses from either faculty group. Refocusing concerns were reflected in 9 faculty responses (9.1%). Impact level concerns were represented by 33 of the 99 responses (33.3%). Table 15 displays frequency of faculty concerns regarding the integration of technology in teacher education.

Table 15

Frequency of Faculty Concerns Regarding the Integration of Technology in Teacher Education

Item 12: When you think about the integration of technology into teacher education, what are your concerns?

Stage of Concern	Tenured & Tenure-Track Faculty Responses (n = 60)	Affiliate Faculty Responses (n = 39)	Total Responses (n = 99)
(0) Awareness	10 (16.7%)	10 (25.6%)	20 (20.2%)
(1) Informational	0 –	1 (2.6%)	1 (1.0%)
(2) Personal	9 (15.0%)	3 (7.7%)	12 (12.1%)
(3) Management	20 (33.3%)	13 (33.3%)	33 (33.3%)
(4) Consequence	15 (25.0%)	9 (23.1%)	24 (24.2%)
(5) Collaboration	0 –	0 –	0 –
(6) Refocusing	6 (10.0%)	3 (7.7%)	9 (9.1%)

Note. Number of responses is greater than the number of faculty because some responses were coded in more than one category and counted as separate responses.

Phase II: Case Study Results

Phase II of this study examined faculty use of technology in required undergraduate teacher preparation courses and explored the formation of a systematic plan for integrating technology throughout the teacher preparation program. Three research questions guided Phase II:

1. How is technology currently being used by College of Education faculty?
2. What factors influence the integration of technology in undergraduate teacher education?
3. What are the outcomes of a technology integration planning process?

Setting

The College of Education (COE), located within a state-funded university, contained four departments: Instructional and Curricular Studies, Special Education, Educational Psychology, and Educational Leadership. Sixty-eight tenured/tenure-track faculty and approximately 90 affiliate faculty taught courses in the COE during the Spring 1997 semester in which this study was conducted.

Changes occurring in the leadership and organizational structure in the COE were potentially important to examination of the effect of the culture of teaching (Fullan & Hargreaves, 1992) on the integration of technology in teacher preparation. During the Spring 1997 semester, the COE was operating under the leadership of an interim dean who was also a candidate in a national search for the position of COE Dean. An additional change involved the selection of a faculty member from the Department of Educational Leadership to

fill the associate dean position. The Department of Instructional and Curricular Studies (ICS) had a temporary chairperson for the semester as well.

The organizational structure of the COE was affected by the drafting of a reorganization plan. Reactions of faculty to the dean's reorganization plan resulted in the formation of a COE faculty committee to draft an alternate plan. A final decision regarding the reorganization was not reached by the end of the Spring 1997 semester. Other extenuating circumstances that required faculty attention included searches for six tenure-track faculty positions and formation of a commission to reevaluate the teacher licensure program based on a need of the local school district for more teachers.

Technology Resources

Three computer labs were located in the COE. One was a public lab for students operated by University Computing Services. A teaching lab with 35 Macintosh 7600 computers was available but used primarily for COE computer education classes in the undergraduate teacher preparation program and the graduate level educational technology program. A small classroom adjacent to the teaching lab contained 18 older Macintosh computers of various types and a large-screen monitor for demonstrations. Faculty could reserve the room for students to use the computers, for software demonstrations, or for multimedia presentations on the large-screen monitor.

At the beginning of the Spring 1997 semester, one multimedia cart was available for faculty to use in classrooms. It contained a Macintosh multimedia computer, a 100-megabyte Zip drive (removable storage device), a VCR, and

an LCD large-screen projector. By the end of the Spring 1997 semester, three additional multimedia carts with projection systems were added for classroom use. One of the multimedia carts contained a Windows-compatible laptop and one had a Macintosh Powerbook. Laptops increased portability of the computers, and faculty could check out computers and LCD portable projectors for conference presentations as well.

Technology resources within the college included a computer in each faculty office with the exception of two faculty members who did not want a computer. Campus-wide networking provided faculty access to the World Wide Web, electronic mail (e-mail), and later in the semester to a local COE file server (dedicated computer) containing educational software. While network access was available to faculty in their offices and in the computer lab, it was not in place for teaching situations except in the lab. Classrooms were wired for access to the network but most of the connections were not operational. Multimedia cart computer connections to the network became problematic because the network required that the outlet and the computer have coinciding network identification numbers, and the same number could not be used in more than one classroom.

Technology Support

Support for technology use was available to faculty from several people. Two full-time technology professors, one of whom served as computer coordinator for the college, were on the faculty in ICS. Both were involved with supporting technology use in the COE through membership on the Technology

Committee (TeCom) and by providing help to faculty on a limited basis. A full-time doctoral student worked 19 hours per week, supervising the COE network, providing support in the COE computer lab, and helping faculty with technology problems. The researcher, who was specifically assigned to facilitate COE faculty use of technology, offered one-on-one assistance, planned and conducted faculty workshops, and provided guest lectures in classes to demonstrate technology use and educational software programs. Also, a graduate assistant completing her Master's degree with an emphasis in educational computing and technology was assigned to work with two faculty members, providing each with approximately 10 hours of help per week.

Faculty Use of Computers

Faculty use of computer-based technology ranged from limited use (primarily word-processing and e-mail) to involvement in distance education courses and creation of World Wide Web pages. One of the two faculty members who elected not to have computers in their offices claimed the electric typewriter did all that was needed. This individual did, however, acknowledge that a desire to learn about the World Wide Web might prompt change: "I think I am going to need to learn [about computers] for information access."

At the other extreme, a few faculty members were involved in creating and teaching distance education courses and were incorporating use of presentation software in those courses. Some faculty members were learning to create World Wide Web pages, experimenting with on-line course syllabi and assignment descriptions as well as subject area information for students.

The Case

Phase II was a descriptive case study employing a single-case design (Merriam, 1988). The case included eight participants, six full-time faculty members and two doctoral students teaching undergraduate teacher preparation courses in the COE. Part-time faculty were not included in the case because access to them for day-to-day interactions and observations throughout the semester was too limited. Participants with full-time status provided the researcher more frequent contact in a natural setting, allowing numerous observations and informal conversations throughout the semester.

Participants

Eight participants were included in the case study. Purposeful sampling (McMillan & Schumacher, 1997) was employed to select two participants, an assistant professor and a full professor, who were collaborating on a new teaching venture with plans to include a technology component during the Spring 1997 semester. Neither had previous experience with using computer-based technology in their teaching. The other six participants were selected from the population of COE faculty teaching required courses in the undergraduate teacher preparation program during the Spring 1997 semester. Courses from both the Department of Instructional and Curricular Studies and from the Department of Special Education were included. Faculty who taught computer survey courses were excluded as were those who participated in a pilot study during the Spring 1996 semester. The decision to eliminate the pilot

study participants was arbitrary, based on the fact that they had worked closely with the researcher the previous year.

Stratification for participant selection was based on four stages of career categories: (a) professor, (b) associate professor, (c) assistant professor, and (d) doctoral student. Including two participants from each stage of career (Fullan & Hargreaves, 1992, 1996) provided the opportunity to compare and contrast experiences within the categories while at the same time assuring a manageable number of participants in the overall case study. Also, a limited number of potential participants existed in some of the stage of career categories (e.g., there were few full professors who taught required undergraduate teacher preparation courses). In addition to the two participants selected by purposeful sampling, six other participants were randomly selected from the appropriate categories to provide a total of eight participants. They were given pseudonyms and all references to participants in the study are in the masculine form to further guard anonymity. Table 16 lists the participants, their stages of careers, and the types of courses they were teaching.

The Researcher

The researcher, a graduate assistant, was in the role of participant-observer with the assigned job (20 hours per week) of facilitating (a) faculty use of technology for professional productivity, (b) integration of technology into teacher education classes, and (c) the use of technology in teaching. Participant-observation allows the researcher to assume various roles or to participate in events being studied (Yin, 1994), providing access to events, an

Table 16

Stage of Career and Type of Course Taught by Each Participant

Participant	Stage of Career	Type of Course
Dr. Willows	Full Professor	Education Core Course
Dr. Tabbot	Full Professor	Teaching Methods
Dr. Lund	Associate Professor	Teaching Methods
Dr. Foster	Associate Professor	Education Core Course
Dr. Murphy	Assistant Professor	Teaching Methods
Dr. Becker	Assistant Professor	Teaching Methods
Mr. Schultz	Doctoral Student	Teaching Methods
Mr. Evans	Doctoral Student	Teaching Methods

inside viewpoint, and "the ability to manipulate minor events" (p. 88). In this study, planning assistance, one-on-one help in learning programs, guest lectures, and general technical support were all offered by the researcher, but the degree to which technology was included in a course was determined by each participant, not the researcher.

Data Collection

Seven types of data were collected for the study.

1. An initial semistructured interview (Borg & Gall, 1989) was conducted with each participant near the beginning of the Spring 1997 semester (see Appendix J). This initial interview was designed to elicit

information about teaching experience, personal background with technology, and perceptions of the COE culture of teaching.

2. A second semistructured interview was conducted near the end of the *Spring 1997 semester as an exit interview* (see Appendix K). It was created to gather additional information related to technology use during the semester, the influence of the COE culture of teaching on technology use, and the perceived importance of technology in teacher education.
3. A semistructured interview was conducted with the COE dean near the end of the Spring 1997 semester for an administrative perspective on the integration of technology in the COE (see Appendix L)
4. Informal interviews with participants and other faculty members (McMillan & Schumacher, 1997) took place throughout the Spring 1997 semester. Sometimes these informal interviews were initiated with a question such as "How is the PowerPoint presentation coming along?" Informal interviews were included in field notes.
5. Two types of observations were employed in the present study, direct observation and participant-observation (Yin, 1994). Direct observation provided data regarding participant and student use of technology during specific class sessions. Participant-observation allowed the researcher to "participate in the events being studied" (p. 87), such as working one-on-one with participants as they learned new software programs, conducting hands-on computer sessions as a

guest lecturer, or taking part in faculty interest group and college meetings. Observation data were recorded in field notes.

6. Documents were examined to furnish details and confirm data from other sources (Yin, 1994). Agendas and minutes of faculty interest group meetings, department meetings, and COE meetings were collected as well as course syllabi. Other documents of interest included the Course Implementation Matrix (Handler & Strudler, 1997) (see Appendix M) used in the planning process for systematic technology integration, and various items created by participants (i.e., a sign-up sheet for student use of a digital camera).
7. E-mail correspondence was used as data when it pertained to use of computer-based technology. Some of the participants sent e-mail messages to the researcher with specific comments and reflections about technology. Occasionally these e-mail messages were prompted by researcher questions, but most often were voluntary.

Table 17 shows the relationship between the types of data collected and the research questions.

The Data Analysis Process

Interviews were recorded and the text transcribed verbatim. Constant comparison analysis (LeCompte & Preissle, 1993) was used to identify emerging patterns, beginning as the data were first collected and continuing throughout the study. Initially, a process of repeated reading and highlighting of printed copies of data was employed. Interviews and observational data were

Table 17

Relationship Between Research Questions and Data Collection

Research Questions	Methods of Investigation	Forms of Data
1. 0 How is technology currently being used by college of education faculty?	Primary Sources	
	semistructured initial interviews	transcripts
	semistructured concluding interviews	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes
	documents	syllabi, meeting notes
2.0 What factors influence the integration of technology in teacher education?	Primary Sources	
	semistructured concluding interviews	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes
2.1 How does *teacher's purpose* influence the integration of technology in teacher education?	Primary Sources	
	semistructured initial interviews	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes
	documents	course syllabi
2.2 How does *teacher' as person* influence the integration of technology in teacher education?	Primary Sources	
	semistructured initial interviews	transcripts
	observations	field notes
	Secondary Sources	
	informal interviews	field notes
	e-mail correspondence	print-outs

(table continues)

Research Questions	Methods of Investigation	Forms of Data
2.3 How does *context of teaching* influence the integration of technology in teacher education?	Primary Sources	
	semistructured initial interviews	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes
	documents	course syllabi
2.4 How does the COE *culture of teaching* influence the integration of technology in teacher education?	Primary Sources	
	semistructured initial interviews	transcripts
	semistructured concluding interviews	transcripts
	interview with the COE dean	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes
	documents	minutes from meetings
3.0 What are the outcomes of the technology integration planning process?	Primary Sources	
	documents	planning matrices
	planning sessions	field notes
	semistructured initial interviews	transcripts
	semistructured concluding interviews	transcripts
	Secondary Sources	
	observations	field notes
	informal interviews	field notes

coded into categories based on ideas within the text as illustrated in the transcript excerpt in Table 18. These categories were, in turn, grouped within the theoretical framework: (a) teacher's purpose, (b) teacher as person, (c) context of teaching, and (d) culture of teaching (Fullan & Hargreaves, 1992, 1996). Additional categories of "technology use" and "change" were added to allow exploration of those topics. Digital versions of the files were also coded using Q.S.R. NUD*IST (1995), qualitative analysis computer software that allows hierarchical coding. Tree diagrams, a feature of the software, provided a schematic of how the data were being organized (see Figures 3 and 4). The software facilitated exploration of the data by category or by keywords, and data explorations could be saved as separate files. Lines or segments of text could also be coded into multiple categories.

Multiple data sources including interviews, observations, documents and e-mail provided a means of triangulation (Merriam, 1988). For example, informal questions and observations recorded in field notes were frequently used to verify interview information. If a participant stated in an interview that use of technology was connected to a class assignment, corroborating evidence was sought through observations and/or the course syllabus. An interview with the COE dean provided information for additional triangulation. Member checking, defined by Stake (1995) as presenting draft materials to participants for confirmation and feedback, was used to give participants opportunity to comment on selected portions of interview transcripts and drafts of the writing.

Table 18

Exit Interview with Dr. Willows - 5/2/97 - Transcript Excerpt

Response of Dr. Willows to interview Question 3:
What factors facilitated your use of technology in teaching this semester?

Line	Discourse	Coding
077	Oh, several.	
078	One is the team planning that I've done with Dr. Murphy.	*collaboration*
079	I mean, we set this as a goal at the beginning, and	
080	I work really well in a team kind of situation.	
081	And I felt, not only the personal obligation	
082	to meet the goal that I had,	
083	but the obligation to my teammate.	
084	And she was committed as well and	*commitment*
085	we really sort of encouraged one another.	
086	So the teaming with her was key.	
087	Another was having you and Nicki [Graduate Assistant]	*people support*
088	there and available,	
089	because I would not have felt the confidence	
090	to have 20 students working on HyperStudio for example,	
091	if I didn't have someone there	
092	that could handle a question or a problem	
093	with the computer, should it occur,	*technical support*
094	that I wouldn't be able to answer	
095	because I'm learning along with them--the technology.	*professional*
096	And they know that.	*self-esteem*
097	I mean I've been very clear that this	
098	is something that I'm modeling--the import of learning--	
099	and that if I can take the risk	
100	in teaching in a university course	
101	and learning along with students,	
102	then they certainly can when they're working	
103	with eight-year-olds or ten-year-olds.	
104	So those two things.	
105	A third would be the availability of the equipment	*access*
106	and Dr. Murphy and I were able to check out the cart	
107	and schedule room 211 and that had to be there.	
108	When you make it too cumbersome,	
109	then you know,	
110	it's really hard to incorporate the technology.	
111	So the equipment was available,	*access*
112	the room was available,	
113	you made yourself available, and Nikki,	*people support*
114	and then the teaming.	*collaboration*
115	So all of those things are really important.	

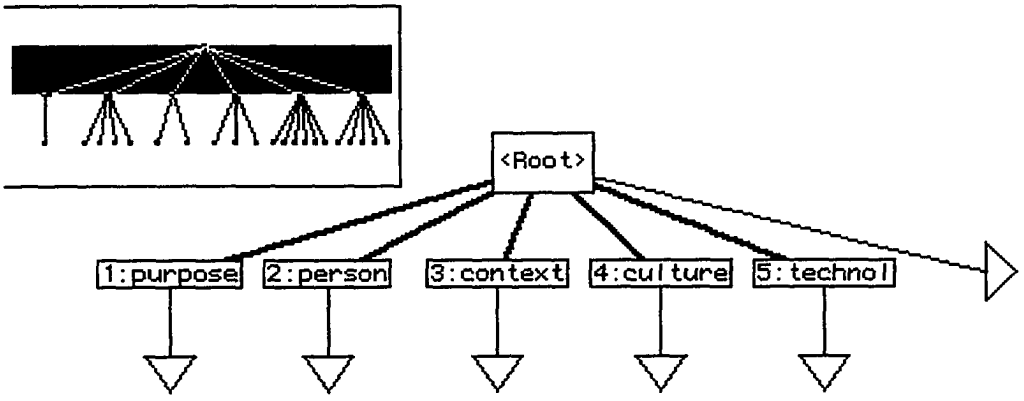

Figure 3. **Tree Diagram from NUD*IST Software Showing Coding Categories.**

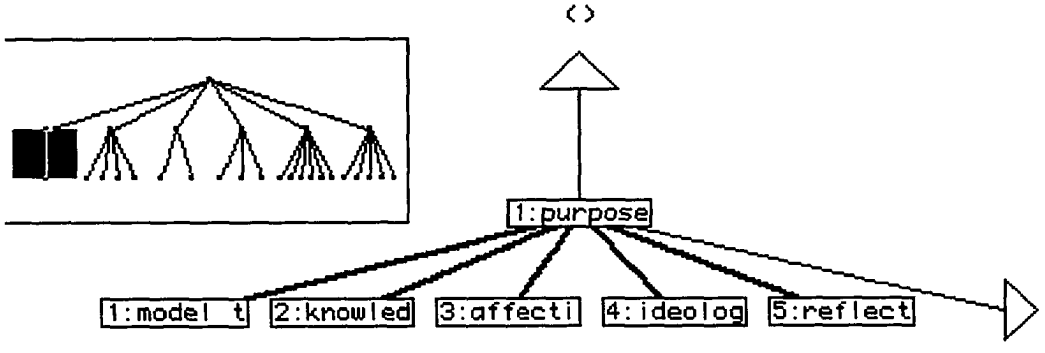

Figure 4. **Tree Diagram from NUD*IST Software Showing Sub-Categories of 1: Purpose.**

Since the words of the participants gathered through semistructured and informal interviews formed much of the data used for analysis, quotes are used throughout this chapter to support the assertions made. Long quotes are blocked in italics, and short quotes are contained within the text.

Trustworthiness

Merriam (1988) cautions that researchers and others need to be able to trust the results of educational inquiry, suggesting appropriate standards for assessing reliability and validity of qualitative studies need to be used. Three issues of trustworthiness were considered in this study:

1. Internal validity is concerned with the match between a researcher's findings and reality. Basic strategies for addressing internal validity are (a) triangulation of data through multiple data collection methods, (b) member checks, and (c) clarification of researcher's biases (Merriam, 1988).
2. Dependability of results (Lincoln & Guba, 1985) places emphasis on insuring that results make sense with the data collected. Techniques to support dependability of results are (a) describing the researcher's position relative to the study participants, (b) triangulation of multiple data sources, and (c) describing research methods in detail.
3. External validity refers to generalizability, which is not a goal of qualitative research. Instead, external validity can be thought of "in terms of the reader or user of the study" (Merriam, 1988, p. 177). In

other words, the reader determines a study's generalizability to another setting or situation. Description of the setting, participants, and methods used assist the reader in identifying aspects of the study which may apply in another setting.

Participants' Use of Technology in Classes

The researcher offered to assist each of the eight participants as needed for planning, designing student activities, learning software programs, demonstrating software, or providing hands-on sessions for students. Although help in adding or using technology in the courses was made available by the researcher, pressure was not imposed on the participants to include or increase technology use. Data on Table 19, collected through interviews and confirmed through observations, show technologies used by the study participants in classes during the Spring 1997 semester.

Table 19

Technologies Used by Instructors in Classes

	Participant							
Technology	Willows	Tabbot	Lund	Foster	Murphy	Becker	Schultz	Evans
World Wide Web	x	x	x	x	x		x	
PowerPoint	x			x	x		x	
HyperStudio	x				x			
Instructional Software	x				x		x	
E-mail	x	x		x	x		x	x
Other		x				x		

Through analysis of the interviews and observations, four categories emerged which focused on overall perspectives of technology use in the eight teacher education courses. The categories are not mutually exclusive.

1. Technology as an add-on reflected perceptions of faculty in courses where use was introduced or discussed, but not integrated into course goals or assignments.
2. Technology as a communication medium included use of technology primarily as a delivery system such as using presentation software for lectures or for communicating with students via e-mail.
3. Technology as a resource focused on facilitating student use of the World Wide Web and other computer-based resources while making explicit connections to course goals or assignments. Technology as a Communication Medium was included within this category.
4. Technology as a teaching/learning tool included efforts to model computer-based technology in teaching as well as to involve students in using technology for course requirements. Emphasis was on technology use both for learning and for teaching. Technology as a Resource and Technology as a Communication Medium were included as well.

Descriptions of the ways in which each of the eight participants integrated technology are presented within the four categories.

Technology as an Add-on

Two views were represented in the category of technology as an add-on.

The first view reflected a willingness to experiment with using technology within an existing syllabus, an exploration of technology. In the second view, technology was considered a separate topic.

Dr. Lund. A required undergraduate methods course for Special Education majors was taught by Dr. Lund. After agreeing to be involved in the study, Dr. Lund expressed interest in looking at how he might start including some technology in his courses, but flatly stated, "I don't know how I can. I don't know how." The course syllabus, which contained no mention of technology, was examined by the researcher and instructor together. It was agreed that a session on the World Wide Web would benefit students and would "fit" with objectives and assignments in the course. Dr. Lund confessed to having limited knowledge about the World Wide Web, but expressed interest in learning more about it for his own work and felt it could be an important source of information for his students. He suggested relevant topics and the researcher designed a hands-on session for the students to explore resources available on the World Wide Web. During the hands-on class, students first watched a brief demonstration given by the researcher, then participated in a Scavenger Hunt designed to practice ways of locating information. After completing the activity, students were free to visit recommended sites provided on the handout or to conduct searches of their own.

Although Dr. Lund had "added" technology to his course, it was somewhat experimental because he had not included it before in his teaching. In the semistructured exit interview, he stated that using technology in the

course was "the best thing that happened to me all semester." According to Dr. Lund, when he elicited feedback from students in his class regarding the World Wide Web lesson, they told him that the customized session was "extremely helpful" to them.

Dr. Becker. During the Spring 1997 semester, Dr. Becker did not use computer-based technology in teaching his undergraduate methods course. He did, however, give his e-mail address on the course syllabus and included the topic of technology in a course objective: "Examine the use of technology as a tool to assist the teacher." Effective uses of video for classroom instruction were demonstrated in the course. Dr. Becker included a hands-on World Wide Web session conducted by the researcher for his graduate class, and in previous semesters had arranged for the researcher to provide demonstrations of software for use in teaching. He stated that it was difficult to accomplish the goals of the course in the allotted time and the exposure to computer-based technology was not as critical for the undergraduates. Dr. Becker said he did not believe computers fit into every course and he was also somewhat skeptical of the way faculty seemed to embrace use of PowerPoint (1994) in teaching since it was "simply a delivery medium."

Technology as a Communication Medium

Two of the participants used technology primarily as a communication medium. E-mail was viewed by each of them as a means of communicating with and responding to students. Mr. Schultz, one of the participants, also used PowerPoint (1994) frequently.

Mr. Schultz. PowerPoint (1994) was used by Mr. Schultz for presenting lecture material nearly every class session in a course required for Special Education majors. In an interview, he commented that he felt the use of the technology was successful:

> *Both on my part, because I liked using it, and it's much easier to use than overheads and my students really enjoyed it too. In fact one night I didn't use it...and I had several comments that night, or in their journals that they missed the PowerPoint..*

E-mail journals increased communication between the students and the instructor. "They had to do journals every week and at first they didn't enjoy it." By the end of the semester many of the students thanked the instructor for requiring e-mail. "A lot of communication has gone on between us that I don't think would have ever happened if we didn't have the e-mail access to each other." Although one class session was devoted to demonstrations of software for students with special needs and a discussion of how software could be adapted for students, technology use was not integrated into overall course goals except for the e-mail journals. Requirements for using e-mail were not included in the course syllabus and the e-mail address of the instructor was the only reference to technology in the document.

According to Mr. Schultz, technology was not widely used in the Department of Special Education with the exception of two or three professors. His knowledge of technology use in teaching grew from his dissertation research, and his belief that technology needed to be modeled for students was strong. "I think it's something that if we don't expose them [students] to it and we don't model it, that we can't expect them to use it out in their schools."

Mr. Evans. Students in Mr. Evans' K-8 required teaching methods course had field experiences associated with the class. After helping teachers or working with students in classrooms, they were expected to write e-mail journal reflections. These reflections went to all the students in the class as well as to the instructor via an e-mail distribution list. Responses of the instructor to the individual reflections went to the whole group. Guidelines for the reflections were stated in the course syllabus, but the primary intent was to extend and to share students' classroom experiences. "When you ask a student to share, you know, when they come back to the classroom, they share just one or two sentences, not the whole thing, what happened in the whole class." E-mail reflections, according to Mr. Evans, assured that everyone had a chance to participate in the sharing not just "that five or six people" who tend to speak up. "So through the e-mail you get to see the whole class, what's going on, the whole group."

Technology was not mentioned in the course syllabus and the instructor's e-mail address was not provided on the document. Although Mr. Evans stated that corresponding through e-mail was a requirement for the course, it was not stated in the syllabus.

Technology as a Resource

Two of the participants integrated use of technology into their classes primarily as a resource. This included use of the World Wide Web, e-mail correspondence, and teacher tools such as assessment software. Resources were explicitly connected to course goals and assignments.

Dr. Tabbot. With the exception of one time during the entire semester, Dr. Tabbot was working at his computer whenever the researcher passed his office. Although he had a background in teaching and using educational technology, Dr. Tabbot did not use it to a level he felt was appropriate in his undergraduate K-8 teaching methods course. Equipment access and lack of time were mentioned as the primary constraints. Coming from a college of education where a lab was available to him at any time for use in teaching, he found reserving and transporting the multimedia cart to be cumbersome. Also, Dr. Tabbot mentioned that the benefit of demonstrating technology without hands-on involvement on the part of the students was somewhat questionable. Nevertheless, he did use the multimedia cart to do an activity with a spreadsheet program and graphing, and he demonstrated Exam in a Can (1995), a custom assessment program that was included with the course textbook. An e-mail journal was a requirement in the course with open-ended guidelines in terms of topics and due dates. An underlying requirement of the journal was that entries had to show reflection, and students were encouraged to write about concerns, issues, insights, comments, and revelations.

Dr. Tabbot asked the researcher to guest lecture when he was out of town, providing the students with hands-on activities with the World Wide Web. Since the instructor had the expertise to teach about the World Wide Web, he considered it a matter of convenience rather than necessity to have the researcher conduct the session. The session ensured that the students had an

opportunity to learn about and to explore World Wide Web resources, and the experience was expressly connected to a course assignment.

Throughout the semester Dr. Tabbot repeatedly discussed his concern of how to expose students to technology in meaningful ways without "forcing them into technology." Through a metaphor he explained, "I've shown them the door. I haven't necessarily opened it." In assessing the use of technology in his class, Dr. Tabbot felt he had made progress during the semester.

> *I at least got two things accomplished from my perspective, you know. And that was getting them [students] on the Web and having them demonstrate that they could use that resourcefully with that continuing CEF [Curriculum Essentials Framework] assignment that they kept coming back to different web sites to address. Then the journaling and the e-mail. Those worked well, and it's nice to say something worked well.*

Dr. Tabbot criticized himself for not helping students recognize the value of the Exam in a Can (1995) software included with the course textbook. He felt responsible in the sense that students would not see it as worthwhile if time was not spent with it and expressed concern that a valuable tool would go unused.

> *The demonstrations didn't work very well and certainly the richness of that resource that's with their book, which is, I think it's really a shame... They've got a three hundred dollar piece of software [Exam in a Can] that they don't even recognize its power.*

Dr. Foster. Use of technology as a resource was modeled by Dr. Foster through a listserv (an automatic discussion list service distributed through e-mail) he created for students in a required introductory education course. Students in sections of the course taught by other instructors were also invited to subscribe to the listserv and handouts were provided that explained the

procedure for joining the listserv. The researcher observed Dr. Foster conducting hands-on World Wide Web sessions for his students and for students in two of three sections taught by other instructors. These sessions occurred during class periods early in the Spring 1997 semester to facilitate student use of the World Wide Web and to help them join the listserv if they had not already done so. Although subscribing to the listserv was optional, the instructor estimated about 70.0% of the students participated over the prior three semesters. New subscribers to the list were welcomed with a message that stated the purposes of the list:

1. Send handouts, study guides, and articles to you;
2. Communicate to you special notices or information;
3. Provide you with a way to discuss course content with other students;
4. Supplement communication between and among instructor and students.

World Wide Web resources on course-related topics were disseminated to students via the listserv. For example, near the beginning of the semester a message was sent with the subject heading "Child-Centered Curriculum." In the body of the message was a brief statement: "Here is a discussion of one version of what 'child centered' means...in the near future we will discuss other views," and the Uniform Resource Locator (URL) was provided. To assist students who did not have access to the World Wide Web from home, the text version of the Web page was attached to the listserv message. This allowed students to read the information without having to go to the Web site.

Students could correspond with the whole group through the listserv or with the instructor via e-mail. Based on comments made by students, Dr. Foster

speculated that "a lot of traffic is stimulated by the list and sent via private addresses rather than the list." Many of the e-mail messages to the instructor were personal and he referred to them as "sidecars," adding that he received about 10 to 20 of that type each week. A typical example of a "sidecar" was written by a student early in the semester: "Thank you for directing me to 'what's new'. So far I've only checked out 'Whelmers', but I am hooked. I enjoyed the discussion in class today..."

Specific references to technology in the course syllabus included Dr. Foster's e-mail address. Under Required Texts was a reference to the World Wide Web site he maintained for the class.

> *Summaries and basic fact sheets for all topics, including instructor's notes and handouts are found on the course's Web site. Graphical browsers such as Netscape and Internet Explorer work well. Text based browsers such as Lynx also work well. More details will be given in class. This is required reading.*

During an informal interview, Dr. Foster stated that enough material was provided via the Web site to give the students an education in and of itself.

Technology as a Teaching/Learning Tool

Dr. Willows and Dr. Murphy planned their Spring 1997 semester courses together with an emphasis on integrating "authentic uses" of technology which they defined as uses of technology closely linked with subject area content and classroom experiences. Each of the targeted technologies was purposely woven into course experiences and support was provided by the researcher and another graduate assistant who had educational technology expertise. Issues related to use of educational technology as well as technical expertise

were discussed with students, and topics such as cooperative grouping and classroom management were included.

Dr. Willows. In addition to technologies such as the overhead projector and video equipment typically used in the required education course taught by Dr. Willows, the students in the Spring 1997 semester used computer software such as PowerPoint 4.0 (1994), ClarisWorks 4.0 (1996), Netscape Navigator 3.0 (1996), and HyperStudio 3.0 (1995). One class session was designed to give students an overview of ways technology could be used in teaching, including a group lesson using Rainforest Researchers (1996). An underlying goal of the multimedia group lesson was to promote discussion of management issues relative to using computers in the classroom. One course assignment included working with a team to research and to present information on a controversial topic such as assertive discipline. Students created PowerPoint (1994) presentations combined with hands-on activities to share the information in class. The researcher observed several of the group presentations, noting that students demonstrated mastery of the software and hardware as well as sharing their information. One of the students commented at the end of the class session, "I would not have used the technology without being pushed because of the extra work, but I'm glad I was pushed!"

A graduate assistant who worked with Dr. Willows described the goal of the instructor to "model technology use in the classroom, not just as an add-on, but as a way that you could truly integrate technology in your teaching."

Likewise, Dr. Willows stated several times that he wanted to make explicit the value of technology to enhance teaching and student learning.

In the process of working with technology in the class, Dr. Willows told his students that he was learning along with them. During one class period, a graduate assistant reviewed the basics of working with HyperStudio while the students and the instructor worked in pairs on computers. Some good-natured teasing occurred about the color combinations selected by the instructor, evidence of the rapport between the students and the instructor. At the end of the semester, students demonstrated knowledge of key concepts both through an individual written assignment, and through creating and presenting HyperStudio (1995) stacks with their groups. Within the guidelines of the assignment, students were able to incorporate themes, humor, graphics, and sound effects as well as summarize important points. After the sharing session, Dr. Willows helped make the connection to teaching and learning explicit, guiding the discussion to focus on how this type of project could be developed in the classroom.

Dr. Willows made several references to technology in the course syllabus in addition to his e-mail address. Course Objectives included "To utilize appropriate technology in teaching," and Modes of Instruction listed "Telecommunications" and "Technology: Multi-media." A group project delineated in the syllabus stated that the World Wide Web and other library resources would be used in researching a topic and the description closed with

italics emphasis on "The presentations should incorporate technology and actively involve class members."

Dr. Murphy. Although Dr. Willows and Dr. Murphy planned together, they were for the most part teaching their courses independently. At times during the semester, Dr. Murphy commented on the difficulty of integrating technology into his teaching methods course. "It's hard because I don't know what I'm doing. It's all so new. I do know some of what I'm doing." He reserved the multimedia cart for the entire semester, determined to include meaningful technology experiences in the class. With no background in using computer-based technology in teaching, he was trying to learn programs and use them in class almost simultaneously. Inspiration (1995), a brainstorming program, was used early in the semester to facilitate group work and elicit student ideas.

Dr. Murphy encouraged students to operate the software and to take control of the mouse and keyboard during classroom demonstrations of technology. On one occasion when the researcher was observing in the class, a multimedia encyclopedia CD-ROM reference source was incorporated into instruction as questions arose from class discussion. This use of the multimedia occurred naturally and effectively modeled how it could be done in a classroom. Likewise, a lecture was delivered using PowerPoint (1994) in which the instructor presented the information and demonstrated the characteristics of the software at the same time. He noted to the researcher after class that direct instruction was not his preferred style of teaching, but he felt it was important to show how technology could be used to facilitate that method.

During the previous semester, the researcher provided a hands-on session on researching information through the World Wide Web with the understanding that Dr. Murphy would teach the session himself the next time. Upholding the agreement, he taught the hands-on session in his teaching methods class in the Spring 1997 semester. A sense of support was still provided through the researcher's presence during the session, but the instructor appeared confident as he modeled the basics of moving around the World Wide Web. Students were made aware that information and graphics that they found on the Web pages could be used in their HyperStudio (1995) project, a major assignment for the semester. Dr. Murphy also created a HyperStudio stack with the assistance of the researcher to learn to work with the software and to provide an example for the class. He planned time in classes to work in a computer lab and the researcher provided support for the students. Additional work times were scheduled outside of class where students could continue to obtain help from the researcher. Dr. Murphy considered the use of technology successful in his class and felt that students made the connection to use in teaching.

> *It was tied so much to what we did in class. So I could really see the direct application and more from them seeing also direct application to their classroom teaching. Although they didn't take it that far this semester, I think that they could see how they could use it with their students in their classes.*

Specific references to technology were found in the syllabus for Dr. Murphy's course, beginning with his e-mail address. One of the Course Goals and Objectives stated, "Examine ways to integrate technology and classroom

management effectively into one's [subject] teaching." Modes of Instruction included "Technology: multimedia" and under Methods of Evaluation a statement appeared in bold text: "Evidence of your active use of technology--HyperStudio, PowerPoint, and/or KidPix--must appear in at least one of the following assignments."

Summary

The ways that the participants used technology in their courses separated into fairly distinct categories. Technology as an add-on incorporated the viewpoint of technology as a separate topic, or as a starting point for experimenting with technology use in teaching. Technology as a communication medium included the use of e-mail to facilitate communication and/or the use of the computer as a delivery system (e.g.., using presentation software with lectures). Technology as a resource incorporated technology as a communication medium as well as use of the World Wide Web, listservs, and teacher tools such as assessment software. Technology as a teaching/learning tool represented efforts to integrate technology in a variety of ways throughout the courses with an emphasis on how technology affects teaching and learning.

Factors that Influenced the Use of Technology in Teaching Undergraduate Courses

This study examined the influences of teacher's purpose, teacher as person, the context of teaching, and the culture of teaching (Fullan & Hargreaves, 1992, 1996) relative to university faculty willingness to integrate

technology into teacher education courses. Table 20 shows factors influencing faculty use of technology in teaching organized within the four categories from the framework of Fullan and Hargreaves (1992, 1996). In the following section, each of the influences is described.

Table 20

Factors Influencing College of Education Faculty Use of Technology in Teaching

Categories (Fullan & Hargreaves, 1992, 1996)	Themes
Teacher's Purpose	Conveying Knowledge Ideological Concerns Program Continuity Affective Concerns
Teacher as Person	Technology Experiences Stage of Career Professional Self-Esteem Commitment to Technology Use
Context of Teaching	Course Content Time Issues Confidence Equipment Access
Culture of Teaching	Norms and Beliefs Peer Pressure/Support Acceptance of Technology Institutional Pressure/Support

Teacher's Purpose

Teacher's purpose includes what an individual wants to achieve through teaching, things that are valued in teaching. Participants varied greatly on what they stated as valued in their teaching. Themes that emerged from interview

data were (a) conveying knowledge, (b) ideological concerns, (c) program continuity , and (d) affective concerns. Evidence of how these themes influenced the integration of computer-based technology in COE teaching was sought through interviews, observations, and documents.

Conveying knowledge. Conveying knowledge and increasing skills were mentioned by four of the eight participants as being of primary importance. This was exemplified by Dr. Lund's statement regarding what he wanted to accomplish in his teaching. "I just want to impart knowledge to students. That's what I think, knowledge and skills to students."

This view of teacher's purpose was carried out in class sessions with an emphasis on direct instruction. Course content as outlined in Dr. Lund's course syllabus included numerous topics to be covered within the semester.

Similarly, a view of the importance of "inherited knowledge and understanding" drawn from empirical research was expressed by Dr. Foster. He noted the value of having preservice teachers learn about educational theories and research. His use of technology in the undergraduate education course was classified under *Technology as a Resource* and was consistent with the idea of conveying knowledge.

> *As I work with teacher education students more and more, I realize that they have to come to grips with their own skill levels, make their own determinations, and be able to create knowledge for themselves or at least hypotheses to test in their own teaching. At the same time I have absolutely no problem with giving them a lot of information to get them on the way. I don't think you have to construct everything from nothing. There's a lot of inherited knowledge and understanding that can be conveyed to people that greatly facilitates their growth.*

Ideological concerns. Three participants espoused ideological concerns such as wanting students to understand the complexity of teaching and learning, and the desire to help students become reflective practitioners. Dr. Becker, who questioned the importance of integrating computer-based technology into his undergraduate course, verbalized his concern:

> *For undergraduate students I think it's critically important that they understand that teaching is an incredibly complex endeavor... that teaching is not the same as studenting. I think it's so important at the undergraduate level and at the graduate level, that people become reflective practitioners, reflective in their thinking about what it means to teach.*

Dr. Willows and Dr. Murphy attempted extensive integration of technology into their courses. Dr. Murphy's concern about fostering a constructivist approach to teaching was clear:

> *I'm trying to model for my preservice teachers a method of teaching children. So what I'm trying for my students, a constructivist approach to teaching, so that they can then experience it as learners and see it modeled as teachers, and then be able to take it to their classrooms and take it to their children.*

Program continuity. A third theme regarding things that COE teachers value involved program continuity. Data supporting this theme emerged from participant interviews and faculty interest group meetings. Comments from Dr. Foster and Dr. Williams illustrated the theme:

> *I want to see a product from beginning to end, not just one course and then the next group comes to my course and then the next group comes to my course. So the continuity through a program.*

> *I value having courses that are connected in meaningful ways, faculty doing what it is we want students to be doing.*

Affective concerns. Dr. Tabbot focused on appreciation of the subject as what he most valued, an affective concern. He spoke frequently about wanting students to "appreciate mathematics."

> *I guess I want people to appreciate mathematics as much as maybe I appreciate mathematics...The subject has just as much beauty as a well-written poem or a well-written novel, or a well-painted landscape or abstract or whatever. And I try to communicate that because I think if you recognize that beauty and then you want to share that with others, there's a certain enthusiasm, there's a certain acknowledgment that what we are doing is in part more than just a "lifeskill."*

Effect of teacher's purpose on technology integration. The influence of teacher's purpose on the integration of technology into courses was related to how technology was viewed (i.e., add-on, communication medium, resource, or teaching/learning tool) relative to things that teachers wanted to accomplish in their teaching. For example, using technology primarily as a communication medium or as a resource worked well for participants who viewed much of their purpose in teaching as that of conveying knowledge.

Teacher as Person

Included in teacher as person are characteristics such as life experiences, stage of career, sex, and age which can "affect people's interest in and reaction to innovation and their motivation to seek improvement." (Fullan & Hargreaves, 1996, p. 27). Life experiences as they related to technology and stage of career were examined in this study to explore their effect on the integration of technology in teacher education courses.

Technology experiences. With the exception of two participants with long histories of computer use, the backgrounds of the participants did not prepare them for using technology in teacher education. Past technology experiences of the participants could be grouped into four basic categories: (a) traditional programming, (b) data analysis, (c) word processing, and (d) e-mail. When relating computer histories, two of the eight participants noted experience with programming languages such as FORTRAN and BASIC. They had experience with early computer systems that included punch cards, tapes, and mainframe computers. Both of these participants mentioned the novelty of working with computers as the attraction for them and they experimented with early versions of personal computers such as Texas Instruments 99-4A and the Apple IIe.

Word processing and e-mail were the predominant uses of computers in the history of each of the participants, with most of them describing use of computers for writing in graduate programs. One participant mentioned using an electronic grading program as a secondary teacher and one described working with the development of computers in education courses at the university level.

Stage of career. The influence of stage of career on the integration of technology in teaching was explored in this study. While it can be argued that technology skills were considered in the hiring of new faculty, time constraints and competing elements such as tenure-track requirements represented inhibiting factors. Likewise, full professors might be expected to be resistant to

changing their teaching styles to incorporate technology since their jobs were secure and academic freedom was respected.

Dr. Willows and Dr. Tabbot were full professors, the former with no experience in using computer-based technology in teaching, and the latter with extensive experience. While Dr. Willows lacked expertise in educational technology, he was determined to include "authentic uses of technology" in his course. On the other hand, Dr. Tabbot had expertise in using technology, but was not convinced that using technology was as important as "truly integrating technology." Dr. Tabbot stated that at this point he felt uncomfortable with that integration.

Dr. Lund and Dr. Foster, associate professors, were also representative of technology experience extremes. Dr. Lund readily acknowledged not knowing how to incorporate technology into his course, but was open to learning more about it at the same time as his students in a class session conducted by the researcher. In describing his use of computers, he stated, "I see myself as being, on a scale of zero to ten, a two as far as using the potential of computers." In contrast, Dr. Foster was confident and competent in technology use. He applied his knowledge in a practical way, providing resources and facilitating communication through a listserv. Stage of career impacted these two participants differently. Dr. Lund indicated he felt he was student-oriented and focused on his job. Dr. Foster, however, was somewhat preoccupied with job interviews at other universities throughout the semester, and he stated that the job search affected the amount of time and effort given to

providing resources for the students on the listserv.

Dr. Murphy and Dr. Becker were besieged with the demands of being assistant professors. Whether the demands originated from the COE or from their own determination, they were foremost in their minds. Pressure to publish and keep up with tenure requirements, involvement in committees, and individual commitment to teaching were all part of the stress they felt. Dr. Murphy summed it up:

> *In order to be able to walk in here every day and to be able to breathe, I just have to realize that I'm just doing the best at the thing I can do today, the best job I can do today as an educator based on my own values, and do the scholarly work that I enjoy to the best of my ability based on my own standards.*

Dr. Murphy and Dr. Becker were representative of opposite ends of the spectrum regarding willingness to incorporate technology into their courses. Dr. Murphy was extremely enthusiastic about including technology in his course, believing it provided "one more way for students to be able to do within the classroom, as opposed to just one way." In contrast, Dr. Becker included one computer-based technology activity in his graduate class, but saw it as an add-on for undergraduate students.

> *It's clear that preservice people need to be aware of conversations in technology that are taking place because they'll have students that are as advanced in most, in many cases probably more advanced than they are in the uses and in technology. But I don't know where to fit it in.*

Also, Dr. Becker emphasized a more general definition of technology.

> *I envision this term "technology" to be much broader. There are [students] who don't know how to use a videotape player in an academic way or instructional way... I think foremost about the kind*

of instructional technology that the students in public schools will have available to them, so that's where our discussion goes. And that's different than the computer screen behind me.

Mr. Schultz and Mr. Evans were both full-time doctoral students in the midst of writing their dissertations. As course instructors, they were trying to balance time for their research and writing with time for their teaching responsibilities. Although both participants used technology in their courses, integration of it relative to course goals and requirements was limited. Mr. Schultz was comfortable working with technology and had taught a distance education course the previous semester. PowerPoint (1994) and e-mail were built into his style of teaching and he could "not imagine teaching without technology." Although much of his teaching involved direct instruction using the computer as a delivery system, other uses of technology included e-mail journals and one class session was used to demonstrate software that could be adapted for students with special needs. Likewise, Mr. Evans required students to correspond with him and with the other students via e-mail. He was comfortable with e-mail and stated "I think it's important for us to get interaction, and also for the efficiency of this class." Students were able to learn about each other's classroom experiences and "in this way they can know each other."

Effect of teacher as person on technology integration. Within the teacher as person category, stage of career influenced the use of technology primarily in relation to competing factors. To some participants, integrating technology became a focus, while to others it was considered to be less important. In this

study, stage of career had less influence on the decision to use technology than factors such as personal commitment.

Two themes that emerged from the data in the teacher as person category were professional self-esteem and commitment to using technology. These themes were instrumental in the decision by individual faculty members to integrate technology into their courses.

Professional self-esteem. Throughout the semester, one of the strongest characteristics of those implementing technology use in their classes was a confidence, a professional self-esteem, that allowed them to participate as learners and to admit to their students that they were not "experts." For example, the enthusiasm of Dr. Lund was fostered by a motivation to learn about the World Wide Web for himself and to provide a means for his students to use its resources. After the hands-on session he remarked, "In some ways students may be ahead of me, but I know a lot of students in my class, it was new to them and exciting to them, too." Sharing with his students that this was new to him was not an issue. "They probably just thought I was a real person in that sense."

Some participants saw themselves modeling the role of teacher as both facilitator and learner. They shared with their students that they were in the process of learning about technology and how to use it in teaching. Interview quotes such as the following were typical of the participants using technology in their classes and were documented through observations:

> *I'm learning along with them, the technology. I've been very clear that this is something that I'm modeling--the import of learning--*

> *and that if I can take the risk in teaching in a university course and learning along with students, then they certainly can when they're working with eight-year-olds or ten-year-olds.*
>
> *I'm struggling to figure it out like they are. I'm doing, I'm with them, and I'm OK with that. I'm not so sure how OK they are with that, but I'm OK with that... I went into teaching because I like to learn, and being a teacher in a classroom is a good place to learn, often with your students.*

Commitment. Several times during the semester the researcher asked Dr. Willows why he was determined to integrate technology into his course. His responses were most often along the lines of believing technology was a force in our lives that could not be ignored and that students must come out of teacher preparation programs knowing how to use technology for teaching and for learning.

> *You can't stay in this profession and not use it as far as I'm concerned. We know that it is a way of living. We know that things are going to get even more technologically sophisticated in our society. We must as leaders of those that are preparing teachers who will be working with children in the schools, be prepared to use technology with our students.*

Commitment was coupled with enthusiasm, a typical characteristic in Dr. Willow's teaching style, and that came across as he modeled technology use and as he praised students for their accomplishments with technology assignments. After the class session where students took part in the Rainforest Researchers (1996) simulation lesson, one of them jokingly asked the instructor if he was getting a "kick-back" from the company for "selling the program." At the conclusion of a class session where a student demonstrated sites on the World

Wide Web that might be of interest to teachers, the instructor remarked, "I continue to be amazed at what we can do. Go technology!"

For some instructors, commitment to integrating technology was aligned with a view of technology use as a strategy for teaching, a means with which to engage students in researching, creating, and synthesizing ideas. Typical of that view was a comment made during an interview:

> *My thinking is, OK, what's another way so we can get this or how can we solve the problem? How can we make it better? You know, what will bring our understanding, our ideas together in the most efficient way or the way we're going to learn the most? I don't know. I think it's just kind of consistent. I don't think it's like anything really because it's technology. It's just another way.*

Consistent with the view of technology as a teaching strategy, Dr. Murphy designed assignments that were closely linked with subject area content and classroom experiences. For example, students designed presentations using HyperStudio (1995) to share information gained from a class project that lasted several weeks. In the process, they had to synthesize information and decide which elements were important to present to the rest of the class.

Commitment to technology use was also evidenced by Mr. Schultz in his use of technology as a delivery system for lectures and as a means of communication between student and instructor. Mr. Schultz completed his doctorate during the Spring 1997 semester and would be moving to his first faculty position at another university. He stated that technology resources at the university where he was hired were somewhat limited, but his plans for teaching "definitely include technology."

Context of Teaching

Three important aspects of the context of teaching include (a) the varying context of teaching, (b) realism and practicality, and (c) contextual characteristics that set boundaries (Fullan & Hargreaves, 1996). In this study, characteristics that set boundaries were of interest because they were considered to be factors influencing the integration of technology in the COE. Among those boundaries were course content, time issues, confidence in planning for and using technology, and equipment access. In some cases, class size also produced a boundary. For example, a class of 15 or 20 students fit easily in the small teaching lab with 18 computers, while a class of 30 students was too large for the room to hold comfortably. Dr. Murphy, who used the small lab several times during the semester, commented that "it has everything in there I could use with a small class; a large class gets to be too hard, too tight." Likewise, a teaching lab in the Computing Services building available by reservation had only 15 computer stations. Although students could work in pairs, the room itself became quite crowded under those conditions.

Course content was a boundary in the sense that some participants had difficulty seeing how technology could enhance or extend topics, pointing to the importance of support in planning. For example, Dr. Lund was willing to experiment with encouraging student use of the World Wide Web in conjunction with course goals, but only with assurance of the researcher's assistance. A discussion of technology use during an Elementary Faculty Interest Group meeting prompted Dr. Willows to acknowledge the support of the graduate

assistants with technology expertise and the assistance of the researcher "to figure out appropriate ways to build it [technology] in."

Time created boundaries in two ways. First, from the standpoint of the instructor, learning new software programs and new ways of teaching with technology required personal time commitments. Second, using technology in classes, particularly where hands-on sessions were involved, sometimes took a large portion of total class time. As one participant commented, "I still run out of time in my content areas of the charge I'm given in my classes and where I fit this stuff in." For those participants who were novices in using technology in teaching, perceived problems such as learning new software had to be balanced with the benefits of providing technology experiences and modeling technology use for preservice teachers. Conversely, instructor knowledge and experience with using computer-based technology did not ensure that it would be integrated into courses.

Lack of confidence in teaching with technology was verbalized to the researcher by several participants. This lack of confidence produced a boundary for some instructors, but it was overcome to a great degree by the amount of support available from the researcher and from two other graduate students. Dr. Lund included an introduction to the World Wide Web in his course for the first time based on the agreement that the researcher would design and present the class session. Likewise, Dr. Murphy stated that he would not have attempted all the technology integration he did during the Spring 1997 semester without the planning assistance and support of the researcher.

Equipment access was a boundary for those who felt it was troublesome to transport the multimedia cart to a classroom or who could not reserve it for the times they needed it. Two of the participants had classes during the same time slots and sometimes had to compromise regarding reservations for the multimedia cart or the small computer lab. Dr. Murphy argued that the computer should be a tool readily available to students at all times and speculated the optimum arrangement would be ten computers and a projection device in his methods classroom. "The tools should be right there in the classroom." Dr. Tabbot planned a lesson around use of the multimedia cart only to find there were technical difficulties with the computer the day he needed it. Being flexible, he postponed the lesson to the next class period and went on with other activities, but that kind of obstacle might have discouraged some instructors from pursuing further use of technology.

Culture of Teaching

The culture of teaching is defined informally by Fullan and Hargreaves as "the way we do things and relate to each other around here" (1996, p. 37). In addition to ways of doing things, school culture includes expressed norms and beliefs.

Norms. Standards for faculty were mentioned as a norm by half the participants and included the traditional teaching, scholarship, and service categories considered in tenure and promotion. In general, however, the participants were not comfortable giving examples of norms in the COE. Dr.

Tabbot claimed it takes a long time to recognize the norms of an organization, and having been in the COE only two years, he felt he had formed only "perceptions." His reasoning might explain why the two doctoral student participants had difficulty providing examples as well. Dr. Willows who had only been in the COE for one semester, commented that "norms here are being built," suggesting that the norms were in flux and not embedded in COE culture.

Negative norms, accepted ways of doing things that are not necessarily good, were expressed by more than one participant. Participants who noted negative norms varied in length of time they had been in the COE, from one year to seven years. Negative norms included artificial urgency (i.e., short deadlines on decisions that impacted people and programs), inconsistency in expectations and the handling of situations, and hegemonic or power relationships as perceived by individuals working toward promotion and tenure. Instability of the COE in the midst of leadership and organizational changes may have influenced participants' perceptions of the norms.

Beliefs. COE beliefs derived from participant interviews are summarized in Table 21. Categories were based on themes that emerged from interview data. Participants were in agreement concerning several of the expressed beliefs such as the importance of teaching, the need to be student-centered, and the value of scholarship. Faith in each other was addressed from opposing viewpoints, however. Dr. Foster specifically stated the belief in the COE was that faith in one another was lacking, while Dr. Becker claimed faculty had faith in each other as professionals. This opposing view of faith in each other was

based on personal experiences with Dr. Foster feeling his ideas and contributions were largely unrecognized while Dr. Becker believed a great deal of professionalism was evident in faculty interactions.

Table 21

Beliefs in the COE

	Participant							
Technology	Willows	Tabbot	Lund	Foster	Murphy	Becker	Schultz	Evans
Collaboration not Valued				x			x	
Faith in Each Other				x		x		
Importance of Teaching	x		x		x		x	x
Public Versus Tacit				x		x		
Student-Centered	x	x			x		x	
Value of Scholarly Work	x		x		x			x

Ways of doing things. Groups that form within school cultures have been studied (Hargreaves, 1994), usually at K-12 grade levels. Distinct groups can be found in the COE, primarily within departments. Some of these groups are formed by the nature of working on committees and by self-selecting into special interest groups such as the Elementary Faculty Interest Group or the Secondary Faculty Interest Group in the Department of Instructional and Curricular Studies. Hargreaves (1994) used the term "balkanized" to describe patterns where teachers work "neither in isolation, nor with most of their colleagues as a whole school, but in smaller sub-groups within the school

community" (p. 213). Cognizant of the departmental boundaries, the Dean commented:

> *I don't think that faculty have a sense of college by and large. I think they have a sense of department... My perspective as Dean, is that I want to cut those walls down. I want to remove them and make us a cohesive whole and see it as a collective whole instead of the individual parts.*

Although many faculty members participated in more than one faculty interest group, distinct divisions were evident. Some aligned themselves more with general areas such as literacy while others were concerned with elementary or secondary program issues.

Influence of COE culture of teaching. The influence of the COE culture of teaching on technology use was strongly felt by some participants. Themes that emerged were peer pressure and a general acceptance of technology. Peer pressure was evident in casual exchanges among faculty members, most often when a faculty member would show a colleague something a student had created on a computer, or a new software program. Faculty were beginning to investigate how they could include technology in their courses if they were not doing so already. These ideas were summarized by two participants:

> *I think that there are a number of faculty that are seeing the use of technology as important and it's been demonstrated on a lot of fronts. I'm thinking, just at the doc colloquia this semester, you used technology, I did... There is sort of a spirit or a beginning change, perhaps in the culture--I'm saying change because I'm assuming that it hasn't always been here since technology is new... I think we're seeing this sort of lifting of the expectation among faculty.*

> *Well, it seems to be a valued commodity, if not in word alone. I mean, not always in deed. But, technology has a foothold in the college here that is not necessarily firm. I mean, it's not ensconced, but there seems to be an acceptance mentality I guess, maybe is the strongest word to use, that it's not an evil tool and that it's something that we can make use of.*

Other culture influences mentioned by participants more than once included institutional pressure and productivity. In contrast, Dr. Murphy believed the culture did not influence his decision to integrate technology into his methods course. He did acknowledge the importance of the support he had received during the semester in learning programs and in using technology in teaching, but for him, use of technology was a personal "explosion of knowledge."

> *It [technology use] didn't seem important, but now I've got a space for it. I think it's very, very interesting and fun, for me. I like it. I personally like it. I mean, so, it makes it very easy to incorporate it in my teaching. I mean easy in the respect that it's not a task. It's fun to learn.*

Summary of Factors Influencing the Integration of Technology in Teacher Education

Facilitating factors. The three factors most frequently mentioned by the participants as influencing technology use in teaching were support and interest, equipment access, and commitment. Support and interest took a variety of forms. For example, Dr. Willows noted that in planning for technology use with a colleague, they "really sort of encouraged one another." Informal assistance was often provided by colleagues, and interactions of that type were

frequently observed by the researcher. On one such occasion, a faculty member who noticed that a colleague accessed his e-mail through Netscape instead of through Pine asked him for help in setting up his e-mail the same way.

In addition to technical assistance, interest and encouragement were important in facilitating technology use. Some references to support were directly related to the involvement of the researcher such as "I didn't do much, but I'm not sure I would have done that had it not been for your presence and your encouragement." Similarly, another participant remarked that "there's got to be nurturance and interest taken."

Equipment access was mentioned by five of the eight participants, often in conjunction with people support. Comments from two of the participants summarized the importance of equipment and technical expertise:

> *The fact that we can take the whole class down to the computer room, and let them have some hands-on time with the Web certainly facilitated it [technology use]. And without that I'm not sure where we would have been... So the lab itself and your willingness to help out with that facilitated it.*

> *When you make it too cumbersome, then you know, it's really hard to incorporate the technology. So the equipment was available, the room was available, you made yourself available, and [my graduate assistant], and then the teaming.*

Commitment essentially took the form of determination to include technology in courses. Comments from the exit interviews of two participants serve to illustrate commitment: "I will continue because I think it's a good thing" and "Once I started using it, I didn't really want to go back to anything else." The two participants who planned their course activities together found it created another level of commitment. "I felt, not only the personal obligation to meet the

goal that I had, but the obligation to my teammate." Table 22 shows factors that facilitated use of technology as derived from interview data.

Table 22

Factors That Facilitated Use of Technology

	Participant							
Factor	Willows	Tabbot	Lund	Foster	Murphy	Becker	Schultz	Evans
Equipment Availability	x	x			x	x	x	
Commitment	x		x		x	x	x	
Efficiency								x
Enjoyment							x	
Familiarity							x	x
Support/Interest	x	x	x	x	x	x		

Inhibiting factors. Lack of knowledge, time, and equipment access were factors most frequently mentioned by participants in regard to factors that inhibited use of technology in teaching. Dr. Lund expressed concern about his lack of technology knowledge and a "lack of understanding on what the possibilities are." Dr. Murphy described the time factor both in terms of his personal time investment in trying to learn new programs and in terms of feeling time constraints relative to student use of technology in classes. "Time always crunches exploration."

Equipment availability was mentioned by four of the eight participants as a factor that inhibited use of technology. Interestingly, Dr. Willows and Dr. Murphy spoke of equipment availability both as a factor that facilitated and as a

factor that inhibited technology use. They were committed to making technology an integral part of their courses and although they acknowledged the availability of equipment in the COE, they realized they wanted more. Their vision of technology integrated throughout their courses was outgrowing the reality of sharing equipment and the logistics of using the small computer lab. Only one participant, Mr. Schultz, indicated that no factors inhibited his use of technology. Table 23 shows factors mentioned by participants in interviews.

Table 23

Factors That Inhibited Use of Technology

	Participant							
Factor	Willows	Tabbot	Lund	Foster	Murphy	Becker	Schultz	Evans
Equipment Access	x	x			x			x
Lack of Knowledge	x		x		x	x		x
Lack of Recognition				x				
Lack of Software	x							
Time			x	x	x	x		
No factors inhibited							x	

Emerging Themes

Emphasis on technology in teacher education. Several people within the COE were starting to speak out about the importance of technology in teacher education. Experiences with integrating technology in their courses are shared with colleagues, written about in manuscripts submitted for publication, and presented at conferences. Announcements for faculty positions regularly included qualifications related to technology use.

Organizational influences were evidenced in written documents such as the College of Education Strategic Plan (dated 11/27/96). It began with an executive summary and then explained how the COE mission, objectives, and specific action items would advance the seven university goals. Some action items specifically addressed technology and the need for ongoing support personnel:

> Goal 1.
> Become more student focused
>
> Action item C.
>
> Use technology and other innovative teaching approaches to promote student learning. This might include, but not necessarily be limited to:
>
> - increasing access to COE computer labs for (a) individual students to work on course-related assignments and (b) non-technology methods and foundations classes to use on a sign-up basis
>
> - increasing faculty access to portable, computer-based multimedia teaching stations
>
> - increasing students' access to both major computer platforms through a cooperative, lab-sharing arrangement with the College of Engineering by exchanging our use of their Windows lab for their use of the COE Macintosh lab
>
> - the delivery of courses on-line
>
> - increasing the use of distance education technologies housed within the COE for courses, teacher inservices, and meetings with [School District] personnel.
>
> Goal 3.
> Increase research, scholarly activity, and national recognition
>
> Action item E.
>
> Increase the presence of the COE on the WWW [World Wide Web] by designing a web page for faculty

Goal 6.
Develop a service-oriented, responsive, accountable administration
Action item B.
Create the position of COE Technology Support Coordinator to provide faculty with technical support as well as coordinate the various COE technology initiatives. This position would be a new 12-month professional staff position.

The National Council for Accreditation of Teacher Education (NCATE) has included technology requirements in official documents such as Standards, Procedures, and Policies for the Accreditation of Professional Education Units (1995). Technology skills expected of students upon completion of teacher education programs and technology expectations for education faculty are addressed. An indicator under faculty qualifications states "faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship" (p. 24).

Emphasis on the importance of integrating technology in teacher education has helped increase technology resources for both COE faculty and students. A college-wide Technology Committee (TeCom) helps process requests for technology such as faculty computer upgrades. Awareness of the need to continually increase resources has been raised through faculty interest groups and individual faculty members. Requests to the Dean during the Spring 1997 semester included activation of two classroom network connections to enable use of the World Wide Web in teaching. (These connections did not become usable during the Spring 1997 semester due to problems with connecting portable multimedia cart computers to the network).

Influence of opinion leadership. As defined by Rogers (1995), opinion leadership refers to an individual's ability to informally influence the attitudes or behavior of other individuals. The candidate for Chair of the ICS Department gave a presentation at a department meeting in April to share her vision and ideas for the department. She began the PowerPoint slideshow by saying, "I thought it was important for me to model technology." Things did not go smoothly at the beginning of the presentation because the program was in the edit mode instead of the presentation mode, eliminating the transitions and effects she had created. After the researcher intervened and helped correct the problem by clicking on the appropriate button, one of the faculty members quipped to the candidate, "You're just one icon away from being a techie!"

The faculty member serving as the Doctoral Program Coordinator used PowerPoint to present her research at a doctoral colloquium, even though it involved extra work in creating the presentation and arranging for equipment to be available at the meeting. She made a statement before beginning the presentation that it was important to her to model the use of technology wherever the opportunity presented itself.

Outcomes of Technology Integration Planning

A technology integration matrix (Handler & Strudler, 1997) was used by the researcher as a tool to facilitate planning of systematic integration of technology throughout the teacher preparation program. This matrix (see Appendix M) was introduced at faculty interest group meetings in the

Department of Instructional and Curricular Studies. Samples of the matrix and of ISTE's Foundation Technology Standards for All Teachers (see Appendix A) were distributed to faculty at interest group meetings, and the researcher explained the rationale of creating a systematic plan for technology integration throughout the teacher education programs. The goal was to plan with faculty, but overall response to the idea of developing a systematic plan was non-committal. During the semester, issues that originated at the university level dominated many meetings, and COE concerns often resulted in lengthy discussions. For example, faculty were asked to streamline programs and reduce credits required for elementary education and secondary education degrees. Systematic integration of technology in teacher education was not perceived as a priority by most of the faculty.

At a Secondary Post-Secondary Faculty Interest Group meeting, before the rationale for developing a technology integration plan was fully presented, one of the faculty members shifted the focus of the discussion by questioning the need for the required undergraduate computer survey course. He claimed many of his students did not need the class and that its content and the software used were not beneficial. During the heated discussion which ensued, introduction of the matrix plan became futile.

Deciding it would be more effective to concentrate first on the elementary teacher preparation program, the researcher began meeting with faculty members who taught required courses in specific subject areas such as children's literature and science methods. In some subject areas, the required

courses were taught by several instructors and although they sometimes agreed that a particular computer program or activity "may be applied," they would not commit to saying it "will be applied" in every section of the course. For example, spreadsheet and graphing software was modeled by some of the mathematics methods instructors, but they were hesitant to require that all instructors incorporate the software.

Many faculty were resistant to the matrix for planning systematic integration of technology throughout the elementary teacher education program. One factor contributing to the resistance was the issue of "academic freedom." Dr. Tabbot attempted to explain the thinking: "By buying into a technology plan, I'm limiting myself." Despite the fact that an NCATE unit indicator specified that faculty integrate computers and technology into their teaching and scholarship (NCATE, 1995) many COE faculty were not convinced that a systematic plan for technology integration was needed.

Despite obvious resistance to creating an overall technology integration plan, many examples of technology use were available. Near the end of the Spring 1997 semester, the researcher asked elementary education faculty to complete a simplified matrix indicating ways in which technology had been used in teaching or by students in their courses during the semester. Collectively, the forms showed a wide variety of activities and software programs were used, suggesting the problem was not in willingness to integrate technology, but rather in agreeing to make specific use of technology a requirement for every instructor.

CHAPTER 5

DISCUSSION OF FINDINGS AND RECOMMENDATIONS

Purpose of the Study

This study describes current levels of technology use by College of Education (COE) faculty and implementation of technology in required undergraduate teacher preparation courses in a state-funded university in the southwest United States. In addition, the formation of a systematic plan for integrating technology throughout the teacher preparation programs was explored. There were two phases in the study. Phase I used quantitative methods and was based on a technology survey of COE faculty. Phase II was qualitative, involving a case study of eight participants who taught undergraduate required courses in regular education and special education teacher preparation programs. Data from both Phase I and Phase II were used in exploring Questions 1 and 2. Question 3 was addressed with Phase II data. Questions 1-3 appear below:

Question 1. How is technology currently being used by College of Education faculty?

Question 2. What factors influence the integration of technology in undergraduate teacher education?

Question 3. What are the outcomes of a technology integration planning process?

Procedures

Phase I of the study took place in January of 1997 with data collected through a technology survey distributed to 146 COE tenured/tenure-track and affiliate faculty. Data from 87 completed surveys provided baseline information to answer research Question 1: How is technology currently being used by College of Education faculty?

Phase II was a descriptive case study employing an embedded, single-case design with "more than one unit of analysis" (Yin, 1994, p. 41). The case included full-time tenured/tenure-track faculty members and full-time doctoral students teaching required undergraduate education courses in the Department of Instructional and Curricular Studies and the Department of Special Education during the Spring, 1997 semester. Eight participants, six full-time faculty members and two doctoral students, who taught undergraduate teacher preparation courses in the COE provided most of the case study data.

Case study data were collected throughout the Spring, 1997 semester. Primary data sources included initial and exit semistructured interviews, secondary data sources consisted of informal interviews, observations, documents, and e-mail. During the observations, the main focus was on use of technology in teaching. The Course Implementation Matrix (see Appendix M), faculty interest group minutes, and researcher field notes provided data about formation of a systematic plan for technology integration.

In January, participants' course syllabi were examined and the offer was made by the researcher to provide support for use of technology in the courses. Initial interviews were conducted in February and the early part of March 1997. Transcription and coding of interviews was initiated in March. Observations in classes were ongoing throughout the semester, sometimes with the researcher leading an activity (e.g., a hands-on session on using the World Wide Web), and other times as an observer. Exit interviews and an interview with the dean were conducted near the end of the semester. Analysis of case study data continued throughout the data collection period and for several months afterward.

Discussion of Findings

Question 1: How is Technology Being Used by College of Education Faculty?

On the survey, faculty rated themselves similarly on their technology knowledge levels and technology skill levels (e.g., knowledge about e-mail and skill with using e-mail). Technology categories listed were (a) word processing, (b) spreadsheets, (c) statistical software, (d) e-mail, (e) educational software, (f) presentation software, (g) Internet/World Wide Web, and (h) multimedia. Most faculty rated themselves as having "some knowledge" or "extensive knowledge" with each of the types of technology and reported their skill levels as "moderate" to "high." From these ratings it can be implied that faculty had confidence in their ability to work with various technologies. A similar survey by Spotts and

Bowman (1995) found that university faculty rated their technology experience levels only slightly less than technology knowledge levels for the same technology.

In this study, survey data indicated that COE faculty used technology more in preparing for classes than they used technology in teaching classes. Word processing and e-mail, which Green (1996) refers to as "low-tech" technologies requiring less technological skill, were reported as the most often used technologies in preparing for classes. Since word processing and e-mail are becoming core tools for university faculty (Green, 1996), it is not surprising that COE faculty would use these technologies more frequently than others. This pattern of word processing and e-mail use is consistent with a national survey of U.S. teacher education faculty (J. Willis, D. Willis, Austin, & Colon, 1995), which revealed that most faculty viewed themselves as competent in using information technology, but not in teaching with it.

Case study data supported the frequent use of computers for personal productivity and e-mail communication. Participants specifically mentioned the use of word processing and e-mail in their initial interviews or were observed using those tools as they worked in their offices.

Despite giving themselves high ratings on knowledge levels and skill levels with the various technologies, survey data indicated faculty use of technology in teaching was limited. This supports the notion that knowledge and skill with technology do not necessarily transfer to use of technology in

teaching. "Knowing about an innovation is often quite different from using a new idea" (Rogers, 1995, p. 167).

Infrequent use of technology in teaching was evident for both tenured/tenure-track and affiliate faculty. For each of the technology categories (e.g., word processing, spreadsheets, statistical software, e-mail, educational software, presentation software, Internet/World Wide Web, and multimedia) no more than 30.0% of affiliate faculty reported using technology in their teaching. Tenured/tenure-track faculty reported a higher level of use for teaching with technology with over 50.0% of them using technology at least once during the semester. While use of technology once during the semester does not ensure that technology is integrated throughout the program, it suggests that faculty are attempting to include a use of technology in their teaching. Tenured/tenure-track faculty reported more frequent use of educational software than any of the other categories, with over 60.0% of them indicating use of it in teaching. They had greater access to software located in the computer teaching lab than did the affiliate faculty, and sometimes faculty received samples of software or purchased specific titles for themselves. For example, Dr. Tabbot had several titles in his personal collection of educational software that he could use in his teaching if he chose to do so.

Although survey data indicated infrequent use of technology in teaching, the detailed picture revealed by case study data showed how some faculty were integrating technology into their courses. Participants' efforts to integrate technology ranged from little or no use of technology in their teaching to

extensive use. Four categories can be used to describe the manner in which technology was used in participants' courses: (a) technology as an add-on, (b) technology as a communication medium, (c) technology as a resource, and (d) technology as a teaching/learning tool (see Figure 5).

Technology as an add-on incorporated the viewpoint of technology as a separate topic, or as a starting point for experimenting with technology use in teaching. Rogers (1995) proposed that "most individuals will not adopt an innovation without trying it first on a probationary basis in order to determine its usefulness in their own situation" (p. 171). This add-on approach to integrating technology was evidenced by Dr. Lund as he agreed to include a hands-on introduction to the World Wide Web, provided the researcher conducted the session.

Technology as a communication medium included the use of e-mail to facilitate communication and/or the use of the computer as a delivery system (e.g., using presentation software with lectures). Several of the case study participants used e-mail regularly with their students as a means of answering questions, for receiving and responding to reflective journals, and to encourage communication among students in their classes. Dr. Willis discussed the power of e-mail communication during the exit interview:

> *I'll go back or you might want to take a look at a file on e-mail of just questions that have surfaced that individual students have e-mailed me directly about, sometimes related to the class, sometimes not related to the class. Write a letter of recommendation, what not. The communication really increased between me and the students from what I've typically had if I don't have e-mail as a way, an additional way that students can reach me.*

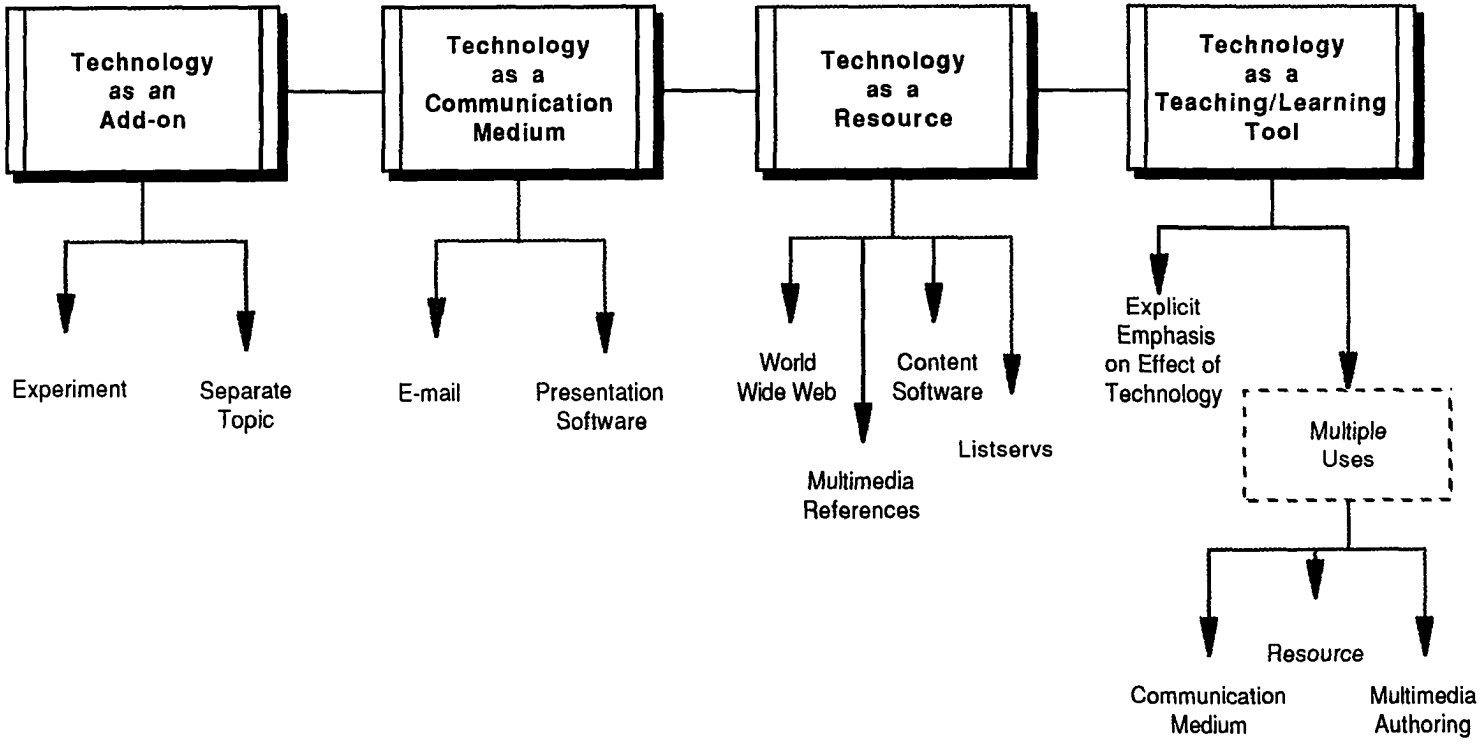

Figure 5. Manner in Which Participants Integrated Technology into Their Courses

Four of the eight participants used PowerPoint (1994) presentations as a delivery medium one or more times during the semester. Use of technology as a communication medium can be viewed as another means of interacting with students. Mr. Schultz mentioned ease of use as one of the factors that influenced his decision to use PowerPoint presentations:

> *I liked using it, and it's much easier to use than overheads and my students really enjoyed it too. In fact one night I didn't use it...and I had several comments that night, or in their journals that they missed the PowerPoint...*

Technology as a resource focused primarily on locating information through use of the World Wide Web, listservs, multimedia encyclopedias and other software. Five of the eight participants used the World Wide Web in teaching at least one class session during the semester. Dr. Foster created and maintained a listserv for students in his class and for students in the sections of the course being taught by other instructors. This listserv was regularly updated by Dr. Foster with suggestions to students of course-related World Wide Web sites to visit. He was able to create this listserv primarily because of his technical expertise, and he sought the help he needed to find a computer location on which to store it. According to Dr. Foster, many of his peers were intimidated when he would show them the listserv. This was possibly because they felt the technical aspects of creating a listserv were beyond their capabilities.

Technology as a teaching/learning tool represented efforts to integrate technology in a variety of ways throughout the courses with an explicit

emphasis on the effect of technology on teaching and learning. Two of the participants modeled multiple uses of technology in teaching many times throughout the semester, reserving the small technology lab or the portable multimedia station for their classes on a regular basis. In addition, they designed some of their course assignments to incorporate technology and provided time for students to share their multimedia projects with the class. For example, students in Dr. Willow's class worked in teams near the end of the semester to synthesize key concepts from the course. They then created and presented interactive multimedia presentations using HyperStudio (1995) to the class. Each time the researcher observed in these classes when technology was used, it was noted that connections to use of technology in classrooms were made explicit. Dr. Murphy described student recognition of classroom connections several times, twice during the exit interview:

> *I think my undergraduates already see a connection with what they can do in a classroom. They see the direct application, how it [multimedia projects] could be done in the classroom, by doing it themselves.*
>
> *I could really see the direct application and, more from them seeing direct application to their classroom teaching--although they didn't take it that far this semester--I think that they could see how they could use it with their students in their class.*

Summary of COE Technology Use

Based on survey data, COE faculty knowledge of and skill with using technology do not necessarily transfer to use of technology in teaching despite the fact that 93.1% of the faculty rated technology in teacher education as "very

important" or "important." Although over 50.0% of tenured/tenure-track faculty reported using technology in their teaching at least once during the semester, no more than 30.0% of affiliate faculty reported use of it. Data on the limited use of technology in teaching on the part of affiliate faculty suggest a need to focus on additional training and support for them.

As evidenced by survey responses, COE faculty are interested in learning more about a wide variety of technology topics. While some uses of technology in teaching need to be customized to specific course syllabi, many topics would be appropriate for faculty workshops. Levels of expertise should be addressed, since needs of novice users and advanced users vary. A plan to provide for faculty development based on survey data or a new needs assessment should be formulated, and follow-up workshops are needed to provide opportunity to discuss implementation and technology concerns.

Case study data allowed examination of the manner in which participants used technology in teaching as: (a) an add-on, (b) a communication medium, (c) a resource, or (d) a teaching/learning tool. These categories were not mutually exclusive, but served to describe emphasis placed on technology use as it was integrated into courses. Based on the findings it appears important to increase COE faculty awareness of how technology can be used to enhance instruction and to help accomplish course goals. This in turn points to the issue of developing a systematic plan for technology integration throughout the teacher education programs.

Question 2: What Factors Influence the Integration of Technology in Undergraduate Teacher Education?

Results of the technology survey indicated faculty believe technology in teacher education is important. Faculty were asked to rate the importance of technology in teacher education on a Likert-type scale ranging from "not at all important" (1) to "very important" (4). Of the 87 responses, 57 faculty members (65.5%) indicated that technology in teacher education was "very important" and 24 faculty members (27.6%) selected "somewhat important." Only six faculty members (6.9%) rated technology as "not too important," and no one selected "not at all important." The mean rating was 3.59. Results of the importance of technology in teacher education in this study were very similar to results of a university faculty survey conducted by Spotts and Bowman (1995) in which 65.0% of the respondents rated instructional technology as "important to critically important."

Expanded reasons supporting COE faculty ratings of the importance of technology in teacher education were elicited through an open-ended survey item. Respondents' statements frequently reflected ideas about technology as part of the modern world or the future. The value of technology as a teaching/learning tool was also a recurrent reason given for the importance of technology in teacher education.

In the case study, participants were asked in both the initial and exit interviews about the importance of technology in teacher education. Responses

varied greatly, with some participants wrestling with trying to decide the level of importance technology should hold. For example, Dr. Becker explained:

> *I think it's important. I don't know that it's, again, a panacea for everything though. It's clear that preservice people need to be aware of conversations in technology that are taking place because they'll have students that are as advanced or more advanced in most, in many cases probably more advanced than they are in the uses and in technology. But I don't know where to fit it in.*

Other case study participants such as Dr. Willows were adamant in their belief that technology in teacher education is important:

> *It's extraordinarily important. You can't stay in this profession and not use it as far as I'm concerned. We know that it is a way of living. We know that things are going to get even more technologically sophisticated in our society. We must as leaders of those that are preparing teachers who will be working with children in the schools, be prepared to use technology with our students. And it is a no-brainer for me. It is absolutely essential.*

Despite the belief that technology in teacher education is important, two factors continue to influence faculty use of technology in teaching. Time and equipment concerns, often cited as factors that inhibit use of technology in education (Barron & Goldman,1994; Carr, Novak, & Berger, 1992; U.S. Congress, 1995; Wetzel, 1993), were selected as the primary constraining factors by survey respondents in this study. "Time to learn new programs" was the overwhelming primary factor constraining use of technology in teaching. Concerns such as promotion and tenure requirements that competed for faculty time surfaced in the case study and may have influenced tenured/tenure-track faculty selection of time as the primary factor. Based on survey data, obtaining equipment for use during instruction was more of a concern to affiliate faculty than to tenured/tenure-track faculty. In general, tenured/tenure-track faculty had

greater access to faculty development and support for technology use. For example, six technology-related workshops were organized by the researcher and offered to COE faculty during the Spring 1997 semester. Lack of awareness of technology resources was also a constraining factor for more affiliate faculty than for tenured/tenure-track faculty.

In an attempt to elicit technology concerns, faculty were asked to respond to an open-ended item in the survey: "When you think about the integration of technology into teacher education, what are your concerns?" Using the Stages of Concern (SoC) model (Hall & Hord, 1987), response statements were coded and grouped (see Appendix G). The seven stages of concern can be grouped into three main levels: (a) awareness, (b) management, and (c) impact.

Statements showing little concern or involvement with technology in teacher education were coded as awareness, and blank responses were included in this stage. The awareness level accounted for 33.3% of faculty concerns when awareness concerns (20.2%) were combined with informational concerns (1.0%) and personal concerns (12.1%). Based on these findings, it appears important to communicate to faculty ways in which technology can be integrated throughout the teacher preparation programs.

Survey results showed 33.3% of faculty concerns were management level. Management concerns refer to issues about resources, access, efficiency, organizing, managing, scheduling, and time demands. This type of concern was consistent with faculty responses to the survey item asking which factors constrained use of technology in teaching. "Time to learn new programs" and

"obtaining equipment for use during instruction" were the primary factors. While access to equipment improved during the semester with the addition of three new portable multimedia stations, faculty had to plan and reserve the technology ahead of time rather than having it available for use as needed. Some participants stated that they appreciated college efforts to make technology available but at the same time they were beginning to recognize that they wanted it to be a normal tool within the classrooms. Dr. Tabbot expressed this sentiment about the need for computers to be present:

> *The computer is not a tool that is part of my class... because it's not a seamless part of my environment... So I think, that's a bit of a sour grapes rationalization, but it's not an important part of my class because it's not there. It used to be, in my former life [at another university], and it [using computers] was easy to do.*

Likewise, Dr. Murphy talked about what it might be like to have computers in his classroom rather than having to go to the computer lab:

> *They can get on-line, right there. We don't have to reserve any room, we can do it right there. That's the way it should be. The tools should be right there in the classroom.*

Consequence, collaboration, and refocusing stages look beyond personal concerns and equipment, and can be grouped at the impact level. Concerns at the consequence stage were expressed in 24.2% of the faculty responses and concerns about refocusing were reflected in 9.1% of the responses. Although no collaboration concerns were expressed, concerns grouped at the impact level represented 33.3% of faculty concerns. Participants in the case study frequently touched on outcomes they would like to see for their

students relative to technology experiences. For example, Dr. Murphy described his concern about relevance:

> *I'm still striving for more relevance for the [COE] students, for them to find something that's close to home, you know, that they want, that they're interested in learning more about... Children would also be doing the same thing. And they would be compiling all the information on--doing this in HyperStudio-- so it would have as an end result a lot of information, a lot of research, a lot of effective research being done, you know, in the classroom where my students are in their school class site and then within the methods class. And it has to remain relevant to them.*

Other factors that influence integration of technology in teacher education were explored in Phase II of the study as well. Drawing from the work of Fullan and Hargreaves (1992, 1996) which described factors that influence faculty development and educational change, case study data were examined relative to their framework categories: (a) teacher's purpose, (b) teacher as person, (c) context of teaching, and (d) culture of teaching (see Figure 6).

Teacher's purpose. Each of the eight participants had a clear sense of purpose, things valued in teaching. Four themes emerged within the category of teacher's purpose from semistructured interview data and informal interviews: (a) conveying knowledge based on empirical research, (b) ideological concerns such as the complexity of teaching and learning, and the development of "reflective" teachers; (c) program continuity leading to a faculty focus on overall teacher development; and (d) affective concerns such as appreciation of a content area. In this study, the influence of teacher's purpose on the integration of technology into courses was often related to how technology was viewed (i.e., add-on, communication medium, resource, or teaching/learning tool)

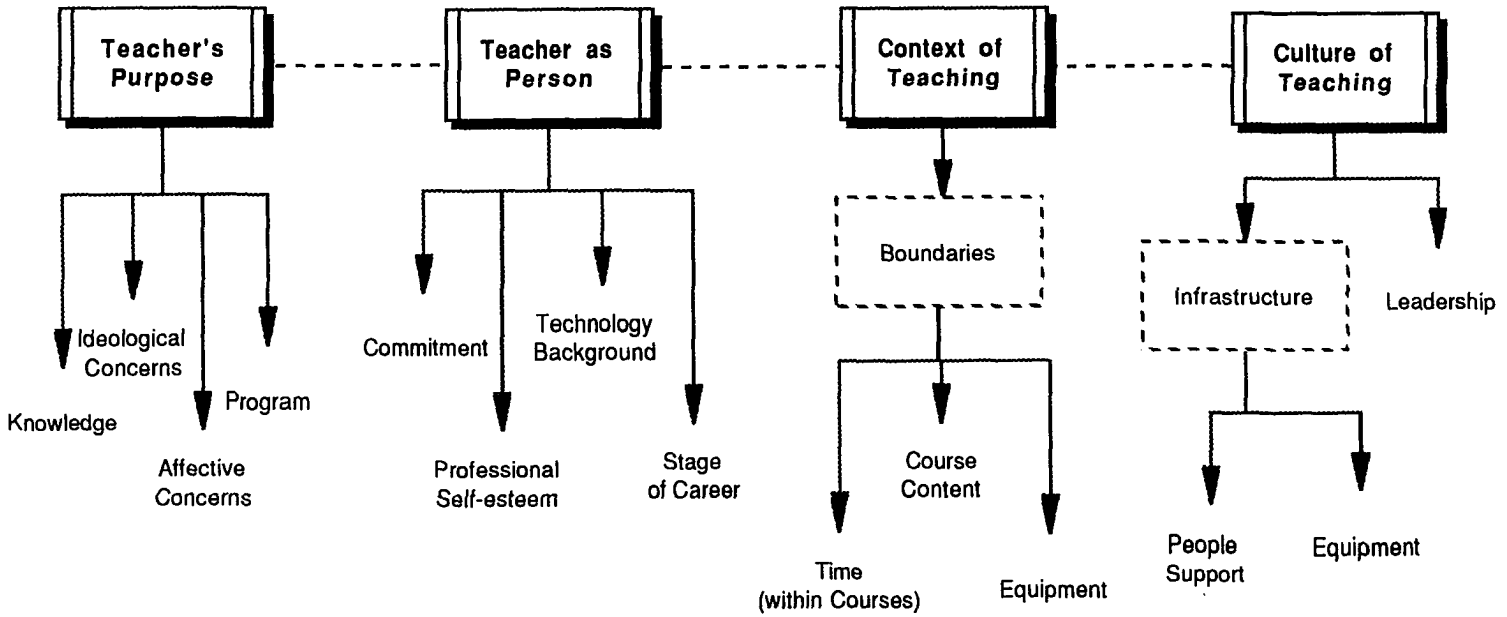

Figure 6. Factors Influencing Use of Technology in Teaching Within the Categories of Teacher's Purpose, Teacher as Person, Context of Teaching, and Culture of Teaching (Fullan & Hargreaves, 1996).

relative to things that teachers wanted to accomplish in their teaching. For example, participants most concerned with conveying knowledge used technology primarily as a resource or as a communication medium. Dr. Lund, stated: "I just want to impart knowledge to students. That's what I think, knowledge and skills to students."

Teacher as person. Included in teacher as person are characteristics such as life experiences, stage of career, sex, and age which can "affect people's interest in and reaction to innovation and their motivation to seek improvement." (Fullan & Hargreaves, 1996, p. 27). Life experiences related to technology and stage of career were examined in this study to explore their effect on the integration of technology in teacher education courses.

With the exception of two participants with long histories of computer use, the backgrounds of the participants did not prepare them for using technology in teacher education. Traditionally, education beyond the doctoral degree is up to the individual, and during undergraduate or graduate work, most college faculty were not trained to use technology, nor did they see it modeled (Willis & Mehlinger, 1996). Pressure to integrate technology in preservice education programs has created a situation in which many faculty members need training and support in the use of new methods and new media (Carr, Novak, & Berger, 1992). Six of the eight case study participants admitted in the initial interviews or informal interviews that they needed help in learning new programs or in determining meaningful ways to integrate technology into their courses. This

help was provided during the Spring, 1997 semester by knowledgeable individuals including the researcher and two other graduate students. One-on-one assistance was made available for participants to work on learning software programs, as well as faculty workshops on topics such as PowerPoint (1994), the World Wide Web, and an introduction to SPSS (1995) for statistical analysis. Clearly, data support the need for ongoing faculty development and support.

Stage of career influenced integration of technology in teaching in ways unique to each individual. Assistant and associate faculty expressed strong awareness of time constraints related to competing factors such as meeting requirements for promotion and tenure. Two of the case study participants, both doctoral students, tended to focus on knowledge outcomes directly related to their courses. This was possibly indicative of the "emerging professor" career stage in which they found themselves. Faculty at the full professor stage of career seemed to weigh the value of including technology rather than being concerned with their expertise. It can be speculated that full professors would have less fear of failure regarding technology use relative to its impact on their career progress.

In this study, commitment was a key factor influencing use of technology in teaching at the "teacher as person" level. Participants most aggressively attempting to integrate technology were not necessarily those who had the expertise, but rather those who had a commitment to using it. For example, the two participants who planned collaboratively for the Spring, 1997 semester

began with the goal of integrating technology throughout the courses in meaningful ways. Neither of them had experience with using computer-based technologies in their teaching but were willing to take the risk of learning with their students. This commitment occurred partly because the participants knew the needed assistance was going to be provided. A positive relationship between teacher commitment to an innovation and project outcomes was found in The Rand Change Agent Study (Berman & McLaughlin, 1977). Similarly, in Roger's (1995) Innovation-Decision Process, implementation follows the choice to adopt an innovation. Data from this study indicate that the availability of support influenced faculty commitment to using technology in teaching. As one faculty member noted:

> *I'm not sure I would have done... what little I did. I didn't do much, but I'm not sure I would have done that had it not been for your presence and your encouragement.*

In addition to commitment, several of the participants exhibited a sense of professional self-esteem that allowed them to implement use of technology in their teaching at the same time they were learning software programs and strategies for teaching with technology. Participants such as Dr. Willows saw themselves modeling the role of teacher as both facilitator and learner:

> *I'm learning along with them the technology. And they know that. I mean I've been very clear that this is something that I'm modeling--the import of learning--and that if I can take the risk in teaching in a university course and learning along with students, then they certainly can when they're working with eight-year-olds or ten-year-olds.*

In sharing with their students that they were in the process of learning about

technology and how to use it in teaching, participants were exemplifying the recommendation from NCATE (1997): "Perhaps the best way the faculty can inspire teachers-in-training to use technology is to cast themselves as learners and to experiment fearlessly in the applications of technology" (p. 10).

Context of teaching. In this study, context of teaching addressed boundaries (Fullan & Hargreaves, 1996) such as course content and time issues. Course content was a boundary in the sense that some participants had difficulty seeing how technology could enhance or extend topics rather than being an added topic, pointing to the importance of support in planning. Time created boundaries in two ways. First, from the standpoint of the instructor, learning new software programs and new ways of teaching with technology required personal time commitments. Dr. Murphy talked about those time constraints:

> *I feel really kind of constrained right now, with my ability to use what I know. My time here is totally not my own, unless I want to come back here at 8 o'clock and work until midnight or something, which I'm not willing to do. You know, I don't have enough time here to do, to play, mess around with stuff.*

Second, using technology in classes, particularly where hands-on sessions were involved, sometimes took a large portion of total class time. This concern was expressed by Dr. Becker: "So, time is a critical issue, and I've never had enough in a class for any subject I've ever taught."

Based on case study data, instructor knowledge and experience with using computer-based technology did not ensure that it would be integrated into

courses. Participants seemed to weigh the time issues and decide if benefits to the students and to themselves made technology use worthwhile.

Culture of teaching. The culture of teaching in the COE promoted use of technology through investments in equipment including upgraded faculty computers and portable multimedia teaching stations. As Green (1996) pointed out, investment in the infrastructure of resources and services is a critical element in fostering use of technology in colleges. During the Spring 1997 semester, the necessary people support was in place for COE faculty development. This support was provided primarily by the researcher and two other graduate assistants working toward degrees in educational computing and technology.

A growing influence of the COE culture of teaching on technology use was noted by some participants. For example, computer-generated presentation materials were recognized as having value. Faculty use of presentation software gradually increased throughout the Spring 1997 semester as evidenced by increased demand for the multimedia carts and attendance at hands-on presentation software workshops. In addition, presentation software was the workshop topic most frequently selected by survey respondents.

In the COE, the decision to adopt or to reject use of technology in teaching was made by each individual, but peer interaction, people support, and openness to including technology were influencing factors. Two of the participants who collaboratively planned their courses for the Spring, 1997

semester noted the influence of working with another faculty member on commitment to using technology in teaching. Dr. Willows acknowledged the impact of working with a peer:

> *We set this as a goal at the beginning [modeling use of technology in teaching], and I work really well in a team kind of situation. And I felt, not only the personal obligation to meet the goal that I had, but the obligation to my teammate. He was committed as well and we really sort of encouraged one another. So the teaming with him was key.*

Another factor at work in the COE culture of teaching was the effect of opinion leadership, a characteristic described by Rogers (1995) as the ability to influence the attitude of others in regard to implementing an innovation. Opinion leaders usually are not the innovators or early adopters, but are in the early majority category of adopters. Individuals within the COE who had opinion leadership emphasized technology as something faculty should be using. For example, the candidate for Chair of the ICS Department gave a presentation at a department meeting in April, 1997, to share her vision and ideas for the department. She began the PowerPoint (1994) slideshow by saying, "I thought it was important for me to model technology."

In addition to the influence of opinion leadership, other factors influencing technology use included peer pressure and a general acceptance of technology. Peer pressure was evident in casual exchanges among faculty members, most often when a faculty member would show a colleague something a student had created on computer, describe a successful use of technology in a class, or informally demonstrate a new software program.

Faculty were beginning to think about how they could include technology in their courses if they were not doing so already.

Summary of Factors Influencing Integration of Technology in Teacher Education

Data suggested that faculty believed technology in teacher education is important, but time to learn software, time to explore with technology use in classes, and equipment access remained inhibiting factors constraining use of technology in teaching. Using the Stages of Concern model (Hall & Hord, 1987) faculty concerns about the integration of technology in teacher education were coded. When concerns were grouped according to awareness concerns, management concerns, and impact concerns, each of the categories ended up with exactly 33.3% of the concerns. Identifying a third of the concerns at the impact level implied that many faculty members had moved beyond basic awareness and management concerns to higher level concerns focused on student outcomes and new ways of using technology. Data supported the importance of the technology liaison in allowing faculty to move past the typical awareness and management concerns.

In the case study, teacher's purpose, teacher as person, context of teaching, and culture of teaching (Fullan & Hargreaves 1992, 1996) were each examined relative to their influences on the integration of technology in the COE. Based on the data, teacher as person and culture of teaching seemed to have the greatest influence on individual faculty decisions to use technology in

courses. Commitment, a quality under "teacher as person," appeared to be a key factor influencing technology use.

Within the culture of teaching category, an infrastructure of equipment and people support was evident during the Spring 1997 semester. Opinion leadership, peer pressure, and a general acceptance of technology were also factors influencing faculty decisions to use technology in their teaching. Based on the findings it appears critical that COE administration find ways to expand the infrastructure as faculty demand for equipment increases, and the need for assistance from a technology liaison continues. For some faculty in this study, creative ideas for incorporating technology were limited by their own lack of technology expertise, and for other faculty, assistance was needed to see where technology could "fit" with course goals and objectives. Knowing technical and curricular support were available gave confidence to faculty who otherwise might not have attempted to use technology in their teaching. Likewise, faculty who had technology expertise benefited from the interest shown in what they were doing.

Question 3: What Are the Outcomes of a Technology Integration Planning Process?

A technology integration matrix (Handler & Strudler, 1997) was used by the researcher as a tool to facilitate planning of systematic integration of technology throughout the teacher preparation program. This planning matrix (see Appendix M) was introduced at faculty interest group meetings in the

Department of Instructional and Curricular Studies. The goal was to plan with faculty for integration of technology in the teacher education programs, but overall response to the idea of developing a systematic plan was non-committal. During the semester, issues that originated at the university level dominated meetings, and discussions regarding COE concerns were foremost. For example, faculty were asked to streamline programs and reduce credits required for elementary education and secondary education degrees, and reorganization of the COE was in progress. Systematic integration of technology in teacher education was not a priority.

Resistance to the matrix for planning systematic integration of technology throughout the elementary teacher education program could be attributed at least in part to the issue of "academic freedom." Some faculty viewed commitment to a technology integration plan as limiting. Even the NCATE unit guidelines requiring faculty to integrate computers and technology in their teaching and scholarship (NCATE, 1995) were not convincing enough for many faculty members to agree a systematic plan was needed. When asked what kind of argument would convince him to agree to a systematic plan for technology integration, Dr. Tabbot reflected:

> *It's highly unlikely that you're going to convince me that I need to do it. What's much more likely is I need to convince myself that I need to do it. And pretty much, no matter what you say, pretty much, that's not going to do it. Those are your arguments, they're not mine.*

Summary of Planning Process Outcomes

The attempt to systematically integrate technology throughout the teacher education programs was not successful. This was primarily due to competing concerns such as reorganization of the COE, which took priority, and issues such as "academic freedom." As COE faculty acceptance of technology grows and organizational pressure to incorporate it increases, formation of a vision and a systematic plan for integration throughout the teacher education programs will become more approachable. Based on the data, it appears that administrative guidance is needed to initiate formation of a systematic plan.

Implications of Findings

Reasons for Limited Use of Technology in Teaching

Several reasons may account for the limited use of technology in teaching. First, based on survey data, knowledge and skill with technology does not necessarily transfer to use of technology in teaching. These findings indicated that ongoing encouragement and implementation support for use of technology in teaching is needed. Second, COE technology needs to be ubiquitous. Several case study participants noted in semistructured interviews and informal interviews that technology should be readily available in classrooms for ease of use in teaching. At present, equipment must be wheeled into classrooms on carts or arranged by reserving a computer lab for teaching. Third, technology expectations for students in the teacher preparation programs need to be addressed and a vision that includes the role of technology should be formulated to ensure that students have the needed experiences. Since

college of education faculty serve as role models to preservice teachers in their attitudes toward and use of educational technology (Huang, 1994), formation of a vision that includes technology is essential. The researcher met with resistance to initiating formation of a systematic plan, but without such a plan integration of technology in courses may be haphazard.

Technology Adoption

Despite limited use of technology in teaching and lack of a plan for systematic integration of technology into courses, survey data can be used to argue that technology is being adopted gradually in the COE. Rogers (1995) conceptualized five adopter categories based on what point in a continuum individuals adopt a new innovation. He described the adoption rate using a normal frequency distribution: (a) innovators (2.5%), (b) early adopters (13.5%), (c) early majority (34.0%), (d) late majority (34.0%), and (e) laggards (16.0%).

COE faculty who reported use of technologies in teaching "once during the semester," "monthly," or "weekly" were grouped together as adopters. Although it can be disputed whether or not faculty who use technology in teaching once during the semester should be considered adopters, they differed from those who indicated no use of technology in their teaching. Each of the technologies was used by a percentage of COE faculty at least once during the semester in teaching classes: (a) educational software (47.1%), (b) Internet/World Wide Web (39.1%), (c)) presentation software (35.6%), (d) e-mail (32.2%), (e) word processing (28.7%), (f) multimedia (28.7%),

(g) statistical computing (18.4%), and (h) computer spreadsheets (14.9%). This combined data suggested that COE faculty who are the latest adopters would be in the early majority category. (see Figure 7).

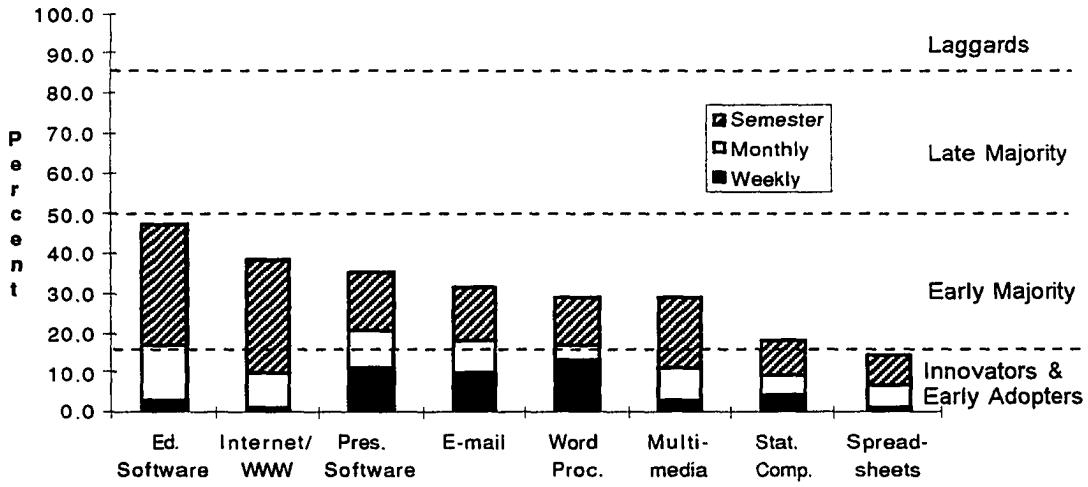

Figure 7. Percent of COE Faculty Using Technology in Teaching at Least Once During the Spring 1997 Semester

Infrastructure

According to Green (1996) infrastructure that includes multimedia computers, technical assistance, and user support fosters innovation. One of the goals of those who advocate the use of technology in education is that the technology be ubiquitous. Faculty frequently talked about the need for equipment in their classrooms and expressed their concerns about student access to technology.

Participants did not feel that portable multimedia carts were sufficient to promote use of technology in teaching. Although they were adequate for occasional use, participants felt that true ease of use required technology-rich classrooms. Teacher education programs that are considered exemplary in their use of technology have planned for both the technology and the people support (Mergendoller, Johnston, Rockman, & Willis, 1994).

People Support

On the basis of findings in this study, support and assistance appear to be essential. Success in working with the mainstream faculty can be fostered by offering applications of technology that have compelling value (Geoghegan, 1994), a strategy used by the researcher when applicable. Faculty who were learning how to use technology themselves at the same time they were integrating it into their courses were dependent on support for hardware, software, and curricular assistance. This type of people support requires individuals with technical expertise and strong interpersonal skills (Strudler, 1987). Knowledge of software and of strategies for teaching with technology are important also.

In addition, support occurred in the form of peer interactions such as a faculty member showing interest in what another was doing. This interest provided reinforcement for the person using technology and sharing the experience sometimes prompted another faculty member to try something new. In effect, a peer can provide a vicarious trial of an innovation for others which in turn influences adoption or rejection (Rogers, 1995). Case study participants

noted that someone showing interest in what they were doing and how they were using technology was a form of support to them. Two of the participants had extensive knowledge of educational technology and did not need technical support or suggestions for incorporating technology, yet both commented on the positive effect of sharing their experiences during the semester. People support is an essential element for the integration of technology in teacher education, not only as a catalyst for change, but also as a means for sustaining change. This study adds to the body of literature that confirms the importance of people support in the adoption of technology for use in teaching.

Limitations of the Study

Phase I

One of the major limitations of survey research is that it reflects self-reported data and respondents may be motivated to give desirable answers (McMillan & Schumacher, 1997). A second limitation in this study was the low number of surveys returned from affiliate faculty, with only 37 out of 80 affiliate faculty (46.3%) returning it. Many of them worked full-time at other jobs and taught one or two classes that semester for the college. Since efforts to include affiliate faculty in meetings and faculty development workshops were sporadic, it can be speculated that they did not view themselves as active participants in the culture of the college.

Phase II

The researcher's role as participant-observer was both an asset and a

limitation of Phase II. As one case study participant stated, "I didn't do much, but I'm not sure I would have done that had it not been for your presence and your encouragement." While knowledge of the setting and established credibility with the participants provided a high level of trust, a researcher bias existed with respect to integrating technology into teacher education. Some of the participants acknowledged the effect of this study in prompting them to "do more with technology." One participant passed the researcher in the hallway one day and asked, "Is there anything else you want me to do with technology in my class?" This implied that the initiative to expand technology use was external rather than determined by the participant.

Recommendations for Colleges of Education

Based on the findings of this study, the following recommendations are offered for colleges of education seeking to progress in their efforts to integrate technology into teacher education programs:

1. Plan systematically to ensure integration of technology throughout teacher education programs. A combination of administrative leadership and faculty input would facilitate development of the plan. Faculty commitment to use of technology in teaching is important but without a systematic plan, integration of technology in teacher education programs can be haphazard.
2. Provide a technical liaison to work with volunteer faculty who are willing to explore uses of technology in teaching. In addition to

technical skills, this liaison needs good people skills, knowledge of curriculum and software, and the ability to model technology use in teaching. Successes of volunteer faculty should be documented and shared to encourage reluctant faculty.

3. Mandate change at the administrative level, using NCATE unit standards as the basis. Expectations that faculty use technology in their teaching should be conveyed and modeled by the administration and evidence of use should be required and rewarded in yearly evaluations.
4. Work with affiliate faculty, assessing needs, disseminating information about technology resources, and providing professional development opportunities. Since many colleges of education depend on affiliate faculty to deliver some of their courses, ongoing support for their technology use in teaching should be established.

Recommendations for Future Research

1. This study explored "culture of teaching" as one of several factors influencing integration of technology in teaching in a COE. Since research on school culture at the university level is limited, it is recommended that a study be conducted to examine the effect of school culture on the integration of technology in several colleges of education.
2. The present study did not address student perceptions of the use of technology in their required courses. Assuming technology resources

and integration throughout the teacher preparation program, what are the effects on students' attitudes, knowledge of teaching with technology, and use of technology in their teaching once they have completed their programs?

3. Further study is recommended to explore the relationship between a faculty member's epistemology and the manner in which the person uses technology in teaching. To what degree does one influence the other?
4. In this study, commitment to technology use in teaching was found to be a stronger factor in the integration of technology into courses than technological expertise. It is recommended that factors that lead to commitment be explored.

APPENDIX A

ISTE's Foundation Technology Standards for All Teachers

1. Demonstrate ability to operate a computer system in order to successfully utilize software.
2. Evaluate and use computers and related technologies to support the instructional process.
3. Apply current instructional principles, research, and appropriate assessment practices to the use of computers and related technologies.
4. Explore, evaluate, and use computer/technology-based materials, including applications, educational software, and associated documentation.
5 Demonstrate knowledge of uses of computers for problem solving, data collection, information management, communications, presentations, and decision making.
6. Design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations.
7. Evaluate, select and integrate computer/technology-based instruction in the curriculum of one's subject area(s) and/or grade levels.
8. Demonstrate knowledge of uses of multimedia, hypermedia, and telecommunications to support instruction.
9. Demonstrate skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet, and print/graphic utilities.
10. Demonstrate knowledge of equity, ethical, legal, and human issues of computing and technology use as they relate to society and model appropriate behaviors.
11. Identify resources for staying current in applications of computing and related technologies in education.
12. Use computer-based technologies to access information to enhance personal and professional productivity.
13. Apply computers and related technologies to facilitate emerging roles of the learner and the educator.

Note. From "ISTE's Technology Foundation Standards for All Teachers: Time for a Second Look?," by J. Friske, D. Knezek, H. Taylor, L. Thomas, and J. Wiebe,1995-1996, Journal of Computing in Teacher Education, 12, p. 9

DATES	1996		1997												1998			
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Obtain Human Subjects approval																		
Defend proposal																		
Code surveys, distribute survey, cover letter																		
Send reminder cards																		
Analyze survey data																		
Work on technology matrix																		
Write Phase I results																		
Conduct interviews																		
Do observations																		
Transcribe interviews																		
Work on coding																		
Examine documents																		
Search for themes																		
Writing																		
Finish analysis of case study data																		
Finish writing and editing																		
Dissertation defense																		

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APPENDIX C

DATE: November 14, 1996

TO: Christy J. Falba (ICS)
M/S 3005

FROM: Dr. William E. Schulze, Director
Office of Sponsored Programs (X1357)

RE: Status of Human Subject Protocol Entitled:
"Integrating Technology into Teacher Education:
Planning, Implementing, and Assessing Change"

OSP #311s1196-131e

The protocol for the project referenced above has been reviewed by the Office of Sponsored Programs and it has been determined that it meets the criteria for exemption from full review by the UNLV human subjects Institutional Review Board. This protocol is approved for a period of one year from the date of this notification and work on the project may proceed.

Should the use of human subjects described in this protocol continue beyond a year from the date of this notification, it will be necessary to request an extension.

cc: N. Strudler (ICS-3005)
OSP File

Office of Sponsored Programs
4505 Maryland Parkway • Box 451037 • Las Vegas, Nevada 89154-1037
(702) 895-1357 • FAX (702) 895-4242

APPENDIX D

Technology Survey

Please complete the following survey. Upon completion, return to Christy Falba, ICS Dept., Mail Code 3005.

1. How **knowledgeable** would you rate yourself with respect to the following technologies?
(Please circle one response for each row)

	No Knowledge	Very Little Knowledge	Some Knowledge	Extensive Knowledge
Word processing	1	2	3	4
Computer spreadsheets	1	2	3	4
Statistical computing	1	2	3	4
E-mail	1	2	3	4
Educational software	1	2	3	4
Presentation software	1	2	3	4
Internet/World Wide Web	1	2	3	4
Multimedia (laserdisc, CD-ROM, etc.)	1	2	3	4
Distance education	1	2	3	4

2. How would you rate your **skill level** with using the following technologies?
(Please circle one response for each row)

	None	Little	Moderate	High
Word processing	1	2	3	4
Computer spreadsheets	1	2	3	4
Statistical computing	1	2	3	4
E-mail	1	2	3	4
Educational software	1	2	3	4
Presentation software	1	2	3	4
Internet/World Wide Web	1	2	3	4
Multimedia (laserdisc, CD-ROM, etc.)	1	2	3	4

3. How frequently do you use the following technologies in **preparing** for class?
(Please circle one response for each row)

	Not at all	Once during Semester	Monthly	Weekly
Word processing	1	2	3	4
Computer spreadsheets	1	2	3	4
Statistical computing	1	2	3	4
E-mail	1	2	3	4
Educational software	1	2	3	4
Presentation software	1	2	3	4
Internet/World Wide Web	1	2	3	4
Multimedia (laserdisc, CD-ROM, etc.)	1	2	3	4

4. How frequently do you demonstrate the use of the following technologies while **teaching** class?
(Please circle one response for each row)

	Not at all	Once during Semester	Monthly	Weekly
Word processing	1	2	3	4
Computer spreadsheets	1	2	3	4
Statistical computing	1	2	3	4
E-mail	1	2	3	4
Educational software	1	2	3	4
Presentation software	1	2	3	4
Internet/World Wide Web	1	2	3	4
Multimedia (laserdisc, CD-ROM, etc.)	1	2	3	4

5. Which of the following do you use at home?

(Check all that apply)

____ Computer
____ Modem
____ *Netscape* or other World Wide Web browser
____ None of the above

6a. What factors restrict or constrain your use of technology in teaching?
(Please circle all numbers that apply)

The College of Education does not have the software I need	1
I find technology frustrating to use	2
Time to learn new programs is a problem for me	3
I am not aware of the technology resources available	4
Technology will not enhance my subject area	5
Changes in hardware and software are too rapid to keep current	6
Obtaining equipment for use during instruction is a problem	7
Keyboarding skills are a problem for me	8
Something else *(please specify)*_____	9
No factors restrict my use of technology in teaching	10

(If you circled 10, skip to Question 7a)

6b. Of the factors you selected above, which do you consider the **primary** factor restricting or constraining your use of technology in teaching? *(Please circle one choice)*

1 2 3 4 5 6 7 8 9

7a. How would you rate the importance of integrating technology in teacher education?

Not at all Important	Not too Important	Somewhat Important	Very Important
1	2	3	4

7b. Please expand on reasons for your selection in 7a.

_____

_____

_____

_____

8.Which category best indicates the length of time you have been using a computer for personal/academic use?

____ Less than one year
____ 1-3 years
____ 4-6 years
____ 7-9 years
____ Over 10 years
____ I don't use a computer

9.Which of the following workshop topics would be helpful to you?
(Please circle all numbers that apply)

Statistical computing (SPSS)	1
Advanced E-mail	2
Educational software	3
Presentation software (PowerPoint, Persuasion)	4
Internet/World Wide Web	5
Multimedia (laserdisc, CD-ROM, etc.)	6
Multimedia authoring software (HyperStudio, HyperCard, etc.)	7
Creating a World Wide Web page	8
Distance education	9
Other topics? _____	10

10. Which of the following conditions works best for you when learning new things about technology?
(Please rank order, with 1 being your first choice)

____ Figuring things out by yourself
____ One-on-one assistance
____ Workshops
____ Using manuals or other published materials
____ Other? *(Please specify)* _____

11. What type of assistance do you need in helping you integrate technology into your teaching?

_____

_____

_____

_____

12. When you think about the integration of technology into teacher education, what are your concerns?
(Please use the inside back cover if you need additional space)

_____

_____

_____

_____

_____

13. Which category best indicates your years of teaching experience at the university level?
____ 1-5 years
____ 6-10 years
____ 11-15 years
____ 16-20 years
____ Over 20 years

14. What is your department?
____ Educational Leadership
____ Educational Psychology
____ Instructional and Curricular Studies
____ Special Education

15. Please indicate your current position:
____ Instructor/Lecturer
____ Assistant Professor
____ Associate Professor
____ Professor
____ Affiliate Faculty (P-99 category)
____ Other _____

16. What is your age?
____ 21-30 years
____ 31-40 years
____ 41-50 years
____ 51-60 years
____ Over 60 years

17. Please indicate your sex.
____ Male
____ Female

APPENDIX E

January 13, 1997

Dear Faculty Member:

Integration of technology in teacher education is the focus of my dissertation. My interest in increasing faculty use of technology was prompted by Standards, Procedures, and Policies for the Accreditation of Professional Education Units published in 1995 by the National Council for Accreditation of Teacher Education (NCATE). Within the faculty qualifications is the unit standard indicator which states, "Higher education faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship"
(p. 24).

Please take a few moments to help me pursue this topic by completing the attached questionnaire. I know you will appreciate how important it is for me to obtain a high response rate. Time required to complete the survey averaged about 13 minutes when it was tested for item clarity. Upon completing the survey, fold, staple, and return it through campus mail to the Department of Instructional and Curricular Studies, 3005.

All responses will be treated confidentially and individual names will not be linked to survey results. Once I have received your completed survey, I will use the code number to check your name off the faculty list, and then remove the code number on the survey form.

If you have any questions or would like a summary of the survey results, please contact me at 895-1432 or cfalba@nevada.edu. Thank you very much for your participation in my data collection effort.

Sincerely,

Christy J. Falba
Doctoral Candidate

APPENDIX F

January 27, 1997

Dear Faculty,

This is a reminder to take a few minutes to complete the **College of Education Technology Survey**. I know your schedule is crowded and time is precious, but a good return on the survey is essential to Phase I of my dissertation. Survey data will allow me to describe faculty use of technology, and will help in future planning. Anonymity is assured; survey covers and codes are destroyed as soon as I receive them.

If you have misplaced your copy of the survey, please contact me at 895-1432 or by e-mail to cfalba@nevada.edu. My reminder list was updated Friday, January 24th.

Sincerely,

Christy J. Falba
Doctoral Candidate

APPENDIX G

Survey Item 12: Stages of Concern about the Innovation

Impact	6	REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form the innovation.
	5	COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.
	4	CONSEQUENCE: Attention focuses on impact of the innovation on student in his/her immediate sphere of influence. The focus is on relevance of innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.
Task	3	MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost. (Funding, resources, time, access)
Self	2	PERSONAL: Individual is uncertain about the demands of the innovation, his/her inadequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected. (Keeping up)
	1	INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.
Unrelated	0	AWARENESS: Little concern about or involvement with the innovation is indicated. (Blank responses)

Note. From Change in Schools: Facilitating the Process (p. 60), by G.E. Hall and S.M. Hord, 1987, Albany, NY: State University of New York Press.

APPENDIX H

Required Undergraduate Education Courses
in Elementary Education, Secondary Education, and Special Education

Elementary Education Requirements

ICE 201	Introduction to Elementary School Teaching
ICE 334	Survey of Computer Uses in Education
ICE 450	Strategies for Effective Elementary Classroom Teaching
ICE 452	Teaching Elementary School Mathematics
ICG 315	Literature Selections for Children
ICE 453	Teaching Elementary School Language Arts
ICE 455	Teaching Elementary School Science
ICE 458	Teaching Elementary School Social Studies
ICE 459	Classroom Management in the Elementary School
ICG 455	Teaching Elementary School Reading
ICG 457	Diagnosis and Correction of Reading Difficulties

General Secondary Education Course Requirements

ICS 201	Perspectives in Secondary Teaching
ICS 308	General Methods of Secondary Teaching
ICS 330	Classroom Management in the Secondary School
ICS 334	Survey of Computer Uses
ICS 4XX	Subject Matter Methods Courses

Special Education Generalist Requirements

ESP 200	Introduction to Students with Disabilities
ESP 420	Education of Students with Mental Retardation
ESP 431	Education of Students with Emotional Disabilities
ESP 454	Education of Students with Learning Disabilities
ESP 456	Practicum in a Resource Room
ESP 463	Oral and Written Language Instruction for Students with Disabilities
ESP 468	Collaborative Consultation in Special Education
ESP 477	Behavior Management Techniques for Students with Disabilities
ESP 478	Strategies for Students with Disabilities
ESP 480	Student Teaching in Special Education I
ESP 483	Parent-Teacher Interaction in Special Education
ESP 486	Diagnostic and Prescriptive Strategies for Students with Disabilities
ESP 487	Group Teaching Methods for Students with Disabilities
ESP 492	Career Education for Students with Disabilities
ESP 494	Student Teaching Curriculum Seminar
ICG 455	Teaching Elementary School Reading
ICG 457	Diagnosis and Correction of Reading Difficulties
ESP 472	Math Methods for Students with Disabilities

APPENDIX I
CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Project Title: Integrating Technology into Teacher Education: Planning, Implementing, and Assessing Change

Researcher: Christy J. Falba
Doctoral Student
University of Nevada Las Vegas
Department of Instructional & Curricular Studies

Purpose:
You are being asked to participate in a research study which will describe the current levels of technology use by College of Education faculty, document the formation of a systematic plan for integrating technology throughout the teacher preparation program, and assess the initial implementation of the technology integration plan in methods classes.

Procedure:
This study will employ a case study design with the researcher in the role of participant observer. Data will be collected through questionnaires, formal and informal interviews, examination of pertinent documents, and observation.

Benefits:
This research project will add to the body of knowledge on the educational change process in general, and innovation implementation in particular. Practical significance of the study will include identification of successful strategies for developing a systematic plan for technology integration, and evaluation of the initial implementation of the plan. Research results will benefit others in planning for effective technology integration in teacher education programs.

Conditions:
Information collected in this study is confidential and your real name will not be used. Length of involvement in the study is ten months. No compensation will be given for participation.

Your participation in the current study is entirely voluntary and you are free to withdraw your consent at any time. If you have any questions during your association with the research study, before or after its completion, please feel free to ask for further information from the project researcher, Christy J. Falba, at 895-1432 or cfalba@nevada.edu.

For questions about the rights of research subjects, contact the Office of Sponsored Programs, 895-1357.

Information gathered during this study may be used to inform other professionals through conferences, journal articles, or books.

You will be given a signed copy of this agreement to keep for you personal files.

YOUR SIGNATURE BELOW WILL INDICATE THAT YOU HAVE DECIDED TO VOLUNTEER AS A RESEARCH PARTICIPANT AND THAT YOU HAVE READ THE INFORMATION PROVIDED ABOVE.

_____ _____
Signature of Participant Date

_____ _____
Signature of Researcher Date

APPENDIX J
Semistructured Initial Interview

This interview is for me to collect information relevant to my dissertation on the integration of technology in our teacher education program. It is not an evaluation of you, but a means of soliciting your views and perceptions.

1. The first few questions will give me some background on you as a professional. What types of teaching experience have you had other than at the university level? (Probe for grade levels, subject areas, length of time.)

2. *What courses do you teach for the College of Education* (COE)?

3. What kinds of things do you want to achieve through your teaching? (What do you value?)

4. Tell me about how you learned to teach adults.

5. What kinds of professional development are most helpful to you?

6. I'm interested in learning more about the culture of the COE.
   School culture is defined as expressed norms, beliefs, and ways of doing things.
   a. Can you give me examples of norms in the COE?
   b. What kinds of beliefs are expressed in the COE?
   c. How did you learn about the norms and beliefs of the faculty in the COE?

7. Now I'd like to talk about educational change.
   a. In your opinion, what makes change happen in the way people do things?
   b. What is your perception of the department's openness to change?
   c. What about your own openness to change? Can you give me an example?

8. In this part of the interview, I would like to focus on technology.
   a. Describe your personal history of computer use.
   b. (If not expressed in previous answer) What is one of the most recent things you have learned about technology?
   c. What contact have you had with others in working with computers/technology?
   d. Are there some technology skills you feel you need to develop in the near future? Explain.

8. Do you think modeling technology use in the curriculum is important in teacher education? Explain...

9. Let's discuss student use of technology.
   a. Are you aware of the content of the educational technology courses (ICE 334 and ICS 334)?
   b. What evidence have you seen that students make use of technology skills?

10. If the educational technology survey course were eliminated in the future, would you be willing to be responsible for specific technology requirements within your courses (i.e. evaluation of software, creation of multimedia projects)?

APPENDIX K

Semistructured Exit Interview

This is an end-of-semester interview for me to gather additional information related to technology use this semester.

1. This semester I am aware that you used [technology/ies] in [prefix and course number].

   Did you consider the use of _____ successful? (Elaborate).

2 What were the student outcomes associated with using the technology?

3. What factors facilitated your use of technology in teaching this semester?

4. What factors inhibited your use of technology in teaching this semester?

5. What plans have you made for next semester regarding technology use in your courses?

6. Culture of teaching is defined informally by Fullan and Hargreaves as "the way we do things and relate to each other around here" (1996, p. 37). In what ways has the COE culture of teaching influenced your use of technology?

7. How important is technology use in teacher education? (and why)

8. What comments would you like to add concerning the use of technology in teacher education?

APPENDIX L

Semistructured Interview with the Dean of the College of Education

This interview for me to collect information relevant to my dissertation on the integration of technology in our teacher education program. It is not an evaluation of you, but a means of soliciting your views and perceptions.

1. First, I'd like to talk about educational change.
   a. In your opinion, what makes change happen in the way people do things?
   b. What is your perception of the departments' openness to change?
   c. What about your own openness to change? Can you give me an example?

2. Michael Fullan and others have written about the critical role of the principal in K-12 school change. How do you see your role as dean in bringing about change at the college level? (Specifically, how does it relate to technology?)

3. I'm interested in learning more about the culture of the COE. School culture is defined as expressed norms, beliefs, and ways of doing things.
   a. Can you give me examples of norms in the COE?
   b. What kinds of beliefs are expressed in the COE?
   c. How do individuals learn about the norms and beliefs of the faculty in the COE?

4. In this part of the interview, I would like to focus on technology.
   a. Describe your use of computers/technology.
   b. (If not expressed in previous answer) What is one of the most recent things you have learned about technology?
   c. What contact have you had with others in working with computers/technology?
   d. Are there some technology skills you feel you need to develop in the near future? Explain.

5. Do you think demonstrating the use of technology in teaching is important in teacher education? Explain...

6. Novak & Berger, Wetzel, and others written about the importance of seeing technology use modeled, particularly in methods classes. Relative to this idea, I have been working on trying to develop an overall plan for systematic integration of technology. (Strudler & Handler's matrix). I am running head-on into the issue of academic freedom. What are your thoughts on that?

7. Is there anything else you would like to add concerning the integration of technology in teacher education?

APPENDIX M

Course Implementation Matrix

A = Skill will be applied. a = Skill may be applied.

	Practicum Course	*Mathematics Methods*	*Language Arts Methods*	*Science Methods*	*Social Studies Methods*	*Student Teaching Field Experience*
1. Demonstrate ability to operate a computer system in order to successfully use software.						
2. Evaluate and use computer and related technologies to support the instructional process.						
3. Apply instructional principles, research, and appropriate assessment practices to the use of computers and related technologies						
4a. Explore computer- and technology-based materials, including applications, educational software, and associated documentation.						
4b. Evaluate and use computer- and technology-based materials, including applications, educational software, and associated documentation.						
5. Demonstrate knowledge of uses of the computer for: a. Problem solving and decision making.						
b. Data collection and information management.						
c. Communication and presentation.						
6. Design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations						
7. Evaluate, select, and integrate computer- and technology-based instruction into the curriculum of one's subject area(s) and grade levels.						
8a. Demonstrate knowledge of the uses of multimedia and hypermedia to support instruction.						
8b. Demonstrate knowledge of the uses of telecommunications to support instruction.						
9. Demonstrate skill using productivity tools for professional and personal use. a. Word processing						
b. Databases						
c. Spreadsheets						
d. Print and graphics utilities						
10. Demonstrate knowledge of equity, ethical, legal, and human issues of computing and technology use as they relate to society. Model appropriate behaviors.						
11. Identify resources for staying current in the application of computing and related technologies in education						
12. Use computer-based technologies to access information and to enhance personal and professional productivity						
13. Apply computers and related technologies to facilitate emerging roles of the learner and the educator.						

An ISTE Copy Me! Page

APPENDIX N

Coding Categories for Survey Item 7b

Importance of Integrating Technology in Teacher Education: Expanded Reasons

1. MODERN WORLD/FUTURE: Technology is part of our everyday existence in many aspects of life. The world is changing rapidly and teachers need to be prepared. Expectations are that students/teachers will know technology.

2. INFORMATION/COMMUNICATION AGE: Access to information, Internet is essential in education. The "global village" needs to be part of the classroom. Students need to make use of communications and be able to discern reliability of information.

3. TEACHING/LEARNING TOOL: Technology is a tool that should be part of the classroom. It facilitates instruction, allows for student presentations.

4. RESEARCH: More evidence is needed to demonstrate effectiveness of technology use in education.

5. MODELING: University faculty should be modeling what teachers are expected to do.

6. SOCIAL/ECONOMIC ISSUES: Equity concerns, opportunities for students to have access to computers.

7. OTHER

8. NO RESPONSE

APPENDIX O

Coding Categories for Survey Item 11

Type of Assistance Needed to Integrate Technology into Teaching

1. EQUIPMENT: Availability, access, updating
2. SOFTWARE: Acquisition of software for faculty/teaching
3. LIST OF RESOURCES
4. PROFESSIONAL DEVELOPMENT/SUPPORT: Techniques for using technology in teaching, workshops, one-on-one assistance, technical expertise
5. TIME
6. COMPENSATION: Money, release time
7. NONE
8. UNSURE
9. OTHER
10. NO RESPONSE

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