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Faculty computer self-efficacy and integration of electronic communication in teaching college courses

Leah Chepngéno Keino Kagima
Iowa State University

Faculty computer self-efficacy and integration of electronic communication in teaching college courses

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Leah Chepng'eno Keino Kagima

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UMI Number: 9911606

UMI
300 North Zeeb Road
Ann Arbor, MI 48103

Graduate College
Iowa State University

This is to certify that the Doctoral dissertation of

Leah Chepng'eno Keino Kagima

has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

Major Professor

Signature was redacted for privacy.

For the Major Program

Signature was redacted for privacy.

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DEDICATION

This work is dedicated to my parents Hellen & Lisa Keino and my late father Joel arap Keino for teaching me to pray and trust in the Lord at all times. Thank you for your prayers, sacrifices, immense faith, love, caring, and support.

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ABSTRACT

As technological innovations continue to change and expand, it becomes increasingly necessary to support faculty in adopting innovations to keep up with the educational demands of the 21st century such as the changing learning environments, distance education, computer based course management, and delivery technologies. Recent studies have indicated that successful implementation of educational technologies depends largely on educators who guide the daily experiences of learners. Understanding more about faculty confidence and skills for computer technology use can provide insights for intervention strategies in faculty development efforts. To prepare for this intervention, it is important to identify the extent to which faculty have integrated technology and their confidence in using educational technologies.

The overall purpose of this study was to determine faculty computer self-efficacy and the extent of integration of electronic communication in teaching college courses. This study sought to determine: faculty computer-self-efficacy, extent of integration of electronic communication, faculty characteristics that influence adoption of technology, and characteristics of faculty integrating technology in teaching distant students via the Iowa Communications Network (ICN).

Extent of integration was examined from two related theoretical frameworks: Roger's (1995) diffusion of innovations, and Bandura's (1986) theory of self-efficacy. Results revealed that for faculty teaching in both delivery

systems, no significant differences were found in extent of integration of electronic communication in teaching face-to-face on campus or in teaching via the ICN. Based on the two theories, faculty categorized as high integrators and with high self-efficacy integrated technology more than those categorized as laggards and with low self-efficacy. Over half of the teaching faculty (52%) indicated that when using electronic communication in teaching college courses, they used it the most for course-related announcements/deadlines and least for real-time synchronous communication. Hierarchical regression analysis identified self-efficacy in using the World Wide Web to be a strong predictor of integration of electronic communication in teaching college courses.

Results of this study partially support past studies that faculty characteristics including attitudes, computer experiences, technology education, age, self-efficacy, rank, and discipline have an influence on faculty's decisions to adopt technology. Based on the findings, it is recommended that faculty education be focused on increasing self-efficacy and providing hands-on experiences with a variety of computer applications in technologically supported learning environments. Future studies should incorporate both positivistic and interpretive modes of inquiry to gain in-depth understanding of the motivations and circumstances regarding the lack of innovativeness among teaching faculty and their perceptions of distance education, integration of technological innovations, and confidence in working in computer-related environments.

CHAPTER I. INTRODUCTION

Background for the Study

The rapid growth of information technologies has provided public accessibility to a vast assembly of educational resources and learning opportunities. This growth has transformed the capacity of higher education to deliver educational and training programs to learners (Abou-Dagga & Huba, 1997; Clark, 1993; Hanson, 1998; Keegan, 1986; Owston, 1997; Windschitl, 1998). Miller (1997) observed that institutions of higher education report increased enrollments of adult learners who demand an education using these new communication technologies. Universities also are changing to accommodate these new audiences and increasingly restructuring their academic policies (Olcott, 1991), curricula, and communications systems to allow educators to interact with learners using these emerging delivery systems (Herring, 1997). In some institutions, both asynchronous and synchronous delivery systems have been utilized to reach both regular on-campus and distant students (Miller, 1997). As computer technologies continue to decline in cost and become more user friendly and versatile, opportunities are created for educators and learners to explore the vast landscape of this emerging digital environment.

From the findings of research on technology integration in education, several authors (Albright & Graf, 1992; Kelsey 1997; Miller, 1997; Perraton & Potashnik, 1997) suggested that technology alone is no panacea and argued that educators are central to the adoption of these technologies in educational institutions. Although technology will not solve all instructional problems in education immediately, thoughtfully used, technologies can introduce many promising improvements over traditional modes of teaching and learning (Herring, 1997). From reviewing the history of educational technology, Zhao (1998) suggested that technological potentials do not easily transfer into direct educational benefits. However, Percival and Ellington (1984) argued that the principal role of technology in education is to help improve the overall efficiency of the teaching and learning process over time.

Computer related technologies can be used to help facilitate major changes in the ways teachers teach and the ways students learn. Simonson and Thompson (1997) concluded that the computer can be used specifically to help teachers focus on active learner-centered activities, with teaching activities focused on facilitating learning. In these learner-centered approaches, the educator becomes one of the resources available to learners who in-turn become active participants in the learning process. In using the learner-centered approach, educators add to prepared study materials by providing explanations, references, and reinforcement for the learner (Beaudoin, 1990). According to Albright (in press), students participate in active learning through interaction on a person-to-person basis using synchronous computer applications. Passey and Samways (1996) cautioned against the assumption that all educators embrace the same vision of the changes in classroom practice that ought to result from technology use, or that the majority of educators will change their methods as they incorporate technology. Although learner-centered issues are critical, research on educators' use of computers in teaching is important because educators who are comfortable using computers model positive uses of technology to learners (Chiero, 1997).

Much attention has been focused on student adoption of technology. Even though there is a body of evidence that points to the centrality of educators in adoption of technological innovations (Knupfer, 1993), the educator's role in the acceptance, implementation, and utilization of educational computing has received less attention. Parry and Whatrom (1995) argue that the extent to which faculty use technology themselves becomes critical as they are preparing students to face the emerging telecommunications reality. It also has been documented that successful implementation of educational technology depends largely on educators who determine the daily educational experiences of their learners (Cuban, 1986).

To gain an accurate view of educational change resulting from adoption of innovations, it is imperative to consider changes brought into the teaching and learning process. Educators are not disposed toward replacing familiar strategies, techniques, and methods of instruction learned over several years and which have worked successfully (Hope, 1998). For educators to integrate technology into their teaching and learning environments, they need to believe that using technology is more efficient and effective than their usual methodologies (Hope, 1998; Simonson & Thompson, 1997).

After a review of research studies on educators' adoption of educational technologies, Abou-Dagga and Huba (1997) suggested that acceptance of new technologies does not occur readily. McNeil (1990) agreed in the observation that although implementation of technologies is growing, the rate of adoption is still quite slow. Several barriers have been identified that hinder educators' capacity to adopt computer related technologies in their educational practices. Herring (1997) and Kelsey (1997) identified career concerns, lack of institutional support, fear of being replaced by the technology, and the lack of technological competence as key barriers. In addition, Knupfer (1993) stated that educators' existing attitudes, skills, and working habits also influence acceptance, styles of implementation, and outcomes related to the implementation of electronic communication technologies.

In the last decade, telecommunications networks in the classroom became a widespread component of numerous technology integration efforts (D'Souza, 1991). These efforts have contributed to the broad-based agreement that telecommunications can enhance the range and scope of what students can learn in a classroom by creating an enriched environment that supports more effective educational practices (Honey & Henriques, 1993). Distance education learning environments presently offer interactivity with individuals and information resources thereby exposing educators and learners to multiple viewpoints, broader global perspectives, and varying opportunities for personal construction of knowledge. Distance education technologies not only make delivery of information faster and more accessible to geographically limited zones, but Khan (1997) notes that they also can be used to facilitate learners construction of personal meaning and to create new knowledge, influencing the quality of student and faculty interaction and ultimately that of learning.

Although new models, methods, and technologies are continually being developed to support effective teaching and learning at a distance, diffusion of these innovations resides with educators who choose to adopt or integrate to existing systems (Miller, 1997). In a study of factors related to adoption of a distance education technology, Abou-Dagga and Huba (1997) indicated that the use of interactive distance education technologies offered more educational opportunities for learners and educators to engage in productive interaction with each other and with the environment. In addition, distance education technologies give educators the opportunity to use different pedagogical approaches for teaching and learning (Dede, 1996). As such, preparing to use distance learning technologies requires a shift in pedagogy to a more learner-centered orientation (Herring, 1997). Albright and Graf (1992) reported that in order for educators to be successful, new methods of student-teacher interactions need to be adopted in distant education settings.

As educators attempt to reflect on and react to societal changes brought about by advancement of technology, Herring (1997) noted that educators are expected to provide leadership in integrating these emerging information systems. Herring further argued that change-makers often are not supported with in-depth staff development and follow-up activities resulting in minor integration of new educational technologies into teaching. In addition, Pelgrum and Plomp (1991) reported that studies on faculty use of computer related technologies have concluded that training opportunities and support for making changes are the most significant barriers to integration of technology.

Theoretical Framework

Faculty integration of electronic communication will be examined from two related theoretical frameworks: diffusion of innovations (Rogers, 1995) and self-efficacy (Bandura, 1986). Rogers' (1983, 1995) diffusion theory has developed over the years as a framework for examining and understanding the integration of innovations. Rogers (1995) states that the process for the adoption and diffusion of an innovation entails specific attributes: the relative advantage of the innovation to the adopter; the compatibility of the innovation with the adopters existing values, previous experiences, and current needs; the level of complexity in using the innovation; the ability of the innovation to be tested; and the direct observation of the results of the innovation (Rogers, 1995).

Bandura's (1986) theory of self-efficacy—a belief in one's capability of performing a specific task—has been applied to computer use. Self-efficacy beliefs determine the goals people set for themselves, how much effort they expend, how long they persevere, and how resilient they are in the face of failures and setbacks (Bandura, 1997). Computer self-efficacy refers to self-judged capabilities for using computers in instruction (Faseyitian, Libii, & Hirschbuhl, 1996; Olivier & Shapiro, 1993). Bandura (1986) identified four sources of information that people use to judge their self-efficacy: (1) performance attainments, (2) vicarious experiences through observing the performance of others, (3) verbal persuasions that one possesses certain capabilities, and (4) psychological states by which people judge their capability, strength, and vulnerability.

The concept of self-efficacy has been used to examine and understand computer self-efficacy. This notion is supported in two ways: first, studies have consistently shown that self-efficacy correlates highly with the use of complex technologies (Compeau & Higgins, 1995; Delcourt & Kinzie, 1993; Hill, Smith, & Mann, 1987; Landino & Owens, 1988); second, in a study of faculty in universities, Faseyitan and Hirshbuhl (1992) concluded that computer self-efficacy is related significantly to the adoption of computers for instruction. They further reported that faculty who judge themselves unable to use computers effectively and confidently did not adopt this technology in the classroom even when the hardware and software were available to them. This supports the precept that individuals who have a high self-efficacy tend to perform better than individuals who have low self-efficacy (Bandura, 1986, 1997; Compeau & Higgins, 1995; Delcourt & Kinzie, 1993; Taylor, Locke, & Gist, 1984).

Need for the Study

As technological innovations continue to change and expand, it becomes increasingly necessary to support faculty in adopting innovations to keep up with the educational demands of the 21st century such as distance education and computer based course management technologies. Several accredited universities offer courses to regular on-campus and distant students simultaneously (Khan, 1997). Although leaders in higher education are devoting substantial amounts of resources to development of the information technology infrastructure, Miller (1997) reported that little is budgeted for faculty development to integrate these new systems.

It is important therefore to identify and understand characteristics that may influence faculty's computer use and their decision to integrate computers in their teaching. In a review of literature, faculty characteristics including attitudes, experience, training, access, time, workloads, age, gender, self-efficacy, rank, and discipline have been mentioned as critical to integrating computers in teaching (Beaudoin, 1990; Clark, 1993; Dillon, 1989; Dillon & Walsh, 1992; Wolcott, 1993). Further exploration of specific characteristics that may encourage integration of technology provides insight for maximizing faculty development efforts. Morano (1990) pointed out that interventions can be planned effectively when educators recognize faculty characteristics that influence decisions to adopt computers. In a fast changing educational arena, faculty have more options concerning mode of delivery in teaching (Kagima & Hausafus, in press).

At Iowa State University of Science and Technology, faculty are faced with the challenge of integrating emerging computer technologies in their teaching whether in classes face-to-face on campus, through the two-way interactive Iowa Communications Network (ICN), or on the Internet. Understanding more about how faculty come to feel capable about using computers and assessing their skills can provide a foundation for specific intervention strategies that may be helpful in faculty development efforts.

To prepare for intervention, it is important to identify the extent to which faculty have integrated electronic communication in teaching college courses, and the confidence they have in their ability to use the computers competently in delivering college courses. Knowledge of a faculty member's computer self-efficacy will allow intervention designed to reduce computer anxiety and resistance to change (Simonson, Maurer, Montag-Torardi, & Whitaker, 1987; Olivier, 1993; Rosen, Sears, & Weil, 1987). Because some faculty characteristics related to adoption of innovations may predict behavior, an awareness of the influence of any of these characteristics for decisions to adopt electronic communication would be especially informative for planning intervention strategies. The identification of these characteristics is substantiated by the diffusion of innovation theory, computer self-efficacy, and empirical evidence that relate to technological integration.

Purpose of the Study

The purpose of this study was to determine faculty computer self-efficacy and integration of electronic communication in teaching college courses.

Statement of the Problem

The problem for this study consisted of the following components:

1. Determine the extent of integration of electronic communication in teaching courses in various modes of delivery.

2. Examine effect of faculty characteristics on extent of integration of electronic communication in teaching courses.
3. Determine computer self-efficacy of teaching faculty.
4. Examine relationships between faculty computer self-efficacy and extent of integration of electronic communication in teaching courses.
5. Describe characteristics of faculty who integrate electronic communication technologies in teaching via the ICN.

Research Questions

The study was guided by the following research questions and corresponding hypotheses:

Question 1: To what extent are faculty integrating modes of technologically based telecommunications in their teaching in various modes of delivery?

H1: There is a significant difference in extent of integration of electronic communication in courses being taught through the ICN and on-campus.

Question 2: Is the extent of electronic communication integration influenced by the mode of course delivery (ICN or regular on-campus)?

H2: There is a significant difference in level of electronic communication integration between courses offered through the ICN and those offered face to face on-campus.

Question 3: Is the level of computer self-efficacy influenced by specific faculty characteristics?

H3: Faculty will differ significantly on computer self-efficacy when compared on faculty characteristics of college, gender, age, educational level, rank, tenure, and years of teaching.

Question 4: Does faculty computer self-efficacy affect extent of integration of electronic communication in teaching college courses?

H4: Faculty with a higher level of computer self-efficacy will exhibit a higher level of integration of electronic communication.

Question 5: Is there a relationship between faculty characteristics of gender and rank and extent of electronic communication integration?

H5.1: There is a significant relationship between faculty gender and electronic communication integration.

H5.2: There is a significant relationship between faculty rank and electronic communication integration.

Dependent and Influence Variables

The composite model conceptualized for this study is the adoption of electronic communication in teaching which has two independent variables: computer self-efficacy and adoption group based on computer experience. These variables are hypothesized to have a directional influence on the dependent variable, extent of integration of electronic communication in teaching college courses. Faculty characteristics of college, gender, age, educational level, rank, tenure, years of teaching, training, access to computers and mode of delivery are all independent variables (Figure 1.1).

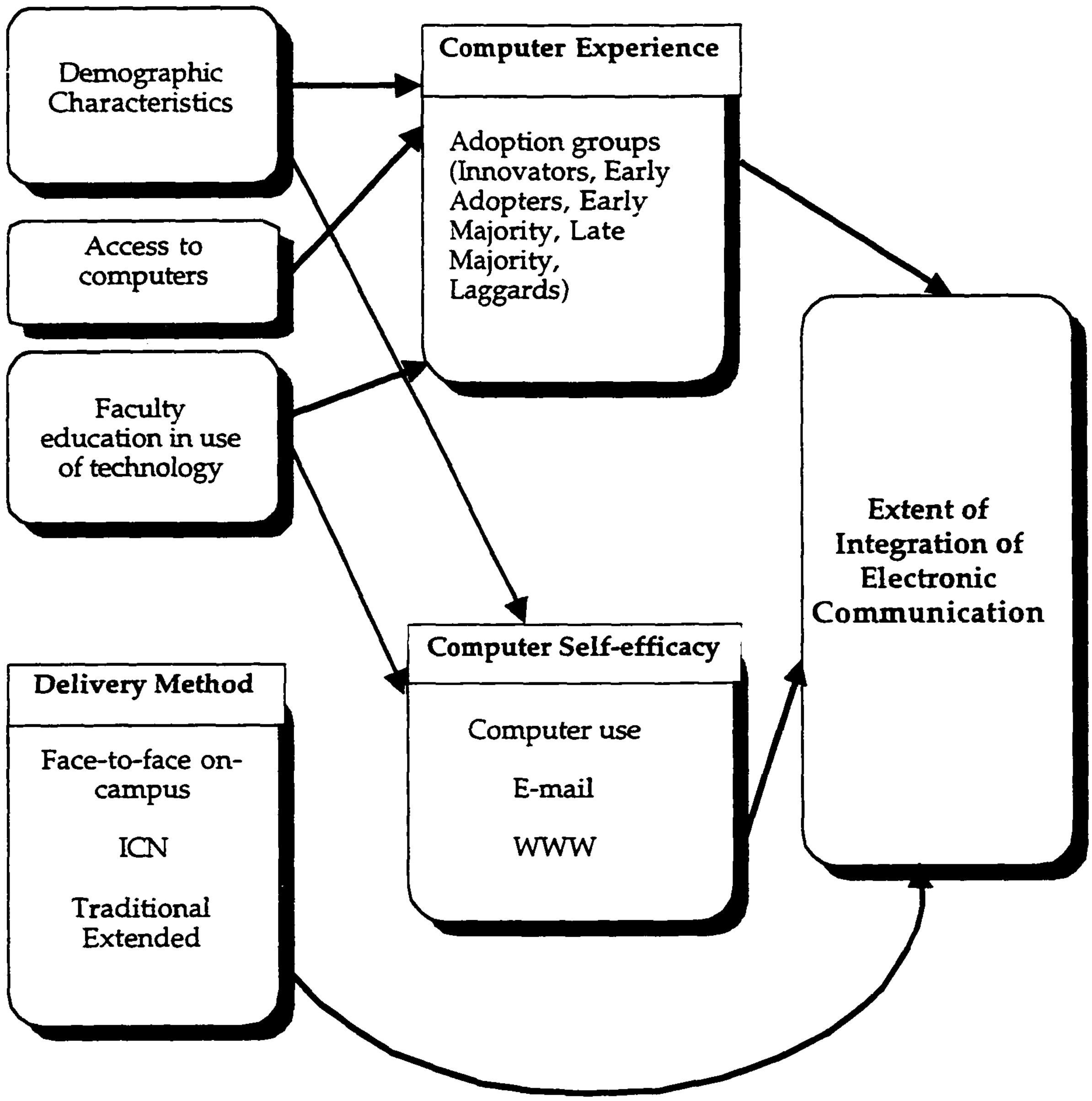

Figure 1.1. Conceptual model for integration of electronic communication in teaching

Significance of the Study

With the exponential rate of growth of information systems, institutions of higher education will continue to adopt emerging distance education technologies for delivery of courses (Kagima & Hausafus, in press). Faculty as well as students will be expected to utilize these new modes of instructional delivery. At Iowa State University of Science and Technology, faculty are scheduled to teach courses face-to-face on-campus or by using the two way interactive Iowa Communications Network (ICN). With changing student population and increased demand for courses taught at a distance, faculty are expected to deliver instruction to accommodate the challenges and demands of each program. Faculty characteristics for those who have integrated electronic communication technologies provide baseline data for planning faculty development programs and interventions.

Dillon and Walsh (1992) reported that although much of the literature in distance education stresses the importance of faculty involvement, this group has been neglected by researchers. Their search identified 225 articles on distance education, but only 24 studies dealt with college and university faculty concerns and needs. Cyrs and Smith (1990) also noted that very few formal or informal programs have been offered to educate faculty to integrate distance education technologies. This study will add to the body of knowledge on faculty use of electronic communication and the factors that may influence the integration of electronic communication in their teaching at the university level.

Definition of Terms

The definitions of terms in this study have been categorized into two groups: those that have been included in its entirety and those used in the survey instrument.

Definitions used in the entirety of the study

Computer – An electronic device capable of storing, processing, and communicating information in accordance with encoded and user-supplied instructions (Hackbarth, 1996).

Constructivisim – A theory holding that people draw upon what they already have come to know and believe to interpret new experiences in ways that, in some aspects, are unique to each individual (Hackbarth, 1996).

Electronic mail (e-mail) – An Internet application through which users can exchange messages with individuals or groups of individuals who are also connected to the Internet.

Internet – The largest network of networks. It is a three level hierarchy composed of backbone networks (e.g. NSFNET, MILNET), mid-level networks, and stub networks.

World Wide Web (WWW) – A hypertext based software through which the user can access files located throughout the Internet. Hypertext uses links, or pointers, so that users can easily access related files throughout the WWW, Gopherspace, and FTP. WWW sites are interactive and contain text, graphics, video and sound.

Definitions used in the survey instrument

Download – The transfer of files from one computer to another. In terms of the Internet, this refers to transferring files from the Internet onto the user's computer.

Homepage – A starting point for a World Wide Web site. A homepage contains introductory text and graphics on a particular topic, individual, or organization as well as pointers that connect elsewhere.

Hypertext Markup Language (HTML) – A set of codes placed in documents so they can be displayed on the World Wide Web (Hackbarth, 1996).

Listserv – A software that maintains mailing lists of the electronic addresses of Net participants sharing a specific interest. This software also provides processing support for communication within such groups. Sometimes an e-mail list also is referred to as a listserv.

Newsgroup – A text information source organized by topic and operating in the USENET network but usually accessible through the Internet. Newsgroups are available by subscription, but unlike mailing lists, news does not transfer automatically to the subscriber's mailbox; it must be accessed.

Password – A coded entry by which a host Telnet system recognizes the authority of the user to access some of all of its files and operations.

Search engine – A software that helps users search for files or data matching particular criteria such as keywords and their combinations. Examples include Alta-Vista, Excite, Yahoo and Web Crawler.

Ecological Setting

The ecological setting of this study was Iowa State University of Science and Technology (ISU), located in Ames, Iowa, USA. ISU was established in 1858 as one of the first land-grant colleges in the United States. Throughout its history, ISU has been a leading land-grant institution with a statewide system for extension education and a full range of high quality educational programs.

At Iowa State University, credit courses are offered using several delivery options. The four major modes of delivery include:

1. Regular resident teaching on campus where students and faculty meet face-to-face in the classroom, laboratories, or field.
2. Using the Iowa Communications Network (ICN), courses are delivered across Iowa via the fiber optic cable network system which links participating sites for live, two-way audio and visual communication.
3. Using the World Wide Web, courses allow students to study independently and interact with the instructor and other students through e-mail and real-time synchronous communication.
4. Using the traditional extended instruction system where ISU educators teach upper-level undergraduate and graduate courses at selected sites across the state of Iowa (ISU Extended and Continuing Education, 1998).

Concerning computing infrastructure at Iowa State University, reports from the Office of Institutional Research indicated that network connections are available in all classrooms and student residence hall rooms (p. 22). Students have adequate access to computers in public computer labs and departments. Iowa State University operates eight ICN classrooms and 127 student accessible labs with over 2,300 institutionally owned computers (ISU Fact Book, 1997-98). Many of these labs are open 24 hours daily. During the 1997/98 academic year, there were an estimated 29,620 electronic communication user accounts and 7,000 registered WWW homepages (ISU Fact Book, 1997-98).

A review of ICN course offerings in 1997 revealed that the College of Agriculture offered 20, the College of Education offered 12, and the College of Family and Consumer Sciences offered 10 courses (ISU Extended and Continuing Education, 1998). Concerning faculty development programs, reports from the Instructional Technology Center (ITC) at ISU indicated that, in 1997, 15 formal campus-wide programs were developed for faculty education to use new technological innovations related to teaching and learning.

Limitations

This study was geographically limited to one land-grant university, Iowa State University of Science and Technology, located in Ames, Iowa. It also was limited to teaching faculty in the colleges of agriculture, education, and family and consumer sciences. A third limitation was the use of only one measure, a self-report instrument, to collect data on the research constructs. Therefore, results are accurate only to the degree that respondents' self-perceptions are accurate, that they could recall teaching activities occurring over a full year, and that they were willing to answer honestly. The university extension program in agriculture and family and consumer sciences depends to a large extent on the use of electronic communication and the ICN. Generalizations from this study should be made carefully to faculty in institutions bearing similar characteristics and infrastructure.

CHAPTER II. LITERATURE REVIEW

This chapter will discuss literature on integration of educational technologies in teaching and learning, process for adopting innovations, computer self-efficacy, and faculty characteristics that influence their decision to integrate electronic communication in teaching. In reviewing literature on key areas related to this study, few studies were found that examined integration of electronic communication in teaching credit courses in higher education.

Communication in Educational Settings

Modern information technologies such as computers, CD-ROMs, fax, and video among other means of communicating today have changed the ways in which people communicate as well as the number of people able to communicate at the same time. In an educational environment, changes in communication systems alter the way information, content, and knowledge are passed on to the student during the teaching and learning process. Kurshan and Harrington (1996) noted that throughout the history of education, classroom communities have consisted mainly of teachers and students interacting directly by talking and writing while in visual proximity (p. 5). According to Ehrmann (1992) the printed book as an example of an early communication tool was revolutionary because it increased the number of experts with whom students could interact. The printed material also allowed one teacher to work with several students in live contact or students could be assigned chapters to read on their own time (p. 24). With emergence of visual media in educational settings, messages were relayed that directed and controlled student learning. Learning using visual media required learners to view and retain information presented by technology such as photograph, film, video or computer (Jonassen, Peck, & Wilson, 1999). Ravitz (1998) noted that the history of educational technology is filled with promises of technological innovations offered as a way to improve teaching and learning to bring about educational change. In addition, educational technology has been used to reduce barriers of space and time allowing learners greater access to education and capacity to interact with a greater variety of academic resources (Ehrmann, 1992). With development of educational technologies that are more powerful, accessible, cheaper, and versatile, response to educational reforms has been to utilize these emerging digital technologies to transform education to be more reflective of societal changes (Figure 2.1).

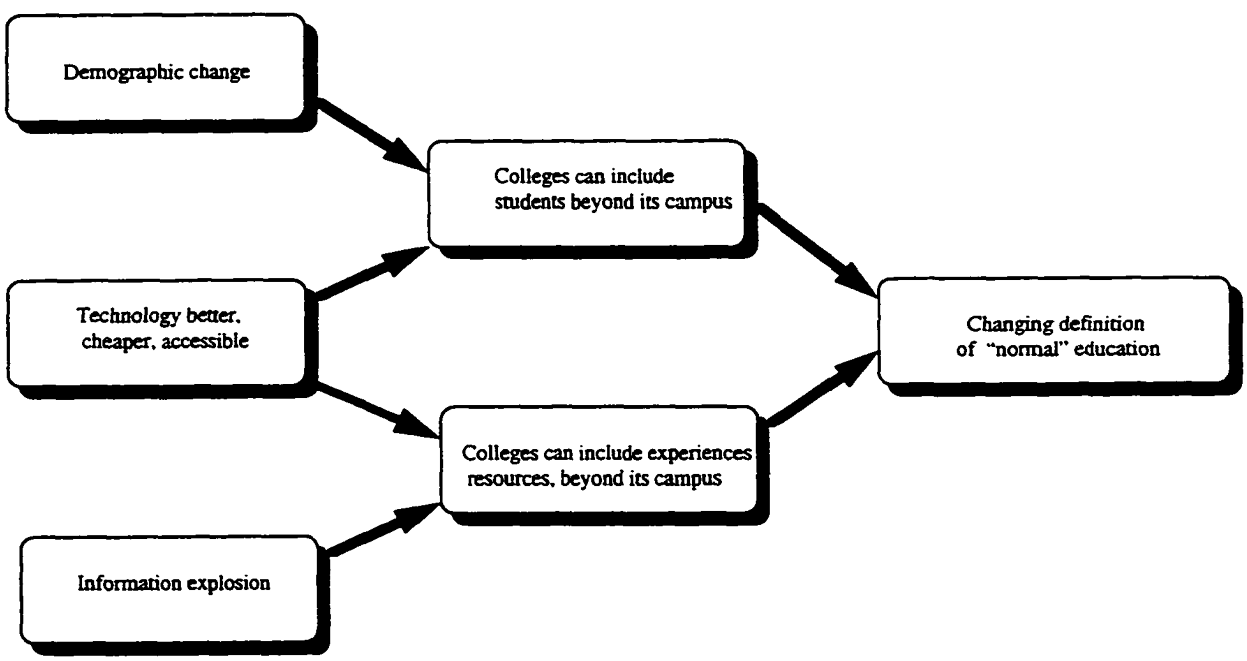

Figure 2.1. Forces transforming normal education (Ehrmann, 1992) (Used with permission [Appendix A])

Electronic communication in teaching

New information technologies have been transforming the perspectives for teaching and learning in all societies. Hanson (1996) observed that society is experiencing an explosive growth in availability and variety of information resources, an ever-increasing need for information and lifelong learning skills, and continued accelerated developments of new technology. These information technologies have challenged educators to re-evaluate the strategies used in teaching and learning and to find new ways of using these technologies to enrich the learning environment (Perraton & Potashnik, 1997). New technological developments are challenging educators to reduce the barriers to knowledge created by poverty, distance, family circumstances, physical disabilities, gender, race, and campus-bound formal education systems (Brouwer, 1994; Ehrmann, 1992; Khvilon & Patru, 1997).

In higher education, recent advances in electronic communication technology have made it possible for educators to explore new ways to use computers to promote student learning. With these changes, educators are encouraged to integrate emerging technologies to enrich the teaching and learning environment (Kagima & Hausafus, in press). In addition, Albright and Graf (1992) observed that societal pressure alone will mandate that faculty make significant changes in their approaches to teaching in the new millennium (p. 13). However, full integration of electronic communication innovations may not always be feasible given the exponential rate in development of information systems.

As emphasis for integration of electronic communication has continued to grow in the educational environment, more attention has been focused on how these electronic communication tools can be used to develop new instructional strategies in the presentation and delivery of classroom instruction. Reports of research in the use of electronic communication tools (electronic mail and Internet) for instructional support have indicated that these tools reduce time and distance barriers common in conventional classroom instruction (D'Souza, 1991).

Electronic mail (e-mail) communication provides for storage and distribution of messages from one individual to another through an electronic network. According to Merrill (1996) e-mail has a combined advantage of telephone and the normal postal service. With e-mail, messages are transferred at electronic speed to a specific individual(s) on a network. E-mail allows for synchronous communication or real-time interaction (*chat*) as well as asynchronous communication in delivery of messages to bulletin boards, listservs, newsgroups, and to individuals.

The Internet is defined as a network of networks which connects Local Area Networks (LANs), Wide Area Networks (WANs), and regional networks into one global network (Merrill, 1996). The World Wide Web (WWW), also called the web, is an Internet navigation system that uses hypertext links to connect text, graphics, sound, video and other files. According to Albright (in press), the WWW brought the point and click technology of the desktop computer to the Internet. In the early stages of development, the WWW was used to store largely text-based documents. With the evolution of more powerful servers and desktop computers, the web has rapidly evolved into an interactive medium that allows for real-time communication between sites, submission of forms, response to surveys, and a marketplace for ordering merchandise (Jonassen et al., 1999; Merrill, 1996). Green (1998) notes that universities are doing more with technology and his 1998 national campus computing survey shows that more college classes are using e-mail (44.4 percent) and the WWW (22.5 percent). These latest findings indicate a significant increase in faculty use of e-mail and the WWW in teaching over the last three years (Green, 1998).

Few studies have been carried out that focus specifically on the use of the e-mail and the WWW in classroom instruction. The literature reviewed below includes studies of teacher educators and their attempts to integrate emerging educational technologies in their teaching and learning environments.

Lowell (1998) conducted a study to examine technology integration into higher education teacher preparation programs. In the study, 153 teacher educators from 12 colleges and schools of education responded to a self-reported survey about their personal use of technology and the support they received in using technology. Educators in this study indicated that they were proficient at using word-processing and online communication. Lowell concluded that a support system of collaboration between administrators, faculty, and support personnel was needed for technology to be integrated.

Ruth (1996) investigated faculty acceptance and resistance to Internet technologies at a state university in the US. He surveyed 261 full-time tenured and non-tenured faculty to determine the extent with which they used the Internet and factors inhibiting use of the Internet. Faculty use of technology was similar to that of Internet users in other schools. Time, access to networks, and lack of technical support influenced faculty capacity to integrate the Internet into their teaching.

In a study to identify faculty use of technology resources for instructional purposes, Blanco (1996) reported that faculty use of technology for teaching purposes was minimal. Respondents in this study when asked to describe the major purposes for using technology in teaching, they indicated that technology assisted them in streamlining instruction and assignments. Few faculty reported that they required technology resources for instruction.

Parry and Whaton (1995) investigated the factors that influenced adoption of electronic networking among faculty in a mid-sized university in the US. Their study sought to identify how rank, discipline, years of experience, age, and gender impacted use of networks, types of use, and confidence in using networks. In this study, older faculty used networks less frequently and felt less confident with network technology. The study sample constituted faculty from various disciplines within the university. Faculty in sciences and engineering reported higher levels of network use, wider variety of experience with technology, and a higher level of confidence in using networks.

In a study to identify factors that influence beginning teachers integration of technology in their classrooms, McCathy (1997) reported that although beginning teachers had current technology skills, they were unable to integrate technology commensurate with their knowledge level. McCathy noted that teachers identified inadequate, inappropriate technology resources, lack of training and lack of on-site technical resource personnel as barriers to technology integration.

Sherman (1998) reported on an ethnographic action-research study that examined the extent and manner of integration of technology into teachers' instructional purposes in a middle school in Georgia. The major aims of this study were to identify access, on-site technical support, and staff development, among other objectives. Results of this ethnographic study showed teachers needed more equipment, lacked time for planning and training, lacked consistent site support, and were unable to clearly articulate or sustain purposes of technology plans.

Findings of a study to identify the dominant factors which motivated teachers to integrate technology in curriculum indicate that teachers personal interest, background experiences in technology and their view of technology as a means to improve teaching practices were significant factors (Bianchi, 1996).

In reviewing literature related to integration of electronic communication in teaching and learning by faculty in higher education, it was found that most of the documented work involved conceptual reflections on the potential of electronic communication technologies in education. Studies by Barritt (1998), McKinzie (1997), Crowe (1998), Rea (1997), although related to adoption of computers in education, each focused on specific uses of computer programs in a limited ecological context. Electronic communication in teaching and learning is an emerging area and most of the work is largely anecdotal and non-empirical with little or no relationship to previous research or larger contexts (Simonson, 1997; Windschitl, 1998).

Electronic communication in teaching and learning

In an educational environment, electronic communication tools have created unmatched opportunities for academic enrichment and have transformed numerous classrooms into interactive laboratories allowing access to almost limitless resources, people, and timely information (Herring, 1997). In working with both on-campus and distant students, educators can use these tools to provide immediate feedback for specific concerns of the students; to help students solve problems in understanding the subject matter of a course; to serve as a medium of transmission for sending in homework and returning test papers, scores and comments; and to offer assistance in team projects and self-help groups (D'Souza, 1991).

At Iowa State University, the inclusion of technology in the classroom has increased the ways in which students and faculty communicate, interact, teach, and learn (Turner, 1998). Instruction is no longer limited to a few hours per week that students and faculty spend in the same classroom; rather, learning and communication exist through many channels including the use of *ClassNet*[1], an Iowa State University course delivery and management tool (Turner, 1998). It is reported that in spring 1998, 3,000 students used *ClassNet* on more than 130 courses offered (Turner, 1998).

Although electronic communication technology is no panacea for shortcomings of traditional classroom instruction, thoughtfully used, technology can introduce many promising improvements over traditional modes of teaching and learning. In a recent World Bank Report (Perraton & Potashnik, 1997), it was noted that:

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[1]*ClassNet* is World Wide Web server software developed by Dr. Peter Boysen at Iowa State University. *ClassNet* manages Internet class activities including: creation of a class; enrollment in a class by students; creation of tests; submission and grading of tests; reporting of scores; discussion forums and chat rooms; email between students and instructors; and portfolio development by students.

- interactive technologies that offer sound, animation, and visualization facilitate and enrich teaching and learning through visualization and simulation of experiences.
- technology can provide teachers with new sources of information and knowledge that can be incorporated into classroom instruction or used for self-development.
- active two-way communication keeps learning involved thereby enhancing the learning process with distant students.
- telecommunications and information technologies can provide an efficient and cost effective means for increasing access to education and training particularly in the less developed countries. (pp. 14-15)

By utilizing a combination of capabilities of computer and related technologies, instructors and students can be creative in ways not previously imagined (Hanson, 1995). Clouse and Alexander (1998) suggested that if technology is used appropriately, it can help educators restructure the classroom's traditional learning environment. In a study of integration of computers into the classroom, Sheingold and Hadley (1990) observed that computer-using teachers felt significant changes were taking place as they integrated technology in their classrooms and perceived the following changes:

- they presented more complex materials and expected more out of their students;
- they met the needs of individual students better; and

- their classrooms became student-centered rather than teacher-centered. (pp. 25-26)

Computer related technologies offer many opportunities to restructure the teaching-learning process to actively involve students in the construction of their own knowledge and understanding while educators support, facilitate, and coach students in their learning (Herring, 1997). From a constructivist's point of view, knowledge is seen as temporary, nonobjective, internally constructed, and socially and culturally motivated (Fosnot 1996, p. ix). While describing student experiences in constructivist learning environments, Herring (1997) noted that:

> in order to generate knowledge, students are engaged in tasks that allow them to self-select learning paths. As students move along their learning paths, they attempt to make sense of new information and experiences by transforming and organizing encounters in relation to their knowledge base. (p. 61)

Even with modern information technologies a paradigm shift has not occurred from the didactic view of educators as the "font of knowledge" and the students as "passive receptacles" to a constructivist view where educators are facilitator-coaches and students are active knowledge creators (Clouse & Alexander, 1998). For the transition period between constructivist and didactic teaching practices, Duguet (1990) noted that classrooms will become mini research centers as teachers strive to understand how students learn (p. 171). Albright and Graf (1998) suggested using technology to encourage reflection and critical thinking by involving students in higher-order thinking skills such as analysis, synthesis, and evaluation (p. 17). However, Clouse and Alexander (1998) argued that unless educators embrace the philosophical change from didactic to constructivist teaching, technology is likely to remain on the fringes of teaching and learning instead of becoming an integral part of education (p. 98).

Electronic communication has the potential to enable learners to access information formerly the domain of the educator thereby requiring the educator to distribute responsibility in the classroom. This can lead to a less bureaucratic relationship between educators and learners and one that yields respect for a diverse population of learners (Clouse & Alexander, 1998).

The emergence of electronic communication has come at a time when education itself in under pressure for reforms. Several educators have argued for a shift from traditional modes of teacher-centered or technical approaches of teaching to more inclusive constructivist or emancipatory methods of teaching and learning (Apple, 1991; Herring, 1997; Willis, 1996). In teaching and learning environments where constructivism has been embraced, Collins (1991) identified several shifts in teacher's practices including changes from:

- whole class instruction to small group instruction;
- lecture and recitation to coaching;
- working with better students to working with weaker students;
- assessment based on test performance to those based on products, progress, and effort;
- competitive to cooperative social structures;
- all students learning the same thing to different students learning different things; and

- primacy of verbal thinking to integration of verbal and visual thinking. (29-30)

A report from the Office of Technology Assessment (1995) indicated that constructivism is not just another education fad in the process of educational reform. Rather, it noted that the abilities to construct knowledge, value complexity, and solve complex problems are skills that all students will need to succeed in an information-based society (p. 6). The creation of learning environments that combines emerging technology and constructivist based learning can engage learners in active, constructive, intentional, authentic, and cooperative learning (Jonassen et al., 1999; Herring, 1997). In addition, Zhao (1998, p. 307) and Cohen (1988, p. 253) noted that educators naturally would embrace technology and readily integrate it into their teaching because educators believe that technology opens up many new opportunities to make teaching and learning more exciting. In addition, constructivism is flexible enough to co-exist with other instructional philosophies that educators have used over time (OTA, 1995). As institutions of higher education incorporate technological innovations into their settings, they are aspiring to achieve widespread adoption and considerable change of practice in teaching and learning.

Process for Adopting Innovations

Technological innovations are not always diffused and adopted rapidly even when the innovation has obvious advantages (Faseyitan, Libii, & Hirschbuhl, 1996; Rogers, 1983). Casey (1996) noted that the process of adopting innovations has been used to understand the integration of computers and other technologies in education. Research using Rogers (1983, 1995) diffusion theory with regard to adoption of innovations in educational technology have been documented in recent studies (Abou-Dagga, 1995; Bigilaki, 1996; Hanson, 1998; Maushak, 1997). Rogers theory of the diffusion of innovations was constructed based on a meta-analysis of 2,585 empirical diffusion publications available in 1981 from nine disciplines. This theory is sufficiently general to be applied to any discipline (Rogers, 1983, p. 42; Casey, 1995, p. 18). Hanson (1998) observed that Rogers' definitions and descriptions of the diffusion of innovation elements, adopter categories, and terminology have dominated literature discussions regarding diffusion of innovations in educational technology (p. 33). From Rogers (1983, 1995) theory of the diffusion of innovations, the process of adoption of innovations was used in the current study.

According to Rogers (1983, 1995) an innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." Diffusion is defined as the process by which an innovation is communicated through certain channels over time among members of a social system. The innovation decision process, according to Rogers and Shoemaker (1971), can lead either to adoption, a decision to make full use of an innovation as the best course of action available, or to rejection, a decision not to adopt an innovation. Rogers further observed that this innovation decision process involves five steps that occur in a time-ordered sequence of knowledge, persuasion, decision, implementation, and confirmation. He also adds that innovations are likely to be adopted if they demonstrate the following five characteristics:

1. have a high *relative advantage* over present practices; that is, it must be viewed as better than the idea it supersedes. The greater the perceived advantage, the faster the innovation will be adopted.
2. be *compatible* with the values, past experiences, and ability to meet the felt needs of the adopting group.
3. not be too *complex*, or difficult to understand and use.
4. have *trialability*, that is, it must allow the adopting group to try out or experiment to see if it meets the adopters' needs.
5. have its success visible or *observable* to others. The greater the degree to which these results can be seen, the higher the rate of adoption.

(Moskal, Martin & Foshee, 1997, pp. 7-8)

Innovations are adopted at different rates depending on how they are perceived by the adopters. Studies have reported that as members of a social system adopt an innovation, the diffusion begins slowly with a few individuals and then accelerates as more and more individuals adopt the innovation, and finally the diffusion rate drops off as fewer and fewer individuals remain to adopt the innovation (Rogers, 1995).

Rogers (1983, 1995) categorized the innovativeness of individuals by their relative earliness in adopting new ideas compared to others. He identified five adopter categories as innovators, early adopters, early majority, late majority, and laggards.

2.5%	13.5%	34%	34%	16%
Innovators	Early Adopters	Early Majority	Late Majority	Laggards

Diffusion of innovations in educational organizations is more complex than that of individual innovativeness although both fall into the above mentioned five adopter categories (Rogers, 1995). Unlike individual innovativeness that is influenced by personal knowledge, attitudes, willingness, and persuasion, organizational innovativeness is influenced by size, individual leadership characteristics, structure of the organization, and external characteristics of the organization (Rogers, 1995).

According to Marcinkiewicz (1994), integration of computers into teaching and learning has been considered to be an example of the adoption of innovations because the full integration of computers into the educational system has not yet been achieved. Rogers (1995) observed that in many organizations, the introduction of computer-related technologies has not been successfully achieved. Relative to teaching and learning, the use of computers and related technologies is still new behavior although it is believed that advancements of these technologies can create new opportunities for educational institutions to increase their effectiveness (Hanson, 1995).

In an attempt to gain an understanding of innovativeness, a study of adoption of computer-related technologies among college faculty in a large land grant university was the focus of the current study. Past studies have identified some demographic characteristics (gender, age, rank, experience) and organizational attributes (access, resources, training, infrastructure) that enhance or hinder faculty integration of computer-related technologies in teaching and learning. Few studies have looked at the attribute of self-efficacy as it relates to computer use and adoption of electronic communication innovations in a teaching and learning environment.

Computer Self-efficacy

Although research is limited on computer self-efficacy, there is evidence to support the importance of the construct as a critical predictor of future trends in computer attitudes and usage patterns (Olivier & Shapiro, 1993). Bandura's theory of self-efficacy provides a framework for understanding the behavior of individuals with respect to the acceptance or rejection of technology (Olivier & Shapiro, 1993; Schunk, 1990; Woolfolk & Hoy, 1990; Zimmerman, 1989). Self-efficacy theory has been used to address self-judgment about how well one can organize and execute actions which deal with prospective situations containing ambiguous, unpredictable and stressful elements (Bandura, 1986; Jorde-Bloom, 1988; Schunk, 1990).

Self-efficacy refers to perceptions about one's capabilities to organize and implement actions necessary to attain a designated performance skill for specific tasks (Olivier, 1985). According to Bandura (1986), people acquire information about efficacy from four sources: performance attainments, vicarious experiences, through observing the performances of others, verbal persuasion, and physiological states from which people partly judge their capability, strength, and vulnerability (p. 126). Perceived self-efficacy has been defined as a person's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances (Compeau & Higgins, 1995). Olivier and Shapiro (1993) also pointed out that understanding an individual's beliefs of their capability for using the computer can provide a foundation for developing positive strategies for introducing computer related skills.

Literature on self-efficacy theory has indicated that it differs from other self-related theories such as self-esteem and self-concept, although all are concerned with an individual's overall global image (Olivier & Shapiro, 1993). Also, Brett (1984) and Brockner (1988) noted that self-esteem refers to a more general level of self-confidence, feelings of adequacy, self-acceptance and self-worth. Self-concept is a collection of beliefs about oneself and has direct influence upon one's behavior (Gorell, 1990). Rather than a generalized judgement, self-efficacy refers to one's belief in being capable of a certain performance (Bandura, 1986).

Findings of research on computer self-efficacy have indicated that individuals who have a high degree of self-efficacy tend to perform better than those who have a low degree of self-efficacy (Faseyitan, Libii & Hirschbuhl, 1996). In their study of the role of efficacy expectations in predicting decisions to use advanced computer technologies, Hill, Smith, and Mann (1987) reported that computer self-efficacy of college students was a factor in deciding to use computers. Efficacy expectations vary on three dimensions: magnitude, generality, and strength. These dimensions have implications for eventual performance.

In several studies, researchers have reported that computer self-efficacy is significantly related to the adoption of computers for instruction (Faseyitan, Libii & Hirschbuhl, 1996; Murphy, Coover & Owen, 1988; Olivier & Shapiro, 1993). Faseyitan, Libii, and Hirschbuhl (1996) indicated in their study of computer self-efficacy among faculty, that individuals who judge themselves unable to use computers effectively and confidently will not adopt this technology even when the hardware and software are available to them. In addition, faculty who do not use computers in their classrooms have significantly lower computer self-efficacy scores than those who do (pp. 215). Marcinkiewicz (1994) in a study of factors influencing computer use in the classroom reported that the selection of self-competence as an aspect of motivation contributes to one's pursuit or avoidance of computer use. He added that in his study, the variable of self-competence, which is related to self-efficacy, was a significant predictor of behavior related to use of computers. He also noted that the shared element between self-efficacy and self-competence is the individual's expectation of competence in controlling behavior (p. 232). This expectation of competence is recognized as confidence.

Efficacy measurements provide information on current status of faculty concerning knowledge related to computer use. Such information is necessary for designing intervention strategies that enable educators to adjust to technological change and assume leadership for integrating emerging technologies in education (Murphy, Coover & Owen, 1988; Olivier & Shapiro, 1993). In addition, academic administrators recognize a need to develop strategies to help faculty become comfortable with the use of computers in their instructional activities.

Faseyitan, Libii, and Hirschbuhl (1996) suggested that a high self-efficacy about computers will enhance the following attributes among faculty: a feeling of compatibility for computers in their teaching; a sense of control of the classroom situation when using computers; and an intrinsic interest in developing innovative educational uses of computers (p. 215). Marcinkiewicz (1994) also suggested that it will become increasingly necessary to help educators adopt technological innovations as a way to keep current with and have access to increasing amounts of information.

Measures of self-competence, self-efficacy, or innovativeness could be used as initial indicators of educators' eventual integration of computers. As well, Marcinkiewicz (1994) added that for educators who do not appreciably demonstrate self-competence or innovativeness, intervention can be done through staff development to increase their self-efficacy (Hirschbuhl & Faseyitan, 1994), and their willingness to change (Abou-Dagga & Herring, 1997). The current study investigated the relationship between computer self-efficacy of teaching faculty and the extent of electronic communication integration in teaching college courses.

Obstacles to Integration of Technology

Educators have faced significant obstacles in their attempts to implement and integrate technology in their classrooms (Leggett & Persichitte, 1998). Moskal, Martin, and Foshee (1997) identified three major barriers to increased use of communication technologies among teaching faculty: (1) required equipment not available in the classroom; (2) lack of time to learn to use the technology; and (3) lack of funds for the necessary materials (p. 18).

Other factors cited in the literature include expertise, required changes in practice as technological innovations are intertwined with distance teaching, pedagogical issues, and organizational issues related to incentives and rewards (Beaudoin, 1990; Dillon, 1989; Dillon & Walsh, 1992; Schrum, 1995). In addition, workloads, reduced student interaction, technical and administrative problems and faculty personal characteristics (gender, rank, attitudes, computer experience, and training) have been identified as barriers to integration of technology (Dillon & Walsh, 1992).

Brooks and Kopp (1997) in a survey of faculty reported that lack of funding for appropriate training, hardware, and software were identified as the biggest obstacles in the instructional use of technology in higher education. Faseytian and Hirschbuhl (1996) in a study of variables that influence adoption of computers for instruction among university faculty concluded that computer self-efficacy, computer utility beliefs, and attitudes towards computers were predictors for adoption for integrating computers in their classrooms. In their study, factors of gender, rank, research commitment, instructional policy, technical support and staff development did not relate to adoption. According to J. J. Hirschbuhl (personal communication, April 9, 1997), these factors may have changed from the early 1990s because extensive use of email and the Internet has increased faculty self-efficacy which in turn will have an effect on the other variables that contribute to adoption of computer related innovations.

Of the factors identified, time appears to be one of the most critical barriers to integration of technology found in summarized research reports (Beaubodin, 1990; Dillon, 1992; Dillon & Wright, 1993; Leggett & Persichitte, 1998; Spotts & Bowman, 1995). In relation to time needs, Leggett and Persichitte (1998) noted that faculty require:

- time to plan, collaborate, prepare, and use technology in the classroom;
- uninterrupted time during the day to go on-line;
- time during and outside of the school day for technology training; and

- time to personally explore, digest, and experiment with technology as well as maintain skills. (p. 33)

They further observed that faculty who have expertise, access, and resources but lack time to participate in staff development activities related to technology did not implement technology in their teaching (p. 33).

Although educators have increased productivity exponentially during the last decades, their teaching techniques and procedures have essentially remained unchanged (Clouse & Alexander, 1998). Because of a lack of hands-on, meaningful, systematic, developmental and ongoing technology education, educators never have understood fully how to integrate technology into the classroom (Leggett & Persichitte, 1998). Hope (1998) observed that although an estimated 5.8 million computers were present in the nation's schools, their presence did not indicate the extent to which these computers and related technologies were being integrated into the teaching and learning process.

A report from the Office of Technology Assessment (1995) indicated that although classrooms have technology, evidence suggests that they are not integrated into educator's practice. Hope (1998) identified five obstacles that educators face in integrating computers and related technologies in teaching and learning:

1. lack of a clear vision of how technology can transform teaching;
2. failure to identify the problems to be addressed by integrating technologies;
3. lack of access to the technology they are expected to integrate;

4. failure of change agents to articulate the advantages technology has over what educators presently do to accomplish their work; and
5. failure to recognize educators' vested interests in other pedagogies that accomplish teaching and learning objectives. (p. 139)

For technology integration to be successful, leaders in educational institutions should consider those factors that influence adoption of innovations and associated educational technologies in a timely manner. Artkins (1997) noted that for education to realize technology's potential, classroom practices, curricula, educators' roles and behaviors, and classroom activities need to be orchestrated onto a well-integrated environment. She added that there was a need for a clear vision, administrative support, adequate budget, dedicated staff, decent supplies and consistent patterns of expectations with clear evaluation systems for technology integration programs to succeed.

Although negative faculty attitudes ranging from apathy to open antagonism remain as barriers to adoption of innovations, Brock (1987) cited a growing acceptance of computer related technologies among university faculty despite their continued struggle with changes related to relinquishing familiar teaching patterns, practices and control of the teaching-learning process (p. 40). In an assessment of faculty capabilities and experiences with distance education, Moskal, Martin, and Foshee (1997) reported that faculty identified several factors that promote their willingness to adopt the use of educational technologies. They also noted that:

1. using technology must improve student learning, that is, it must be shown that students learn more, or learn more efficiently using this new approach
2. technology must offer a clear advantage over traditional delivery approaches for faculty to make an effort to change to the new approach
3. the required equipment must be available for use in the classroom
4. faculty must have adequate access to technologies which require minimal maintenance, repair, or replacement. (p. 17)

Finkelstein (1984) concluded that faculty receptivity to innovation is highly innovation-specific and based on individual considerations of feasibility, desirability, familiarity, and status. Although education in use of technology is sometimes offered to faculty, Clouse and Alexander (1997) contend that a lack of modeling for integration is a glaring omission in in-service training programs. They further observed that time in faculty education was devoted to teaching "how to", rather than dealing with critical conceptual frameworks and pedagogical issues related to teaching with technology. Albright and Graf (1992) added that when faculty are not properly educated, they use technology for the wrong reasons or in the wrong ways with minimal satisfaction for both themselves and their students.

In a survey of teachers who had integrated computer technology into their teaching, Sheingold and Hadley (1990) reported that teachers expended their own extra time and effort to learn how to integrate computers. Further, Zammit (1992) reported that several educators have had to invest substantial time and energy to develop their computing skills and adults find this a difficult skill to master. She continued to argue that it is inappropriate to expect educators to undertake such fundamental and critical professional development completely on their own time.

According to Zammit (1992), adequate funding can give educators both the opportunity and time to practice, learn, and access the options offered by the fast changing computer technology. She added that in the history of computers for educational purposes in higher education, it has been easier to approve expenditures to purchase equipment than to pay for time to enable educators to develop their own knowledge and expertise. This lack of faculty development and time continues despite recognition that acquisition of the best equipment does not guarantee that it would be used to the best advantage unless faculty have been educated to use it effectively (Zammit, 1992 p. 65).

Faculty characteristics impacting integration of technology

Personal characteristics can influence faculty's use of electronic communication in the teaching and learning environments. Gender differences, computer experience, and faculty rank have been identified in several studies as having an influence on faculty's willingness to integrate technology.

Research on computer use by males and females suggests differences in perceptions, attitudes, and level of use (Marcinkiewicz, 1994; Gilliand, 1990). Busch (1995) in a study of gender differences in self-efficacy and attitudes toward computers among undergraduate students of business administration, reported that male students had significantly less computer anxiety and higher computer self-efficacy than female students with regard to complex computing tasks. In the study, however, he found no differences in computer liking, use of word processing and spreadsheet programs.

In a study of faculty use of instructional technologies in higher education, Spotts and Bowman (1995) reported a significant difference between males and females with regard to use of older technologies (such as audio, film, and video). Female faculty rated their experience higher than their male colleagues while in the use of newer technologies (such as multimedia, distance learning, CAI, e-mail, computer conferencing, and presentation software), male faculty rated their experience higher than female colleagues (p. 62). Based on research, these gender differences are consistent regardless of the subjects providing the data. In a similar study, Busch (1996) reported gender differences in self-efficacy regarding accomplishing complex tasks in both wordprocessing and spreadsheet software. However, gender differences were found in computer attitudes or self-efficacy regarding completion of simple computer tasks (p.147).

In a meta-analysis review of 82 studies to identify gender differences in computer related attitudes and behavior, Whitley (1997) found that although gender differences were statistically significant, these differences were small, raising the question of their practical significance. In another study, Whitley (1996) reported that both men and women had positive attitudes towards computers although on average, men tended to rate their attitudes higher than women. Based on these findings, gender was considered as an important characteristic in this study.

Olcott (1991) observed that most faculty pursue activities that contribute to professional advancement. He added that in academia, professional advancement is often synonymous with promotion and tenure. Embarking on an endeavor such as distance teaching without providing appropriate recognition toward promotion and tenure will deter faculty participation (Olcott, 1991). However, Moskal, Martin and Foshee (1997) reported in their study that release time and contributions to faculty promotion and tenure were not considered important, arguing that administrators in community colleges were more amenable to providing release time and other benefits for developing distance education courses than university administrators. Spotts and Bowman (1995), in a study of faculty use of technology in higher education, found no significant differences for different academic ranks and concluded that faculty rated their computer knowledge and experience with different instructional technologies as very similar regardless of rank (p. 62).

Summary

Recent developments in interactive multimedia technologies that promise to facilitate individualized and collaborative learning are blurring the distinctions between distance and traditional education (McIsaac & Gunawardena, 1996, p. 403). In universities that have adopted the use of electronic communication, it is becoming increasingly difficult to differentiate face-to-face courses from distant courses. This is because colleges are using highly interactive technology that makes the distant and local classrooms as closely equivalent as possible.

Interest in distance education has been growing in recent years creating a demand for this service in higher education institutions (Kelsey, 1996). Kelsey identifies two reasons for the increased demand of distance education: first, an increasing availability of electronic and digital technologies at affordable prices and with ease of use and second, the changing needs of business and industry that call for technologically competent workers. Adult learners are turning to higher education in search of new skills and competencies in order to remain competitive in their careers. Also, adults are considered space-bound by family responsibilities, business commitments, or time limitations, to their communities and cannot therefore attend traditional campus-bound universities (Ehrmann, 1992). Central to ensuring that these target populations for distance education and emerging new populations (on-campus students) can be served are the faculty responsible for course delivery. Literature reviewed in this chapter supports the notion that faculty are central to the adoption of distant education practices in higher education.

Key information and previous research related to three areas important to this study have been reviewed. First, emerging electronic information and delivery systems and their effect on teaching and learning environments was presented. Second, Rogers (1995) process for adoption of innovations was discussed; and third, Bandura's (1986) theory of self-efficacy was used to gain further understanding of self-efficacy in relation to use of computers by educators. In addition, obstacles and faculty concerns related to adopting computer-related technologies also were discussed.

CHAPTER III. METHODOLOGY

Introduction

This chapter discusses the methodology used to collect and analyze data. It describes the research design, sample selection, instrument development, data collection procedures and data analysis plan. This study was developed as part of the Iowa Distance Education Alliance (IDEA) project. Support for data collection and data analysis was provided by the US Department of Education Star Schools Grant (# R203 B 50001-97) and the College of Family and Consumer Sciences Graduate Student Research Fund.

The overall purpose of this study was to determine faculty computer self-efficacy and extent of integration of electronic communication in teaching college courses. More specifically, this study was designed to fulfill the following objectives:

1. Determine the extent of integration of electronic communication in teaching courses.
2. Examine the effect of faculty characteristics on extent of integration of electronic communication in teaching college courses.
3. Determine computer self-efficacy of teaching faculty.
4. Examine relationships between faculty computer self-efficacy and extent of integration of electronic communication in teaching courses.

5. Describe characteristics of faculty who integrated electronic communication technologies in teaching through the Iowa Communications Network (ICN).

Research Design

This study is a positivistic inquiry using a cross-sectional survey research design. In positivistic research, the primary data consist of persons, objects, or events of the natural world (Gay, 1995). In using the positivistic approach, it is assumed that nature is so constituted that whatever is true with any one case is probably true in many instances in the past and will probably continue to hold true in the future (Langenbach, Vaughn, & Aagaard, 1994).

This study utilized a cross-sectional survey research design to address the research problem. Fraenkel and Wallen (1995) have pointed out that survey research obtains data to determine specific characteristics of a group. According to Gay (1995), a survey is an attempt to collect data from members of a population with respect to one or more variables. He further notes that cross-sectional surveys collect information from a sample that has been drawn from a predetermined population at just one point in time. This study used mailed surveys for data collection. Mangione (1998) suggested that mailed surveys are a good choice when the questions are written in a close-ended style and when the research sample respondents have a moderate to high investment in the topic.

The items in this survey were close-ended and concerned teaching faculty's use of electronic communication in teaching, access to computers, technology education, and their confidence in using computers. Results of this study would be of interest to this population, and as such, they should be willing to complete the survey. In addition, a mailed survey gives one time to reflect on the questions resulting in thoughtful responses. A need for a method that would afford faculty adequate time to respond was considered because they were asked to report on their instructional activities which spanned an entire year, 1997. A mailed survey was deemed the most appropriate procedure for collecting data in this study.

Population and Sample

A census population of the teaching faculty in the colleges of agriculture, education, and family and consumer sciences (FCS) at Iowa State University of Science and Technology who had taught courses in 1997 were invited to participate. These three colleges were chosen because at the conceptualization stage of the study, these colleges were developing or offering graduate programs and courses to distant students through the use of the Iowa Communications Network (ICN) and the Internet. In addition, faculty in these colleges were involved in research in distance education in Iowa (Encyclopedia of Distance Education in Iowa, 1997).

Respondents were selected from a list of teaching faculty obtained from the administrative office of each college. Using departmental lists and course schedules for spring, summer, and fall of 1997, a purposive sample was selected. Further, a telephone call was made to each department to ascertain whether those in the sample had teaching assignments. A total of 299 faculty were selected from Agriculture (n=155), Education (n=80), and Family and Consumer Sciences (n=64). There were 26 departments represented in the group.

Instrument Development

The data were collected using a mailed survey. The survey developed by the researcher integrated items following an analysis of scales developed by Delcourt and Kinzie (1993) Self-efficacy for Computer Technologies (SCT); Murphy, Coover, and Owen (1988) Computer Self-Efficacy Scale (CSE); and Faseyitan and Hirschbuhl (1992) Faculty Instructional Computing Questionnaire (FICQ). Murphy, Coover, and Owen's (1988) CSE had 32 items in three parts: beginning level computer skills (16 items); advanced level computer skills (12 items) and mainframe computer skills (3 items). Faseyitan and Hirschbuhl's (1992) FICQ contained 39 questions grouped into four sections: (1) subject data (2) type and frequency of use of computing activities (3) level of organizational support for instructional computing and (4) faculty computer self-efficacy, utility belief and computer attitude (p.186). Delcourt and Kinzie's (1993) SCT scale had 25 items in 3 sections: word processing (10 items); electronic mail (9 items); and CD-ROM data bases (6 items).

The instrument was developed from a combination of items from these three scales and adapted to include new technological concepts and to indicate extent of integration in teaching college courses on campus, using the two-way interactive Iowa Communications Network, and the traditional Iowa State extended education system. The survey consisted of four parts: faculty characteristics, computer experience, extent of integration, and computer self-efficacy.

Part one of the survey concerned professional and demographic characteristics of teaching faculty, including academic department, academic position, gender, age, educational level, tenure status, years of college teaching, and teaching-related characteristics (number of courses taught, number of credits, and mode of delivery of courses taught in 1997).

Part two solicited responses on faculty access to computers outside the university, recent computer training, computer experience using a checklist of nine computer software applications, and an open-ended option to indicate other software faculty have used.

Part three consisted of 11 items on extent of electronic communication integration in teaching college courses with responses ranging from 1= 0 hours a week to 3= ≥ 3 hours a week.

Part four consisted of 27 items on computer self-efficacy using a five-point Likert-type response scale ranging from 1=not confident to 5=extremely confident. From the Murphy et. al. CSE (1988) scale, items 28, 32, 24, 13, 29, and 26 were adapted as items 1, 2, 4, 5, 7, and 9 and from Delcourt and Kinzie (1993) SCT scale, items 14, 15 and 18 were adapted as items 13, 14, and 19 in the computer self-efficacy scale in this study. Minor changes were made to reflect current computer terminology and use.

The remainder of the items was developed by the researcher in consultation with an instructional technology specialist at the Instructional Technology Center at Iowa State University and faculty teaching educational computing courses. All items in the computer self-efficacy scale were positively-worded and reflected a range of skills and knowledge in using computers, electronic mail, and the World Wide Web (WWW).

DeVellis (1991) observed that measurement scales are developed to measure phenomena that is believed to exist because of some theoretical understanding of the world and cannot be assessed directly (p. 9). Measurement of the construct (computer self-efficacy) can be facilitated by identifying a clearly defined set of skills, tasks and behaviors (Murphy et. al, 1988). High scores on the computer self-efficacy scale (or subsequent sub-scales) represent the respondents' high degree of confidence in their capabilities to use computer technology. Kinzie, Delcourt and Powers (1994) suggested that when using a self-efficacy measure, scale scores can be reported individually, as each relates to a different task (p. 747). They added that within an attitude measure, individual scale scores can also be summed to determine an overall attitude score (p. 747).

To establish content-related and format-related evidence of validity, this survey was reviewed: first, by a panel of judges; second, by faculty; and third, by members of the program of study committee. According to McMillan and Schumaker (1997), content-related evidence of validity is the extent to which the content of a test is judged to be representative of some appropriate universe or larger domain of content (p. 236).

In this survey, content-related evidence of validity was established by a panel of three experts in the field of instructional technology. These experts examined the test items and indicated whether they measured predetermined criteria, objectives, and domain of content. After incorporating their recommendations, a pilot survey was distributed to seven teaching faculty in the Colleges of Engineering, and Liberal Arts and Sciences at Iowa State University. From their suggestions, six items (part 2: question 1 and 3; part 3: question 2; part 4: question 1 and 7) were reworded for clarity and an estimated time to complete the survey was determined and indicated on the cover letter. After making changes to the pilot study, a survey and cover letter were sent to each of the five members of the program of study committee for further scrutiny concerning validity and formatting. Their comments were integrated in the final version of the survey.

Human Subjects Review

Approval to conduct the study was granted by the Iowa State University Committee on Use of Human Subjects in Research (Appendix B). After reviewing the survey instrument and cover letter, the committee concluded that the rights and welfare of human subjects in this study were adequately protected and the suggested format for reporting group data ensured confidentiality of the individual.

Data Collection

Data were collected by mailed survey using the Iowa State University campus mailing system. The survey instrument and a personalized cover letter (Appendix C) explaining the nature of the study and the human subjects safeguards for confidentiality were delivered to each participating department on January 28, 1998 for distribution. An unobtrusive coding system was established by assigning a number on the right hand corner of the survey to facilitate the follow-up process.

Three weeks after the initial mailing, on February 21, 1998, a follow-up e-mail (Appendix C) was sent to the 139 non-respondents. E-mail addresses were obtained from the Iowa State University On-line Directory. Each non-respondent was sent a personalized e-mail reminder message. On March 5, 1998 a total of 190 surveys had been received.

Although the total return rate was 63.12% (n=190), 14 surveys were not included in the final data producing sample. These 14 were not useful for the following reasons: 7 faculty members did not teach in 1997 although their names were listed in the course schedules, 2 had assumed administrative positions, 3 had retired, 2 were out of the office traveling, and 3 did not complete the survey as requested. A final total of 176 surveys provided complete and useable data for a response rate of 58.86%. Colleges represented in this data producing sample were agriculture, education, and family and consumer sciences as shown in Table 3.1.

Table 3.1. Response rate by college (N =176)

Sample	College		
	Agriculture	Education	FCS
Invited	155	80	64
Responded	89	48	39
Response Rate	57.41%	60.00%	60.93%

According to Mangione (1998), response rates between 50% and 60% are barely acceptable unless additional information is provided that can contribute to confidence about the data (p. 405-406). To increase the confidence, hence generalizability of this data, non-response error was evaluated by a t-test comparison of early respondents and late respondents (Miller & Smith, 1983) on computer self-efficacy with results indicating no significant difference at the .05 level between the two groups. In this study, the final 58.86% (n=176) response rate was therefore judged to be adequate.

Data Analysis

The data were coded and prepared for analysis using the statistical analysis software SPSS version 8.0. (1998). From the research hypotheses, several statistical tests were performed including frequencies, t-tests, ANOVAs, Scheffè post hoc tests, correlations and reliabilities.

Frequencies and measures of central tendency were used to check for discrepancies, examine response rates, summarize faculty characteristics, and report checklist items. To compare means and determine if there were significant differences in extent of integration among colleges, gender, rank, mode of delivery, and computer self-efficacy, t-tests and ANOVAs were computed. Correlations and regressions were calculated to determine relationships of computer self-efficacy and faculty characteristics with electronic communication integration in teaching college courses.

Reliability coefficients were calculated from the sample respondents. The post-hoc internal consistency reliability (Cronbach's alpha) estimates were reported to be: .83 for extent of integration of electronic communication; .93 for self-efficacy in using computers; .77 for self-efficacy in using e-mail; .90 for self-efficacy in using the WWW; and .94 for the summated computer self-efficacy scale (computer use, e-mail use, and WWW use). According to McMillan and Schumacher (1997) a coefficient of .90 indicates a highly reliable instrument but coefficients ranging from .70 to .90 are acceptable for most instruments (p.240). In this study, coefficients ranged from .77 to .94 and were therefore found to be within the acceptable range (Table 3.2). The level of significance for both directional and non-directional tests was established at $p \leq .05$.

Table 3.2. Research constructs, summated variables, definitions, measurement, and items

Construct name	Definition	How the construct is measured	Survey item number	Reliability coefficient
Extent of electronic communication integration scale	Extent of integration identifies the frequency of use of Internet tools in teaching college courses on campus.	Eleven items were used to measure this construct. <u>Response format</u> Items were assessed on a 3-point Likert-type scale: I don't use (1) to use regularly (3).	Part 3 (Q.2) 11 items	.83
Computer self-efficacy scale	Individual feeling of confidence in performing computer-related tasks.	Twenty-seven items were identified to measure a summated variable defined as computer self-efficacy scale.	Part 4 items 1-9, 12-22, 24-30	.94
	A one level multidimensional sub-scale of the computer self-efficacy. Identifies faculty's level of confidence in using computers in general.	Nine items were identified to measure the construct in relation to general computer use. Items were developed using Advanced Computer Skills section of the CSE scale (Murphy, Coover & Owen, 1988).	Part 4 items 1-9	.93
	Sub-scale of computer-self-efficacy in using e-mail. Identifies faculty's confidence in using e-mail.	Eleven items were identified to measure the construct in using e-mail. They were developed using the e-mail section of the SCT scale (Delcourt & Kinzie, 1993).	Part 4 items 12-22	.77
	Sub-scale of computer-self efficacy in using the World Wide Web. Identifies faculty's level of confidence in using the WWW.	Seven items were identified to measure the construct with relation to the World Wide Web.	Part 4 items 24-30	.90
		<u>Response Format</u> Items were assessed on a 5 point Likert-type scale: Not confident (1) to extremely confident (5).		

CHAPTER IV. RESULTS

The purpose of this chapter is to report the results of the statistical analysis of the data obtained from teaching faculty. The first part presents descriptive statistics for faculty characteristics, computer experience, extent of integration, and computer self-efficacy. The remaining part responds to the guiding hypotheses using tests of significance and measures of relationship.

Descriptive Summary of Faculty Characteristics

The gender breakdown for teaching faculty who participated in this study was 36.9% (n=65) female and 63.1% (n=111) male. The overall mean age of the respondents was 46 years with 72.2 % of the respondents between the ages of 40 to 59 years, 18.8% less than 40 years, and 9.1%, 60 years or older. Nearly all (93.2%, n=164) of the teaching faculty held doctoral degrees, but 6.8% (n=12) reported their highest degree to be at the masters level. When asked to report on their rank, faculty indicated that 5.7% were instructors, 25.7% assistant professors, 26.9% associate professors, and 40.6% professors. Most (71.3%, n=124) of the faculty were tenured and more than one fourth (28.4%, n=50) reported that they did not have tenure. Faculty also were asked to report on their teaching years at the college/university level and 68.6% had more than ten years, 22.9% had between four to nine years, while 8.5% were in their first three years of teaching (Table 4.1).

Table 4.1. Summary of faculty characteristics

Variable	Categories	Number	Percent
College	Agriculture	89	50.6
	Education	48	27.3
	Family & Consumer Sciences	39	22.2
Gender	Female	65	36.9
	Male	111	63.1
Age (years)	21-30	1	.6
	31-39	32	18.2
	40-49	60	34.1
	50-59	67	38.1
	≥60	16	9.1
Educational Level	MA/M.Ed./MS	12	6.8
	Ed.D./Ph.D.	164	93.2
Rank	Instructor	10	5.7
	Assistant Professor	45	25.7
	Associate Professor	47	26.9
	Professor	73	41.7
Tenure	Not Tenured	50	28.4
	Tenured	124	70.5
Years of college/university teaching	1st year	6	3.4
	1-3 years	9	5.1
	4-6 years	22	12.5
	7-9 years	18	10.3
	≥ 10 years	120	68.6
Access to computer outside work environment	No	23	13.1
	Yes	153	86.9

Most teaching faculty reported that they were regular computer users; 86.9% (n=153) had access to a computer outside the work environment. More than two-thirds (68.4%) of teaching faculty reported that they had not attended in-service computer training within the last year (Table 4.2).

Table 4.2. Recent computer training of teaching faculty

Item	Number	Percent
Within the last 3 months	28	16.1
Within the last 4-6 months	9	5.2
Within the last 7-9 months	8	4.6
Within the last 10-12 months	10	5.7
More than a year ago	76	43.7
Never	42	24.7

Computer Experience

Responding to a checklist of nine computer applications, 96.0% reported that they had used word processing and 11.6% had knowledge of other programming applications including BASIC, C++, FORTRAN, JAVA, and VISUAL BASIC (Table 4.3 & Figure 4.1).

Table 4.3. Computer experience of teaching faculty

Item	Number	Percent
Word-processing	169	96.0
Electronic mail (e-mail)	158	89.8
Presentations	136	77.3
Spreadsheets	132	75.0
Statistics	111	63.1
Databases	102	58.0
Multimedia	52	29.5
Hyper Text Markup Language (HTML)	52	29.5
Desktop publishing	51	29.0
Other	21	11.9

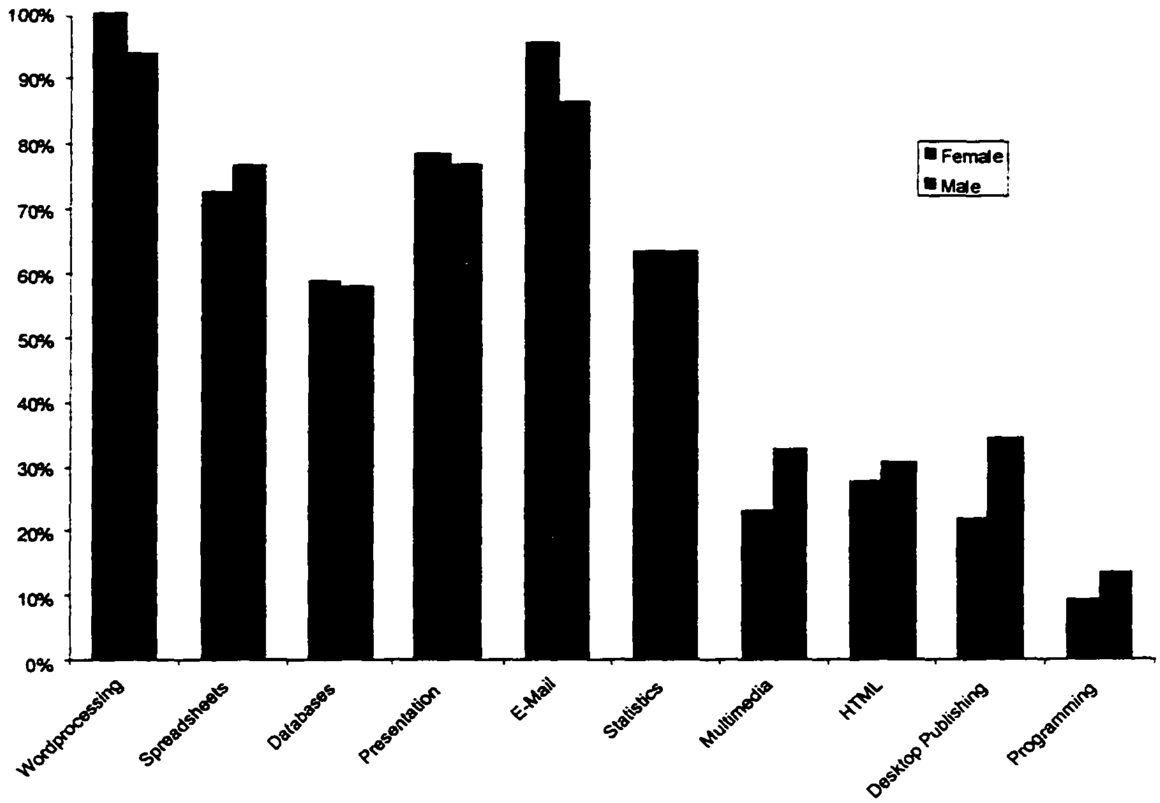

Figure 4.1. Computer experience of teaching faculty

To measure faculty experience with computer use, a computer index was established by counting the number of diverse computer applications with which faculty had experience. Email and word processing were not used in developing the category list because 90% to 96% of faculty respectively were competent with these skills. A count of the remaining listed computer applications were categorized into five groups to fit onto Rogers' (1993, 1995) five categories of adoption of innovations.

Rogers (1995) categorized innovativeness of individuals by their relative earliness in adopting new ideas compared to others. In chapter two, these five groups were identified as: innovators, early adopters, early majority, late majority and laggards. Diversity of computer experiences was categorized into these five groups (Table 4.4) and nearly half of the teaching faculty had experience with four or more computer applications. Figure 4.2 shows the distribution of faculty in each category by gender (n=65 female; n=111 male).

Table 4.4. Faculty computer experience with computer applications

Adoption group	**Computer applications**	**Frequency**	**Percent**
Laggards[a]	-	11	6.3
Late majority	1-2	41	23.3
Early majority	3	40	22.7
Early adopter	4	38	21.6
Innovator	5-6	46	26.1
Total		**176**	**100.0**

[a]no use beyond word-processing and e-mail

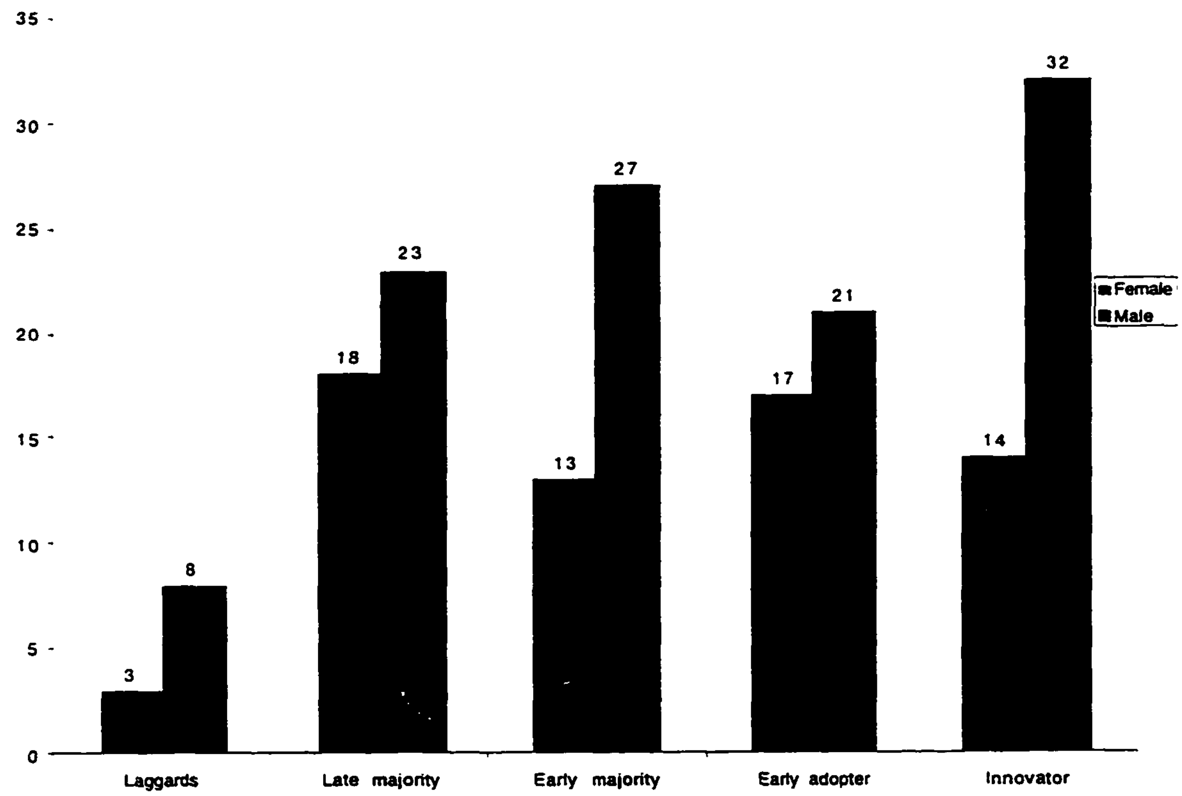

Figure 4.2. Adoption groups based on computer experience and gender (N=176)

Extent of Electronic Communication Integration in Teaching

All teaching faculty were asked to report if they used electronic communication in teaching courses and 51.7% indicated use while 48.3% did not. Those who did indicate use of electronic communication were asked to respond to 11 items related to use of Internet tools—e-mail, listservs, newsgroups, WWW—in delivery of those courses taught in 1997. Responses reported in Table 4.5 indicate that electronic communication was used most for identifying resources for course assignments with a mean score of 1.84 on a three point response scale (1=0 hours a week, 2=1-2 hours a week, 3=3 or more hours a week).

Table 4.5. Extent of electronic communication integration[a]

	On-campus (n=91)		ICN (n=24)	
Item	**Mean**	**SD**	**Mean**	**SD**
Resources for assignments	1.84	.73	1.54	.79
Course announcements	1.75	.71	1.33	.64
Course homepage	1.71	.78	1.50	.59
Mailing list	1.69	.73	1.67	.76
Schedule	1.67	.72	1.71	.69
Syllabus	1.66	.70	1.21	.51
Presentation of course content	1.60	.73	1.42	.65
Assignment submission	1.55	.69	1.63	.82
Retrieval of course grades	1.30	.61	1.13	.45
Real time discussions	1.23	.47	1.33	.70
Online office hours	1.23	.52	1.13	.45
Total	**1.57**	**.67**	**1.42**	**0.64**

[a] Likert-type response scale of 1-3 with 1=0 hours a week, 2=1-2 hours a week, and 3=3 or more hours a week.

Nearly all, 23 out of 24, faculty who integrated electronic communication in teaching courses also integrated for courses taught face-to-face on campus. Because some of the ICN courses include a "face-to-face" section, a small sample of respondents (10%) were asked in an informal setting if they could differentiate between integrating technology to a regular on-campus course and to one taught to distant students through the ICN. They said they could confidently differentiate between the two.

A summated variable was computed for "extent of integration" by summing all the three levels 1=0 hours, 2=1-2 hours a week, and 3=≥3 hours a week. This variable with data from 92 faculty had a mean of 17.13, a median of 16.00, a mode of 13.00, a standard deviation of 4.57 and a range of 17.00 with a minimum and maximum of 11 to 28, respectively.

Scores on this summated variable were then standardized to group high integrators and low integrators. From these standardized scores a new dichotomous variable was created called "integrator groups". To compute this variable, faculty scoring at least 0.5 standard deviations or more above the mean were labeled high integrators and those scoring -0.5 or less were labeled low integrators. That is, the 39.1% of respondents scoring around the mean were not included in the high or low groups (Figure 4.3). Thus, a subgroup of 55 faculty was used to test hypotheses related to high or low integrators.

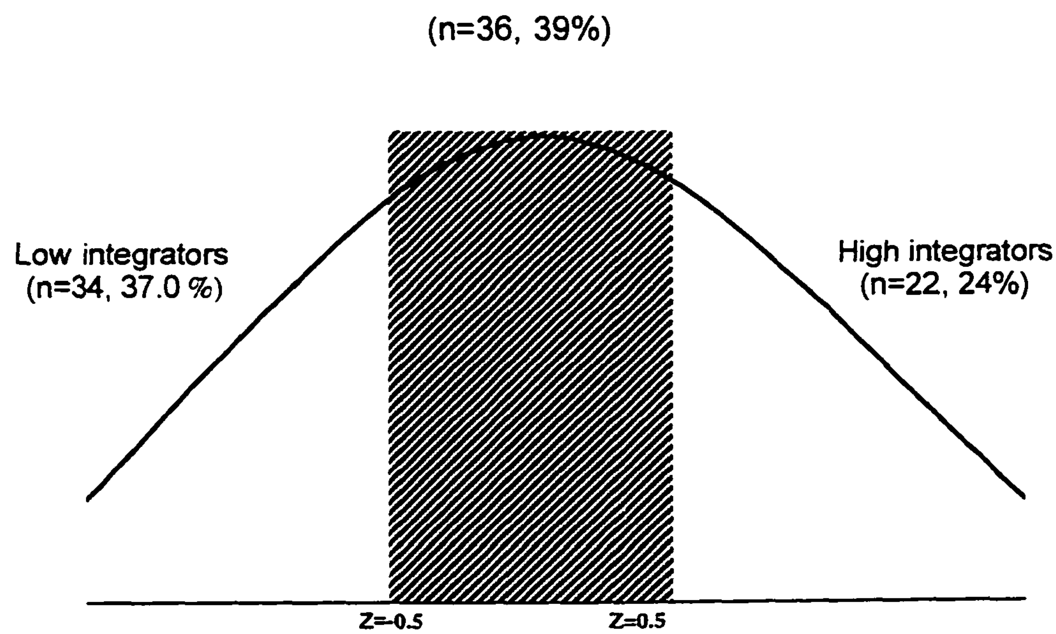

Figure 4.3. Normal curve of integrator groups

Integration scores for all faculty who indicated that they integrated technology both in teaching face-to-face and in using the ICN (n=23) were compared to determine if there was a significant difference between the delivery modes on integration of technology. From the results of this paired t-test (Table 4.6), it can be concluded that there are no significant differences in the level with which a faculty member integrates technology in delivering courses whether using the ICN or teaching a regular face-to-face course. Further, a correlation of the two modes showed a strong relationship in technology use between the two modes of delivery (r=.73).

Table 4.6. Paired t-test for extent of electronic communication integration

Mode of delivery	Mean	SD	t-value	p
ICN	14.65	3.27	.35	.93
Face-to-face on campus	14.65	3.17		

Computer Self-efficacy

On a five point Likert-type scale with 1=not confident to 5=extremely confident, teaching faculty were asked to respond to 27 items concerning their confidence in using computers, electronic mail, and World Wide Web (Table 4.7 to 4.9).

Faculty computer self-efficacy in computer use received a mean score of 2.80 indicating a confidence level between a little confident=2 and somewhat confident=3 (Table 4.7). On specific items within the computer use scale, faculty reported confidence levels ranging from 2.21 (for using textual data analysis software) to 3.58 (for using a variety of software packages).

Part two of the computer self-efficacy scale asked teaching faculty to respond to 11 items about their confidence in using electronic communication (e-mail). Faculty confidence levels ranged from 1.31 (for initiating Listservs) to 4.96 (for deleting e-mail messages). The overall mean confidence level was reported at 3.98 indicating that faculty were confident in using e-mail (Table 4.8).

Faculty computer self-efficacy with using the World Wide Web received a mean score of 2.82, indicating a confidence level between a little confident=2 and somewhat confident=3 (Table 4.9).

Table 4.7. Computer self-efficacy: Computer use[a] (N=176)

Item	Mean	SD
Using a variety of software programs.	3.58	1.23
Consulting the users guide when help is needed.	3.40	1.26
Describing basic computer functions.	3.02	1.35
Installing software programs.	2.99	1.42
Using statistical analysis software.	2.93	1.39
Explaining why a software program will or will not run on a given computer.	2.45	1.33
Troubleshooting computer problems.	2.36	1.23
Dealing with computer viruses.	2.28	1.29
Using textual analysis software.	2.21	1.34
Total	**2.80**	**1.32**

[a] Likert-type response scale of 1-5, with 1=not confident to 5=extremely confident

Table 4.8. Computer self-efficacy: Electronic mail (e-mail)[a] (N=176)

Item	Mean	SD
Deleting e-mail messages.	4.96	3.87
Printing e-mail messages.	4.76	.59
Sending e-mail messages.	4.67	.65
Forwarding e-mail messages.	4.51	.89
Editing text before forwarding mail.	4.31	1.17
Appending file to message.	3.89	1.43
Saving e-mail messages in an organized filing system.	3.88	1.39
Creating and managing a mailing list.	3.81	1.37
Changing password.	3.51	1.47
Participating in Listservs'.	3.13	1.55
Initiating Chat Room communication.	1.81	1.19
Total	**3.93**	**1.42**

[a] Likert-type response scale of 1-5, with 1=not confident to 5=extremely confident

However, on specific items within the World Wide Web scale, teaching faculty reported a somewhat confident score of 3.69 (for using a variety of search engines), and a score of 1.78 (for using *ClassNet* course management software) indicating an extremely low confidence level.

Table 4.9. Computer self-efficacy: The World Wide Web (WWW)[a] (N=176)

Item	Mean	SD
Finding specific information on the WWW.	3.69	1.24
Using a variety of search engines.	3.59	1.36
Understanding how the WWW works.	3.17	1.33
Explaining how information is stored on the WWW.	2.61	1.43
Downloading new software.	2.56	1.51
Developing a home page.	2.34	1.64
Using WWW course management software such as *ClassNet*.	1.78	1.23
Total	**2.82**	**1.39**

[a] Likert-type response scale of 1-5, with 1=not confident to 5=extremely confident

Overall, faculty are somewhat confident with using the World Wide Web as shown by a mean score of 2.82. Faculty reported that they were not aware of the Iowa State University developed course management and delivery software *ClassNet* which would allow for real time interaction and continued out of class discussion using the *discuss* and *chat* features. Asked how confident they were with using *ClassNet*, 6.3% (n=11) were extremely confident and 63.6% (n=112) were not confident. The overall mean response was 1.78 and fell within the not confident=1 to a little confident=2 range.

Comparison of computer self-efficacy sub-scales

During instrument development, the construct of computer self-efficacy was grouped into three sub-scales: computer self-efficacy in using computers, in using e-mail, and in using the World Wide Web. It was felt that some faculty characteristics might fail to show significant differences in the total construct and might instead show differences in the sub-scales given that measuring self-efficacy is related to confidence in doing specific tasks. Tasks therefore can be grouped logically into the three areas: general computer use, using e-mail, and using the WWW.

In the following three sections, each sub-scale is a dependent variable in comparison tests to identify differences between groups of dichotomous and categorical variables. Results are shown on Tables 4.10 to 4.15.

Self-efficacy in using computers

In comparing differences of dichotomous variables and the construct of computer self-efficacy in using computers, female faculty and those who reported lower level of integration of electronic communication reported a significantly lower self-efficacy (Table 4.10). Significant differences were found in faculty's computer experience with those having a working experience of five or more computer applications indicating a higher level of computer confidence in using computers. Other demographic characteristics that showed significant differences are age, college, and number of teaching years (Appendix D).

Table 4.10. T-test results for self-efficacy in using computers

	Mean	SD	t-value
Extent of integration			
Low integrators	22.68	8.88	-3.76*
High integrators	32.23	9.87	
Gender			
Male	26.75	9.82	2.82*
Female	22.65	8.32	
Tenure			
Non-Tenured	27.42	8.81	1.91
Tenured	24.42	9.58	
Educational level			
Masters	20.92	7.65	-1.64
Doctoral	25.55	9.54	

* significant at $p<.05$

Faculty over 60 years of age, those from the College of Family and Consumer Sciences, and with more than 10 years of teaching at the university reported a lower computer self-efficacy in using computers (Table 4.11; Appendix D).

Self-efficacy in using e-mail

Computer self-efficacy in using e-mail was the dependent variable for the independent t-tests and one way analysis of variance. Several independent variables produced significant differences and included faculty categorized as high integrators, non-tenured, mostly from colleges of education and agriculture with no more than 10 years of teaching, and less than 60 years of age reported a higher level of confidence in using electronic mail.

Table 4.11. ANOVA results of computer self-efficacy in using computers

Variable	Group	Mean	F ratio
Faculty rank			
	Instructor	20.90	
	Assistant Professor	27.96	2.33
	Associate Professor	25.55	
	Professor	24.16	
College			
	FCS	21.50	
	Education	26.17	4.86**
	Agriculture	26.52	
Teaching years			
	1st year	25.33	
	1-3 years	27.33	2.42*
	4-6 years	29.68	
	7-9 years	28.00	
	Over 10 years	23.83	
Age			
	31-39 years	29.50	
	40-49 years	26.15	4.17**
	50-59 years	23.15	
	≥ 60 years	22.19	
Adoption groups			
	Laggards	12.55	
	Late majority	19.44	
	Early majority	22.32	34.32**
	Early adopter	28.12	
	Innovator	33.58	
Training			
	Never	26.05	
	Last 3 months	27.29	
	Last 4-6 months	22.67	.87
	Last 7-9 months	20.87	
	Last 10-12 months	23.30	
	>1 year	25.21	

* significant at p<.05
** significant at p<.01

Table 4.12. T-test results for self-efficacy in using e-mail

	Mean	SD	t-value
Extent of integration			
Low integrators	41.29	8.53	-3.87**
High integrators	51.95	12.11	
Gender			
Male	43.53	11.12	.51
Female	42.72	7.75	
Tenure			
Tenured	42.38	11.68	2.07*
Non-Tenured	45.80		
Educational level			
Masters	40.50	8.59	.98
Doctoral	43.43	10.09	

* significant at p<.05
** significant at p<.01

Also, faculty who reported using no more than two computer applications showed a lower level of confidence in using electronic mail (Table 4.12 and 4.13).

Self-efficacy in using the WWW

The sub-scale of self-efficacy in using the WWW served as the dependent variable in comparison of means of faculty characteristics. Results of independent t-tests (Table 4.14) and one way analysis of variance (Table 4.15) showed significant differences for gender, level of integration, colleges, age, and computer experience(Appendix D). Male faculty, those categorized as high integrators, outside the College of Family and Consumer Sciences, less than 60 years of age, and using at least two or more computer applications beyond word processing and e-mail had higher levels of computer self-efficacy in using the World Wide Web.

Table 4.13. ANOVA results of computer self-efficacy in using e-mail

Variable		Mean	F ratio
Faculty rank			
	Instructor	40.80	
	Assistant Professor	46.49	2.34
	Associate Professor	43.28	
	Professor	41.81	
College			
	FCS	38.92	
	Education	43.43	6.34**
	Agriculture	46.35	
Teaching years			
	1st year	47.17	
	1-3 years	42.67	
	4-6 years	48.32	2.60**
	7-9 years	45.44	
	Over 10 years	41.77	
Age			
	31-39 years	47.15	
	40-49 years	44.57	4.82**
	50-59 years	41.49	
	≥ 60 years	37.31	
Adoption groups			
	Laggards	31.54	
	Late majority	38.82	
	Early majority	40.90	14.71**
	Early adopter	47.28	
	Innovator	48.63	

Table 4.13. (Continued)

Training			
	Never	26.05	
	Last 3 months	27.29	
	Last 4-6 months	22.67	1.89
	Last 7-9 months	20.87	
	Last 10-12 months	23.30	
	>1 year	25.21	

* significant at p<.05
** significant at p<.01

Table 4.14. T-test results for self-efficacy in using the WWW

Variable	Mean	SD	t-value
Extent of integration			
Low integrators	17.53	6.58	-7.05*
High integrators	29.18	5.07	
Gender			
Male	20.98	8.07	2.80*
Female	17.63	6.91	
Tenure			
Tenured	19.23	7.99	1.62
Non-Tenured	21.34	7.16	
Educational level			
Masters	19.67	8.03	.036
Doctoral	19.75	7.82	

* significant at p<.05
** significant at p<.01

Summated computer self-efficacy

The construct of self-efficacy was examined as a total of all efficacy measures for computer use, use of e-mail, and the World Wide Web. Results from t-tests and ANOVAS shown on Table 4.16 and Table 4.17 indicated that there were significant differences in self-efficacy of teaching faculty with age, college, gender, tenure, and teaching years (Appendix D).

Significant differences were found between integrator groups, with high integrators having a higher average of computer self-efficacy. Faculty also differed along gender lines with male faculty reporting a higher level of computer self-efficacy. Non-tenured faculty members (although constituting

Table 4.15. ANOVA results of computer self-efficacy in using the WWW

Variable		Mean	F ratio
Faculty rank			
	Instructor	20.30	
	Assistant Professor	20.73	0.39
	Associate Professor	19.02	
	Professor	19.68	
College			
	FCS	15.62	
	Education	21.26	7.80**
	Agriculture	20.29	
Age			
	31-39 years	21.84	
	40-49 years	21.18	2.88**
	50-59 years	18.43	
	≥ 60 years	15.50	
Adoption groups			
	Laggards	11.00	
	Late majority	16.34	
	Early majority	17.35	20.97**
	Early adopter	20.60	
	Innovator	26.23	
Training			
	Never	19.51	
	Last 3 months	22.79	
	Last 4-6 months	19.33	1.34
	Last 7-9 months	15.75	
	Last 10-12 months	20.30	
	>1 year	19.34	

* significant at p<.05
** significant at p<.01

Table 4.16. T-test results for summated computer self-efficacy

Variable	Mean	SD	t-value
Extent of integration			
Low integrators	81.50	21.50	-5.35**
High integrators	113.36	22.17	
Gender			
Female	83.00	20.29	2.33*
Male	91.26	26.62	
Tenure			
Not tenured	94.56	24.53	-2.10*
Tenured	86.04	24.09	
Educational level			
Masters	81.08	22.73	1.04
Doctorate	88.73	24.71	
Access to computers at home			
Without access	84.08	24.57	0.86
With access	88.83	24.62	

* significant at $p<.05$
** significant at $p<.01$

only 28% of the sample), had a higher level of computer self-efficacy than did tenured faculty (Table 4.16). Faculty in the College of Family and Consumer Sciences exhibited a lower level of self-efficacy than the other two colleges. In addition, faculty with more than 10 years of college teaching reported a lower self-efficacy. In testing for differences with the variable of age, the category with only one faculty member (21-30 years) was excluded from the analysis. Results shown in Table 4.17 revealed a significant difference with faculty over 60 years of age having a lower computer self-efficacy.

Table 4.17. ANOVA results for summated computer self-efficacy

Variable	Groups	Mean	F ratio
Faculty rank			
	Instructor	82.00	
	Assistant Professor	95.18	1.73
	Associate Professor	87.87	
	Professor	85.66	
College			
	FCS	75.69	
	Education	91.21	7.00**
	Agriculture	92.81	
Teaching years			
	1st year	94.00	
	1-3 years	91.44	
	4-6 years	100.86	2.89**
	7-9 years	95.61	
	Over 10 years	84.18	
Age			
	31-39 years	98.50	
	40-49 years	91.90	5.15**
	50-59 years	83.07	
	≥ 60 years	75.00	
Adoption groups			
	Laggards	55.09	
	Late majority	74.61	
	Early majority	80.58	29.40**
	Early adopter	96.00	
	Innovator	108.46	
Training			
	Never	86.95	
	Last 3 months	96.71	
	Last 4-6 months	91.56	1.09
	Last 7-9 months	77.00	
	Last 10-12 months	86.20	
	>1 year	87.25	

* significant at p<.05
** significant at p<.01

Finally, a comparison between computer self-efficacy and faculty use of a variety of computer applications was made and those faculty who reported only using word-processing and electronic mail (categorically referred to as laggards) had a lower computer self-efficacy.

Tests of Significance for Extent of Integration

The first hypothesis predicted that there would be no significant difference in extent of integration of electronic communication in courses being taught through the ICN and those taught on campus. A paired t-test showed no significant difference (Table 4.6). Faculty did not integrate electronic communication any differently when teaching face-to-face or to distant students through the ICN.

The second hypothesis predicted that courses taught through the ICN would have a higher level of electronic communication integration. The number of faculty who integrated electronic communication in teaching through the ICN was too few for further comparisons. However, the 24 faculty members who integrated technology when teaching via the ICN provided a very interesting profile: 14 female, 12 from the College of Family and Consumer Sciences, 3 from the College of Education, 12 aged between 40 to 59 years, all with doctoral degrees, 9 associate professors, 11 tenured, 10 having more than ten years of college teaching, 10 having used three or more computer applications, and 10 identified as middle to high integrators (Table 4.18).

The third hypothesis predicted that male and female faculty will differ significantly on computer self efficacy. Female faculty differed with male faculty in self- efficacy. T-test results showed that male faculty have a higher computer self-efficacy. However, when computer sub-scales are compared, female and male faculty do not differ on self-efficacy on using computers and the World Wide Web (Table 4.19). They differ on self-efficacy only on using e-mail.

Table 4.18. Summary characteristics of faculty teaching via the ICN (n=24)

Variable	Groups	Number	Percent
College	Agriculture	5	20.8
	Education	7	29.2
	Family & Consumer Sciences	12	50.0
Gender	Female	14	58.3
	Male	10	41.7
Age (years)	31-39	3	12.5
	40-49	7	29.2
	50-59	12	50.0
	≥60	2	8.3
Educational Level	Ed.D./Ph.D.	24	100
Rank	Assistant Professor	7	29.2
	Associate Professor	11	45.8
	Professor	6	25.0
Tenure	Not Tenured	18	75.0
	Tenured	6	25.0
Years of college/university teaching	1-3 years	1	4.2
	4-6 years	3	12.5
	7-9 years	3	12.5
	≥ 10 years	17	70.8
Training	Never	4	16.7
	Last 3 months	7	29.2
	Last 4-6 months	3	12.5
	Last 10-12 months	1	4.2
	>1 year	9	37.5
Access to computer outside work environment	No	1	4.2
	Yes	23	95.8

* significant at $p<.05$
** significant at $p<.01$

Table 4.19. T-test results for gender and computer self-efficacy

	Mean	SD	t-value
Self-efficacy in using computers			
Male	26.74	9.82	0.52**
Female	22.64	8.32	
Self-efficacy in using e-mail			
Male	43.53	11.13	2.95
Female	42.72	7.75	
Self-efficacy in using the WWW			
Male	20.98	8.06	2.92**
Female	17.63	6.91	
Summated computer self-efficacy			
Male	91.26	26.62	2.36*
Female	83.00	20.29	

* significant at $p<.05$
** significant at $p<.01$

The fourth hypothesis predicted that there would be a significant difference in extent of integration between faculty rank. A one-way analysis of variance (ANOVA) was carried out on four categories of rank (instructor, assistant professor, associate professor, and professor). No significant differences were found between rank and extent of integration.

The fifth hypothesis predicted that there would be a relationship between extent of electronic communication integration and faculty characteristics of gender and faculty rank. A measure of relationship was computed for extent of integration and both variables and no significant relationship was found neither between extent of integration and rank (r=-.07) nor by gender (r=.12). These correlations are very weak with rank showing an inverse relationship. That is, faculty at the lower level seem to be integrating electronic communication more than associate or full professors but this relationship is very weak and is not significant.

Predicting Integration of Electronic Communication

A two step hierarchial regression procedure was used in two separate analyses to predict integration of electronic communication by teaching faculty. The extent of integration of electronic communication in teaching college courses served as a dependent variable for the regression analysis. Faculty characteristics including age, gender, rank, teaching years, access to technology, educational level, tenure, college, training, use of a variety of computer applications, and three sub-scales of computer self-efficacy served as independent variables. Two dummy variables were created for college data because college was a categorical variable with three categories (Norusis, 1998).

Using a two-step hierarchial regression procedure, demographic variables, including educational level, gender, age, rank, teaching years, College of Agriculture, College of Family and Consumer Sciences, and access to computers outside the work environment were entered as a first block. In block two, training, experience in using a variety of computer applications, self-efficacy in using computers, self-efficacy in using e-mail, and self-efficacy in using the WWW were entered.

Results indicate that variables entered in the first block (demographic and faculty characteristics) did not explain any of the variance for integration of electronic communication in teaching college courses at $p<.01$.

In the second block, faculty confidence in using the WWW accounted for 24% of the variance, no other variable in this block contributed significantly. Therefore, the final regression equation was:

Extent of integration = 9.876 + 0.485 x (computer self-efficacy in using WWW)

CHAPTER V. DISCUSSION AND CONCLUSIONS

As technological innovations continue to change and expand, it becomes increasingly necessary to support educators in adopting innovations to keep up with educational demands of the 21st century such as distance education and use of computer-based educational technologies. Review of literature indicates that leaders in higher education are devoting substantial amounts of resources to development of the information technology infrastructure. It therefore is important to identify and understand characteristics that may influence educators' computer use, their confidence in using computers, and their decision to integrate computers in their teaching.

The overall purpose of this study was to determine faculty computer self-efficacy and extent of integration of electronic communication in teaching college courses. This study was guided by the following objectives:

1. Determine the extent of integration of electronic communication in teaching courses.
2. Examine effect of faculty characteristics on extent of integration of electronic communication in teaching courses.
3. Determine computer self-efficacy of teaching faculty.
4. Examine relationships between faculty computer self-efficacy and extent of integration of electronic communication in teaching courses.

5. Describe characteristics of faculty who integrated electronic communication in teaching via the Iowa Communications Network.

Using a mailed survey instrument, data for the study were collected from 176 teaching faculty in 26 departments within the colleges of agriculture, education, and family and consumer sciences at Iowa State University of Science and Technology, Ames, Iowa. This data producing sample consisted of teaching faculty who taught credit courses in the year 1997.

Extent of Electronic Communication Integration in Teaching College Courses

With the fast paced development of electronic communication, attention has been focused on how these emerging educational innovations are being integrated into teaching and learning environments. Findings of this study revealed that over half of the teaching faculty (52%) indicated that they used electronic communication in teaching college courses either face-to-face on campus or via the ICN. Faculty reported that they used electronic communication the most for identifying resources for assignments, mailing lists to make course related announcements and deadlines, and least for real time synchronous communication. Of these 92 faculty who integrated electronic communication in teaching college credit courses, only 24 integrated in courses taught via the ICN. A paired t-test showed no significant differences in extent of integration of electronic communication in teaching using either mode of course delivery. However, a strong positive relationship with a correlation coefficient of r=.90 was found between the two modes of delivery. This strong relationship supports Simonson and Schlosser's (1998) notion of distance education where educators provide equivalent learning situations for both regular face-to-face students and distant students in an attempt to achieve equivalent learning outcomes as well as to create opportunities to make teaching and learning more exciting (Cohen, 1988; Zhao, 1998).

Because faculty integrating electronic communication in teaching courses over the ICN were few (n=24), a summary description of their characteristics was given. The summary list in Table 4.19 shows that faculty teaching via the ICN were predominantly female associate professors from the college of family and consumer sciences. These ICN integrators were between 40 to 59 years of age and had over ten years of teaching experience. These faculty members were categorized as high integrators, had a high overall computer self-efficacy, with experience of four or more computer applications, and constituted 50% of the ICN integrators group.

Although teaching faculty in family and consumer sciences have an overall low computer self-efficacy, low integration of electronic communication, and experiences with few computer applications, this observation for the ICN integrators group of a high level integration of electronic communication in teaching via the ICN also contradicts literature on gender and technology integration (Busch, 1995; Gilland, 1990; Marcinkiewicz, 1994). Although this sample of ICN integrators is small, results of analysis from this group of teaching faculty should be examined carefully in order to explain discrepancies that might occur in reporting results from a combination of departments. Measures of faculty involvement in use of electronic communication can be subsumed easily by aggregate analysis based on colleges rather than individual departments or programs.

The overall low level integration of electronic communication in teaching via the ICN is a suprising finding because electronic communication provides faster transmission of materials than regular postal mail service to distant students who are target audiences for courses taught using this delivery system. Electronic communication has been identified as having an advantage of providing a communication medium not bound by time nor proximity. Brouwer (1997) notes that e-mail, for example, although self-paced can enable one to complete interactions within a very short time frame (p. 192).

Reports from the Office of Institutional Research indicate that all classrooms at Iowa State University can accommodate computer-related technologies (p. 22). This might explain to some extent the higher level integration of electronic communication in on-campus face-to-face courses. It therefore can be argued that given the existing infrastructure, electronic communication can be integrated into most courses at the university. The report also indicates that students have adequate access to computers in public computer labs and departments. Iowa State University operates 127 student accessible labs with over 2,300 institutionally owned computers (ISU Fact Book, 1997-98). Many of these labs are open 24 hours daily. In addition, network connections are available in all classrooms and all student residence halls (ISU Fact Book, 1997-98).

Another possible explanation to the overall low-level integration of technology might reside in the faculty. Several studies have indicated that faculty education in emerging technological innovations is key to increased development of capabilities, interest, and confidence in integrating technology into their teaching and learning environments (Hirschbuhl & Faseyitan, 1994; Olcott & Wright, 1995). When faculty were asked to report on their involvement in computer related educational activities, 44% stated that they had not participated in any formal programs for more than a year and 25% had never been involved.

Although reports from the Instructional Technology Center (ITC) at ISU indicate that in 1997, 15 formal campus-wide programs were developed for faculty education to use new technological innovations related to teaching and learning, still a high percentage of faculty did not participate. A review of faculty participation in campus-wide educational activities reveals that five programs were offered in spring 1997 and 10 in fall 1997.

M. J. Albright (personal communication, October 13, 1998) noted that the ITC was the only center on campus that offered training events on a campus-wide basis specifically aimed at technology in teaching. However, he cautioned against generalizing from courses offered through the ITC because individual colleges may offer additional technology-related seminars or workshops. Records to this effect were not available and verbatim accounts were not conclusive. It was also beyond the scope and objectives of this study to investigate factors contributing to lack of involvement in technology education programs by a high percentage of teaching faculty.

Faculty Computer Self-efficacy and Electronic Communication Integration

Faculty integration of electronic communication was examined from two related theoretical frameworks: process for adopting innovations, Rogers (1995); and self-efficacy (Bandura, 1986). Adoption groups were developed based on faculty experience with a diversity of computer applications. Faculty who were categorized as innovators reported a high level of integration of electronic communication. This result supports Rogers proposition that knowledge and experience influence adoption of innovations. Significant differences also were found among adoption groups with laggards reporting lower confidence in using computers, e-mail, and the World Wide Web.

From the review of literature, it was found that the construct of self-efficacy was a significant factor in predicting integration of electronic communication in teaching (Delcourt & Kinzie, 1993; Faseyitan, Libii & Hirschbuhl, 1996; Murphy, Coover & Owen, 1988). As hypothesized, faculty computer self-efficacy scores were significantly different when based on age, gender, college, extent of integration, and computer experience. Low integrators, female faculty, faculty in college of FCS, and laggards reported lower confidence in using computers than any other group of faculty. These results support past findings that gender and computer experience are significantly related to computer self-efficacy (Faseyitan, Libii & Hirschbuhl, 1996; Murphy, Coover & Owen, 1988; Delcourt & Kinzie, 1993).

Additional faculty characteristics that showed significant relationship with computer self-efficacy were age, college and teaching years. Scheffé post-hoc comparison tests revealed that faculty in the College of Family and Consumer Sciences, faculty with more than ten years of teaching, and faculty who are 60 years of age or older were less confident in integrating electronic communication in teaching college courses. Past studies had not identified these characteristics.

Faculty Computer Self-efficacy and Gender

Compeau and Higgins (1995) defined computer self-efficacy as a judgment of one's ability to use a computer (p.192). Whitley (1997) pointed out that because measures of attitudes such as self-efficacy have been examined as unitary units rather than sub-scales depicting specific tasks unique to each domain of the construct, conflicting results regarding the effect of gender have been reported. In this study, the construct of computer self-efficacy was examined as a unitary scale and also as three multi-dimensional sub-scales concerning the use of computers, e-mail, and the World Wide Web.

Except for computer self-efficacy in using e-mail, female faculty in this study reported lower confidence than their male colleagues, supporting previous findings on computer self-efficacy and gender (Delcourt et al., 1993; Faseyitan et al., 1996; Olivier & Shapiro, 1993; Whitley, 1997). In addition, results of a study by Spotts and Bowman (1995) showed that female faculty reported lower confidence in use of newer technologies and higher confidence in use of older technologies. The lower confidence reported by female faculty in this study supports Spotts and Bowman's findings that females have a lower confidence in using newer technologies. Faculty confidence did not differ in use of e-mail which is considered an older technology because it has been in use at Iowa State University for inter-office communication (LAN) as well as for Wide Area Networks (WAN). Further, it can be argued that e-mail has become a predominant means of communication in the last few years and faculty have experience and a high level of confidence in sending, receiving, forwarding, and deleting messages.

Differences in confidence in general computer use and the World Wide Web can be attributed to ubiquitous changes in hardware, operating systems, software and networking systems. This lack of confidence in using newer technologies supports the Spotts and Bowman (1995) study that female faculty tend to report lower confidence in using of newer technologies. Further studies are needed to examine the origin of the lack of confidence among female faculty in performing tasks related to the use of newer technologies including general use of computers and the World Wide Web.

Characteristics of Faculty Teaching via the ICN

Of the 52% (n=92) who responded that they integrated electronic communication in teaching college courses, only 14% (n=24) integrated electronic communication in teaching via the Iowa Communications Network.

Faculty teaching via the ICN were found to be mostly female from the college of family and consumer sciences. This interesting finding on the innovativeness of female faculty in integrating electronic communication in teaching is not supported in the literature reviewed for this study.

A possible explanation to this finding can be attributed to limitations of the study. Perhaps because the chief investigators in this study were from the College of Family and Consumer Sciences, respondents may have felt a greater incentive to respond. However, response rates from all colleges were found to be closely related (agriculture=57%, education=60%, family and consumer sciences=60%) ruling out the possibility of bias from data collection.

Another proposition that may have been a limitation was that courses offered via the ICN were predominantly from the College of Family and Consumer Sciences. However, a review of ICN course offerings in 1997 reveals that the College of Agriculture offered 20, the College of Education offered 12, and the College of Family and Consumer Sciences offered 10 courses (ISU Extended and Continuing Education, 1998). It can be concluded therefore that in teaching via the ICN, faculty in the College of Family and Consumer Sciences at Iowa State University have tended to integrate electronic communication more than faculty in colleges of agriculture and education.

A review of Iowa State University literature shows that faculty in the College of Family and Consumer Sciences have been actively involved in distance education research in Iowa. In 1997 alone, faculty from College of Family and Consumer Sciences were involved in four research projects concerning distance education in Iowa and in particular the use of the ICN in teaching and learning (Encyclopedia of Distance Education in Iowa, 1997). In addition, a master of family and consumer sciences offered entirely using the ICN was developed in the college and has been successfully offered since its inception in 1994. These factors (research and degree programs in family and consumer sciences) which were not identified in the study might have enhanced faculty self-efficacy, experience, and interest in using technology to deliver instruction.

Implications and Conclusions

According to Wolcott (1993), land grant universities have a commitment to research, teaching, and service and represent state interests in providing high quality educational programs. In addition, land grant universities strive to provide greater access to educational opportunities to accommodate demands of changing educational needs of the state.

To provide high quality educational opportunities to a changing student population, Simonson (1998) noted that the solution has been to utilize distance education technologies that provide equivalent learning experiences to both on-campus and distant students. The use of the full motion two way interactive ICN at ISU provides a nearly equivalent learning situation for both on-campus and distant learners. In addition, distance education enables land grant institutions to fulfill their commitment of outreach to their communities (Hayenga, 1993).

Teaching distant students requires time, energy, resources, and skills to re-structure regular courses for delivery at a distance. According to Faseyitan and Hirschbuhl (1996), making computers available to faculty is not sufficient to motivate them to integrate technology in the teaching and learning environments. Several educators have noted that effort spent in integrating technology into the teaching and learning process is not recognized or rewarded in the university promotion and tenure guidelines. Faculty promotion and tenure guidelines should reflect changes in universities' vision and priorities to ensure that participation in distance education and integration of technology in teaching and learning is recognized and appropriately rewarded (Wolcott, 1993).

Computer self-efficacy was found to correlate highly with extent of integration of electronic communication, computer experience, and using distance education technologies. It was identified in the literature that faculty who lack confidence in skills are not likely to engage in tasks in which those skills are required and they will give up easily in the face of difficulty (Faseyitan et. al., 1996). This means that faculty development specialists should develop educational programs that can provide hands-on experiences with a variety of technologies and applications, and to enhance computer self-efficacy among teaching faculty. As well, Zamitt (1992) suggested that faculty education ought to be an essential part of introducing computers into the teaching and learning environments. Faculty development specialists ought to identify strategies to improve faculty experience with a variety of emerging educational technologies which, in turn, will influence the adoption of innovations.

Recommendations for Future Research

The following recommendations are made based on the findings of the study.

1. This study focused on personal characteristics of teaching faculty that might influence their decision to integrate electronic communication in teaching college courses. Future studies should focus on other external and organizational factors including availability of technology, funding, administrative and technical support, nature and flexibility of technology education, the context in which faculty work, and rewards and incentives for adopting technology.
2. Results from this study showed that half of the teaching faculty did not integrate technology within their courses. Other studies (Blanco, 1996; Leo, 1996) indicated that faculty use of technology for instructional purposes was minimal. Future studies need to investigate this lack of innovativeness among teaching faculty in higher education.
3. University records revealed that many courses were offered via the ICN but only 14% of the faculty surveyed integrated electronic communication technology. Future studies of faculty teaching via the ICN should be done to identify factors contributing to lack of integration of electronic communication technologies in teaching and learning environments.
4. It is recommended that an interpretive study of integrators from the College of Family and Consumer Sciences be done to identify factors that

influenced their decision to adopt electronic communication in teaching via the ICN.

5. Another recommendation would be to carry out a campus-wide study of all the colleges to validate findings related to computer self-efficacy and adoption. Also, a further study could be carried out in peer land-grant institutions.
6. A study should be done to identify adoption stages specific to integration of technology in education. Results of faculty experience with computer applications revealed that some faculty resisted using more than minimum applications (e-mail & word processing) while others had explored the use of a wide range of applications. A model for the process of adoption of educational technologies should be modified to take into consideration the shelf-life of educational technologies, capabilities of educators, and the unique infrastructure of technology use in higher education.
7. A positivistic mode of inquiry was used in this study. Future studies should incorporate both positivistic and interpretive modes of inquiry to gain in-depth understanding of faculty perceptions regarding distance teaching, integration of technological innovations, and confidence in working in computer-related environments.

APPENDIX A. CONSENT TO USE FIGURE ON FORCES TRANSFORMING NORMAL EDUCATION

From: Steve Ehrmann <ehrmann@tltgroup.org>
Reply-To: "ehrmann@tltgroup.org" <ehrmann@tltgroup.org>
To: "'lkagima@iastate.edu'" <lkagima@iastate.edu>
Subject: Copyright permission
Date: Sun, 11 Oct 1998 09:05:58 -0400
Organization: TLT
MIME-Version: 1.0

Patience and persistence wins the day. You've reached me and you have my permission to use the chart. What's your dissertation about? your conclusions?
Steve Ehrmann

****

Stephen C. Ehrmann, Ph.D.
Director of the Flashlight Project
Vice President, The TLT Group
One Dupont Circle, Suite 360
Washington, DC 20036-1110
Ehrmann@tltgroup.org
http://www.tltgroup.org
202-293-6440 x42 (v)
202-467-6593 (f)

> -----Original Message-----
> From: Leah Keino Kagima [SMTP:lkagima@iastate.edu]
> Sent: Thursday, October 08, 1998 10:38 PM
> To: mjoyce@aahe.org
> Subject: RE: Main Let Us Know! form (forms submission)
>
> Dear Mary:
>
> I would like to get in touch with Steven Ehrmann who published an
> article in EDUCOM review in 1992 entitled "Challenging the ideal of
> campus-bound education. Educom Review, March/April 1992 page 24-27."
>I would like to use the chart on "Forces Trasforming Normal Education" in my dissertation.
> Please acknowledge receipt of this message.

APPENDIX B. HUMAN SUBJECTS APPROVAL

Last Name of Principal Investigator Kagima

Checklist for Attachments and Time Schedule

The following are attached (please check):

12. [X] Letter or written statement to subjects indicating clearly:
    a) purpose of the research
    b) the use of any identifier codes (names, #'s), how they will be used, and when they will be removed (see Item 17)
    c) an estimate of time needed for participation in the research and the place
    d) if applicable, location of the research activity
    e) how you will ensure confidentiality
    f) in a longitudinal study, note when and how you will contact subjects later
    g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. [ ] Consent form (if applicable)

14. [ ] Letter of approval for research from cooperating organizations or institutions (if applicable)

15. [X] Data-gathering instruments

(will make contact with subjects once human subjects approval has been given. — Per Leah Keino Kagima, P.I. 10/1/97)

16. Anticipated dates for contact with subjects:

First Contact	Last Contact
October 1, 1997	November 15, 1997
Month / Day / Year	Month / Day / Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

____
Month / Day / Year

18. Signature of Departmental Executive Officer — Date — Department or Administrative Unit

Leslie J. Ames — 9/29/97 — Family + Consumer Sciences Education + Studies

19. Decision of the University Human Subjects Review Committee:

X Project Approved   ___ Project Not Approved   ___ No Action Required

Patricia M. Keith — 10-6-97 — PM Keith

Name of Committee Chairperson — Date — Signature of Committee Chairperson

Approved with the understanding that specific course #s, names & dates will not be used in written reports or the thesis. Caution will be used in crosstabulations of demographic characteristics.

GC: 8/95

APPENDIX C.

SURVEY INSTRUMENT, COVER, AND FOLLOW-UP LETTERS

Integrating Electronic Communication in College Courses

The purpose of this questionnaire is to examine your experience with using electronic communication in teaching college courses. The questionnaire is divided into four parts. In part one and two, you are asked to provide some basic background information about yourself and your experience with computers, if any. In part three, you are asked to provide some information concerning the extent to which you use Email and Internet in teaching college courses. Part four asks you to indicate the extent to which you are confident when using computers.

Part 1: Demographic Information

Directions: Please indicate your response by checking the appropriate alternative, or filling in the space provided.

1. College ______________________ **Department** __________________________

2. Gender
- ☐Female
- ☐Male

3. Age
- ☐ 21-30 years
- ☐ 31-39 years
- ☐ 40-49 years
- ☐ 50-59 years
- ☐ _60 years

4. Educational Level
- ☐BA/BS Degree
- ☐MA/MEd/MS Degree
- ☐EdD/Ph.D Degree

5. Rank
- ☐Instructor
- ☐Assistant Professor
- ☐Associate Professor
- ☐Professor

6. Tenure Status
- ☐Tenured
- ☐Not Tenured

7. Years of College/University Teaching
- ☐ 1st year
- ☐ 1-3years
- ☐ 4-6years
- ☐ 7-9years
- ☐ >10 years

Courses Taught **Primary Mode of Delivery**

Semester	Course Number	Cr.	On-Campus	ICN	Extended[1]
8. Fall 1997					
9. Summer 1997					
10. Spring 1997					

[1] Courses offered using the traditional distance education or on-site visits.

Part 2: Computer Experience

Directions: Please indicate your response by checking the most appropriate.

1. Please select the computer applications you have used (mark all that apply).

☐ Word-processing.
☐ Spreadsheets.
☐ Databases.
☐ Presentation.
☐ Electronic communication.
☐ Statistics.
☐ Desktop publishing.
☐ Multimedia.
☐ Other (specify)____________________.

2. Do you have access to a computer at home?

☐ No.
☐ Yes.

3. When was the most recent computer training you attended?

☐ Never.
☐ Within the last 3 months.
☐ Within the last 4 - 6 months.
☐ Within the last 7 - 9 months.
☐ Within the last 10 - 12 months.
☐ Within the last 1 - 2 years.

Part 3: Extent of Integration of Electronic Communication in Instruction

1. Do you use **electronic communication** in teaching courses? If yes, continue to question 2 below. If no, go to part 4, page 3.

☐ No.
☐ Yes.

Directions: Considering all of the courses you indicated in Part 1(numbers 8 - 10), please report on how often you used Internet tools (e-mail/chat/listserv's/newsgroups/WWW) in delivery of those courses which were on campus, through the ICN, and in extended education.

2. In teaching college courses, how often do you use Internet tools (e-mail/chat/ listserv/ newsgroups/WWW) for the following functions?

Use the key below:

I don't (0 hours a week)	Few times (1-2 hours a week)	Regularly (≥ 3 hours a week)
1	**2**	**3**

Function	On-campus			ICN			Extended		
Course syllabus	1	2	3	1	2	3	1	2	3
Course schedule	1	2	3	1	2	3	1	2	3
Assignment submission	1	2	3	1	2	3	1	2	3
Course resources for assignments	1	2	3	1	2	3	1	2	3
Presentation of course content	1	2	3	1	2	3	1	2	3
Real time discussions (e.g. chat)	1	2	3	1	2	3	1	2	3
Course announcements/deadlines	1	2	3	1	2	3	1	2	3
Course electronic mailing list	1	2	3	1	2	3	1	2	3
Online office hours	1	2	3	1	2	3	1	2	3
Retrieval of course grades	1	2	3	1	2	3	1	2	3
Course homepage	1	2	3	1	2	3	1	2	3

Part 4: Computer Self-Efficacy

Directions: Below you will find a number of statements concerning how you feel confident about using computers. Please circle the number that best describes how you feel about each statement using the following five-point scale.

My confidence level for performing this task is:

Not confident	A little confident	Somewhat confident	Confident	Most confident
1	2	3	4	5

Item					
Using Computers					
1. Explaining why a software program will or will not run on a given computer.	1	2	3	4	5
2. Troubleshooting computer problems.	1	2	3	4	5
3. Installing software programs.	1	2	3	4	5
4. Describing basic computer functions.	1	2	3	4	5
5. Using a variety of software programs.	1	2	3	4	5
6. Dealing with computer viruses.	1	2	3	4	5
7. Using statistical analysis software.	1	2	3	4	5
8. Using textual analysis software.	1	2	3	4	5
9. Consulting the user's guide when help is needed.	1	2	3	4	5
Using Electronic Mail (Email)					
12. Changing password.	1	2	3	4	5
13. Sending Email.	1	2	3	4	5
14. Forwarding Email.	1	2	3	4	5
15. Editing text before forwarding mail.	1	2	3	4	5
16. Saving Email messages in an organized filing system.	1	2	3	4	5
17. Appending file to message.	1	2	3	4	5
18. Printing Email messages.	1	2	3	4	5
19. Deleting Email messages.	1	2	3	4	5
20. Creating and managing a mailing list.	1	2	3	4	5
21. Participating in Listserv's.	1	2	3	4	5
22. Initiating Chat Room communication.	1	2	3	4	5
Using the World Wide Web (WWW)					
24. Using WWW course management software such as *ClassNet*.	1	2	3	4	5
25. Finding specific information on the WWW.	1	2	3	4	5
26. Using a variety of search engines.	1	2	3	4	5
27. Understanding how the WWW works.	1	2	3	4	5
28. Explaining how information is stored on the WWW.	1	2	3	4	5
29. Developing a home page.	1	2	3	4	5
30. Downloading new software.	1	2	3	4	5

THANK YOU

FOR RESPONDING TO THIS SURVEY. PLEASE STAPLE OR TAPE AND RETURN BY CAMPUS MAIL

Cover Letter

January 28, 1998

Dear Professor «fname» «lname»:

We are currently conducting a study on the extent to which faculty in the Colleges of Agriculture, Education, and Family and Consumer Sciences are integrating electronic communication in their course delivery. The best information about technology use, integration, and related challenges comes from you, the faculty. This type of information is useful in decisions concerning future faculty development programs.

This survey will take approximately 10 minutes to complete. All information will be treated confidentially. Information on titles of courses that you have taught will only be used to categorize the nature of courses using various modes of electronic communication. Further, responses will be treated only as group data in the written report.

Please complete the survey and return it by **Thursday February 12, 1998**. Thank you for providing this valuable information that will contribute to development of quality programs. In addition, if you would like to receive the results of this study, please send us an email at **haus@iastate.edu** or **lkagima@iastate.edu**. Your time and effort in completing this survey are greatly appreciated.

Sincerely,

Dr. Cheryl Hausafus
Associate Professor

Leah Kagima
Research Assistant

Follow-up E-mail to Non-respondents

To: ______@iastate.edu
From: leah k kagima <lkagima@iastate.edu>
Subject: Reminder
Date: Thur, 12 Feb 1998 12:03:53 -0600

February 12, 1998

Dear Professor M-GfnameM-H M-GlnameM-H:

Recently we sent you a survey concerning the extent to which faculty in the Colleges of Agriculture, Education, and Family and Consumer Sciences are integrating electronic communication in their course delivery. We have not yet received your response, and we feel that the best information about technology use, integration, and related challenges comes from you, the faculty. Information you provide regarding technology use is useful in decisions concerning future faculty development programs.

In the event that the original survey has been misplaced, please send us an e-mail and we will mail you another copy immediately.

If you have a copy of the survey, please complete and return it by Thursday February 26, 1998. Thank you for providing this valuable information that will contribute to development of quality programs. In addition, if you would like to receive the results of this study, please send us an email at **haus@iastate.edu** or **lkagima@iastate.edu**. Your time and effort in completing this survey are greatly appreciated.Thank you for responding

Sincerely,

Dr. Cheryl Hausafus
Associate Professor

Leah Kagima
Research Assistant

--

Leah Keino Kagima
lkagima@iastate.edu

APPENDIX D. CONSENT TO USE FICQ

From: John Hirschbuhl <jhirsch@uakron.edu>
Reply-To: "jhirsch@uakron.edu" < jhirsch@uakron.edu >
To: "'lkagima@iastate.edu'" <lkagima@iastate.edu>
Subject: Computer self efficacy
Date: Wed, 09 Apr 1997 10:57:02 -0400
Organization: University of Akron
MIME-Version: 1.0
To: lkagima@iastate.edu

Hi Leah

I think your research objectives are excellent. You should find faculty integrating modes of technologically based telecommunications in teaching. However, I think the self-efficacy is raised due to the simplicity of using E-mail and the Internet. When we did our study 90% of the faculty surveyed used computers but only 10% used them in teaching. Self-efficacy levels were low at the time. I think the demographic factors will also shift for the same reasons. I will fax you a copy of the FICQ and we have no objection to you using it for your study. Would you please keep us informed of your study. We are most interested in what you find.

Regards

John Hirschbuhl

>Dear Dr. Hirschbuhl and Dr. Faseyitan:

>I am interested in using the FICQ questionnaire and adopting it for my study "computer self-
>efficacy and extent of integration of e-mail and Internet to college courses". My study will be
>guided by the following objectives:

>1. To what extent are faculty integrating modes of technologically based
>communications in teaching?

>2. Is extent of integration of e-mail and Internet influenced by the mode of delivery?
>(ICN, face to face and extended education?)

>3. Is computer self-efficacy a significant determinant of the extent of integration of e-
>mail and Internet in teaching college courses?

>4. Are demographic variables (gender and faculty rank) predictors of computer self-
>efficacy?

>I will appreciate your response

>Thank you.

>Leah Keino Kagima

>lkagima@iastate.edu Fax: (515) 294-4493

APPENDIX E: SCHEFFE POST HOC COMPARISONS TESTS

Computer self-efficacy and college

ANOVA

		F	Sig.
subscale cse with using computers	Between Groups	4.861	.009
subscale cse with using e-mail	Between Groups	6.344	.002
subcale cse with using the WWW	Between Groups	7.803	.001
EFFICACY	Between Groups	7.004	.001

Homogeneous Subsets

ANOVA

		F	Sig.
subscale cse with using computers	Between Groups	4.861	.009
subscale cse with using e-mail	Between Groups	6.344	.002
subcale cse with using the WWW	Between Groups	7.803	.001
EFFICACY	Between Groups	7.004	.001

subscale cse with using computers

Scheffe[a,b]

COLLEGE	N	Subset for alpha = .05 1	2
FCS	39	21.1538	
education	48		26.1667
agriculture	89		26.5169
Sig.		1.000	.982

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 51.984.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subscale cse with using e-mail

Scheffe[a,b]

COLLEGE	N	Subset for alpha = .05 1	2
FCS	39	38.9231	
agriculture	89	43.4382	43.4382
education	48		46.3542
Sig.		.063	.312

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 51.984.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subcale cse with using the WWW

Scheffe[a,b]

COLLEGE	N	Subset for alpha = .05	
		1	2
FCS	39	15.6154	
education	48		20.2917
agriculture	89		21.2584
Sig.		1.000	.807

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 51.984.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

EFFICACY

Scheffe[a,b]

COLLEGE	N	Subset for alpha = .05	
		1	2
FCS	39	75.6923	
agriculture	89		91.2135
education	48		92.8125
Sig.		1.000	.943

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 51.984.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Computer self-efficacy and teaching years

ANOVA

		F	Sig.
subscale cse with using computers	Between Groups	2.421	**.050**
subscale cse with using e-mail	Between Groups	2.600	**.038**
subcale cse with using the WWW	Between Groups	2.214	.070
EFFICACY	Between Groups	2.896	.024

Homogeneous Subsets

subscale cse with using computers

Scheffe[a,b]

TEACHYRS	N	Subset for alpha = .05 1
> 10 yrs	120	23.8333
1st year	6	25.3333
1-3 yrs	9	27.3333
7-9 yrs	18	28.0000
4-6 yrs	22	29.6818
Sig.		.641

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 12.916.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subscale cse with using e-mail

Scheffe[a,b]

TEACHYRS	N	Subset for alpha = .05 1
> 10 yrs	120	41.7750
1-3 yrs	9	42.6667
7-9 yrs	18	45.4444
1st year	6	47.1667
4-6 yrs	22	48.3182
Sig.		.584

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 12.916.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Computer self-efficacy and diffusion groups

ANOVA

		F	Sig.
subscale cse with using computers	Between Groups	34.322	.000
subscale cse with using e-mail	Between Groups	14.714	.000
subcale cse with using the WWW	Between Groups	20.974	.000
EFFICACY	Between Groups	29.404	.000

Homogeneous Subsets

subscale cse with using computers

Scheffe[a,b]

diffusion groups	N	Subset for alpha = .05			
		1	2	3	4
laggard no use bey wp & em	11	12.5455			
late majority 1-2/6	41		19.4390		
early majority 3/6	40		22.3250	22.3250	
early adopter 4/6	38			28.1053	28.1053
innovator 5-6/6	46				33.5870
Sig.		1.000	.706	.074	.104

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 26.546.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subscale cse with using e-mail

Scheffe[a,b]

diffusion groups	N	Subset for alpha = .05			
		1	2	3	4
laggard no use bey wp & em	11	31.5455			
late majority 1-2/6	41	38.8293	38.8293		
early majority 3/6	40		40.9000	40.9000	
early adopter 4/6	38			47.2895	47.2895
innovator 5-6/6	46				48.6304
Sig.		.060	.945	.135	.989

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 26.546.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subcale cse with using the WWW

Scheffe[a,b]

diffusion groups	N	Subset for alpha = .05		
		1	2	3
laggard no use bey wp & em	11	11.0000		
late majority 1-2/6	41	16.3415	16.3415	
early majority 3/6	40		17.3500	
early adopter 4/6	38		20.6053	
innovator 5-6/6	46			26.2391
Sig.		.065	.223	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 26.546.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

EFFICACY

Scheffe[a,b]

diffusion groups	N	Subset for alpha = .05			
		1	2	3	4
laggard no use bey wp & em	11	55.0909			
late majority 1-2/6	41		74.6098		
early majority 3/6	40		80.5750	80.5750	
early adopter 4/6	38			96.0000	96.0000
innovator 5-6/6	46				108.4565
Sig.		1.000	.863	.076	.235

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 26.546.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Computer self-efficacy and age

ANOVA

		F	Sig.
subscale cse with using computers	Between Groups	4.170	**.007**
subscale cse with using e-mail	Between Groups	4.824	**.003**
subcale cse with using the WWW	Between Groups	3.811	**.011**
EFFICACY	Between Groups	5.146	**.002**

Homogeneous Subsets

subscale cse with using computers

Scheffe[a,b]

AGE	N	Subset for alpha = .05	
		1	2
5.00	16	22.1875	
4.00	67	23.1493	23.1493
3.00	60	26.1500	26.1500
2.00	32		29.5000
Sig.		.406	.061

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 31.913.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subscale cse with using e-mail

Scheffe[a,b]

AGE	N	Subset for alpha = .05	
		1	2
5.00	16	37.3125	
4.00	67	41.4925	41.4925
3.00	60		44.5667
2.00	32		47.1563
Sig.		.400	.147

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 31.913.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

subcale cse with using the WWW

Scheffe[a,b]

AGE	N	Subset for alpha = .05	
		1	2
5.00	16	15.5000	
4.00	67	18.4328	18.4328
3.00	60		21.1833
2.00	32		21.8438
Sig.		.505	.368

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 31.913.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

EFFICACY

Scheffe[a,b]

AGE	N	Subset for alpha = .05	
		1	2
5.00	16	75.0000	
4.00	67	83.0746	83.0746
3.00	60		91.9000
2.00	32		98.5000
Sig.		.609	.087

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 31.913.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

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"Trust in the Lord with all thine heart; and lean not on thine own understanding. In all thy ways acknowledge Him and He shall direct thy path" (Proverbs 3: 5-6).

IMAGE EVALUATION TEST TARGET (QA-3)

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