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Faculty Adoption of Computer Technology for Instruction in the North Carolina Community College System.

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Faculty Adoption of Computer Technology for Instruction in the North Carolina Community College System

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by

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ABSTRACT

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Computer technology has become an integral part of instruction at the elementary, secondary, and postsecondary levels. Some instructors have enthusiastically adopted technological innovations in their classrooms, often expending their own funds for hardware and software, while others have resisted the trend, citing a myriad of reasons for not including computer technology. Significant research on the adoption of innovations has been undertaken by Everett M. Rogers, who identified individuals on a continuum from Innovator to Laggard. This project used Rogers' research as a basis to classify full-time faculty teaching in degree programs in the North Carolina Community College System into one of five categories developed by Rogers and to compare these faculty members on demographic variables of age, gender, race/ethnicity, teaching experience and highest degree attained. While faculty did not differ in age, gender, or race/ethnicity when classified in Rogers' five categories of innovation adoption, they did differ regarding their years of teaching experience and highest degree attained.

Faculty in the North Carolina Community College were further identified as either users or non-users of computer technology in instruction and were studied using the demographic characteristics of age, gender, race/ethnicity, teaching experience and highest degree attained. No differences were found in any of these five categories between faculty who used computer technology in instruction and those who did not. Faculty members who reported employing technology for instruction often utilized multiple techniques, such as e-mail contact with students, posting assignments and other information on course websites, and using course

management software for recordkeeping functions. Non-users identified a number of reasons for not incorporating technology into instruction, as well as which strategies might be employed to encourage them to adopt computer technology into instruction. Faculty classified as users or non-users of computer technology in instruction identified the presence of technology change agents in their organizations and stated that other faculty members or the president or other members of senior administration filled these roles.

DEDICATION

This dissertation is dedicated, first and foremost, to my family. My husband, Dale, has spent many an evening and weekend left to his own devices while I sat at the computer surrounded by books, articles, and, eventually, survey forms. At times, he had more faith than I did in my ability to complete this journey. His knowledge of computer programming was instrumental in taking raw data and converting it into a usable format for statistical analysis. My dog, Kira, also patiently stayed nearby while I worked, anxiously waiting my need for brain stretch breaks to take a walk.

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CHAPTER 1

INTRODUCTION

The American Classroom in the Early 20th Century

In 1913, Thomas Edison predicted that the motion picture would replace the textbook as the primary learning tool in educational settings (Berg, 2000) within a decade (Voegel, 1994). The classroom of this era relied upon textbooks as its link to outside knowledge for elementary and secondary students, as well as many college students. Edison's prediction began to become a reality about two decades later. This delay was due, in large part, to the popular social notion that "moving pictures" would corrupt the minds of students, and that schools and communities were more adept than the motion picture industry in Hollywood at discerning what students should see and learn in the classroom (Gallagher, 1999).

Technology became an integral part of American classroom instruction in the early 1930s, as a means of improving the educational experiences of students. Revolutionary educator George F. Zook claimed in a report of the American Council on Education, that films would be "the most revolutionary instrument introduced in education since the printing press" (Hoban, as cited in Berg, 2000, p. 349).

Films provided a view of the world not previously available in the classroom. The Division of Visual Instruction, a sub-group of the National Education Association (NEA), supported and promoted the use of film in the classroom, based on Edward Thorndike's concepts of behaviorism and connectionism (DeVaney, 1998), and the works of John Dewey and William Heard Kilpatrick (Saettler, 1967).

Thorndike's connectionist concept was based on the tenets of making connections in the minds of learners and rewarding desirable connections while discouraging undesirable ones. Underlying principles include "(1) self-activity; (2) interest (motivation); (3) preparation and mental set; (4) individualization; and (5) socialization" (Saettler, 1967, p. 51). He contended that the use of instructional media helped students make desirable connections (Saettler).

Dewey's contributions to instructional technology were two-fold, his theories of the psychology of learning and his reflective method. According to Dewey, an interaction occurred between a learner and his/her environment, with the environment providing the learner "with cues and problems" that were interpreted by the nervous system in order to evaluate the cues and solve the problems (Saettler, 1967, p. 53).

Kilpatrick attempted to bring together Thorndike's connectionist theory with the theories of Dewey in his project method. Kilpatrick saw the role of the teacher as helping to initiate, plan, execute, and evaluate an activity, formulate new directions, assist students in critical thinking modes enroute to a solution, and evaluating the entire process "to draw lessons for the future" (Saettler, 1967, p. 57).

Films continued to be valuable media enhancements to the classroom into the 1970s and beyond, with projects reported at Everett Community College in Washington State, and Kingsborough Community College in New York. Films, in concert with international readers, were used at Valencia Community College to help freshman composition students experience multiculturalism (Voegel, 1994).

The Early Proliferation of Technology in the Classroom

The efforts of the Division of Visual Instruction of the National Education Association led to the development of the audiovisual field as a specialty within educational psychology departments at higher education institutions due to the inclusion of audiovisual materials in the pedagogical training of teachers. Private companies and the military were convinced of the value of creating films, filmstrips, and other media-based classroom enhancements. Some manufacturers, such as the Herman DeVry Company and the Bell and Howell Company, found the need to expand the production of machines for the showing of motion pictures, filmstrips, and other media (DeVaney, 1998).

Films and other audiovisual media used in the classroom during the first two decades of the 20th century were primarily theatrical, governmental or industrial in origin. In 1930, the Motion Picture Project, a grant program of the American Council on Education, provided grants to schools and film researchers to develop the first films purely for educational use (Saettler, 1967).

World War II significantly decelerated the progress of developing audiovisual materials. Toward the end of the 1940s, however, the field was flourishing again, in large part due to military involvement in the development of materials. This progression continued into the next two decades (DeVaney & Butler, 1996).

The Nebraska Program of Educational Enrichment Through the Use of Motion Pictures, simply referred to as The Nebraska Study, was published in 1952, and provided evidence to support the benefits of educational media in the classroom. Educational research was presented in the report to validate the belief that the inclusion of films as audiovisual aids enhanced student learning, as evidenced by standardized test results in a variety of subjects (DeVaney & Butler, 1996).

Aitken (1994) traced the use of films and similar audiovisual materials in the higher education classroom to the late 1940s. He attributed their inclusion at that point in history to reductions in the cost of equipment, technical advances, and government sponsorship of programs to provide educational media to classrooms (Aitken).

The overhead projector became a classroom staple after its transition from military uses to the classroom after World War II. Mehlinger (1996) called it, "perfect technology for supporting the kind of instruction that takes place in most classrooms today" (Mehlinger, Technology and Schooling Section, ¶3).

The Introduction of Computer Technology

Computers began to appear in K-12 classrooms during the 1970s. By 1981, approximately 18% of schools had computers, compared to 98% a decade later. With the availability of computers came the proliferation of applications for the classroom, including course management packages and software (Levira, 1997).

A study of computers in the classroom, Apple Classrooms of Tomorrow (ACOT) was launched in 1986. Students participating in this study performed as well as or better than their non-computerized peers on standardized exams, defying the myth that extensive computer use would result in "brain dead" students.

Teachers in the computer-equipped classrooms were found to be capable of accomplishing their job functions with computers. Other types of technology introduced in the 1990s included instructional television programming and videodiscs (Mehlinger, 1996).

Computers were proliferating in higher education classrooms as well. Jewett (2000) noted the increased use of computers across academe during from the late 1960s, with desktop computers becoming common during the 1980s. E-mail began to proliferate during the 1990s, and access to the Internet via the World Wide Web was generally available by the mid-1990s (Jewett).

Voegel (1994) reported a rush by American community colleges to introduce computers into their labs. During 1987-88, academic computing expenditures were reported to represent 43.7% of funding allocated for direct instruction in community colleges, compared to 33% at four-year colleges and universities. Computer use was introduced across curricula, much as "Writing across the Curriculum" became popular after its introduction by James Britton in the mid-1970s (Voegel).

Technological Environments of the Late 20th and Early 21st Centuries

With increasing frequency, community college faculty members are supplementing traditional courses with modes of technology not available even a decade ago. According to Shapiro, Roskos, and Cartwright (1995),

> A "technology-enhanced learning environment" attempts to stimulate classroom activity by demonstrating and using software or tools specific to a particular discipline, by prompting high levels of interaction among students and faculty, and by involving students in simulated activities or data-gathering via the Internet and remote databases. These aims require a reconceptualization of traditional classroom design, not the mere addition of a piece of technology. (p.67)

Batson and Bass (1996) viewed the use of technology to enhance classroom instruction as part of the progression to move education into a more collaborative role, with faculty acting as facilitators rather than presenters. Computers can be instrumental in allowing students to become a more active part of the learning process, by discovering, creating, and sharing knowledge.

Today's classrooms boast a variety of technologically based enhancements that allow students to move beyond the experiences of local classrooms, communities or teachers, into a world of almost unimaginable possibilities. Yet, community college faculty members appear to be on all points ends of a continuum, as some rapidly adopt and frequently use technological enhancements to augment their classes, while others exhibit extreme aversion toward learning and using these techniques.

Statement of the Problem

Technology has been an integral part of classrooms at all educational levels for nearly a century. The types of technology prevalent during the 20th century typically required faculty to select from among pre-developed media. Technologies becoming available during the late 20th century and early 21st century require faculty interaction to develop or customize applications to specific classroom situations. These technologies have also resulted in changes to traditional course syllabi, faculty grading techniques. Their use has enabled more student-focused—as opposed to objectives-focused—instruction to occur.

The purpose of the study was to determine what demographic differences exist between faculty members who adopt and those who appear resistant to infusing technology into their traditional classroom settings. What demographic similarities and differences do they exhibit? Does academic discipline, level of education, or institutional size play a role in adopting or resisting the use of technology? Does institutional size or the presence of a change agent affect the rate of adoption within an institution?

Significance of the Study

The use of new technologies to enhance classroom effectiveness has been steadily growing during the late 20th and early 21st centuries, and seems likely to continue to proliferate due to the increasing availability of technology and the expectations of educational administrators, students, and the greater community. Examining faculty characteristics that identify enthusiasm or reluctance to adopt technology in the classroom could assist professional development specialists and administrators to develop methods of addressing the needs of both groups when planning training activities and institutional policies.

Limitations and Delimitations

This study was conducted in the North Carolina Community College System, which is comprised of 59 independent two-year public institutions that differ in size, mission, and cohort population. The importance of incorporating technology into the classroom instruction may vary from college to college, based upon the availability of dollars to fund technology, administrative and technological support, and community and faculty preferences. The study will be conducted during the spring of 2003, which has been categorized as one of the worst financial times in recent North Carolina history. Colleges have accepted a larger student population resulting from an economic downturn, while receiving fewer dollars to support education (Rives, 2002; Rives & Neff, 2002). As a result, money that may have been earmarked for technology in past years may have been diverted to directly support instruction at some or all institutions.

The survey will be limited to full-time faculty, although some part time faculty also use technological enhancements in their classrooms. Faculty not currently using technology to enhance classroom instruction or those not interested in doing so may choose to decline participation in the study, which may provide a diminished opportunity to characterize faculty who are reluctant to adopt technology to enhance their classrooms.

Definitions of Terms

Change Agent: Individual or group responsible for creating an environment in which a desired alteration in normal operations can be implemented.

Cookies: a small amount of data transferred from a sending computer to a receiving computer, allow the sending computer to recognize subsequent contacts by the receiving computer. Cookies are used extensively in e-commerce, and the sending and receiving of survey data (Microsoft, 2003).

Course Management Software: Computer software packages with features that allow instructors to provide course information and curricula to students, and to track student participation and/or progress via computer.

Diffusion of Innovations: Theory proposed by Everett M. Rogers regarding the adoption of improved or advanced techniques, methods, or machinery by persons within an organization (Rogers, 1995).

Early Adopter: Individual in an organization who is among the first wave of adopters of an innovation as it becomes available within the organization (Rogers, 1995).

Early Majority: Individual in an organization who adopts an innovation ahead of most peers but at a later time than Innovators or Early Adopters (Rogers, 1995).

E-Mail: Electronic communications between two or more individuals by way of an Internet service provider or server.

Hypermedia: A computer-based system providing presentation graphics, video and audio images, and interactive links, to provide a flexible and interactive learning environment.

Innovator: Individual who adopts an innovation through his/her own resources, without waiting for implementation at the organizational level (Rogers, 1995).

Internet: An international connection of computers for the purpose of communications and the sharing of information.

Laggard: Individual who does not adopt an innovation, often due to shortcomings of the organization (Rogers, 1995).

Late Majority: Individual who adopts an innovation late in the adoption cycle and often due to peer pressure or economic necessity (Rogers, 1995).

Presentation Graphics: Applications, such as Microsoft PowerPoint, Harvard Graphics, and Toolbook, that allow instructors to customize still and basic animated information on computer-generated slides.

Technology in the classroom: The use of computers, the Internet, or other computer-related techniques during traditional classroom-based instructional delivery.

Technology Users: Faculty members who have, at some point along Rogers' continuum, adopted the use of computer technology techniques to enhance their traditional classroom methodologies.

Technology Non-Users: Faculty members who have not adopted or had ceased using a form of computer technology to enhance their traditional classroom methodologies at the time the survey was conducted.

World Wide Web: A method of interconnecting large numbers of computers via the use of browsers and capable of incorporating audio and video images, as well as text (Benton, 2001).

Research Questions

1) How do the North Carolina Community College System (NCCCS) faculty members who participated in this study compare with the NCCCS faculty members as a whole with regard to their demographic characteristics?
2) How do the NCCCS faculty participants compare to one another in terms of their adoption of computer technology for instruction, based upon Rogers' schema?
3) How do users and non-users of computer technology in instruction in this study compare with one another as a whole and with regard to each of five demographic characteristics?

4) How do users and non-users of technology in instruction in this study compare with one another based upon their respective teaching fields?
5) How do users and non-users of computer technology in instruction in this study compare with one another regarding their perceptions of the existence of several categories of change agent and institutional support in their respective colleges?
6) How do users and non-users of computer technology for instruction in this study compare with one another based on the sizes of their respective colleges?
7) What specific techniques are employed by users of computer technology in instruction in this study?
8) Why do users of computer technology in instruction in this study say they use technology?
9) Why do non-users of computer technology in instruction in this study say they do not use technology?
10) According to non-users of computer technology in instruction in this study, what methods, services, or policies could their respective colleges employ that would encourage them to begin to use computer technology in instruction?

Organization of the Study

In chapter 1, I have provided an overview of the types of technology prevalent in classrooms throughout the 20th and early 21st centuries, a statement of the problem and significance of the study, and related definitions of terminology. Chapter 2 focuses on a review of relevant literature. The research methodology is described in chapter 3; chapter 4 includes an analysis of data collected through the study. Chapter 5 contains conclusions drawn from the data and some recommendations for future research.

CHAPTER 2

A REVIEW OF RELATED LITERATURE

Introduction

Technology enhancement in the classroom is the educational genre of the 21st century. The Campus Computing Project, which annually surveys 600 2-year and 4-year public and private institutions of higher education from throughout the United States, found that integrating instructional technology into the classroom remains the top priority for all types of higher education institutions in the United States, as it has been for the previous five years, and is expected to remain so for at least the next two to three years (Green, 2001).

Faculty members had used available technologies, such as films, filmstrips, audiotapes, and materials projected with the assistance of overhead projectors and opaque projections, in the classroom for many years. However, the computer technologies that were initially available in the late 20th century required faculty members to become more interactive themselves with the enhancements, in many cases creating materials rather than using materials created by others and mass-produced. The 21st century technological enhancements allowed customization for classes or, in many cases, for individual students. The impact of technology on undergraduate education may be two-fold: the improvement of the educational experience and as a means of cost reduction (Farrington, 1999).

This review of the literature provides an overview of the technologically enhanced classroom, types of technology that may be utilized, and the role of community college faculty in the implementation of technology into their classrooms.

Technology in the Classroom

Technology is a part of everyday life in the 21st century. As a result, according to one author, it should also be prevalent in the 21st century college classroom (Soine, 1998). Classroom technology should also become an integral part of the core mission for the institution (Johnson, 1997), with its primary focus rooted in the paradigm shift from teaching to learning (Jafari, 1999; Reynolds & Werner, 1998). According to Reil, Schwarz, Peterson, and Henricks (2000), programs that foster the use of technology in the classroom increased familiarization with technology and led to empowerment in technology as well as teaching. Bilimoria (1997) cautioned that future generations would be computer literate and would expect technology in the classroom. In order to find ways to avoid becoming "pedestrians on the information superhighway," the author recommended that faculty members cease to view themselves as "the receptacles of knowledge in our societies" and expand their professional competencies as facilitators and technologists.

Technology allows faculty to build a bridge between the classroom and the world (Ward & Clark, 2000) and allows students to experience real-world opportunities in the classroom (Hull, 1999), which are highly valued (Lang, 2000). Technology can be the curriculum, a mechanism for the delivery of course materials, a means of supplementing instruction, or an instructional device (Ginsburg, as cited in Imel, 1998) to enhance learning (Milliron & Miles, 1999). According to Bates (2000), reasons for using technology to enhance the classroom experience included improvement of learning quality, providing students with opportunities to learn technology skills, extending access to post secondary instruction, and expanding the reach of technology into the world outside the classroom.

While the infusion of technology into the traditional classroom delivery can provide what Tait and Mills (1999) termed "...an adventure in the pursuit of knowledge," (p. 152) the curriculum itself must be the driving force, with technology used in an adjunctive capacity (Chizmar & Williams, 2001; Codde, 1996; Duhaney & Zemel, 2000; Hammer & Kellner, 2000; Palloff & Pratt 1999). Smith (1997) reported a tendency of faculty to jump on the technology bandwagon due to the expectations of peers or supervisors or because the technology was available, rather than for the value it would add to the curriculum.

Hammer and Kellner (2000), in examining the effects of technology using the Shoah Project, contended that faculty must get beyond the mechanics of using technology to the point of truly incorporating it into their classrooms. They also expressed a need for faculty to assist students in developing "their own cultural artifacts within the education setting" (New Educational Technology: Challenges and Potential Section ¶ 4) as a means of bringing quality to learning. The use of technology in the classroom should serve to "empower and enlighten" both students and faculty (New Educational Technology: Challenges and Potential Section ¶ 18). The implementation of technology in the classroom can be characterized as the selection of experiences and activities that augment traditional instruction in ways that provide enrichment without overshadowing the intended objectives (Jewett, 2000).

According to Lang (2000), each syllabus designed for use in the technologically enhanced classroom should be structured yet flexible, allowing the course objectives to be accomplished, while allowing the needs of the particular student cohort to be met. Palloff and Pratt (1999) maintained the syllabus should also be user-friendly. Technological enhancements to the traditional classroom also must be user-friendly for both faculty and students (Zhang, 1998).

In a review of technology research, Rogers (2001) discovered that basing a program on a single technological medium does not provide the educational efficacy and student appeal garnered from introducing multiple types of technology into a course. This blending of media facilitates and enables the learning experience, but should also include faculty-student interaction in a traditional classroom setting.

Lang (2000) and Mielke (1999) stated that faculty must be thoroughly grounded in the technologies chosen for use in their classrooms to allow them to provide guidance to students and to allow the technology to effectively blend into the classroom, rather than allow its glitches and misuses to become a distraction or a deterrent to quality classroom instruction. Chizmar and Williams (2001), after surveying over 1,000 college faculty, suggested that information technology professionals direct their efforts toward the creation of instructional templates and the provision of faculty to share their technology successes and failures, as opposed to spending time solving the technology problems of individual faculty (Vannatta &

Beyerbach, 2000). User support for faculty, as a group, was found by Fuller (2000) to be positively correlated with successful use of technology by students. Naquin (2000), in a study of nearly 200 faculty members in Virginia community colleges, found the use of faculty serving as technology mentors to other faculty as a successful technique in motivating reluctant faculty toward the use of technology in the classroom. Similarly, Parr (1999) found peer networking to be significant as related to increasing technology use in the classroom. Faculty confident in using various types of technology were most likely to implement those technologies in their classrooms, and confidence was derived from familiarization (Groves & Zemel, 2000; Hannan, English, & Silver, 1999; Okpala & Okpala, 1997; Parr, 1999; Vannatta & Beyerbach, 2000; Yildirim, 2000).

Technologically sophisticated faculty may lead the way to implementation, but administrative commitment seems essential if technological enhancement is to flourish in the classroom. A flexible, learning-centered environment must be developed and supported throughout the institution in order to maintain student engagement (Johnson, 1997). Administrators must develop a fundamental understanding of the importance and responsibilities of using technology in the classroom, and must ensure that faculty have access to professional development opportunities that will familiarize them with the types of technologies available within the institution and how to effectively utilize those technologies to foster learning. Community colleges must also provide for administrative support (Lang, 2000; Quick & Davies, 1999) and a sufficient level of technology support by skilled technicians to support the classroom (Lang; Mielke, 1999).

Methods of Technological Enhancement

A review of recent literature shows seven primary types of technology being used in college classrooms (Frayer, 1997; Grasha & Yangarber-Hicks, 2000; Green, 2001). Among the more common techniques being used within traditional courses are communication between students and faculty via e-mail, use of the Internet, the creation of course web sites, computer simulations, and presentation handouts (Grasha & Yangarber-Hicks; Green). Course Management Software may be used to create course web sites, but include a variety of other uses in the technologically-enhanced classroom. Hypermedia is a technique that blends a variety of media into an interactive activity that appeals to a wider variety of learning styles than a single type of media. Each of these technologies has been explored in research literature.

The Internet

In 1962, the RAND Corporation began a research project designed to allow military command and control to be transmitted over communication networks. Under the auspices of the Department of Defense, Advanced Research Project Agency (ARPA), a specialized computer network (NET) known as ARPANET was developed in 1965. The intent was to provide scientists a means of sharing data and access to remote computers. In 1969, four universities—Stanford Research Institute, the Universities of California at Los Angeles and Santa Barbara, and the University of Utah—became networked. Two years later, the number of universities and government research centers connected via the ARPANET had grown to 23 institutions and agencies, or hosts (PBS Life on the Internet, n.d.).

The term "Internet" appears to have been used for the first time in 1982. By that point, the network had grown to about 1,000 hosts. The ARPANET did not dissolve totally into the Internet until 1990. In 1991, the University of Minnesota launched Gopher, a more user-friendly way of navigating the Internet, described by one computer programmer as "the first Internet application my mom can use." (PBS Life on the Internet, n.d., 1991-1993 Section, ¶ 2). A computer programmer in Switzerland posted the first code for the World Wide Web (PBS Life on the Internet).

The Internet was totally text-based until 1993, when MOSAIC, the first graphics-based web browser, was introduced. By the late 20th century, the Internet connected over 10,000,000 institutions and agencies in 150 countries in a communications network that has become an integral part of life in many countries around the world (PBS Life on the Internet, n.d.).

The 2001 edition of the *Campus Computing Survey*, a publication of The Campus Computing Project, found nearly half of college courses using Internet resources as parts of their syllabi, nearly a 500% increase from the 1995 survey (Green, 2001). Grasha and Yangarber-Hicks (2000) reported an 83% increase in faculty adopting Internet-based classroom activities. Jafari (1999) held that teaching and learning could be enhanced in any traditional course by implementing an Internet component.

Inclusion of an online component in a traditional classroom was as effective as the traditional classroom as a standalone technique (Dellana, Collins, & West, 2000; Olsen, 2000). Other web-based techniques such as web browsers, web-boards and chatrooms, and software to create web-posted documents and presentations were found to broaden the usability of the Internet even further (Bento & Bento, 2000).

The Internet has been found to be a useful tool in both credit and non-credit courses, at all postsecondary educational levels. Silc (1998) documented successful implementation of the Internet to teach English as a Second Language (ESL) students, while Human and Clark (1999) found it to be useful in teaching a business planning course.

Lundberg (2000) discovered its effectiveness in a counseling course, 56 graduate students reported improved skills in a variety of technology types and the use of the Internet. The students also expressed a preference for Internet-based research over traditional library research.

The Internet was successfully used in medical education programs, such as the incorporation of videoconferencing via the Internet, by Chang and Trelease (2001), who surveyed faculty and students in the School of Nursing at the University of California at Los Angeles. Carter (2000) found that the use of the Internet in a university geography class could be effective if the instructor and students were literate with the technology, and that success was dependent upon such literacy.

Kelly (2001) studied the use of a web-based course materials packet and a paper-based course materials packet in his western civilization courses, enrolling approximately 160 students. The results of the study, which was a part of the Visible Knowledge Project supported by the Carnegie Foundation for the Advancement of Teaching, showed the students using web-based materials to display a higher level of critical thinking skills than their paper-based peers did, with a greater percentage turning in assignments in advance of deadlines.

The effectiveness of the Internet as an instructional tool in the traditional classroom can be enhanced by taking student learning styles into account, according to Sanders and Morrison-Shetlar (2001), in a study of non-major undergraduate biology students. The use of the Internet as a classroom tool is popular with students in all realms of education (Hiles, 1999; Sanders & Morrison-Shetlar). Harvell (2000) surveyed students enrolled in web-enhanced undergraduate economics courses. Students found the Internet provided almost limitless resources and information, and was a convenient time-saver. The web also provided interactive examples to augment the classroom experience available on the student's schedule.

The Internet was found by students to be disadvantageous to instruction by providing a distraction to the classroom, permitting postponement in the completion of class assignments, and minimizing student/faculty interaction. Another drawback was the questionable reliability and validity of information available on the Web (Harvell, 2000).

The use of the Internet is not a miracle technique that can improve an ineffective course. But, it may be able to improve a course that is already effective (Olsen, 2000), so long as faculty are versed in the technique, and its use meshes with the stated course objectives. Both faculty and students must understand how the technology interfaces with the course objectives (Codde, 1996).

Electronic Mail

Electronic mail, or so called e-mail, became a reality due to a program designed in 1981 to transmit messages over networks (Quinton, 1998). The Campus Computing Project reported a 300% increase in the number of professors using e-mail to communicate with students from 1995 to 2001 (Green, 2000). The 2001 edition of the *Campus Computing Survey* found over 64% of all college courses the using e-mail as a means of communications between students and faculty. According to the Grasha and Yangarber-Hicks (2000) data, 85% used regular e-mail contacts and discussions among students in their classes.

E-mail can be an important mode of communication between faculty and their students (Zhang, 1998). It can allow faculty members to individualize their courses for students, provide a means of regular contact between faculty and students (Lang, 2000), and allow for immediate feedback and enhancement of the learning process through better communication (Mitchell, 1998). E-mail is widely used as a communications mechanism between faculty and students, and has been predicted to increase in use and popularity (Sethna, Barnes, Brust, & Kaye, 1999). However, students are likely to use e-mail as an alternative to personal contact with faculty, rather than as an additional means of contact. Faculty can increase the likelihood of student contact via e-mail by ensuring that students are versed in the use of the Internet (Haworth, 1999).

A multi-state study of e-mail use by students at five two-year postsecondary institutions found use by students to be influenced by student age, the number of mathematics and technical courses taken during the first year of college and the self-reported number of study hours. Factors including ethnicity, gender, and socioeconomic background were not found to influence a student's propensity toward using e-mail (Flowers, Pascarella, & Pierson, 2000).

Some faculty require regular student communications via e-mail. Brown (2001) required each student to communicate with him via e-mail concerning the "muddiest point" in the chapter assigned prior to each class. He built class discussions around these e-mails. The benefits derived from this mandatory contact included encouraging the reading of requirement assignments; customization to student needs, which may provide empowerment; encouraging student-to-student collaboration beyond scheduled class sessions; and allowing faculty contact with a larger number of students than could be personally accomplished in the limited time provided before or after class or during office hours (Brown, 2001). According to Arvan (1997), one drawback to e-mail as a means of communications between faculty and students is the proliferation of "junk" e-mail, as e-mail users attempt to separate important from unsolicited communication.

Course Management Software

Course management software has become increasingly important in college classrooms. By 2001, over 57% of all higher education institutions had identified a single course management software system. However, only about 21% of college courses were using such systems. While this number is low in comparison to the percentage of institutions who have identified a single system, this early identification should provide for a smoother and more rapid proliferation of the software throughout colleges in the coming years (Green, 2001), as faculty will not be required to evaluate various packages on their own.

Fredrickson (1999) highlighted 10 commercially available web-based course development software packages. The packages listed offer a variety of features, and are generally user-friendly, even for faculty members who do not possess a great deal of computer expertise. While these software packages are useful for creating web-based courses, they are also effective for assisting faculty to develop web pages to accompany their traditional, classroom-based courses.

Almost one-third of courses at surveyed colleges had web pages in 2000, compared to less than 10% in 1996 (Green, 2001). Such efforts have been very popular with both students and faculty (Stith, 2000). Course web pages, which may be a part of course management software, or may be developed independently, are found in over 35% of all college classes, compared to just 9.2% in 1996. About 25% of all faculty also maintained personal web pages, increasing from 19% in 1999 (Green).

The two most popular course management software applications currently in use are Blackboard and WebCT. Both include presentation tools to enable course designers to create layouts and designs, student tools for communications and assessments, and administrative tools to assist faculty in course management functions, such as maintenance of grades (Goldberg & Salari, 1997; Pittinsky & Gilfus, 2000).

Garcia and Gopalan (1997) found a course web page to be a meaningful addition to the Introduction to International Business course, in which over 200 students had typically enrolled. Self-assessment tools implemented in Management and Entrepreneurship courses may also have provided positive student outcomes (Human & Clark, 1999).

Computer Simulation

The results of the *Campus Computing Survey* found computer simulations being used in approximately 17.4% of the colleges surveyed (Green, 2001). Creighton and Buchanan (2001) viewed computer simulation as leading institutions toward implementation of an e-campus. Faculty can create ingenious uses, given the resources and support within the institution. Based on Kohl's experiential learning technique, computer simulations are designed to incorporate the current wisdom on a topic and to allow students to engage in controlled decision-making while faculty stress outcomes rather than learning activities (Mitri, Karimalis, Cannon, & Yaprak, 2000).

Computer simulations have been successfully developed and used to enhance a variety of curriculum, from using molecular modeling software to help ninth graders through college age students to understand molecules (Malinowski, Klevickis & Kolvoord, 2001), to introducing GIS technology to teach a postsecondary historical geography class (Summerby-Murray, 2001).

The use of computer simulation in the classroom can be challenging to implement. Faculty members often spend more time explaining the simulation, which decreases the time available for students to engage in the simulation (Garcia-Ros, Montoro, Valero, Martinez, & Bayarri, 1999). Brown (1999) found that simulations are often based on what is possible, not what is practical for inclusion in standard postsecondary classroom settings. Faculty members, when incorporating simulations into their classrooms, must be willing to relinquish traditional faculty roles to create a more open environment, but must understand that younger students are more receptive to using this type of technology than their older counterparts (Wishart, 2000). Garcia-Ros, et al. found that instructors typically reacted positively to the inclusion of this technology in their classrooms, as do students (Ip & Linser, 2001).

Presentation Media

Presentation media appear to be second only to the use of electronic mail among technologies currently utilized in college classrooms. Faculty in approximately 44% of institutions surveyed by the Campus Computing Project were using presentation handouts regularly in their courses (Green, 2001). Grasha and Yangarber-Hicks (2000) found 63% of faculty surveyed used PowerPoint slides in their classes.

Presentation graphics packages are available from a number of different manufacturers. Microsoft's PowerPoint appears to be the most widely cited in the literature, and is a standard feature on most versions of Microsoft Office, which is widely available on most academic computers. Other packages in use in educational settings include Software Publishing's Harvard Graphics, Lotus Freelance Graphics, Astound, Macromedia's Director (Tripp, 1997), PowerPlugs, Crystal-Graphics PhotoActive FX I from Crystal-Graphics, Interactive PresentationPro (Jantz, 1999), and Digital Juice. Packages vary in their capabilities, with some limited to very simplistic maneuverability and others capable of importing or developing full-motion images. Tomei and Balmert (2000) reported on a teacher training program at the Duquesne University School of Education, where graduate students were taught how to create and integrate PowerPoint presentations into their curricula. PowerPoint was also successfully used to define the retrograde motion of a plant using various models of Texas Instruments® calculators (Coons & McMullin, 2000). Rankin and Hoaas (2001) found no difference in the grades of introductory economics students provided with PowerPoint enhancements in the classroom, compared to those not provided with PowerPoint enhancements.

Hypermedia: The Total Package

While presentation graphics provide instructors with easy-to-use, visually engaging accessories to the traditional classroom lessons, hypermedia options provide instructors with a means to appeal to a variety of different learning styles in the classroom. Hypermedia applications bring together presentation graphics, audio, video, and internet links, enabling large amounts of information to be accessed in an interactive environment (Backer & Yabu, 1994). Grasha and Yangarber-Hicks (2000) reported 26% of faculty using hypermedia-type activities to supplement the traditional classroom.

In order to maximize the effect on teaching and learning, Ping (2001) asserted that hypermedia must be intertwined with other classroom techniques as part of the learning environment. Program success is dependent upon providing students with an introduction to technical basics and system navigation, along with clearly structured learning objectives and supplemental materials.

The use of hypermedia in the classroom is based upon four learning theories: form theory, dual coding theory, and multiple representations theory from Bruner, and the cognitive flexibility theory. Form theory involves actions, icons and symbols as representations of the real world. Dual coding illustrates the interrelatedness of sound and imagery in learning. The multiple representations theory allows for the development of multiple conceptual viewpoints from the same material. Hypermedia methods provide a cognitively flexible environment through their reliance on multiple media to appeal to a variety of learning styles. Hypermedia techniques provide multi-dimensional learning experiences, opportunities for collaborative learning, greater learner control, and greater options for interdisciplinary learning. The looser structure allows for a greater discrepancy in learner background, the possibility of learner disorientation, the potential for information overload, and chances of improper organization in the information landscape (Liaw, 2001). Use of hypermedia to enhance classroom instruction has been widely reported in the literature at all levels of education and across the curricula, from literature and business management classes to science and mathematics to pre-service teacher training.

Motivation and learning reinforcement have been found to be improved in hypermedia learning environment, (Cooney, Cross, & Trunk, as cited in Liaw, 2001; Luna & McKenzie, 1997), and students have been found to prefer the hypermedia format to other forms of enhancement found in traditional classrooms (Boyd, 1997). Use of hypermedia methods in classrooms were found to be positively correlated with a variety of metacognitive learning styles (Maule, 2001).

According to Conklin (as cited in Backer & Yabu, 1994), hypermedia, as an instructional tool, has been categorized as occurring in four ways. "Browsing systems" are those in which students do not work together with peers or add material to the presentation. "Problem exploration tools" are useful in team-oriented projects. Materials electronically connected via hypertext language (HTML) or "macro-literary systems", and "general-purpose hypermedia," or individualized systems are the final types of hypermedia applications (Backer & Yabu).

Reports of student outcomes have not been so encouraging, with some researchers finding only minimal effects (Levin and Matthews, 1997; Liao, 1998), and others finding no significant differences between the use of hypermedia and traditional classroom techniques when comparing student test scores and other evaluations of successful course completion (Daniels & Moore, 2000; Ellis, 2001; Hartley, 2001). James and Lamb (2000), working with the GTECH project, sponsored by the GTE Foundation, documented improved performance by students in computer and science programs, but disappointing results in mathematics curricula.

Successful integration of hypermedia applications in engineering technologies were reported by both Giannotti and Galletti (1996) and Laaser, and Gerke (2001). Ayersman and Reed (1998) found positive relationships existed between hypermedia use in the classroom and mental models of students in both declarative knowledge structure and procedural action. Drake (2001) incorporated a variety of technologies into the teaching science courses, including Global Positioning Systems and Geographical Information Systems for map creation, and drawing and modeling via software packages, with encouraging student outcomes.

As promising as hypermedia may be as an instructional tool, problems have been identified in the literature. Navigational difficulties can result from a failure on the part of faculty members to match the technological capabilities with the expertise levels of students (Backer & Yabu, 1994).

A second problem involved the presentation of material in a hypermedia format that the students were unable to incorporate into their current cognitive schema. Similarly, a setback may also occur if students experience more information than can be cognitively processed (Backer & Yabu, 1994).

Drawbacks cited in the literature include a lack of opportunity for student input and collaboration in pre-developed hypermedia materials (Swan & Meskill, 1996) and the absence of a promised decrease in course preparation time by faculty (Giannotti & Galletti, 1996).

Takacs, Reed, Wells, and Dombrowski (1999) explored teachers' attitudes on use of Internet and hypermedia, based on Kolb's experiential learning style, and found that the more experienced the teachers were with the technology, the more valuable the technology became. As a result, training teachers to create systems may offer the best opportunities for the use of hypermedia in the classroom.

The Faculty in the Technologically Enhanced Classroom

The essential functions of higher education are, "creating, preserving, integrating, transmitting, and applying knowledge" (Duderstadt, 1999, p.6). While the fundamental role of the educational endeavor does not change, the role of the teacher is evolutionary. The teacher/student/classroom method of instruction replaced the apprenticeship mode, which was the most widely used instructional technique of the previous millennium. Technology may be responsible for another pivotal shift (Duderstadt).

Successful integration of technology into the traditional community college classroom is dependent upon a blend of faculty knowledge and expertise, student familiarization and acceptance, and the existence of knowledgeable and committed information technology specialists (Coppola & Thomas, 2000; Cyrs, 1997; Mielke, 1999; Ryan, 2001).

The availability of technological options to enhance classroom instruction has changed the role of the faculty member from one as provider of knowledge to one of facilitator of the learning experience. This paradigm shift is consistent with a shift toward learner-centeredness in higher education (Dickinson, 1999; Human & Kilbourne, 1999). Greater choices for the learner are a result of this shift; but with this array of choices comes a higher degree of responsibility for one's own learning (Gillespie, 1998). Traditional college-age students entering today's community college classrooms are already familiar and adept at functioning with computers, the Internet, and other forms of technology and learning through them (Barone & Hagner, 2001).

Despite great advances in and widespread availability of educational technology, many faculty continue to teach as their predecessors did, with the standalone lecture format being the foremost delivery technique in the community college classroom (Dickinson, 1999). The ubiquity of computers has not changed the reluctance of many faculty to embrace computing from both professional and personal perspectives (Dusick & Yildirim, 2000). This paradigm shift has also been documented within the promotion and tenure process across American colleges and universities (Seminoff & Wepner, 1997), so its influence will continue to grow in coming years.

Wesley and Franks (1996) found that attempts toward providing technical expertise in various technologies did not lead to increased adoption in the classroom. Instead, they suggested that movement toward an increased use of technology was often influenced by cultural, philosophical, and methodological beliefs of faculty. Ertmer (1999) found that second-order, or intrinsic, barriers to technology integration are often more difficult to overcome than first-order, or extrinsic, barriers. Intrinsic barriers are more personally held and inherent in practice and experience. Individual voluntary participation and interaction with colleagues who were also voluntary participants seemed to be factors positively affecting the adoption of technology in the classroom (Wesley & Franks).

Similarly, one of the findings of the Apple Classrooms of Tomorrow (ACOT) project found that technology moved classrooms, "toward student-centered rather than curriculum-centered instruction, toward collaborative tasks rather than individual tasks, toward active rather than passive learning" (Sandholtz, Ringstaff, & Dwyer, 1997, p. 17). The classroom shift from an emphasis on textbooks and teachers to the integration of technology and facilitators is not merely one of adopting new tools, but also of shifts in pedagogy and epistemology (Bruenjes, 2002). A study by Pierson (2001) found teachers more adept at technology integration to be those who also possessed greater content and pedagogical expertise.

Batson and Bass (1996) identified six epistemological elements that they claim represented a cultural shift from a print culture to a digital culture. The first element, knowledge, requires faculty to be adept at viewing the digital culture as an ongoing creative process, while print culture is static and does not provide an apparent link between product and process.

Teaching, the second element, contrasts digital's "knowledge-in-process" with print's "disembodied knowledge objects." (Batson & Bass, 1996, p. 46) Collaboration is the third element, contrasting print's individual creation of knowledge with the collaborative nature of digital. The fourth element is publication/authority, in which limited access provided in the Print culture is differentiated from the digital culture's infinite access. The fifth element, thinking, contrasts a consensus derived through collaboration found in the digital culture with knowledge products resulting from cognition. The final element is the classroom, which is teacher-centered in the print culture, but learner-centered in the digital culture (Batson & Bass).

Garrels (as cited in Mielke, 1999) described five elements necessary for success in the technologically enhanced classroom. Those elements were: the instructor must be enthusiastic, organized, committed to providing students with opportunities for interaction, familiar with using technology in the classroom, and have the support of knowledgeable technological specialists. Information technology specialists must be capable of providing initial installation of hardware and software, upkeep on equipment, recommendations for system upgrades, and rapid response to technology problems affecting the delivery of classes.

According to Ward and Lee (1995), faculty must be willing to adapt their existing styles of teaching to integrate technology into their classrooms, and must be willing to invest the preparation time to make the endeavor a successful one. Students must also be receptive to the concept, and be provided with opportunities that allow them to participate fully in activities resulting from the use of technology in the classroom (Cyrs, 1997). Faculty should remember that, while traditional college-age students may be familiar with some or all technologies used to enhance the classroom, non-traditional students may not have had experience with any or all technologies prevalent in college classrooms. So, in order for technology to be successfully integrated into the classroom, appropriate time should be built in to the curriculum to provide all students with a requisite comfort level (Grasha & Yangarber-Hicks, 2000; Richards, 1999).

Instructional personnel not familiar with the use of technology in the classroom may view the technologically enhanced classroom as being undisciplined and incapable of providing meaningful learning opportunities. Some teachers just beginning to include technology in their classrooms may exhibit the same reservations. However, the ACOT project showed positive changes in student attitudes, time on task, on-task behavior, initiative, and willingness to experiment and take risks (Sandholtz et al., 1997).

White (2000), in a study of undergraduate commuter students, found problems most frequently frustrating students in technological environments included: slow downloads due to modem speed; e-mail problems that prevented students from turning assignments in on time; difficulty organizing course materials; difficult-to-navigate course websites; dysfunctional web links; difficulty sorting relevant information from the vastness of the Internet; and a lack of clarification from the instructor regarding assignments. According to faculty, problems often resulted from a lack of student participation, variations in student pace or domination by a single student in online chatrooms.

Every course, even to a faculty member who has taught it many times, is a unique mixture of the personalities and experiences of the instructor and that particular group of students. Students must have the opportunity early in the class to provide the instructor with information to allow the course to focus on their needs as learners. However, the faculty member must guide the delivery of the course by keeping student comments and questions on track with the course objectives, a task that may become increasingly difficult when technology is added to the classroom (Byxbee, 2001).

Faculty who are adopting technology into their courses face a variety of challenges from their own expectations for their students, based upon the limitations of the systems available through their institutions. Faculty members may add technological aspects to their courses because the technology is available, because other faculty are doing so, or due to mandates from administration (Smith, 1997). Professional development opportunities may center on mechanistic aspects surrounding the proper use of technology, rather than how to blend it seamlessly into the classroom and how to properly adapt individual teaching and learning characteristics to mesh with its use (Palloff & Pratt, 1999). Enhancing the classroom experience through technology is no substitute for knowledgeable and dedicated faculty.

Smith (1997) identified two types of technology-related failures in the classroom: ineffective course design or participation by faculty and a lack of participation or preparation by students. A third failure, the failure of the technology itself, can be frustrating, especially for the instructor who is a fledgling at incorporating technology into the classroom, as well as for the student who may be somewhat unforgiving (Richards, 1999).

Failures early in the use of technology by faculty or students may lead to reluctance to use or the total abandonment of technology in the classroom. These disappointments may be avoided or minimized by ensuring that faculty members are aware of resources available for questions or problems and by making the technology as standardized and user-friendly as possible (Hull, 1999).

Regardless of the simplicity or availability of resources, not all faculty are eager to embrace technology and to weave it into their existing classroom repertoire. Rogers' (1995) research identified five categories related to adoption of innovation among members of social systems. He defined them as innovators (comprising approximately 2.5% of the survey population), early adopters (13.5%), early majority (34%), late majority (34%), and, finally, the laggards (16%).

Innovators are adventurers, who tend to seek out new ideas and relationships, often from outside the immediate peer group. Their focus seems to be more cosmopolitan than others within the local peer group are. By comparison, the early adopters tend to interact more strongly with a local peer group. As a result, they, more than the innovators, are looked to by peers seeking guidance on the adoption of technology. This category thrives on the respect bestowed upon them by their later adopting peers, and in turn, they become more available to peers seeking information, in exchange for this esteem (Rogers, 1995). While the early majority tends to adopt technology sooner than many of their peers, they followers rather than leaders (Rogers). The late majority is comprised of the skeptics, who choose to adopt technology due to peer pressure and/or economic reasons. They require the removal of barriers and uncertainties to occur in order for them to feel safe in embracing new technologies. The final group, the laggards or the traditionalists, may view the adoption of technology as beyond their current resources or that, if they delay long enough, the idea will fail before they go to the trouble of trying to adopt it (Rogers).

Rogers (1995) further characterized his five categories of adopters into two overarching categories: earlier adopters and later adopters, to compare socioeconomic, personality and communications characteristics. The innovators, early adopters, and early majority comprised the earlier adopters, and the later adopters consisted of the late majority and the laggards. He found the earlier adopters had more formal education, higher socioeconomic status, more upward mobility in society, and to be part of larger work units than later adopters did. He found no significant difference in the ages of earlier adopters and later adopters.

Regarding personality characteristics, earlier adopters were found to be more empathetic, less dogmatic, more rational, better at coping with indecision, and had higher professional aspirations than later adopters had. Earlier adopters also tended to participate more in social activities, and to network regularly with others more, including those outside their immediate peer circle (Rogers).

According to Phillip, Flores, and Sowder (as cited in Jacobsen, 1997), early adopters tended to exhibit greater focus on problem solving, communications, understanding, and theoretical constructs, all characteristics evident in exemplary faculty members. However, they also found that exemplary teachers were not necessarily early adopters of technology (Jacobsen).

Bruenjes (2002), in basing her work on that of Rogers (1995), found faculty typically used technology as a tool for teaching, producing, or communicating. She found Innovators and Early Adopters most likely to use technology for teaching and record keeping, while Innovators, Early Adopters and Hesitant Adopters were all likely to prepare lesson plans on the computer and communicate with students via e-mail.

Personal use of e-mail and the Internet is often the entry point for faculty who will eventually use technology in the classroom. The innovators are responsible for bringing innovations to the attention of the mainstream (Jacobsen, 1997).

Hagner and Schneebeck (2001) classified faculty adoption of technology in three distinct “waves.” The Entrepreneurs were highly committed to the process of teaching and learning, and were eager to infuse the new technologies into their classrooms. Their teaching stemmed from passion, and not from rewards or recognition that could result from their success.

The Risk Aversives lacked technological expertise and were hesitant to risk their current success in the classroom by changing their methods to include technology. Once they had adopted technology, they required intensive support from the informational technology staff (Hagner & Schneebeck, 2001).

The third wave included the Reward Seekers, who were willing to adopt technology as a means of career advancement, such as gaining tenure or promotion. Institutional recognition and reward systems should be examined and revamped as necessary to avoid favoring faculty who adopt technology in the classroom for reasons other than its benefit to the teaching and learning process (Chizmar & Williams, 2001; Hagner & Schneebeck, 2001).

Hagner and Schneebeck (2001) also recognized a fourth group of faculty, the Reluctants, who did not actually constitute a wave. These faculty members were not computer literate, and preferred to cling to the concepts of the faculty member as the provider of knowledge. These faculty were resistant to change (Lick, as cited in Bingham, Davis, & Moore, 1999), and were similar to the Laggards found in Rogers' model.

Demmon (2001), in a study of technology implementation at a community college in the Midwest portion of the United States, categorized faculty by their use of technology in their daily personal and professional lives. By the third year of technology implementation, 49% of faculty surveyed considered themselves to be “advanced” users, compare to 8% who professed to be “low” users, with the remainder falling into the “average” classification.

The Demmon (2001) study further found access to various types of technology, access to student information, improvement of productivity in developing course materials, and communication with students and colleagues via e-mail to be the primary reasons for adoption of technology. Barriers identified included a lack of available technology, inadequate technology support and training, and a lack of e-mail access by students (Demmon).

Another cause for faculty resistance, according to Aloia (1998) was a sense of being overwhelmed by computers and technology. A Pace University study found feeling of alienation and low levels of confidence in faculty receiving technology training from Information Technology professionals, but found similar training sessions to be successful when taught jointly by a specialist and a knowledgeable faculty member (Coppola & Thomas, 2000).

This mode of categorization is similar to that postulated by Duhaney and Zemel (2000), who classified faculty as those exhibiting a fear of technology, the infrequent users, and those who maximized its use, sometimes to the point of overuse. Those who avoided technology or used it infrequently often did so in response to their own limited experiences.

Jacobsen (1998) suggested that, to diffuse the integration of technology into the classroom, four things were necessary: institutional goals that fostered technology, planning of new educational systems, faculty training, and administrative and instructional technology support. According to Hannan et al. (1999) faculty must also see the benefit to learning that can be derived by the inclusion of technology in the classroom.

Adequate support mechanisms, as shown by numerous studies, are crucial to the adoption and proliferation of technology in the classroom (Ertmer, 1999; Ertmer, Gopalakrishnan, & Ross, 2001; Sandholtz et al., 1997; Whitelaw & Feist, 1999). Research by Ertmer (1999) established a lack of support as one of the primary extrinsic barriers to adoption of technology by teachers. While the use of technology is not requisite for exemplary teaching practice, many variables impact exemplary teachers who choose to enhance their curricula with technology. These variables include curricular or resource constraints, their vision of the role of technology in the classroom, their view of the use of technology by colleagues, and by type of institution (Ertmer et al., 2001).

Sandholtz et al. (1997) found faculty to engage in four distinct stages when implementing technology in the classroom, and related these stages to the type of collegial relationships required to foster success. In the initial stage, entry, few changes in instruction are contemplated, and an emotional foundation is key.

During the adoption phase, faculty strive to develop methodologies for enhancing classroom instruction using technology. Emotional and technical support are key collegial components (Sandholtz et al., 1997). In the third stage, adaptation, changes are made to improve the efficacy of technological enhancements. Instructional strategy sharing is added as a collegial communications method. And, finally, in the appropriation and invention phase, faculty shifts in roles and instructional ideas emerge. Classroom collaboration is added as a collegial strategy. Team teaching allows for the sharing of responsibilities, increases in harmony and fervor, individualized instruction, flexibility in student work groups, instructional stability in the absence of a team member, and an increased ability for students to assimilate more advanced information. This collegial relationship can also lead to the creation of interdisciplinary curricula (Sandholtz et al.).

These findings are similar to those found by researchers using the Concerns Based Adoption Model (CBAM), developed at the Research and Development Center for Teacher Education at the University of Texas at Austin. This model set forth a hierarchy of seven concerns through which technology adopters progress. In lower levels, the concern is for self. At transitional levels, task becomes a primary concern, while advanced levels focus on student impact. Over the years, since the development of CBAM, faculty have maintained the interwoven concepts of collegial support, technical support, and sharing, and have allowed them to become even more closely interconnected (Wesley & Franks, 1996).

While collegial relationships are important in the proliferation of technology in the classroom, individual instructors are normally responsible for designing a course. Faculty members are more likely to implement those techniques and strategies in which they feel most comfortable. Teachers are less likely to implement technology when their classrooms with limited technological access or recurrent technical difficulties. Insufficient time in technology rooted staff development activities also decreases the likelihood of implementation (Sandholtz et al., 1997).

Dusick and Yildirim (2000) found ownership of a personal computer, positive attitude toward computing and relevant training to increase the potential for community college faculty to use computers in the classroom. Lack of training has been cited by Ertmer (1999) as an extrinsic barrier toward the integration of technology in the classroom. The type of training required varies among faculty members, with some requiring programs that assist in the development of positive attitudes, others toward how to operate a computer, and a third type regarding using of various software packages. In order to be successful in meeting a wide range of faculty needs, professional development plans must incorporate all three types of courses. Faculty will be more willing to participate in training programs if they are involved in developing them, as programs developed by others within the institution tend not to meet faculty needs (Murray, 1999; Quick & Davies, 1999).

Ryan (2001), in a study of administrators, faculty, and information technology professionals at community colleges in seven American states, found the effectiveness of classroom technology to be linked to support in the providing of adequate funding, appropriate numbers of technical support personnel, administrative commitment, implementation and practice time, and staff development opportunities.

Critical issues for faculty adopting technology in the classroom, as identified by Kirk (2000), included appropriate staff development activities, adequate planning and release time, adequate funding for course development, and the ability to respond in a timely fashion to questions posed by students.

According to Ertmer (1999) success in overcoming personal barriers to the use of technology may be achieved through placing greater emphasis on finding ways to improve teaching and learning through technology, while de-emphasizing the need for faculty proficiency with hardware and software.

While a number of studies have shown age and teaching experience to be significant factors in adoption of technology in the classroom, Blackwood (2001) found only teaching experience to be significant.

Naquin (2000) found younger faculty significantly more willing to adopt technology into their classrooms than their older counterparts, among faculty in community college systems in the southeastern United States. Younger faculty may have also had greater opportunities to participate in educational opportunities that increased the probability they would adopt technology into their own classrooms (Bruenjes, 2002).

Institutions intent on making technology an integral part of the classroom should ensure that impetus for change is apparent within the institution. Rogers (1995) found the presence of a change agent to be important in a centralized effort to infuse an innovation within an organization. College administration, in concert with early adopters and mainstream faculty, should fill the role of change agent in developing tactics and strategies for implementation of technology across the curriculum (Jacobsen, 1997).

Patrikas and Newton (1999) postulated that college administrators should ensure that new faculty hires possess a requisite level of computer literacy, must provide professional development opportunities to current faculty that will improve their expertise with the types of technology in use within institutional classrooms and introduce them to new technologies, provide adequate introductory computer courses and on-campus computer access for students. Policies regarding class sizes should be revised to incorporate research findings that stress more effective uses of technologies in less-crowded classrooms. A majority of faculty believed that their intuitional technology policies were "misguided or insufficient" (Toshido, as cited in Trinkle, 1999).

Bruenjes (2002) theorized that, in order for faculty development programs in technology to be effective, instructional developers should create programs tailored to the various levels of technological integration identified by Rogers (1995). This view concurs with that of Padgett and Conceao-Runlee (2000), who found successful staff development programs to include these individual motivators, as well as institutional factors and involvement by experts from within the institution.

Faculty in the North Carolina Community College System

The North Carolina Community College System is comprised of 58 public two-years institutions located across the state, within commuting distance of every resident. In 1999, it was the third largest in the Nation in terms of enrollment, with an unduplicated headcount in excess of 700,000 students (Lancaster, 1999). The North Carolina General Assembly created the system in 1963 by joining 28 industrial education centers, community colleges, and extension centers from throughout the state. The system grew over the years to its current size. Brunswick Community College was the last of the 58 institutions to join the System, doing so in 1978 (North Carolina Community College System, 2002). An independent board of trustees maintains local oversight at each college. Numerous policies and procedures are developed at the system level and affect operations at all institutions (Lancaster). A 59th institution, the North Carolina Center for Applied Textile Technology, is atypical of the other 58 colleges, and their statistical data is not normally included with that of the other institutions.

Colleges offer a variety of learning options in two distinct program areas. Credit, or so-called "curriculum" programs, may be offered as certificate, diploma, and associate degree options. Certificate programs provide 12 to 18 semester hours credit, diploma programs 36 to 48 hours credit, and associate degrees 64 to 76 semester hours. Non-credit courses are designated "continuing education," and may vary from two to three hours to several hundred hours in length (North Carolina Community College System, 2002).

Colleges vary greatly in size and configuration, from Pamlico Community College with an annual unduplicated headcount of under 500 in credit programs, to Central Piedmont Community College, which reported nearly 29,000 unduplicated headcount in credit programs during the 2000-2001 academic year (North Carolina Community College System, 2002).

During the 2000-2001 academic year enrollment in curriculum programs throughout the North Carolina Community College System totaled 265,761 unduplicated students. These students were being taught by a cohort of 5,200 full-time faculty, who comprised 47% of all faculty members teaching in curriculum programs. Approximately 39% of those faculty had been teaching in the community colleges for five or fewer years, while fewer than 15% had been teaching more than 20 years. A master’s, education specialist, or doctoral had been attained by 59% of full-time faculty members (North Carolina Community College System, 2002).

Summary

A review of the literature lends credence to the belief that administrators and faculty members in institutions of higher education must move past the glitz of educational technology and embrace the more utilitarian aspects. Infusing technology into traditional instruction provides a means of connecting the classroom to the world, while allowing students with a variety of preferred learning styles and learning paces to be on even footings in the classroom. However, some faculty members are not eager to embrace the concepts of the technologically enhanced classroom. Institutions must attune visions and capital—both fiscal and human— to successfully integrate technology into the classroom at the pace determined to be best for each individual institution. Faculty involvement is an essential part of this determination process, and they must be assured of having the necessary resources and support to accomplish changes in their classrooms. Community colleges should evaluate the policy concerns of their faculty but must avoid being blinded by crusades of late majority or laggards intent on maintaining the status quo, or Reward Seekers with their own agendas. Each institution must determine its optimum pace at which to proceed into the new learning based paradigm of incorporating technology into its classrooms.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

Results of the 2001 *Campus Computing Survey* (Green, 2001) indicated that the integration of technology into instruction was the top priority among postsecondary institutions. Yet, in the results of this survey and one conducted by Grasha and Yangarber-Hicks (2000), the authors reported varying degrees of use of various types of technology for instruction, with no technology being universally adopted. For example, 57% of institutions surveyed reported the adoption of a common course management software system, yet such a system was only being used in 21% of courses at surveyed institutions (Green).

Given the reported availability of technology for instruction, why are all faculty not enhancing their traditional classes? And, of those who are using the technology, are many doing so, as Smith (1997) found, due to peer or administrative pressure?

Research Design

This study used a causal-comparative, or ex-post-facto, research design. The causal-comparative method explores behavioral patterns or individual characteristics that lead to certain behaviors (Gall, Borg, & Gall, 1996). Community college faculty surveyed for this study were compared on the basis of their self-reported classroom behaviors and personal characteristics to determine if certain behaviors and characteristics may be present in varying degrees in adopters or non-adopters of technology enhancement in their classrooms.

The survey instrument was pilot-tested using a select group of faculty at local community colleges. These personnel are comprised of full-time faculty at Caldwell Community College and Technical Institute, Catawba Valley Community College, Mitchell Community College, Western Piedmont Community College, and

Wilkes Community College. Modifications made to the survey based on input from beta testers, included the correction of a typographical error and the addition of an "other" choice to one question.

Electronic distribution of the survey proved to be a challenge. Reports of the existence of a group distribution list of faculty members available through the North Carolina Community College System proved to be erroneous. The only direct distribution list to full-time faculty was found to be one created and maintained by the North Carolina Community College Faculty Association, a statewide organization dedicated to facilitating networking among faculty and raising awareness of faculty issues within colleges and the North Carolina General Assembly (North Carolina Community College Faculty Association, 2003). The president of this organization declined direct access to this distribution list for purposes of survey distribution. However, he invited me to join the Faculty Issues Committee of the Association, which could then petition the Executive Board to allow me to use the list for purposes of distributing the survey. This possibility would have lengthened the time to survey distribution by several months. Also, as my job is classified as a professional staff position and not faculty, I am not eligible for membership in the Association, nor could I become a member of any Association committee.

Personnel at the North Carolina Community College System office in Raleigh suggested that the survey be distributed via chief academic officers at each institution. A distribution list for chief academic officers is available through GroupWise, a common electronic mail program. The North Carolina Community College System office has created e-mail databases through GroupWise for specific groups within the community college system. These groups include, but are not limited to, presidents, chief academic administrators, senior continuing education administrators, and business managers. Although 86.2% of all North Carolina community colleges are connected via this electronic mail system (North Carolina Community College System, 2002), even chief academic officers whose institutions do not use GroupWise as their e-mail program can be accessed through this distribution list.

The adding of another layer to the survey distribution process created some additional challenges. While most chief academic officers seemed happy to assist with the distribution of the survey, others appeared not to be, thereby eliminating their colleges from participation in the study. Thirty-one colleges were confirmed as participating, with possible participation from another 21 institutions. Even in schools where the chief academic officer forwarded the survey link, some faculty members may have been likely to ignore the message, as a means of civil disobedience for which there would be no possible repercussion.

The distribution of the survey message and survey link to the faculty was also dependent upon the chief academic officer at each institution having the requisite computer literacy to forward a message via e-mail.

Research Questions, Hypotheses, and Methods

Ten research questions and eight hypotheses were developed. Listed below are the questions and hypotheses and the statistical tests that were used to answer each question and test each hypothesis.

Research Question 1: How do the North Carolina Community College System (NCCCS) faculty members who participated in this study compare with the NCCCS faculty members as a whole with regard to their demographic characteristics? This question was answered using a collection of demographic data from the North Carolina Community College System (2002) and data received from participants in the study.

Hypothesis 1: There is no difference between NCCCS faculty members who participated in this study and NCCCS faculty members;

1a) for all NCCCS participants;

1b) for NCCCS participants based on gender;

1c) for NCCCS participants based on race/ethnicity;

1d) for NCCCS participants based on total years of teaching experience; and

1e) for NCCCS participants based on highest level of education attained.

The above hypotheses tested using a chi-square goodness of fit.

Research Question 2: How do the NCCCS faculty participants compare to one another in terms of their adoption of computer technology for instruction based upon Rogers' schema? This question was answered by comparing data questions 1 through 5 on the common survey to responses to question 15 on the common survey, which permitted the categorization of faculty into five categories as defined by Rogers (1995).

Hypothesis 2: There is no difference between NCCCS participants regarding their adoption of technology in instruction based on their self-reported category in the Rogers' schema;

2a) for all NCCCS participants;

2b) for Rogers categories based on age;

2c) for Rogers categories based on gender;

2d) for Rogers categories based on race/ethnicity;

2e) for Rogers categories based on total years of teaching experience; and

2f) for Rogers categories based on highest level of education attained.

The above hypotheses were tested using a chi-square goodness of fit test. Data was analyzed according to responses from survey participants to questions 1 through 5 and 15.

Research Question 3: How do users and non-users of computer technology in instruction in this study compare with one another as a whole and with regard to each of five demographic characteristics? This question was answered using participant responses to question 16 on the common survey, which classified respondents as either users or non-users of computer technology for instruction, with questions 1 through 5 on the common survey.

Hypothesis 3: There is no difference between NCCCS users and non-users of computer technology in instruction;

3a) for all NCCCS participants;

3b) for Rogers categories based on age;

3c) for Rogers categories based on gender;

3d) for Rogers categories based on race/ethnicity;

3e) for Rogers categories based on total years of teaching experience; and

3f) for Rogers categories based on highest level of education attained.

The above hypotheses were tested using a chi-square goodness of fit test.

Research Question 4: How do users and non-users of technology in instruction in this study compare with one another based upon their respective teaching fields? This question was answered using respondents' answers to question 16 on the common survey with responses to question 6 on the common survey.

Hypothesis 4: There is no difference between users and non-users of computer technology in instruction based on their teaching fields. This hypothesis was analyzed using a chi-square test for independence.

Research Question 5: How do users and non-users of computer technology in instruction in this study compare with one another regarding their perceptions of the existence of several categories of change agent and institutional support in their respective colleges? This question was answered using responses to question 16 on the common survey, compared to questions 27 and 28 on the user survey and questions 33 and 34 on the non-user survey.

Hypothesis 5: There is no difference between users and non-users of computer technology in instruction based on subject's perceptions of;

5a) the presence of an individual identified as a change agent within each institution; and

5b) support for the use of computer technology in instruction within the institution.

The above hypotheses were tested using a chi-square test for independence.

Research Question 6: How do users and non-users of computer technology for instruction in this study compare with one another based on the sizes of their respective colleges? A comparison of responses to questions 7 and 16 on the common survey and was used to answer this question.

Hypothesis 6: There is no difference between users and non-users of computer technology in instruction and institution size. A chi-square test for independence was used to test this hypothesis.

Research Question 7: What specific techniques are employed by users of computer technology in instruction in this study? This question was answered by compiling responses to question 17 on the user survey.

Research Question 8: Why do users of computer technology in instruction in this study say they use technology? Responses to question 18 on the user survey were used to answer this question.

Research Question 9: Why do non-users of computer technology in instruction in this study say they do not use technology? This question was answered by compiling responses to question 29 on the non-user survey.

Research Question 10: According to non-users of computer technology in instruction in this study, what methods, services, or policies could their respective colleges employ that would encourage them to begin to use computer technology in instruction? Question 32 on the non-user survey was used to answer this question.

Hypothesis 7: There is no difference between users and non-users of computer technology for instruction in this study based on having computers in their homes. This hypothesis was assessed using a test for independence.

Hypothesis 8: There is no difference between female and male faculty members and their creation and maintenance of personal web pages on servers at their respective colleges. A chi-square test for independence was used to explore this hypothesis.

Population

Chief academic officers at each of the 58 institutions in the North Carolina Community College System received a message that they were being requested to forward to all full-time faculty within their institutions (See Appendix A). The sample would be based on the self-selected respondents to the survey from the total population who would receive a message (See Appendix B) and a link to the survey. I attempted to reach all full-time faculty members but could only confirm contact with 55.6% (2,893) faculty, with another 25.2% (1,310) possibly having received the survey link from their chief academic officers.

A demographic analysis of the cohort of full-time faculty in the North Carolina Community College System by gender shows 46.5% are male and 53.5% are female. In terms of ethnicity, 87.1% of faculty members are Caucasian, 10.3% Black, 1.0% Asian, 0.8% Indian, and 0.7% Hispanic (North Carolina Community College System, 2002).

Regarding teaching experience, 37.8% of faculty members in the system have been teaching less than six years, while 20.9% have been teaching between 6 and 10 years, 15.8% between 11 and 15 years, 10.5% between 16 and 20 years, and 7.7% between 21 and 25 years. Those with 26 or more years of teaching experience comprised 7.3% of the total faculty (North Carolina Community College System, 2002).

In exploring the highest degree attained, 16.1% hold less than a bachelor's degree, with 24.3% having received a bachelor's degree. Master's degrees were earned by 52.8% of the faculty, with an education specialist degree being the highest reported degree by 0.5% of faculty members, and holding a 6.2% doctoral degree or equivalent (North Carolina Community College System, 2002).

Data Collection

A survey was distributed to all full-time faculty teaching in the North Carolina Community College System in March 2003 via the chief academic officer at each community college. The survey included demographic questions concerning each faculty member's age, race, gender, years of teaching experience, educational background, and area of pedagogical expertise. The instrument also surveyed each respondent's experience with computers, the Internet, and e-mail and asked how long the individual had been using various types of technology to enhance teaching. The document further inquired why these faculty members had or had not chosen to include technology in their instruction; questions about technology training opportunities in which they have participated; and the helpfulness of information technology specialists at their institutions. Faculty members not currently enhancing their classes with technology were asked why they had not chosen to include such enhancements and whether or not they had participated in technology training through professional development or inservice opportunities. Barriers to the use of technology were categorized as individual, departmental, or institutional in origin.

Instrumentation

The use of online surveys has become more prevalent since the turn of the 21^{st} century. Several researchers (Dillman, as cited in Gotten, 2001; Kuhnert

McCauley, as cited in Gotten, 2001) predicted that telephone and paper surveys would become obsolete due to the speed, reliability, ease of response, and cost of online surveys (Gotten).

Response rates for online or e-mail surveys have been reported by some researchers to be lower (Gotten, 2001; McCabe et al., 2002) than surveys distributed via mail. However, other researchers (Bason, 2000; Schaefer & Dillman, 1998) have found no significant difference in rates of return on traditional mail versus e-mail surveys of university faculty members with computer access. Additionally, they found the degree of completeness of e-mail surveys to be significantly higher than those of traditional mail surveys, thereby yielding more usable survey data (Schaefer & Dillman). Len-Rios and Cameron (2001) found rates of response to e-mail surveys increased with multiple contacts. This survey instrument was sent twice for distribution to faculty.

I designed the faculty survey instrument using Survey Builder (Yang, 2002), an application developed by the webmaster at Catawba Valley Community College. This software had received limited use at Catawba Valley Community College since it was initially developed in 2002. Several short surveys had been developed by the coordinator of staff development for distribution within the College. In the fall 2002, a survey was created for distribution to employers in Catawba Valley Community College's service area. Information to access this survey was widely distributed, with the survey link being publicized by traditional mail, articles in local newspapers, and on the college's web page, but only three responses were received for this survey. As a result of the limited testing of the application, some problems associated with its use had not yet been discovered. However, I decided to proceed with developing the survey through this vehicle because of its user-friendly design and the webmaster's assurances of its capabilities.

The faculty survey instrument was built into a web-based document in three parts. The first part of the survey consisted of demographic information and a group of common questions for all participants. The second and third parts of the survey were designed to capture information on classroom computer technology by users and non-users of computer technology in instruction.

Three software modifications were necessary. Response field lengths had to be increased to allow the specific wording in the question dealing specifically with the Rogers' categories. The webmaster also had to reprogram the software to allow the linked question in part 1 to interface with parts 2 and 3 of the survey instrument. A modification was also needed to allow data to be available for inferential statistical examination. Previous researchers had required only that the software be able to provide descriptive data output. The webmaster added a code sequence that allowed for the downloading of individual respondent data into an Excel spreadsheet. This modification will be useful for several other members of the faculty and staff at Catawba Valley Community College who are currently working on their dissertations and plan to employ Survey Builder (Yang, 2002) as a data gathering tool.

Several server adjustments were necessary, given the intricacy of the survey and the number of responses received. Additional server space was allocated and alterations were made to the speed at which pages in the survey were loaded and the response data was accessed.

The survey instrument employed for data collection was very user-friendly in its design, as well as its ease of completion and return. A link appeared in the e-mail message, and a faculty member clicked on the link to be redirected to the survey form web page (see Appendix B).

All faculty answered a list of common questions. This survey instrument included contained 16 questions common questions. By selecting "Yes" to Question 16, "Do you regularly enhance your traditional classroom delivery using e-mail, the Internet, a course website, computer simulations, computer presentations, course management software, hypermedia, or other form of computer technology?" faculty identified as technology users were directed to a series of 12 questions designed to explore their use of technology for instruction.

Answering "No" to Question 16 directed faculty identified as non-users to six questions designed to explore reasons their reasons for not using technology and what might lead them to integrating technology in their classrooms in the future.

Both groups were also asked to specify if an individual or group of individuals within their institution could be identified as a change agent within their institution.

The seamless linking of the user and non-user surveys to the common survey was designed to minimize the possibility of incomplete data. Upon completion of either survey, the participant submitted the survey by clicking the "submit" icon and was forwarded to a screen thanking the respondent for his/her participation. Survey data were captured in a database linked to the survey forms. These data were downloaded into an Excel spreadsheet for ease of importation into SPSS 10.1 (SPSS, Inc., 2000) for data analysis.

Determining Survey Validity

Validity was determined by administering the survey instrument to a select group of instructors from North Carolina community colleges who have agreed to participate in the beta testing process. Colleges represented included Caldwell Community College and Technical Institute, Catawba Valley Community College, Central Piedmont Community College, Mitchell Community College, Western Piedmont Community College, and Wilkes Community College. Feedback was elicited regarding the wording and scope of questions on the survey. This pilot test also provided an opportunity to test the reliability of the Internet link, the hypertext markup language (HTML) coding, and the compatibility of the database and the programming in downloading and properly coding information provided by survey respondents.

While the validity and reliability of online surveys are assumed, few studies have been undertaken in an attempt to prove either. A study by Boeckner, Pullen, Walker, Abbott, and Block (2002) found results of online surveys to be comparable in reliability to paper surveys distributed via regular mail. McCabe et al. (2002) claimed online surveys provided for a higher response rate and a sample that was more representative of the population. Internet-based surveys were also found to be as reliable, significant more cost effective (Pealer, 2000), and provided for a quicker response than mailed surveys (Schaefer & Dillman, 1998).

Data Analysis

Data were analyzed using SPSS 10.1 (SPSS, Inc., 2000). Descriptive statistics were calculated. Based on their responses, subjects were categorized according to Rogers' schema, and ANOVA was performed to determine the existence of any significant differences in the use of technology in instruction, based upon age, gender, highest degree attained, academic field or years of teaching experience of instructors. Characteristics of users and non-users were compared to determine if significant differences existed. Chi square was used to determine if a relationship existed between the adopters or resisters and age, gender, level of educational, or years of teaching experience.

Analysis was also aimed at determining the effect of the presence or absence of change agents, including the institution itself as a change agency, and institution size on the rate of adoption of technology.

Summary

In chapter 3, I have detailed research questions and hypotheses. A brief description of the North Carolina Community College System, the study population, and sample surveyed was also included. Data collection and analysis methods were also noted. The results of the data collection process will be detailed in chapter 4. Conclusions, a summary, and recommendations for practice and for future research will be presented in chapter 5.

CHAPTER 4

RESULTS OF DATA ANALYSIS

Introduction

The North Carolina Community College System has allocated millions of dollars to bring computer technology into college classrooms. But, having technology in classrooms is meaningless without faculty who are willing and able to integrate the technology into the educational process for the purpose of improving teaching and learning.

This survey sought to explore the use of computer technology in North Carolina Community College classrooms by providing an understanding of faculty adoption practices and attitudes since these are determining factors in the use of computer technology for instruction.

Survey Distribution

The survey link was distributed to all community colleges via a distribution list of chief academic officers at each of the 58 community colleges in North Carolina. A message to the chief academic officers explained the goals of the survey, and asked that an attached message be forwarded to all faculty at their institutions. Delivery and confirmation that the message was opened were attainable for 50 of the 58 colleges.

The message to faculty contained an explanation of the project along with a link that could be clicked on to take the faculty member directly to the online survey form via a website link.

A follow-up message was sent to the chief academic officers approximately three days after the initial message. This message also contained the survey link. According to Len-Rios and Cameron (2001), most web-based surveys use between one and four contacts to obtain an optimal data return rate. Beyond four contacts can be perceived as an annoyance (Len-Rios & Cameron). In this study, two contacts, an initial message and a reminder, were sent three days apart. The choice of two contacts, rather than three or four, was based on a desire not to annoy chief academic officers who had responsibilities beyond forwarding e-mail messages to their faculty.

Confirmation was available through the GroupWise e-mail system to indicate that Chief Academic Officers at 50 colleges had received and opened the message containing the survey link for faculty. Contacts from faculty or chief academic officers at certain colleges made confirmation of distribution of the survey to faculty at those colleges possible. Confirmation of distribution via this mechanism was possible for 31 colleges. Further information regarding participation by the remaining 21 colleges was not available due to the anonymous nature of the survey. Information was obtained through contacts at six colleges that the survey had not been distributed to faculty at those locations.

Soon after distribution of the message with the survey link, certain differences in the configuration of networks and computer systems became apparent across the system. E-mail messages were sent from chief academic officers or faculty at certain colleges that indicated some colleges had disabled cookies, either on individual computers or as a college-wide policy. The use of cookies with this survey was essential to allow for the transfer of the survey form to the recipient and for transmitting survey responses back to the originating server. Cookies, in this application, also provided a safeguard to ensure that a faculty member could respond only once to the survey.

Two options were provided in response to the e-mail messages regarding disabled cookies. The first option was to provide instructions to the contact person to allow the enabling of cookies. The other option, which was the only option for colleges where cookies had been disabled campus-wide, was to provide a version of the survey as a Word document that could be completed and returned via e-mail, fax, or postal or courier mail. Possible participation based upon size of institution varied from a minimum of 17.8% for institutions between 5,000 and 7,999 students, to a possible maximum of 100% for schools with fewer than 2,000 students. The minimum and maximum percentage of colleges within a given size category who participated in the survey is presented in table 1. The theoretical survey faculty distribution by college size is detailed in table 2.

Table 1

Minimum and Maximum Percentage of Participating Colleges by Institution Size

Category	Minimum Percent	Maximum Percent
Under 2000	52.5	100
2000-4999	64.3	80.5
5000-7999	17.8	49.1
Over 8000	63.6	63.6

Table 2

Survey Distribution by Institution Size

College Size	Total Faculty Per Category	Number Confirmed as Receiving Survey	Number Confirmed as Not Receiving Survey	Number Unconfirmed as Having Received Survey
Under 2,000	1,211	636	0	575
2,000-4,999	2,488	1,600	486	402
5,000-7,999	655	117	205	333
Over 8,000	848	540	308	0
Total	5,202	2,893	999	1,310

Online Surveys

Response rates less than 10% are common in on-line surveys (Len-Rios & Cameron, 2001). In their study of e-commerce customers, Len-Rios and Cameron (2001) bulk mailed an online survey to 966 respondents and received 65 responses (7%), although nearly 200 others had gone to the website but had not completed the survey (Len-Rios & Cameron).

The potential for significant non-response bias due to a coverage error based upon a lack of access to computers or the Internet is a potential problem for many online surveys (Alvarez & VanBeselaere, 2003; Feld, 2001). This phenomenon should not be as prevalent within this sample due to the proliferation of computer technology availability to North Carolina community college faculty members. However, the possibility of a reduction in the response rate could exist, given that some faculty members with office computers may use their e-mail seldom or not at all, and that those same faculty members may have responded to a paper-and-pencil questionnaire.

Collection of Survey Data

Five-hundred seventy-nine responses to the survey was received during the response period. This constituted 20.0% of the total number of faculty members confirmed as receiving the survey (2,893), or 13.8% of the total number of faculty confirmed as receiving the survey plus those faculty from whom confirmation was not obtained (4,203). The number of surveys received constitutes 11.1% of the total number of full-time faculty members in the North Carolina Community College System (5,202). Approximately 89.4% (518) of these responses were received via the online survey. Forty-one (7.1%) surveys in Word document format were received via e-mail, 14 (2.4%) Word surveys and two (0.3%) online surveys by mail, and four (0.7%) Word surveys via fax.

Data from the server confirmed that 620 accesses to the survey or “hits” had been recorded. A difference of 100 “hits” to surveys received indicated that either someone other than a faculty member (i.e., the chief academic officer, institutional effectiveness officer, or information technology specialist) had viewed the survey or that some faculty members had declined participation after accessing the survey.

Four hundred twenty-five of the respondents (73.4%) identified themselves as faculty who used technology in instruction. The remaining 154 faculty members (26.6%) stated that they did not technology in their classrooms.

A difference in responses to the common survey versus user and non-user surveys was found. User surveys were submitted by 82.1% (349 of 425) of persons identifying themselves as using technology for instruction, versus 94.8% (146 of 154) of faculty members identifying themselves as not using technology in instruction, who answered, the Non-User Survey. Based on his knowledge of the survey, server, and network, the Catawba Valley Community College webmaster theorized that this disparity was most likely cause by one of two factors: some faculty members did not wait for second part of survey to load before moving to another website or exiting the Internet or, due to variances in available bandwidth from college to college, some faculty may have not been able to download the second part of the survey before it timed out.

Respondent Demographics

Research Question 1: How do the North Carolina Community College System (NCCCS) faculty members who participated in this study compare with the NCCCS faculty members as a whole with regard to their demographic characteristics?

The 579 survey respondents consisted of 61.3% (355) women and 38.7% (224) men. System data on gender shows the full-time faculty cohort to be comprised of 54.2% females and 45.8% males (see table 3).

Table 3

Faculty Comparison by Gender

Gender		NCCCS Faculty	Survey Respondents
Female		n = 2,819	n = 355
		54.2%	61.3%
Male		n = 2,383	n = 224
		45.8%	38.7%
	Total	5,202	579

*Chi-square 2.400, df 1, ρ <0.121

In terms of ethnicity, 518 (89.5%) were Caucasian, 38 respondents (6.6%) were African-American, nine (1.6%) were Hispanic, nine (1.6%) were Native American, four (0.7%) were Asian, and one (0.2%) was characterized as “other.”

So, the ethnic make-up of survey respondents was similar to that of the data available through the North Carolina Community College System, where 86.8% of faculty were Caucasian and 1.0% were Asian. Hispanic faculty responded to the survey in greater percentages than the 0.7% found in the system data. The African-American category was assumed to be analogous to the "Black" category found in community college system databases, and the response rate was lower than the 10.3% systemwide. The North Carolina Community College System designation of "Indian" was interpreted to be equivalent to the Native American category on the survey, and the percentage of responses in this category was also higher than the representative population in the system data. Comparisons between system and survey respondent data can be found in table 4.

Table 4

Faculty Comparison by Ethnicity

Ethnicity	NCCCS Faculty	Survey Respondents
Caucasian	n = 4,517 86.8%	n = 518 89.5%
African-American	n = 538 10.3%	n = 38 6.6%
Hispanic	n = 45 0.9%	n = 9 1.6%
Native American	n = 48 0.9%	n = 9 1.6%
Asian	n = 54 1.0%	n = 4 0.7%
Other	n = 0 0.0%	n = 1 0.2%
Total	5,202	579

*Chi-square 2.084, df 1, $\rho < 0.149$

The largest age group represented was the 40 to 59 year olds, which represented 67.7% of survey respondents, with 5.7% being less than 30 years of age, 21.8% being 30 to 39 years of age, and the remaining 4.8% being 60 to 69 years of age. Data regarding the ages of faculty members was not available through the North Carolina Community College System databases.

The mean years of teaching experience for survey respondents fell within the 6 to 10 year range, yielding a mean of approximately 8 years. Years teaching experience for all respondents is detailed in table 5. A lesser percentage of faculty with zero to five years teaching experience chose to participate in the study, while faculty teaching for more than five years participated to a greater percentage than the percentage of total faculty in a given category, as reported in data released by the North Carolina Community College System (2002).

Table 5

Faculty Comparison by Teaching Experience

Years Experience	NCCCS Faculty	Survey Respondents
0 to 5	n = 2,023 38.9%	n = 116 20.0%
6 to 10	n = 1,093 21.0%	n = 136 23.5%
11 to 15	n = 820 15.7%	n = 111 19.2%
16 to 20	n = 502 9.6%	n = 70 12.1%
21 to 25	n = 388 7.5%	n = 66 11.4%
Over 25	n = 376 7.2%	n = 80 13.8%
Total	5,202	579

*Chi-square 8.3077, df 1, ρ <0.004

Master’s degrees or higher were reported to have been earned by 75.1% (435) of survey respondents, with 62.9% (364) holding a master’s degree. Information on educational levels is contained in table 6. Compared to data available through the North Carolina Community College System (2002), a smaller percentage of survey respondents held less than a bachelor’s degree than was found in the system data, with persons holding advanced degrees responding to the survey in greater percentages than their representation among faculty system wide.

Table 6

Comparison of NCCCS Faculty and Survey Respondents by Highest Degree Attained

Degree		NCCCS Faculty	Survey Respondents
Less than Bachelor’s		n = 792 15.2%	n = 44 7.6%
Bachelor’s		n = 1,270 24.4%	n = 100 17.3%
Master’s		n = 2,731 52.5%	n = 364 62.9%
Education Specialist		n = 28 0.5%	n = 10 1.7%
Doctorate		n = 321 6.2%	n = 61 10.5%
	Total	5,202	579

*Chi-square 3.2400, df 1, ρ <0.072

Hypothesis 1: There is no difference between NCCCS faculty members who participated in this study and NCCCS faculty members;

1a) for all NCCCS participants;

1b) for NCCCS participants based on gender;

1c) for NCCCS participants based on race/ethnicity;

1d) for NCCCS participants based on total years of teaching experience; and

1e) for NCCCS participants based on highest level of education attained.

As shown in table 7, the two groups are similar controlling for the following variables: gender, race/ethnicity, and highest degree attained. The two groups differ with respect to years of teaching experience, with survey respondents claiming a greater number of years of teaching experience. Hypotheses 1a, 1b, 1c, and 1e were retained, with hypothesis 1d being rejected.

Table 7

Chi-Square Comparison of North Carolina Community College Faculty and Faculty Respondents to the Survey

Hypothesis	Chi Square Value	Degrees of Freedom	P value
1a	0.011	1	.917
1b	2.400	1	.121
1c	2.084	1	.149
1d	8.3077	1	.004
1e	3.2400	1	.072

Research Question 2: How do the NCCCS faculty participants compare to one another in terms of their adoption of computer technology for instruction, based upon Rogers' schema?

Respondents were categorized within the Rogers' classification matrix based on their responses to Question 15. Fifty-one respondents (8.8%) stated that they had not yet adopted technology in their classrooms. For statistical analysis, these respondents were categorized with those who chose, "I was among the latest faculty at my institution adopting computer technology in my classroom" as their response to Question 15, as Rogers (1995) schema did not include a category specific to non-adopters.

The resulting distribution is different from Rogers' distribution. Over 14.5% of respondents classified themselves as innovators, compared to Rogers' 2.5%. More than 25.2 % of faculty considered themselves to be early adopters, approximately twice the percentage found in Rogers' schema. Rogers' early majority and late majority categories comprised of 34% each of his sample, but was 40.1% for the early majority and approximately 8.3% late majority in this faculty survey. Lastly, the laggard category was approximately 4% lower for this survey than for Rogers' data (16% in Rogers versus 11.9% in the survey data). Figure 1 shows a comparison of the faculty survey data to Rogers' data.

Faculty members in the North Carolina Community College System who responded to the survey were compared on five demographic characteristics from their responses to questions 1 through 5 on the common survey after being classified into one of the five adoption of innovation categories determined by responses to question 15.

As seen in table 8, highest percentage of innovators and early adopters are found in the 40 to 49 year old age group, with the remaining three categories showing the 50 to 59 year old age group. These two age groups also comprised 67.7% of survey respondents. The under 30 year old age group comprised the smallest percentage in all categories except the early majority.

Table 8

Comparison of Faculty in Each Innovation Category by Age

Category	Age					
	Under 30	30 to 39	40 to 49	50 to 59	60 or over	Total
Innovator	n = 1 1.2%	n = 17 20.2%	n = 35 41.7%	n = 28 33.3%	n = 3 3.6%	84
Early Adopter	n = 10 6.8%	n = 26 17.8%	n = 52 35.6%	n = 46 31.5%	n = 12 8.2%	146
Early Majority	n = 18 7.8%	n = 53 22.8%	n = 76 32.8%	n = 80 34.5%	n = 5 2.2%	232
Late Majority	n = 1 2.1%	n = 14 29.2%	n = 15 31.3%	n = 16 33.3%	n = 2 4.2%	48

Table 8 (continued)

Category	Age					
	Under 30	30 to 39	40 to 49	50 to 59	60 or over	Total
Laggard	n = 3 4.3%	n = 16 23.2%	n = 20 29.0%	n = 24 34.8%	n = 6 8.7%	69
Total	33	126	198	194	28	579

*Chi-square 20.814, df 16, ρ <0.186

Female respondents outnumbered male respondents in each of the five categories, comprising 53.6% of the innovators, 59.6% of the early adopters, 63.4% of the early majority, 68.8% of the late majority, and 62.3% of the laggards. Chi-square calculated for this variable was 3.865 with 4 degrees of freedom and a ρ value of <0.425.

Comparing survey respondents based upon their response to question 3, the highest percentages in each of the five categories was found to be Caucasians, who were similarly highly represented in the total responses received at 89.5%. No Asian faculty members were among those faculty placing themselves in the innovator category. Only Caucasians and African-Americans chose to be categorized in the late majority, and there were no Native Americans or Asians self-selecting the laggard category, where the greatest percentage of African-American faculty were clustered. The composition of each category by ethnic designation appears in table 9.

Table 9

Comparison of Faculty in Each Innovation Category by Ethnicity

Category	Ethnicity						
	African-American	Caucasian	Native American	Asian	Hispanic	Other	Total
Innovator	n = 4 4.8%	n = 76 90.5%	n = 2 2.4%	n = 0 0.0%	n = 1 1.2%	n = 1 1.2%	84
Early Adopter	n = 6 4.1%	n = 137 93.8%	n = 1 0.7%	n = 2 1.4%	n = 0 0.0%	n = 0 0.0%	146
Early Majority	n = 17 7.3%	n = 200 86.2%	n = 6 2.6%	n = 20.9%	n = 7 3.0%	n = 0 0.0%	232
Late Majority	n = 4 8.3%	n = 44 91.7%	n = 0 0.0%	n = 0 0.0%	n = 0 0.0%	n = 0 0.0%	48
Laggard	n = 7 10.1%	n = 61 88.4%	n = 0 0.0%	n = 0 0.0%	n = 1 1.4%	n = 0 0.0%	69
Total	38	518	9	4	9	1	579

*Chi-square 23.297, df 20, ρ <0.274

Overall analysis found more faculty members responding to the survey had been teaching between 11 and 15 years. This group did contain the greatest percentage of faculty in the early adopter category, but faculty members teaching between 6 and 10 years were found to comprise the highest percentages in each of the other three of the four remaining categories. In the other category, more faculty who have taught five or fewer years were found to classify themselves in the early majority (see table 10).

Table 10

Comparison of Faculty in Each Innovation Category by Teaching Experience

Category	Years of Teaching Experience						
	0-5	6-10	11-15	16-20	21-25	Over 25	Total
Innovator	n = 7	n = 20	n = 15	n = 19	n = 12	n = 11	84
	8.3%	23.8%	17.9%	22.6%	14.3%	13.1%	
Early Adopter	n = 15	n = 29	n = 41	n = 16	n = 22	n = 23	146
	10.3%	19.9%	28.1%	11.0%	15.1%	15.8%	
Early Majority	n = 65	n = 59	n = 35	n = 22	n = 23	n = 28	232
	28.0%	25.4%	15.1%	9.5%	9.9%	12.1%	
Late Majority	n = 12	n = 13	n = 8	n = 4	n = 5	n = 6	48
	25.0%	27.1%	16.7%	8.3%	10.4%	12.5%	
Laggard	n = 17	n = 15	n = 12	n = 9	n = 4	n = 12	69
	24.6%	21.7%	17.4%	13.0%	5.8%	17.4%	
Total	116	136	111	70	66	80	579

*Chi-square 47.485, df 20, ρ <0.001

Faculty members holding master’s degrees comprised 62.9% of survey respondents. As seen in table 11, faculty with master’s degrees were found to compose the largest percentage in each of the five adoption innovation categories.

Table 11

Percentage of Faculty in Each Innovation Category by Highest Degree Attained

Category	Highest Degree Attained					
	Less than Bachelor's	Bachelor's	Master's	Education Specialist	Doctorate	Total
Innovator	n = 3	n = 19	n = 49	n = 1	n = 12	84
	3.6%	22.6%	58.3%	1.2%	14.3%	
Early Adopter	n = 4	n = 20	n = 102	n = 2	n = 18	146
	2.7%	13.7%	69.9%	1.4%	12.3%	
Early Majority	n = 23	n = 36	n = 150	n = 4	n = 19	232
	9.9%	15.5%	64.7%	1.7%	8.2%	
Late Majority	n = 6	n = 15	n = 21	n = 2	n = 4	48
	12.5%	31.3%	43.8%	4.2%	8.3%	
Laggard	n = 8	n = 10	n = 42	n = 1	n = 8	69
	11.6%	14.5%	60.9%	1.4%	11.6%	
Total	44	100	364	10	61	579

*Chi-square 28.924, df 16, $\rho < 0.024$

Hypothesis 2: There is no difference between NCCCS participants regarding their adoption of technology in instruction, based on their self-reported category in the Rogers' schema;

2a) for all NCCCS participants;

2b) for Rogers categories based on age;

2c) for Rogers categories based on gender;

2d) for Rogers categories based on race/ethnicity;

2e) for Rogers categories based on total years of teaching experience; and

2f) for Rogers categories based on highest level of education attained.

North Carolina community college faculty have a greater cluster than Rogers' (1995) respondents do in the Innovator, Early Adopter, and Early Majority categories, with lesser response in the Late Majority and Laggard categories (see figure 1). As shown in table 12, age, gender and ethnicity variables were not found to be significant to the alpha .05 level, while variables related to teaching experience and highest degree attained were found to be significant. As a result, hypotheses 2a through 2d were retained but Hypotheses 2e and 2f were rejected.

Figure 1

Graphic Comparison of Rogers' Distribution to Faculty Distribution

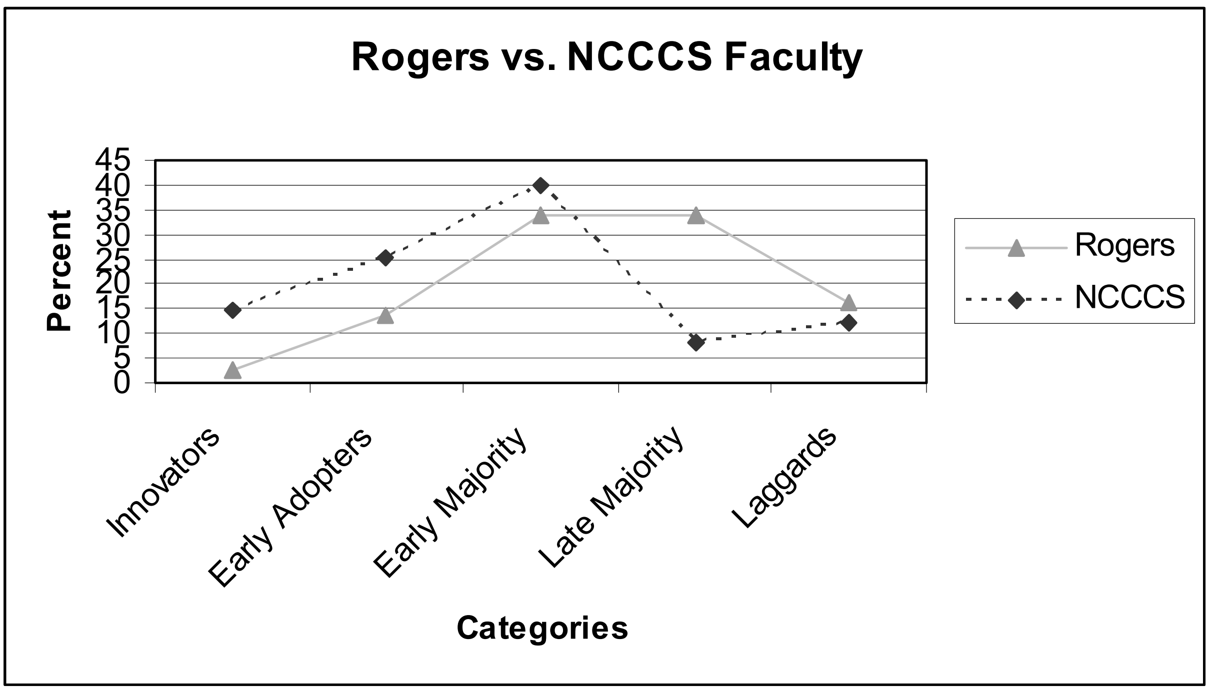

Table 12

Chi-Square Comparison of Faculty Survey with Rogers' Data on Adoption of Innovations with NCCCS Respondents Adoption of Computer Technology in Instruction

Hypothesis	Chi Square Value	Degrees of Freedom	P value
2a	1433.109	1396	.239
2b	20.814	16	.186
2c	3.865	4	.425
2d	23.297	20	.274
2e	47.485	20	.001**
2f	28.924	16	.024*

* significant to alpha level <.05
** significant to alpha level <.01

Research Question 3: How do users and non-users of computer technology in instruction in this study compare with one another as a whole and with regard to each of five demographic characteristics?

Responses to questions 1 through 5 on the common survey were used to compare faculty members who identified themselves as either users or non-users or computer technology in for instruction on question 16. Questions 1 through 5 included the five demographic variables of age, gender, ethnicity, teaching experience, and highest level of educational attainment.

According to table 13, 40 to 49 and 50 to 59 year age groups comprised the largest percentage of faculty responding to the survey (67.7%), and these two groups also held the most users (40 to 49 year old age group) and non-users (50 to 59 year old age group).

Table 13

Comparison of Users and Non-Users by Age

Use	Age					
	Under 30	30-39	40-49	50-59	60 or Over	Total
User	n = 26 6.1%	n =86 20.2%	n = 152 35.8%	n =139 32.7%	n = 22 5.2%	425
Non-User	n = 7 4.5%	n = 40 26.0%	n = 46 29.9%	n = 55 35.7%	n = 6 3.9%	154
Total	33	126	198	194	28	579

*Chi-square 4.038, df 5, ρ <0.401

A greater percentage of women responded to the survey (61.3%), and women were also found to comprise the greatest percentage of users (62.4%) and non-users (58.4%) of computer technology in North Carolina community college classrooms (please see table 14).

Table 14

Comparison of Users and Non-Users by Gender

Use	Gender		
	Female	Male	Total
User	n = 265 62.4%	n = 160 37.6%	425
Non-User	n = 90 58.4%	n = 64 28.6%	154
Total	355	224	579

*Chi-square 0.729, df 1, ρ <0.393

Caucasians, the largest group of respondents to the survey from an ethnic perspective, were also found to be the largest percentage of users and non-users, as seen in table 15.

Table 15

Comparison of Users and Non-Users by Ethnicity

Use	Ethnicity						
	African-American	Caucasian	Native American	Asian	Hispanic	Other	Total
User	n =29 6.8%	n = 377 88.7%	n = 8 1.9%	n = 3 0.7%	n = 7 1.6%	n =1 0.2%	425
Non-User	n = 9 5.8%	n = 141 91.6%	n = 1 0.6%	n = 1 0.6%	n = 2 1.3%	n = 0 0.0%	154
Total	38	518	9	4	9	1	579

*Chi-square 1.829, df 5, ρ <0.872

While the highest percentage of respondents to the survey were found to have been teaching between 11 and 15 years, the greatest percentage of users and non-users were contained the 6 to 10 year experience group, as shown in table 16.

Table 16

Comparison Users and Non-Users by Teaching Experience

Use	Years of Teaching Experience						
	0-5	6-10	11-15	16-20	21-25	Over 25	Total
User	n = 87 20.5%	n = 96 22.6%	n = 84 19.8%	n = 49 11.5%	n = 50 11.8%	n = 59 13.9%	425
Non-User	n = 29 18.8%	n = 40 26.0%	n = 27 17.5%	n = 21 13.6%	n = 16 10.4%	n = 21 13.6%	154
Total	116	136	111	70	66	80	579

*Chi-square 1.605, df 5, ρ <0.901

Faculty holding a master's degree were found to be 62.9% of the total percentage of survey respondents, and were also the largest percentages of both users (61.2%) and non-users (67.5%), when comparing faculty members by highest degree attained (see table 17).

Table 17

Comparison of Users and Non-Users by Highest Degree Attained

Use	Highest Degree Attained					
	Less than Bachelor's	Bachelor's	Master's	Education Specialist	Doctorate	Total
User	n = 32 7.5%	n = 81 19.1%	n = 260 61.2%	n = 7 1.6%	n = 45 10.6%	425
Non-User	n = 12 7.8%	n = 19 12.3%	n = 104 67.5%	n = 3 1.9%	n = 16 10.4%	154
Total	44	100	364	10	61	579

*Chi-square 3.757, df 4, ρ <0.440

Hypothesis 3: There is no difference between NCCCS users and non-users of computer technology in instruction;

3a) for all NCCCS participants;

3b) for Rogers categories based on age;

3c) for Rogers categories based on gender;

3d) for Rogers categories based on race/ethnicity;

3e) for Rogers categories based on total years of teaching experience; and

3f) for Rogers categories based on highest level of education attained.

An exploration of the chi-square analyses for the six variable, the group as a whole, or by age, gender, ethnicity, years of teaching experience, or highest degree, hypothesis 3 showed no differences in any of the variables, as detailed in table 18. Each of the above hypotheses was retained in its entirety.

Table 18

Chi-Square Comparison of Faculty Survey Users and Non-Users of Computer Technology in Instruction

Hypothesis	Chi Square Value	Degrees of Freedom	P value
3a	579.000	577	.469
3b	4.038	4	.401
3c	.729	1	.393
3d	1.829	5	.872
3e	1.605	5	.901
3f	3.757	4	.440

Research Question 4: How do users and non-users of technology in instruction in this study compare with one another based upon their respective teaching fields?

Responses from users and non-users, as identified in question 16 on the common survey, were compared to those received for question 6 of the common survey. A higher percentage of users than non-users was found in every discipline category, except Foreign Language, which received only two responses (0.3%), one from a user and one from a non-user (see table 19).

Table 19

Comparison of Users and Non-Users by Academic Field

Discipline	Use: User	Use: Non-User	Total
Business	n = 87 80.6%	n = 21 19.4%	108
Foreign Language	n = 1 50.0%	n = 1 50.0%	2
Humanities	n = 55 65.5%	n = 29 34.5%	84
Math/Science	n = 71 67.0%	n = 35 33.0%	106
Social Science	n = 36 73.5%	n = 13 26.5%	49
Engineering	n = 21 72.4%	n = 8 27.6%	29
Health Sciences	n = 78 83.0%	n = 16 17.0%	94
Industrial Technologies	n = 37 77.1%	n = 11 22.9%	48
Public Services	n = 30 65.2%	n = 16 34.8%	46
Other	n = 6 75.0%	n = 2 25.0%	8
Missing	n = 3 60.0%	n = 2 40.0%	5
Total	425	154	579

*Chi-square 15.146, df 10, ρ <0.127

Hypothesis 4: There is no difference between users and non-users of computer technology in instruction based on their teaching fields.

There was no difference in the adoption of technology in instruction based upon discipline (p = .127). This hypothesis was retained.

Research Question 5: How do users and non-users of computer technology in instruction in this study compare with one another regarding their perceptions of the existence of several categories of change agent and institutional support in their respective colleges?

Question 5 contrasted the responses of users and non-users, as identified in question 16 on the common survey, with their responses to questions 27 and 28 on the user survey and the corresponding questions on the non-user survey, listed as questions 33 and 34. Of faculty members responding to the user survey, 83.9% (293 of 349) identified one or more change agents within their organizations (see table 20). The most commonly noted change agent among faculty using technology in instruction was faculty members, followed by the president or members of senior administration, with Information Technology staff mentioned third.

By contrast, only 63.4% of faculty not using computer technology in instruction (92 of 145) identified one or more change agents within their organizations (see table 20). The three individuals or groups noted by users were again mentioned by non-users as serving as technology change agents within their organizations. Details of the responses for both user and non-user faculty are noted in table 21.

Regarding open support of their institutions for using technology in instruction, over 88.2% (308) of the user respondents, responding to question 27 on the user survey, stated that their institutions did support its use, compared to only 63.4% (92) of the non-users, responding to question 33 on the non-user survey (see table 22). Nearly equal percentages, 5.2% (18) of users and 4.8% (7) of non-users reported a lack of institutional support. Nearly 6.6% (23) of the users declined to answer the question, compared to 24.8% (36) of the non-users.

Table 20

Comparison of Identification of Change Agent Between Users and Non-Users of Computer Technology in Instruction

Use	Identification of Change Agent		
	Yes	No	Total
Users	n = 288 82.5%	n = 61 17.5%	349
Non-Users	n = 93 64.1%	n = 52 35.9%	145
Total	381	113	494

*Chi-square 19.623, df 1, $\rho < 0.001$

Table 21

Responses of User and Non-User Faculty Regarding Presence of Change Agent

Change Agent Category	User	Non-User
President/Senior Administration	143	30
Staff Development Professional	43	1
Information Technology Specialist	91	14
Faculty	175	45
Outside Source	14	2

Table 22

Comparison of Users and Non-Users by Perception of Institutional Support

Use	Institutional Support		
	Yes	No	Total
Users	n = 308 88.3%	n = 41 11.7%	349
Non-User	n = 92 63.4%	n = 53 36.6%	145
Total	400	94	494

*Chi-square 40.905, df 1, ρ <0.001

Hypothesis 5: There is no difference between users and non-users of computer technology in instruction, based on subject's perceptions of;

5a) the presence of an individual identified as a change agent within each institution; and

5b) support for the use of computer technology in instruction within the institution.

Chi-square ρ values for statistical tests related to perceptions of a change agent and institutional support for the use of computer technology in instruction were both found to be at the .001 level. Therefore, both hypotheses were rejected (see table 23).

Table 23

Chi-square Comparison of User and Non-User Perception of Presence of Change Agent and Institutional Support

Hypothesis	Chi Square Value	Degrees of Freedom	P value
5a	19.623	1	.001**
5b	40.905	1	.001**

** significant to alpha level <.01

Research Question 6: How do users and non-users of computer technology for instruction in this study compare with one another based on the sizes of their respective colleges?

Data used to answer question 6 were gathered from responses from users and non-users of technology for instruction, as identified in question 16 of the common survey, to those responses in question 7 of the common survey.

The highest percentages of both users and non-users by institution size were found among faculty members in colleges with enrollments between 2,000 and 4,999 students (see table 24). This group was also found to contain the largest percentage of faculty responding to the survey (56.1%).

Table 24

Comparison of Users and Non-Users of Computer Technology in Instruction by College Size

Use	College Size					
	Under 2,000	2,000-4,999	5,000-7,999	Over 8,000	Missing	Total
User	n = 107 25.2%	n = 233 54.8%	n = 50 11.8%	n = 33 7.8%	n =2 0.5%	425
Non-User	n = 34 22.1%	n = 92 59.7%	n = 16 10.4%	n = 10 6.5%	n =2 1.3%	154
Total	141	325	66	43	4	579

*Chi-square 2.488, df 4, ρ <0.647

Hypothesis 6: There is no difference between users and non-users of computer technology in instruction and institution size.

Institution size was found to have no effect on whether a faculty member had a computer in his/her office, used the Internet at work, or used e-mail at work (see table 25). The null hypothesis was retained.

Table 25

Chi-Square Comparison of Institution Size and Use of Computers at Work

Computer Functions at Work	Chi Square Value	Degrees of Freedom	P value
Computer in Office	2.217	4	.696
E-mail at Work	7.786	4	.100
Internet at Work	2.357	4	.670

Research Findings Related to User Survey

Two primary areas were explored related specifically to the data in the user survey. The first was faculty use of technology and the second related to motivation toward the use of technology.

According to responses to question 19 on the user survey, faculty members using technology in their classrooms had been doing so for a mean of four years. Responses to questions 20 and 21 on the user survey showed that over 73.3% (256) of users claimed to have other technology users with whom they regularly interact to discuss, either formally or informally, the use of technology in instruction and to discuss successes and setbacks experienced in the development and use of technology for instruction. For the average faculty member, this group consists of two to four others, and 76.5% reported that some or all of these are personnel are from within his/her own institution.

Research Question 7: What specific techniques are employed by users of computer technology in instruction in this study?

Respondents to the user survey identified 1,129 technology uses, or approximately 3.25 uses per faculty member identifying himself/herself as a user of technology in instruction, according to information provided for question 17 on the user survey. Table 26 provides a detailed listing of the types of technology used by faculty members for instruction, including the number and percentage of surveyed faculty using each technique.

The most frequently used technology is e-mail. The use of course presentations developed with PowerPoint, Harvard Graphics, or other software packages was the second most-frequently cited technique. In-class use of the Internet was the third most popular technique, followed by the use of a course website for notes, assignments, grades, and student discussions. One-hundred thirty-six (38.9%) responding faculty stated that they use course management software to maintain class records. Faculty members also frequently used computer simulations. A small number of technology users reported the use of hypermedia techniques in instruction.

Table 26

Technology Uses in Instruction

Method of Use	Number of Responses	Percent
E-mail Contact with Students	244	69.9%
Course Presentation Software	233	66.7%
Internet in the Classroom	206	59.0%
Course Website	161	46.1%
Course Management Software for Recordkeeping	136	38.9%
Computer Simulations	127	36.4%
Hypermedia	22	6.3%

Research Question 8: Why do users of computer technology in instruction in this study say they use technology?

In question 18 of the user survey, respondents were asked to identify their primary reasons for incorporating technology into instruction. Instead, the average faculty member responding to the user survey cited approximately two reasons for using technology in instruction (745 responses for 349 faculty). Over 68.4% (239) of faculty stated that they believed using technology for instruction helped students to learn. Two-hundred one (57.6%) faculty felt it was important to include technology in their classrooms because students would encounter it in their professional lives. Personal enjoyment by the faculty member was cited by nearly 38.8% (135) of faculty, while 35.2% (123) said that it made him or her a better instructor. Only 6.0% (21) responded that they included technology because their peers were doing so or because it was an expectation of college administration. Only five (1.5%) of the faculty members completing the user survey stated that they used technology as a means to gain either performance pay or merit pay.

Research Findings Related to Non-User Survey

Faculty not using computer technology in their classrooms were asked why they were not using it and what would encourage them to begin incorporating these techniques into their classrooms.

Research Question 9: Why do non-users of computer technology in instruction in this study say they do not use technology?

By comparison, only 110 of the 145 (75.8%) faculty members identifying themselves as non-users of technology provided a reason for not using it, according to responses to question 29 on the non-user survey. The most frequent reason cited for not using technology in instruction was a lack of availability (24 or 16.6%). Twenty-two faculty (15.2%) stated that it was not necessary in order to effectively teach in their courses, while 11.7% (17) claimed an insufficiency of funding within their institutions to purchase necessary equipment.

According to 8.9% (13) of non-user faculty, creating materials takes too long. Little or no financial reward offered for the additional work was noted by 6.9% (10) of responding faculty, while 4.1% (6) claimed that they did not know how to use it.

Five faculty (3.4%) stated that they had tried to use technology and that it did not work correctly or that they believed it detracted from the learning experience. Nobody in their departments used it or they had nobody to call if they had problems or questions, according to 2.1% (3) of non-user faculty. Two faculty (1.4%) said that their students did not like the use of technology for instruction. No faculty members claimed that technology was a fad that would soon pass.

Research Question 10: According to non-users of computer technology in instruction in this study, what methods, services, or policies could their respective colleges employ that would encourage them to begin to use computer technology in instruction?

When asked in question 32 of the non-user survey, what would encourage them to begin using technology in instruction, non-user faculty gave an average of

1.3 responses. Approximately 31.7% (46) of respondents said they would consider infusing technology into their courses if they were offered more technology-focused professional development.

Over 19.3% (28) of faculty members not using technology in instruction stated that they would be encouraged to use technology for instruction if they had computers in their offices. Twenty-five faculty (17.2%) responded that receiving quicker response from an information technology specialist or receiving an increase in salary or a bonus for adopting technology would persuade them to become technology users. Having one-on-one training with a knowledgeable faculty member, having a network of knowledgeable colleagues within their institution with whom to interact or receiving an endorsement from their college administration to adopt technology, were each selected by 15 non-technology users (10.3%). Being granted release time for incorporating technology into the curriculum was a chosen response by 9.7% (14) of non-using faculty, with having someone show them how to infuse technology into the curriculum was preferred by eight faculty (5.5%). One faculty member (0.7%) stated that he or she would prefer one-on-one training with an information technology specialist. Fifteen faculty (10.3%) claimed that nothing would persuade them to adopt technology in their classrooms. None of the faculty responding to the non-user survey stated that they would be encouraged to adopt technology in their classrooms if they had equipment available in their classrooms.

Over 99.3% (575) of survey respondents reported having computers in their offices according to question 8 on the common survey, with questions 9 and 12 relating to having Internet access and e-mail capabilities. Of the four faculty members without office computers, two were technology users and two were not. Only three (0.5%) faculty members reported not having Internet access, and two of these used technology in instruction. Only one (0.7%) faculty member reported not using e-mail at work.

Faculty Access to and Use of Computers at Home

An analysis of data related to question 10 on the common survey showed that faculty having a computer at home comprised 94.9% (550) of respondents.

The 29 faculty (5.1%) who did not have computers at home included 4.6% (16) of faculty who used technology in their classrooms and 8.9% (13) of faculty who identified themselves as non-users. Over 93.6% (327) of users and 91.0% (132) of non-users who have home computers have Internet access at home, as shown in responses to question 11 on the common survey. Of those with home computers, 88.9% (291) of users and 84.8% (112) of non-users have e-mail at home, responses to question 13 showed.

Hypothesis 7: There is no difference between users and non-users of computer technology for instruction in this study based on having computers in their homes.

As seen in table 27, having a computer at home significantly impacts the likelihood that a faculty member will use computer technology in instruction (p = .023). However, having the Internet or e-mail at home does not affect the use of technology for instruction (p=.236 and .206, respectively). This hypothesis was rejected.

Table 27

Comparison Between Use of Computer Technology in Instruction and Having Computer at Home

USE	Computer in the Home		Total
	Yes	No	
User	n = 409 96.2%	n =16 3.8%	425
Non-User	n =141 91.6%	n =13 8.4%	154
Total	550	29	579

*Chi-square 5.197, df 1, ρ <0.023

Faculty Web Pages

Only 17.1% (99) faculty members reported maintaining personal web pages on their college server, as found in responses to question 14. This number was comprised of 50 female faculty members (14.1% of total female respondents) and 49 male faculty members (22.8% of total male respondents).

Hypothesis 8: There is no difference between female and male faculty members and their creation and maintenance of personal web pages on servers at their respective colleges.

A difference was found between the creation and maintenance of personal web pages on college servers by female and male faculty members. According to the analysis found in table 28, this difference was significant at the alpha .05 level (p = .015). Male faculty members were more likely than female faculty members to create and maintain a personal web page. This hypothesis was rejected.

Table 28

Comparison Between Gender and Posting a Personal Web Page

Personal Web Page	Gender		Total
	Female	Male	
Yes	n = 50 50.5%	n =49 49.5%	99
No	n =305 63.5%	n =175 36.5%	480
Total	355	224	579

*Chi-square 5.880, df 1, ρ <0.015

Professional Development and Information Technology Specialists

Both users and non-users of computer technology for instruction appear to be participating in technology-related professional development, according to responses to questions 24 and 25 on the user survey and questions 30 and 31 on the non-user survey, and a comparison to question 16 on the common survey (see table 29). A difference was found between the amount of time reported by users and non-users regarding the amount of professional development on the use of technology in instruction in which faculty members have participated.

Table 29

Comparison of Professional Development Between Users and Non-Users

Use	Hours of Professional Development							
	No Response	None	Less than 5	6-10	11-15	16-20	Over 20	Total
User	n = 23 6.6%	n =40 11.5%	n =82 23.5%	n =82 23.5%	n =29 8.3%	n =18 5.2%	n =75 21.5%	349
Non-User	n = 44 30.3%	n = 16 11.0%	n = 37 25.5%	n = 22 15.2%	n = 11 7.6%	n = 7 4.8%	n = 8 5.5%	145
Total	67	56	119	104	40	25	83	494

*Chi-square 61.824, df 6, $\rho < 0.001$

Nearly 74.7% (239) of 320 computer technology users, responding to the question 26 on the user survey, stated that they could normally get a response from an information technology specialist either immediately or within a day. Approximately 19.4% (62) stated that a response was usually received with a week. Nineteen (5.9%) responded that they did not have an information technology specialist within their colleges.

In chapter 5, research data analyses findings will be summarized. Also included will be conclusions drawn from the study and recommendations for further research.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

None of the faculty non-users of technology responded that, "technology is a fad that will soon pass." My inference is that computer technology is viewed by faculty in the North Carolina Community College System as an integral part of instruction for the foreseeable future. I find this outlook to be an encouraging one.

Results of the faculty survey have shown a number of similarities between faculty who have and have not adopted technology in their classrooms, as well as some differences and directions for further study.

Findings from the Common or Related Survey Questions

Faculty in North Carolina community colleges are relatively homogeneous in two demographic categories, race and highest degree earned, based upon both statistics provided by the North Carolina Community College System and respondents of the study. The vast majority is Caucasian (87.1%, according to System data, and 89.5%, based upon survey data). Persons having earned at least a master's degree comprise 59.5% within the System statistics, and 75.1% among survey respondents. Women constitute 61.3% of faculty who replied to the survey and 53.5% of faculty system wide, but differences in technology based upon gender did not appear to play a role. In fact, the only finding in which gender proved to be a significant factor was in the maintenance of a personal web page on the college server.

Faculty who use and do not use technology in their classrooms are scattered across nearly a dozen disciplines contained within some or all North Carolina's community colleges. Responses from smaller colleges (enrollments less than 2,000) imply that access to and use of technology does not seem to be limited to larger, and seemingly more affluent, colleges. An initiative to infuse technology throughout the system may be largely responsible for a lack of clustering of classroom technologies based upon discipline or college size.

While there were no significant differences found between the distribution of the five groups of adopters according to Rogers (1995) and distribution of the North Carolina community college faculty, some differences appear to exist regarding adoption practices. A greater percentage of faculty viewed themselves as innovators, and percentages in the early adopter and early majority categories were higher, as well, in comparison to Rogers' data. Persons in each of these groups were categorized as computer technology users for the purposes of this study. The average number of years since adopting technology for instruction coincides with a technology initiative within the system. Some colleges may have been ahead of the system regarding technology integration. Based upon 84 faculty members who classified themselves as innovators, these faculty most likely spent their own monies on hardware and software to satisfy their desire to bring technology into their classrooms.

The relationship between North Carolina community college faculty members' teaching experience and their adoption of technology according to Rogers' (1995) schema may be related to a feeling of complacency or comfort within the discipline and a desire to branch into new areas coupled with a greater availability of computer equipment due to system wide initiatives. This significance may wane as students who have experienced computer technology in their classrooms at pre-kindergarten through twelfth grade (PK-12) or postsecondary schools enter teaching positions in community colleges.

The significant finding between a faculty members' self-reported Rogers (1995) category and highest level of education achieved may be an anomaly resulting from the large number of faculty members holding a master's as their highest degree (62.8%). In fact, when categories were combined to yield 4 categories—less than a bachelor's, bachelor's, master's, and above master's—highest educational level was not found to be significant at the 95% confidence level ($p = .228$).

No differences were noted when comparing faculty who use computer technology in instruction with those who do not, based upon age, gender, ethnicity, years of teaching experience, or highest attained educational level.

Nearly all faculty responding to the survey reported having computers in their offices, most with Internet access and e-mail. Fifty of the 58 community colleges are linked via a common e-mail system, powered by Novell's GroupWise software. So, a large degree of homogeneity exists regarding computer applications faculty members have available in their offices.

Four faculty claimed not to have a computer in their offices, yet 28 (19.3%) respondents who did not use computer technology for instruction stated that they would be more likely to use computer technology in instruction if they had computers in their offices. Only two of the faculty members not having computer access in their offices were non-users. Perhaps the 26 remaining faculty members share a computer with other faculty members in a common office.

Regarding access to a computer, the Internet, and e-mail at home, most faculty, including those who do not use computer technology in their classrooms, have all three components. A significant ($p = .023$) link was found to exist between having a computer at home and using computer technology for instruction. That significance was not found for either having the Internet ($p = .236$) or e-mail at home ($p = .206$).

A difference between users and non-users of computer technology for instruction was found in the amount of computer technology-related professional development engaged in by study participants ($\rho < .001$).

The role of the information technology specialist was mentioned in both the user and the non-user surveys. Users of computer technology in instruction reported that 74.7% of requests for assistance were answered within a day of the initial contact. However, non-users seemed less involved with the information technology function. Only 2.1% stated that they had not adopted technology for their classrooms because they had nobody to call if they had questions. Because 5.9% of faculty identified as using technology reported not having a designated information technology specialist at their institutions, individual colleges may have some gaps in making sure that equipment is properly functioning in the classroom.

There may also be some gaps in the training of information technology specialists, as was implied by a survey comment received from a faculty member at my own institution who agreed to have her comments shared. This faculty member, a computer user, expressed disappointment with the Information Technology Department's lack of response to the problems experienced by faculty using Macintosh computers in instruction, instead of the more prevalent personal computers (Faculty Member, March 15, 2003). The two different types of computers operate on vastly different platforms, allowing for little or no interface of software, applications, or peripherals.

A faculty member in a humanities discipline also agreed to allow her comments to be shared anonymously. She had left a teaching position at a doctoral university in the northeastern United States to join the teaching staff at a large community college in the North Carolina Community College System. This faculty member complained about outdated equipment, lack of response by information technology specialists, and a shortage of quality training, which she said effectively combined to deter faculty from using technology in for instruction at the community college, despite encouragement toward the adoption of technology from college administration (Faculty Member, March 13, 2003).

The finding of a significant difference based on gender for faculty who maintain a web page on their college server may be a statistical anomaly based upon the small percentage of faculty members who maintain such web pages. The finding showed male faculty to be more likely than female faculty to maintain a personal web page on the faculty member's college survey. This statistical finding may be related to the number of men and women maintaining web pages being almost equal on this variable (50 women versus 49 men), despite a larger number of women than men responding to the survey (61.3% women versus 38.7% men).

Both groups were also asked if their institutions actively supported the use of technology. While users overwhelmingly reported the support of their institutions, the story for the non-users exists in what they did not say. Thirty-six (24.8%) non-users declined to respond to the question. If all the non-responses to the question were interpreted as a lack of support a significant result ($\rho < .001$) would be found to exist.

Users were more likely than non-users to identify the existence of one or more change agents within their institutions. However, information regarding who filled the role of change agent for technology within institutions was comparable for users and non-users. Both groups noted the role faculty from within their institutions had played in moving toward the use of technology in instruction, while nearly as many responded that the president or other members of the senior administration had served this function. Sullivan (2001) noted that presidents in the 21st century must be fluent in technology as well as proficient as change agents. Community colleges are seen as being able to adapt more quickly to change than other types of institutions of higher learning (McFarlin, 1999). As a result, having a president who is viewed as and views himself or herself as a change agent is important to the viability and the image of the college. While McFarlin found that most community college presidents viewed themselves as change agents within their institutions, the results of this study suggest that faculty view other faculty members, more than the president, as being an agent of change in proliferating technology throughout their colleges. Also, the wording of the response, "The president or other member(s) of the senior administration" allowed the inclusion of other administrators who may be impacting technology implementation at some colleges to a greater degree than their presidents. So, the actual role of the president in the integration of technology throughout North Carolina community colleges may be minimal or may be more indirect than that of faculty members as perceived by other faculty. Based upon the survey data for this study, it appears that presidents could improve their perceptions as change agents among faculty at their institutions by ensuring that computer technology is prevalent in the organization's mission statement and goals, becoming more conversant in computer technology, and conveying institutional support through their words and actions. Also, presidents may demonstrate institutional support for technology by initiating and supporting financial incentives to hire and retain faculty to fill vacancies within their institutions, who are fluent in the use of technology in instruction.

Findings from the User Survey

Faculty who incorporate computer technology into their classrooms have been doing so for approximately four years and incorporate technology in multiple ways. The average faculty member using computer technology for instruction uses an average of more than three different techniques. The implication seems to be that once a faculty member has chosen to include one form of computer technology into the curriculum, he or she becomes interested in integrating other technologies as well.

The two most popular forms of technology used are also, theoretically, the most widely available. The prevalence of the e-mail system through GroupWise at 86.2% of colleges allows ease of communications between faculty and students with e-mail access. Computers purchased through the state contract system for community colleges normally have Microsoft software packages, including Microsoft Office, which includes PowerPoint.

Software used for course websites also includes components for course management, including records maintenance. The Blackboard software program, which many institutions use for the development of online courses, also provides faculty with the opportunity to maintain a course website and manage course records with the same software, thereby saving colleges the expense of separate packages for each of these functions.

Computer simulations and hypermedia often require the purchase of expensive software packages unless a faculty member has gained expertise to develop his or her own applications. As the use these techniques becomes more prevalent and more desirable, the price will likely drop.

Regarding the reasons given by faculty members for using computer technology in their classrooms, the most popular reason for use was to help students learn. Faculty also noted as important allowing students to experience technology in instruction so they would be familiar with it in the future as they enter the work world. Many indicated that the use of technology made them more effective classroom instructors. These reasons are related to student learning and student success.

The remaining reasons for integrating technology into instruction, many of which received lower response rates, linked to personal characteristics of faculty members. These reasons for technology integration included personal enjoyment, peer pressure, administrative expectations, or additional pay.

Most (73.3%) faculty members who used technology for instruction interacted with others within their institutions regarding the use of technology. This support network may be essential for continued use of computer technology in instruction. While all faculty members who identified themselves as innovators according to Rogers (1995) schema were still technology users, 16.4% of those identified as early adopters had ceased using technology for instruction, and the discontinuation percentages continued to rise through the early majority (25.9%), late majority (39.6%), and laggard (73.9%) categories. Rogers (1995) identified networking and social activities as being characteristics of early adopters and early majority, so perhaps they were not able to develop and maintain meaningful connections to sustain their technology interest and expertise, and the late majority did chose to adopt technology into their classrooms for reasons that did not support its continued use by faculty members.

Findings from the Non-User Survey

Two of the top responses by non-users regarding not using technology for instruction were a lack of equipment and insufficient institutional funding, both first-order and extrinsic factors according to Ertmer (1999). Other factors mentioned that could be considered as extrinsic barriers included having a lack of success with previous attempts at integration and having nobody to contact with regard to problems or questions. These may be related to a lack of institutional or peer support that made the integration of technology into instruction more difficult for some faculty members. The belief that materials took too long to create may also be linked to a lack of support, as networking with other technology users may provide the faculty member with a means of not having to “reinvent the wheel” or of learning shortcuts that might decrease the amount of time required to develop classroom materials related to technology.

Reponses that appeared to be in direct contrast with beliefs of the technology user respondents were that technology detracted from the learning experience, that the students did not like it, and that it was not necessary for certain curricula. The large percentage of user faculty who saw technology as supporting learning (68.4%) varies markedly from the small number of non-user faculty who viewed technology as a distraction (3.4%). The variety of disciplines in which the technology user respondents teach implies that technology across the curriculum is possible, in contrast to the number of non-using faculty who do not see a need to implement it due to the disciplines in which they teach (15.2%).

Several second-order or intrinsic reasons for non-adoption were also cited by faculty. A few faculty (2.1%) stated that they did not use technology because others in their department also did not. This percentage was less than that of technology users who used technology because others in their departments did (6.0%). So, peer pressure did not seem to be a factor in either the adoption or the lack of adoption of technology for instruction.

Another second-order factor, financial reward, appeared to be more important as a contingency for adopting technology in instruction for non-users than for users. Some (17.2%) non-users cited a lack of financial reward as a reason for not adopting technology for instruction, while only 1.5% of user faculty reported adopting technology to gain a financial reward. Only 75.8% of non-user faculty cited any reason for not having adopted computer technologies in their classrooms.

When asked what would encourage them to adopt technology in their classrooms, training was a frequent response. Faculty members indicated that they wanted additional professional development focused on technology in instruction as well as individualized training with either another faculty member or a member of the information technology staff. A quicker response from an information technology specialist was also noted as a method by which participation could be encouraged.

Non-user faculty who said they would be encouraged to use technology for instruction if they had computers in their offices comprised 19.3% of this group. Yet only 1.4% of the non-users stated that they did not currently have computers in their offices.

Only 1.5% of the faculty members identified as users had adopted technology in instruction to gain a financial reward. However, 17.2% of the non-user faculty stated that they would be more likely to integrate technology into their classrooms if they received a bonus or salary incentive for doing so. Release time as an inducement for adopting technology was noted by 9.7% of non-user faculty. Truell and Price (1998) found financial incentives not to be a significant motivating factor for full-time community college faculty.

While a lack of equipment for instruction was seen by some faculty as a reason for not infusing technology into the curriculum, none of the non-user faculty cited having equipment purchased for their classrooms as something that would encourage them to begin using it.

A mixture of extrinsic and intrinsic factors are found in the reasons given by faculty who have not adopted technology in instruction and some of these reasons are in stark contrast to the very reasons cited by faculty users for integrating computer technology into their classrooms. Contrast can also be seen between some reasons why faculty used technology for instruction, and some factors cited by non-using faculty that might motivate them to join the ranks of the users.

The literature suggests that other factors not explored herein, such as student expectations, may be even more powerful driving forces toward adoption of technology for instruction.

A Glimpse into the Future

In her best selling book, *Failure to Connect: How Computers Affect Our Children's Minds—for Better and Worse*, Jane Healy (1998) wrote of her dismay when she witnessed the activity by persons in their 20s and 30s at a work center at 10:30 on a Saturday night near her home in Manhattan. While Healy (1998) found this to be a disconcerting scene, it was likely business as usual for the work center customers. Computers and other forms of modern technology are a part of the culture of coming generations, who will view the use of technology as an expectation and not an option in their educations and other aspects of their lives (Barone & Hagner, 2001; Boettcher, 1999; Harvell, 2000; McKenzie, 1998; Rogers, 2001; Tapscott, 1998). According to the National Center for Educational Statistics (2000), 84% of teachers in the public schools reported having computers in their classrooms, with 99% of teachers having access to computers within their schools. An increase in home computer use by all students was reported to have occurred between 1992 and 1998 (National Center for Educational Statistics).

A similar trend in home computer use is seen in higher education, as the Campus Computing Survey (Green, 2001) showed the number of students who are computer owners have increased from 58.6% to 71.5% between 2000 and 2001. Students who are accustomed to using computers will instinctively look toward institutions of higher learning that will allow them to continue their learning in this mode that has become an integral part of their lives (Creighton & Buchanan, 2001; Kirk, 2000).

Tapscott (1998) theorized that faculty members who did not infuse technology into their classrooms and become accustomed to collaborating with students, thereby creating a more learner-focused environment, would become obsolete and unnecessary. He also voiced a need for all people to become fluent in the technologies of the digital age in order to be able to function in the world of the 21st century. He urged institutions of higher education to begin adapting to technology, as has been occurring in the PK-12 arena.

Predictions of the future of higher education as influenced by technology, show a greater degree of collaboration among faculty (Boettcher, 1999; McClenney, 1998) in response to the stretching of their responsibilities beyond time constraints (Healy, 1998). With most faculty using technology already interacting with other faculty, both within and outside their home institutions, some collaboration is likely already taking place. While faculty tend to view their curricula as a personal extension of themselves, many faculty may, in time, discover the time savings that can be realized by collaborating with others within or across disciplines to develop technological applications and methodology for incorporation into their lesson plans.

Planning for Technology

According to Gandolfo (1998), purposeful planning for technology was not taking place. Colleges and universities must develop technology plans that address appropriate uses of technology in instruction and that will be supported by the institution's information technology staff members.

Each college or university should develop its own plan. Shapiro, et al. (1995) recommended the development of three goals to guide the process: 1) using technology to enhance mathematics and science programs; 2) establishing links to local high schools for the transmission of video and data; and 3) the development of highly-interactive methods to enhance teaching and learning.

Bates (2000) noted the need for a strong relationship between the technology infrastructure and academic planning. Maintaining current equipment, retaining competent information technology specialists, and assessing student access to technology outside instruction must all be a part of a well-developed plan.

Rogers (2001) highlighted three trends that would by likely to transform higher education in the short-term: 1) a desire for increased access, 2) an emphasis on the concept of lifelong learning, and 3) technology. However, the technology focus should be modified from an emphasis on the aspects of hardware and software to learning aspects, including individualized instruction and interactivity (Rogers).

Conclusions

Faculty have integrated computer technology into their classrooms at a variety of paces and due to varying motivations, some of which may have been illuminated through this study. With the possible exceptions of highest attained educational level and years of teaching experience, none of the demographic factors explored in this study was related to a faculty member's use of technology in instruction.

Despite some differences in the rate of computer technology adoption practices, the faculty of the North Carolina Community College System appear to be similar to the ratios expressed by Rogers (1995) and others who previously studied the dissemination of an innovation across a given population.

Faculty themselves and presidents or other members of the senior administration are seen as change agents in leading the efforts to facilitate the adoption of technology in North Carolina community college classrooms. The presence of information technology specialists and the availability of technology-focused staff development are also important factors for infusing technology into instruction.

Institution size and academic discipline do not appear to affect the likelihood that a faculty member will adopt computer technology in his or her community college classroom. The finding regarding the lack of a significant result based on discipline is further underscored by the low percentage of user faculty who were incorporating technology because others were doing so, and non-user faculty who did not use it because others in their departments did not (6.0 % for users and 2.1% for non-users).

Much remains to be accomplished before all faculty incorporate technology into their classrooms. To continue the proliferation of computer technology in North Carolina community college classrooms, a three-pronged model must exist: 1) sufficient funding must be allocated at each college toward the purchase of the necessary computer equipment for classrooms, and this equipment must be maintained and upgraded as needed; 2) staff development activities must be planned and funded to enable faculty members already functioning in a technological environment to continue to move forward, while faculty functioning at a lower level or not functioning with technology are incorporated into the technology initiative; and 3) this environment of change must be encouraged and nurtured by the president of each institution acting as a change agent. To adequately fulfill the role of change agent, the president must ensure that the mission and goals of the college are consistent with the incorporation of technology into instruction, and that appropriate funding initiatives occur. Presidents must also ensure that an suitable focus on professional development to support technology in is occurring within his or her institution. Lastly, presidents must ensure that a technology mindset extends to the hiring of new faculty with classroom computer technology expertise.

Recommendations for Further Research

Several arenas for continued analysis have emerged from the findings of this study. As with previous similar studies, demographic characteristics appear to have little or no relationship to the adoption of technology in instruction. However, the motivations for using technology, as documented in this study, could be used as a basis for further exploration, perhaps in a qualitative framework. Intrinsic motivators may be explored for a link to whether a faculty member chooses to include computer technology in his or her classroom presentation. Similarly, the theory of Wesley and Franks (1996) that cultural, philosophical, and methodological influences are more important than the development of technical expertise in the adoption of technology for instruction, may be useful to incorporate in this approach.

Based upon implications of this study, a follow-up study could be constructed to explore methods of delivering professional development to encourage the use of technology in instruction by faculty who are resistant to the use of technology, and addresses some of the reasons for not incorporating technology into instruction that were mentioned in this study. A qualitative study of early experiences of community college faculty members as they integrate technology into their classrooms could also be undertaken.

An exploration similar to Ertmer's (1999) first order (extrinsic) and second-order, or intrinsic, barriers to technology integration could be accomplished at the postsecondary level. Such a study could also include the methodology of the subsequent research of Ertmer, et al., (2001).

The purpose for integrating computer technology for instruction is to facilitate student learning, and several studies have been undertaken to test student learning. With a large contingent of students exposed to technology in their classrooms at the PK-12 level expected to enter college in the coming years, a study of the experiences of students in community college classrooms who have previously used technology in their classrooms could be illuminating, especially if they were involved in some college classes that expanded on their use of technology in education, while other classes did not incorporate technology.

Based on the works of McFarlin (1999) and Sullivan (2001), the role of the president as a change agent in the infusion of technology in the 21st century community college could be further investigated, based on the findings that faculty members were seen more often as change agents within a college than was its chief executive officer, by both users and non-users of computer technology.

The need exists for college administrators to place a priority on hiring faculty who use technology for instruction to meet the demands of future generations of students. An examination of the current status of this concept and a proposal to address the need, if it is not being met, from the standpoint of an educational system as well as individual institutions, may be practical.

Recommendations to Improve Current Practice

Implementation of the following procedures may result in improvements at individual colleges and within the North Carolina Community College System:

1) Build the use of technology for instruction into the mission and goals of each community college.
2) Develop plans for the acquisition, maintenance, and upgrade of computer technology equipment for all classrooms.
3) Create a two-tiered professional development system that addresses the needs of faculty currently using technology in instruction, while encouraging non-users to overcome their resistance to the use of technology for instruction and to address the training needs of those faculty who previously adopted and abandoned using technology in their classes.
4) Fund the Information Technology Department to an adequate level that will enable staff to properly maintain equipment and rapidly respond to needs and requests. Information technology personnel should act as resources and instructors, as necessary, for professional development activities.

5) Encourage presidents to take a more active role in technology within their institutions, acting as change agents to bring about a technology focus in mission and goals, providing adequate classroom technology funding, and supporting a technology focus in professional development and the hiring process.

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APPENDICES

APPENDIX A—COVER MESSAGE TO CHIEF ACADEMIC OFFICERS

Dear Chief Academic Officer:

I am contacting you for assistance at the suggestion of Mike Pittman from the System Office. I work at Catawba Valley Community College, and am currently completing my dissertation toward a doctorate in Educational Leadership at East Tennessee State University. My topic relates to the use of computer technology in the classroom by full time faculty in the North Carolina Community College System. I am interested in surveying faculty at all 59 institutions in our system, and Mike believed that you would be willing to assist me in distributing the link to my survey. The survey can easily be completed by faculty members online in about 5 minutes.

I would appreciate your forwarding the enclosed email message, which includes the survey link, to all full time faculty members in your institution. I will send a follow up message on Thursday afternoon as a reminder, and would appreciate your also forwarding that message to your faculty members.

Thank you in advance for your willingness to assist me with my dissertation research.

Karen Less, Ed.S., Director
Public Safety Training
Corporate & Continuing Education
828/327-7000, extension 4331
kless@cvcc.edu

APPENDIX B--MESSAGE TO FACULTY

I am the Director of Public Safety Training at Catawba Valley Community College, and a doctoral student at East Tennessee State University, working on my dissertation in Educational Leadership and Policy Analysis. My dissertation topic relates to the degree of use of technology to enhance traditional classroom instruction by full-time community college faculty members in North Carolina. The information from the enclosed survey will be used to complete my study. Your assistance with this project will be greatly appreciated.

At the bottom of this message, you will find a web link. Please click anywhere on this link and it will take you to a questionnaire that will take approximately 10 minutes to complete. The questionnaire has been pilot-tested by instructors from within the North Carolina Community College System. The questions deal with demographic information, the use of technology in the classroom, and procedures relating to technology that may by present within your institution. Your responses will be returned to me in a database that will include no means of identifying respondents based on institution, so your anonymity will be assured. Participation in this study is voluntary and can be withdrawn at any time, upon your request.

Whether or not you currently use technology in your classroom, your participation in this study is extremely important. I would appreciate receiving your responses no later than March 19, 2003.

Thank you for your contributions to this project.

Please click on this link to go to the survey:

http://www.cvcc.edu/survey/export/?q_id=491673058271

APPENDIX C--FACULTY SURVEY

Please respond to the following questions by choosing the answer that best fits you and/or your classroom practices. Just double-click the appropriate box(es) and select "checked" in the default value block. To return the survey electronically, please save it to your hard drive then attach it to an e-mail address to me at kless@cvcc.edu. If you would prefer, you may print a paper copy of the form, complete it, and fax it to me at 828/879-3008, or return it by mail to: Karen H. Less, Corporate and Continuing Education, Catawba Valley Community College, 2550 Highway 70 Southeast, Hickory, NC 28602. Please feel free to contact me if you have questions or problems with the survey. I may be reached via e-mail at kless@cvcc.edu or by phone at 828/327-7000, extension 4331. Thank you for participating in this survey.

1. Age
   - ☐ Under 30
   - ☐ 30-39
   - ☐ 40-49
   - ☐ 50-59
   - ☐ 60-69
   - ☐ 70 or over

2. Gender
   - ☐ Female
   - ☐ Male

3. Race/Ethnicity
   - ☐ African-American
   - ☐ Caucasian
   - ☐ Native American
   - ☐ Asian
   - ☐ Hispanic
   - ☐ Other (please specify) _____________

4. Total Years of Teaching Experience
   - ☐ 0-5 years
   - ☐ 6-10 years
   - ☐ 11-15 years
   - ☐ 16-20 years
   - ☐ 21-25 years
   - ☐ 26-30 years
   - ☐ 31-35 years
   - ☐ over 35 years

5. Highest Level of Education Achieved
   - ☐ High School Diploma/GED
   - ☐ Bachelor's Degree
   - ☐ Education Specialist Degree
   - ☐ M.D./D.D.S./J.D.
   - ☐ Associate Degree
   - ☐ Master's Degree
   - ☐ Doctoral Degree
   - ☐ Other (please specify) _____________

6. Teaching Area
   - ☐ Business
   - ☐ Foreign Language
   - ☐ Humanities
   - ☐ Math/Science
   - ☐ Social Sciences
   - ☐ Engineering
   - ☐ Health Sciences
   - ☐ Industrial Technologies
   - ☐ Public Services
   - ☐ Other (please specify) _____________

7. Size of community college in which you teach
   - ☐ Under 2,000 curriculum FTE
   - ☐ 2,000-4,999 curriculum FTE
   - ☐ 5,000-7,999 curriculum FTE
   - ☐ Over 8,000 curriculum FTE

8. Do you have a computer in your office?
☐ Yes ☐ No

9. If yes to Question 8, does this computer have Internet access?
☐ Yes ☐ No

10. Do you use a computer at home?
☐ Yes ☐ No

11. If yes to Question 10, does this computer have Internet access?
☐ Yes ☐ No

12. Do you use e-mail at work?
☐ Yes ☐ No

13. Do you use e-mail at home?
☐ Yes ☐ No

14. Do you maintain a personal web page on your college's server?
☐ Yes ☐ No

15. Please choose the category that best describes your adoption of technology in the classroom (choose only one).
- ☐ I was using computer technology in my classroom before most faculty members in my college knew what it was or before the college purchased equipment.
- ☐ I was one of the first faculty members in my college to adopt computer technology in the classroom when the college first purchased equipment.
- ☐ I was not one of the first faculty members in my college to begin using computer technology in the classroom, but adopted it ahead of most of my colleagues.
- ☐ I adopted computer technology in my classroom later than most of my colleagues.
- ☐ I was among the latest faculty at my institution adopting computer technology in my classroom.
- ☐ I have not adopted computer technology in my classroom.

16. Do you regularly enhance your traditional classroom delivery using e-mail, the Internet, a course website, computer simulations, computer presentations, course management software, hypermedia, or other form of computer technology?

☐ Yes (please continue with Question #17)
☐ No (please skip to Question #29)

17. Which of the following computer enhancements do you use regularly use in your classroom? (choose all that apply)
- ☐ e-mail contact with students
- ☐ in-class use of the Internet
- ☐ course website for notes, assignments, grades, student discussion, etc.
- ☐ use of computer simulations
- ☐ course presentations (PowerPoint, Harvard Graphics, etc.)
- ☐ use of course management software for recordkeeping
- ☐ hypermedia
- ☐ other (please specify) ___________________

18. What is your primary reason for using technology to enhance your classes?
- ☐ It helps the students learn. (choose one)
- ☐ Students need exposure to technology because they will encounter it in their professional lives.
- ☐ It makes me a better teacher.
- ☐ I enjoy it.
- ☐ Many of the faculty in my department are using it.
- ☐ To be eligible for performance or merit pay.
- ☐ My administration expects it to be used.
- ☐ Other (please specify) ___________________________________

19. How long have you been using technology to enhance your classroom presentations?

☐ Less than 1 year	☐ 6-7 years
☐ 1-2 years	☐ 8-10 years
☐ 3-5 years	☐ over 10 years

20. Do you interact with a group of colleagues within your institution to discuss, either formally or informally, the use of technology in the classroom and to discuss successes and setbacks experienced in the development and use of technology in the classroom?

☐ Yes	☐ No

21. If yes to Question 20, how many faculty members make up this group?

☐ 1 other faculty member	☐ 5-10 other faculty members
☐ 2-4 other faculty members	☐ over 10 other faculty members

22. If yes to Question 21, are these colleagues with whom you discuss technology uses in the classroom
- ☐ from within your own college
- ☐ from outside your college (other colleges or businesses)
- ☐ a combination of persons inside and outside your institution

24. Does your college provide training in the use of technology in the classroom through professional development or inservice training programs?
- ☐ Yes
- ☐ No

25. How much professional development on the use of technology in the classroom have you participated in at your college?
- ☐ None
- ☐ Less than 5 hours
- ☐ 6-10 hours
- ☐ 11-15 hours
- ☐ 16 to 20 hours
- ☐ over 20 hours

26. If you have a problem or question regarding the use of technology in the classroom, how quickly does your Information Technology Specialist respond?
- ☐ Immediately
- ☐ Within a day
- ☐ Within a week
- ☐ My college does not have a specialist

27. Does your institution openly support the use of technology in your institution?
- ☐ Yes
- ☐ No

28. If yes to Question #27, whom would you characterize as a moving force or change agent(s) for your institution?
- ☐ The president or other member(s) of the senior administration
- ☐ Staff development provider
- ☐ Information technology specialist
- ☐ Faculty member(s)
- ☐ An outside force such as someone from business or industry
- ☐ Other (please specify)____

If you answered “Yes” to Question 16, you may stop here.
Thank you for participating in the survey.

If you answered “No” to Question 16, please begin the second part of the survey here.

29. Why have you chosen not to use technology to enhance your classes (choose all that apply)?
- ☐ It detracts from the learning experience.
- ☐ It is not necessary for my curriculum.
- ☐ I do not know how to use it.
- ☐ Technology is a fad that will soon pass.
- ☐ My students don’t like it.
- ☐ Sufficient technology funding is not available within my college to purchase the necessary equipment.
- ☐ Nobody in my department uses it.
- ☐ I do not have access to technology in my classroom(s).
- ☐ I have tried to use it before and it did not work correctly.
- ☐ There is no one to call if I have problems or questions.
- ☐ Creating materials takes too long.
- ☐ Little or no financial reward is offered for the additional work.
- ☐ Other (please specify) ____

30. Does your college provide training in the use of technology in the classroom through professional development or inservice training programs?

☐ Yes ☐ No

31. How much professional development on the use of technology in the classroom have you participated in at your college?

☐ None ☐ 11-15 hours
☐ Less than 5 hours ☐ 16 to 20 hours
☐ 6-10 hours ☐ over 20 hours

32. What would encourage you to begin using technology in your classroom? (choose all that apply)

☐ Having the equipment available in the classroom.
☐ Having more technology-focused professional development available.
☐ Receiving a quicker response from an Information Technology specialist.
☐ Having a network of knowledgeable colleagues in my institution with whom I could interact.
☐ Having the administration of my college endorse the adoption of technology.
☐ Having someone show me how to use technology in my curriculum.
☐ Having a computer in my office.
☐ Having one-on-one training with an Information Technology specialist.
☐ Having one-on-one training with a knowledgeable faculty member.
☐ Being granted release time for incorporating technology in my curriculum.
☐ Receiving an increase in salary or a bonus for adopting technology into the classroom.
☐ Other (please specify) ____
☐ Nothing.

33. Does your institution openly support the use of technology in your institution?

☐ Yes ☐ No

34. If yes to Question 33, whom would you characterize as a moving force or change agent(s) for your institution?

☐ The president or other member(s) of the senior administration
☐ Staff development provider
☐ Information Technology Specialist
☐ Faculty member(s)
☐ An outside force such as someone from business or industry, the local school system, or another college or university
☐ Other (please specify) ____

Thank you for participating in the survey.

VITA

KAREN HILL LESS

Personal Data:

Date of Birth: May 9, 1952

Place of Birth: Wheeling, West Virginia

Marital Status: Married

Education:

Public Schools, Ohio County, West Virginia

West Virginia Northern Community College, Wheeling, West Virginia;
Degree: Associate in Arts, Liberal Arts, 1974
Degree: Certificate in Applied Science, Emergency Medical Services, 1976

West Liberty State College, West Liberty, West Virginia;
Degree: Board of Regents Bachelor of Arts, 1975

The University of Texas at Austin, Austin, Texas;
Degree: Master of Education, Higher Education Administration, 1991

Appalachian State University, Boone, North Carolina;
Degree: Education Specialist, Higher Education—Teaching, 1998

East Tennessee State University, Johnson City, Tennessee;
Degree: Doctor of Education, Educational Leadership, 2003

Professional Experience:

Paramedic, Kanawha County Emergency Ambulance Authority, Charleston, West Virginia; 1981-1986

Clinical Coordinator/Instructor, Paramedic Technology Program, Austin Community College, Austin, Texas; 1987 to 1992

Director of Public Safety Training, Catawba Valley Community College, Hickory, North Carolina; 1993 to present

Awards and Honors:

Who's Who Among Students in American Junior Colleges, 1976

Kappa Delta Pi, Delta Chapter, The University of Texas at Austin, 1989

Businesswoman of the Month, Hickory Business and Professional Women's Organization, October 1998