An Assessment of the Status of the Diffusion and Adoption of Computer-based Technology in Appalachian College Association Colleges and Universities

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(ABSTRACT)

This descriptive study examines the status of the diffusion and adoption of computer-based technology in the 33 Appalachian College Association schools and universities. The study was conducted in two phases. In Phase I a survey instrument was sent to six hundred randomly selected Appalachian College Association full-time faculty. This survey instrument was used to determine the frequency with which faculty use computer-based technology in the curriculum of the ACA liberal arts colleges and universities. The results of this survey were compared to those of the same survey administered to 59 full-time faculty at Milligan College.

In Phase II, in-depth interviews were conducted with sixteen Milligan College faculty members to determine <u>why</u> computer-based technology is or is not being used, <u>how often</u> it is being used, and with what <u>results</u>. An analysis of the results of the study show that word processing software, e-mail, and WWW resources at school are the most frequently used computer-based technologies. Other technologies are occasionally used and, still others, rarely or never used. Faculty gave only anecdotal evidence that the use of computer-based technology in the classroom was effective, but they were able to describe instances where they felt computer-based technology was effective and instances where its use should be avoided. In addition, these interviews provided insight about faculty attitudes toward the use of computer-based technology in the teaching/learning process, support and resources that are available, faculty training and professional development preferences, and anticipated future uses of computer-based technology. The survey instrument and interview questions are included with the document.

CERTIFICATION OF EXEMPTION OF PROJECTS INVOLVING HUMAN SUBJECTS

Investigator(s): Carolyn W. Carter and Dr. Glen Holmes

Department(s): Teaching and Learning

Project Title: An Assessment of the Status of the Diffusion and Adoption of Computer-based Technology in Appalachian College Association Colleges and Universities

Source of Support: Departmental Research - Sponsored Research - Proposal No.: Graduate Research

1. The criteria for "exemption" from review by the IRB for a project involving the use of human subjects and with no risk to the subject is listed below. Please initial all applicable conditions and provide the substantiating statement of protocol.

cwc a. The research will be conducted in established or commonly established educational settings, involving normal education practices. For example:

_____ 1) Research on regular and special education instructional strategies;

_____ 2) Research on effectiveness of instructional techniques, curricula or classroom management techniques.

_____ b. The research involves use of education tests (___ cognitive, ___ diagnostic, ___ aptitude, ___achievement), and the subject cannot be identified directly or through identifiers with the information.

cwc c. The research involves survey or interview procedures, in which:

_____ 1) Subjects cannot be identified directly or through identifiers with the information;

cwc 2) Subject's responses, if known, will not place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability;

cwc 3) The research does not deal with sensitive aspects of subject's own behavior (illegal conduct, drug use, sexual behavior or alcohol use);

_____ 4) The research involves survey or interview procedures with elected or appointed public officials, or candidates for public office.

_____ d. The research involves the observation of public behavior, in which:

_____ 1) The subjects cannot be identified directly or through identifiers;

_____ 2) The observations recorded about an individual could not put the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability;

_____ 3) The research does not deal with sensitive aspects of the subject's behavior (illegal conduct, drug use, sexual behavior or use of alcohol).

_____ e. The research involves collection or study of existing data, documents, recording pathological specimens or diagnostic specimens, of which:

cwc 1) The sources are publicly available; or

_____ 2) The information is recorded such that the subject cannot be identified directly or indirectly through identifiers.

2. I further certify that the project will not be changed to increase the risk or exceed exempt condition(s) without filing an additional certification or application for use by the Human Subjects Review Board.

Note: If children are in any way at risk while this project is underway, the chairman of IRB should be notified immediately in order to take corrective action.

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Dedication

This document and the work that it reflects are dedicated to my parents, Arvel and Golda Walsh, who have encouraged and supported every educational endeavor I have undertaken. I thank them and love them so much for the opportunities, encouragement, and love they have always given me.

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I have just completed a step in my life that I never dreamed possible. I thank God for giving me the courage, strength, and wisdom to complete this project.

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And finally, I must acknowledge my greatest source of strength, my husband Milton. He was so patient with those long absences from home and was always willing to do whatever was necessary to promote my success.

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Donald P. Ely (1995)

Chapter 1

Introduction

The Appalachian College Association (ACA) is a non-profit organization governed by an Executive Board composed of presidents of 33 liberal arts colleges in the Appalachian region of Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. A list of these colleges is in Appendix A. These colleges share the goal of service to the people of the Appalachian region through higher education and related services (Gillespie, 1995).

The mission of the ACA is to help Appalachia's small independent colleges improve the quality of education and to facilitate the development and sharing of ideas, information, programs, and resources for these 33 institutions. The ACA promotes cooperation and collaboration among its member institutions in order to serve the people of Appalachia and to the mutual benefit of member colleges. Currently the ACA has eight task forces addressing areas of need or concern to education in Appalachia. One of these is the Technology and Teacher Education Task Force which is charged with bringing the use of technology to small colleges and educating faculty in the appropriate use of this available technology (Gillespie, 1995).

The Andrew W. Mellon Foundation supports faculty of Appalachian College Association (ACA) colleges and universities in their efforts to incorporate computer-based technology in the classroom. The Foundation has funded the Technology Assistance Project (T.A.P.) to stimulate interest and involvement of ACA member schools and universities in technological improvement programs which relate to teaching skills. By August 1997, the total funding amount had reached $204,859. From October 1997 to March 1998, available funding for all new projects was $250,000 (*The Appalachian Messenger*, Fall 1997).

On May 29, 1996, President Clinton, along with eleven education organizations, announced the 21st Century Teachers Initiative. The goal of this initiative is to select and train 100,000 volunteer teachers to help other teachers and educators become proficient in using the latest computer technologies in schools. Teachers should be, in the words of President Clinton, "as comfortable with computers as they are with chalkboards."

Rationale for the Study

The primary purpose of this descriptive study is to assess the status of computer-based technology in the ACA colleges and universities. The study will assess the use of computer-based technology in the curriculum, its impact on the teaching and learning process, and attitudes of college faculty about the use of computer-based technology. The study will seek to understand why faculty are using computer-based technology and with what results.

Understanding when and how computers are best used and the support needed to incorporate them into the curriculum could aid faculty and students in using them most effectively. An awareness of the barriers faculty face and the training they need in order to use computer-based technology might allow steps to be taken to overcome these barriers and useful training programs to be developed.

In this information age, technology is the symbol of progress, and the growth of information technology is inevitable. The motivation for the rush to purchase computer-based technology without fully understanding what purpose it serves and the ultimate consequence of the adoption of this technology is unclear (Ely, 1995).

Many schools are rushing to purchase computer-based technology and to incorporate it into their classrooms. A better understanding of <u>how</u> and <u>why</u> computers are being used by faculty and students on college campuses could assist schools in using them more effectively. Insight into the benefits and limitations of its use could assist faculty in incorporating computers where they can be most advantageous to the teaching and learning process.

Knowledge of faculty attitudes about using computer-based technology in the curriculum, the availability of adequate support for its use, and faculty training preferences are important considerations in the effort to incorporate computer-based technology into the college curriculum. Identifying barriers faculty face in their attempts to use computer-based technology in the classroom could lead to the development of solutions for overcoming these barriers and could encourage the use of computers where they have found to be most effective.

Chapter 2

Review of Related Literature

This chapter reviews diffusion, adoption of innovation, and educational reform literature as they are the central issues to the development of this study. Also reviewed will be contributions of computer-based technology to the teaching/learning process, barriers to effective use of computer-based technology in the college curriculum, and literature suggestions for future research.

Diffusion and Adoption

"Studies of diffusion and adoption help to explain the what, where, and why of technology acceptance or rejection in education" (Holloway, 1997, p. 1107). Diffusion and implementation research aids in understanding why a field is in a given condition at a particular time. Adoption decisions may be administrative, sociological, or economic.

"Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1983, p. 5). Rogers, in 1962, described an innovation as "any idea or product perceived by the potential innovator to be new" (p. 13). In later work, he clarifies this definition by noting someone may have been aware of an innovation for a while but not developed a favorable or unfavorable attitude toward it. The idea may not have been adopted or rejected at the present time (Rogers, 1983).

The Innovation-Decision Process

The innovation-decision process is the process through which an individual or organization passes from first knowledge of an innovation to forming an attitude about or an interest in the innovation, to a decision to adopt or reject, to implementation of the new idea on a trial basis, and to confirmation of this decision by regular use of the innovation (Boone & Kurtz, 1995; Rogers, 1983). These steps usually occur in a time-ordered sequence of knowledge, persuasion, decision, implementation, and confirmation (Rogers, 1983).

Some researchers claim the individual plays a passive role in being exposed to awareness-knowledge about an innovation (Coleman, 1966), while others feel individuals tend to expose themselves to ideas that are in accordance with their interest, needs, or existing attitudes (Hassinger, 1959). If individuals do not find the information relevant to their situations, or if enough knowledge is not obtained to persuade the individual to use the innovation, the knowledge step is skipped (Rogers, 1983).

At the persuasion stage, the individual actively seeks information about the new idea. The individual examines the advantages, disadvantages, and consequences of the innovation and opinions of peers are the most valued. The persuasion stage will result in either a favorable or an unfavorable attitude toward the innovation.

The decision stage is where the individual will choose to adopt or reject the innovation. Individuals will adopt innovations more readily if the innovation can be used on a trial basis. Change agents often attempt to speed up the innovation process by demonstrating the idea. The idea is just as likely to be rejected as adopted.

Two types of rejection might occur. With active rejection, the individual considers adoption of the innovation, but rejects it. With passive rejection, the individual never really considers using the innovation. Although these two types of rejection are quite different, a distinction has rarely been made between them in past diffusion studies (Rogers, 1995).

In the implementation stage, the individual puts the innovation to use. Here the individual actively seeks information about the innovation and the role of the change agent is mainly to provide technical assistance. Problems of implementation are often more serious when the adopter is an organization rather than an individual because the implementers are often a different set of people from the decision makers. The implementation stage ends when the adopter institutionalizes the innovation and makes it a regular part of the ongoing operations.

At the confirmation stage the adopter seeks reinforcement for the innovation decision already made and may reverse this decision if exposed to conflicting messages about the innovation. The role of the change agent at this stage is to provide supporting messages to individuals who have previously adopted. Negative messages at the confirmation stage may lead to discontinuance (Rogers, 1983).

Replacement discontinuance occurs if the adopter makes a decision to reject an idea in order to adopt a better idea. Disenchantment discontinuance is a decision to reject an idea because of dissatisfaction with its performance. This could be because the innovation is inappropriate for the individual or does not show the perceived relative advantage over available alternatives. Discontinuance of an innovation is one indication that the idea may not have been fully adopted as standard practice for the individual or organization (Rogers, 1983).

Rate of Adoption

Rate of adoption is the relative speed with which members of a social system adopt an innovation. Five characteristics influence the rate of adoption.

1) Relative advantage – the degree to which the adopter perceives an innovation as superior to previous ideas. Sub-dimensions of relative advantage are the degree of economic profitability, low initial cost, a decrease in discomfort, savings in time and effort, and the immediacy of the reward. Many change agencies offer incentives or subsidies to clients in order to speed the rate of adoption in innovations.

2) Compatibility – the degree to which an innovation is perceived to meet the needs of potential adopters. A faster rate of adoption occurs when an adopter perceives an innovation as meeting the needs of the client.

3) Complexity – the degree to which an innovation is perceived as difficult to understand and use. The perceived complexity of an innovation is negatively related to its rate of adoption.

4) Trialability – the degree to which an innovation may be experimented with on a limited basis. First adopters face two types of risks – financial loss and ridicule from others – if the new product proves unsatisfactory. Change agents often use low introductory rates and money-back guarantees to encourage sampling of a product. Innovative peers then act as a psychological or vicarious trial for the later adopters.

5) Observability – the degree to which the results of an innovation are visible to others. Displaying an innovation's superiority in a tangible form will increase the adoption rate (Boone & Kurtz, 1995; Mahatoo, 1985; Rogers, 1983).

"In general, innovations that are perceived by receivers as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations" (Rogers, 1983, p.16). An effort by Moore and Benbasat (1991) to evaluate user perceptions of information technology innovations supported the characteristics of innovations described by Rogers. Their results suggests voluntariness of use, image enhancement possibilities, relative advantage, compatibility, ease of use, trialability, result demonstrability, and visibility are the most important perceived characteristics in the adoption and use of an information technology innovation.

Research by Holloway (1977) found a sixth dimension called "status conferring" present in predicting rate of adoption for educational innovations. One of the important motivations for almost any individual to adopt an innovation is the desire to gain social status. Rogers (1983) notes this has been understudied in past diffusion research possibly because of the reluctance of respondents to admit that they adopted a new idea in order to secure the status associated with the innovation.

Establishing peer networks among those who have adopted the innovation will increase the rate of adoption. As this communication environment grows, it creates an important interrelationship between the rate of knowledge about an innovation and its adoption (Rogers, 1983).

<u>Adopter Categories</u>

"Adopter categories are the classifications of members of a social system on the basis of innovativeness" (Rogers, 1983, p. 22). Rogers (1983) divides adopters into five ideal types or conceptualizations based on observations of reality. Comparisons are possible from these divisions.

1) Innovators - venturesome, control sufficient financial resources to absorb the possible loss from an unprofitable innovation, able to understand complex technical knowledge, able to cope with a high degree of uncertainty.

2) Early adopters - a more integrated part of the local social system, greatest degree of opinion leadership, serve as a role model for others in adopting the innovation, must make judicious innovation decisions to maintain their status as role models, have a shorter innovation decision period than later adopters.

3) Early majority - interact frequently with their peers and are willing to adopt new innovations but seldom hold leadership positions.

4) Late majority - adopt because of economic necessity and network pressure; adopt after most others in the social system have done so, can be persuaded that an innovation is useful but only peer pressure will motivate them to adopt.

5) Laggards - the last to adopt an innovation, possess almost no opinion leadership, decisions are influenced by what has been done in the past, tend to be suspicious of innovations and change agents.

An S-shaped curve depicts the flow of innovation acceptance by individuals through time. This S-shaped curve shows the adopters of an innovation on a cumulative basis (Rogers, 1983).

Kershaw (1996) describes a three-step transformation process to bring about change in an organization. In step one, individuals must understand that there is an urgent need to change. In step two, individuals come to understand that they themselves must change, and finally the individuals have to change the way in which they perform their roles in the institution. This can be plotted on the same S-shaped curve Rogers described, but Kershaw uses only four adopter categories—innovators, early majority, late majority, and laggards (Figure 1).

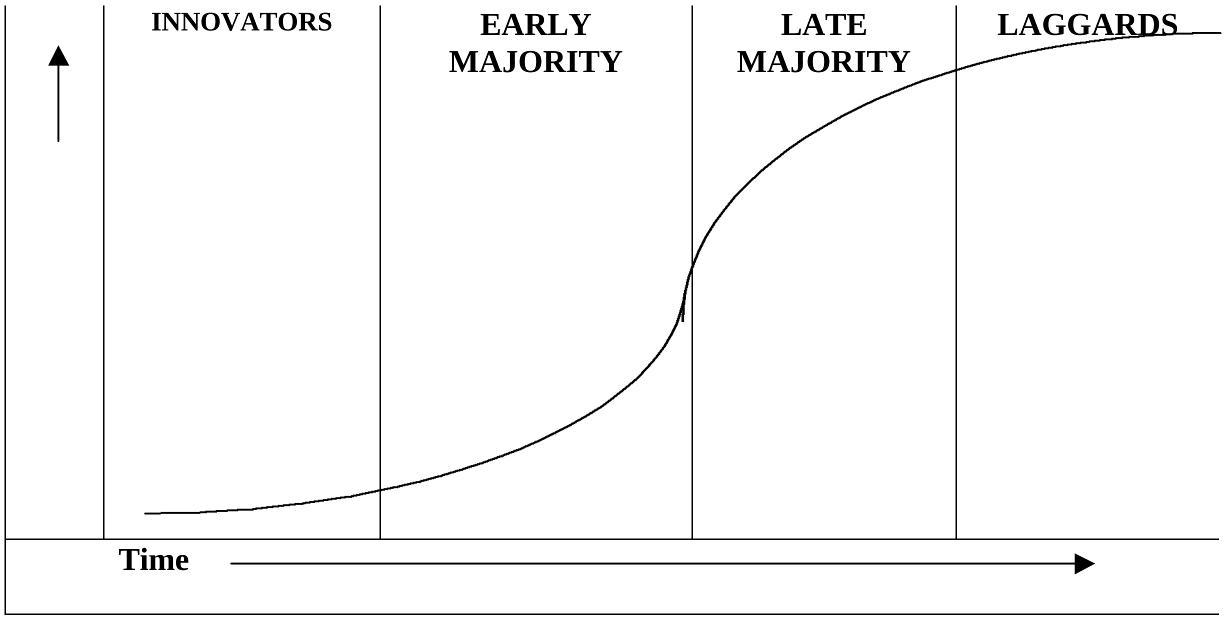

Figure 1. Innovation acceptance curve. Source: Kershaw (1996, p. 45).

Early innovators readily embrace change and are the primary change agents. Rogers (1983) notes the first individuals to adopt a new idea do so not only because they become aware of the innovation sooner than their peers, but because they require less time to move from knowledge to decision. The early and late majorities will need to be reassured that there is sufficient administrative and technical support available to them as they embark on the transformation process. They come successively later to the acceptance of change and later yet before change actually occurs. The laggards will not change. The laggards may progress to step two of the transformation process and accept the need to change but, for some reason, choose not to do so (Kershaw, 1996).

Geoghegan (1995) describes the adoption process for information technology for instruction a bit differently. He divides faculty into two groups: early adopters and mainstream faculty. Early adopters, made up of techies, experiment with every new technology that comes along. These are the first to adopt and use any technology innovation. The mainstream tends to be more conservative in its approach. Its members focus much more on the problems, processes, and tasks at hand than on the tools that might be used to address them and tend to prefer incremental change. Table 1 summarizes some of the differences cited by Geoghegan as separating early adopters from the mainstream faculty.

Table 1

<u>Adoption categories for information technology.</u>

Early Adopters	**Mainstream**
Favor revolutionary change	Favor evolutionary change
Visionary	Pragmatic or conservative
Strong technology focus	Strong problem and process focus
Risk-takers	Risk-averse
Experimenters	Want proven applications of compelling value
Largely self-sufficient	May need significant support
“Horizontally” networked	“Vertically” networked

<u>Note.</u> Source: Geoghegan (1995, p. 30)

It has been Geoghegan’s experience that early adopters often turn out to be poor role models and change agents. Their success in using technology to bring about qualitative improvements in teaching and learning, and the visibility that occasionally accompanies such success, can actually have an alienating effect. It can help to foster an administrative belief that most faculty ought to be using technology and that greater access to technology and training is the major prerequisite to success. It can also set inappropriately high expectations with which subsequent users may be quite uncomfortable.

<u>Opinion Leaders</u>

Opinion leadership is the degree to which an individual is able to influence other individual’s attitudes or overt behavior informally. These people serve as role models for the innovation behavior of their followers and are members of the social system in which they exert their influence (Rogers, 1983). Ely (1990) divides opinion leaders in his study into two distinct groups: (1) those who possess a vision about the benefits of the innovation and take steps to promote its acceptance; and (2) individuals in government and higher education who are strong advocates for the innovation and serve as promoters of the innovation.

The two-step flow model of mass communication. Studies of the two-step flow model of mass communication (Lazarsfeld and Menzel, 1963; Lazarsfeld et al., as cited in Rogers, 1944) have shown people are more influenced by direct contact with other people than by mass media. The tested hypothesis of the two-step flow model is that “the first step, from sources to opinion leaders, is mainly a transfer of information, whereas the second step, from opinion leaders to their followers, also involves the spread of influence” (Rogers, 1983, p. 273). This implies that the influence of mass media is not as powerful or direct as was once thought. Mass media creates knowledge; interpersonal networks persuade individuals to adopt or reject an innovation.

Homophilous/heterophilous communication. The transfer of ideas occurs most frequently between individuals who have similar beliefs, education, social status, and the like. Homophilous communication is more rewarding and effective for those involved. Heterophilous communication may cause cognitive dissonance because individuals are exposed to messages that are inconsistent with existing beliefs (Rogers, 1983).

Homophilous communication acts as a barrier to the flow of innovation. Since new ideas generally enter a system through higher status and more innovative members, a high degree of homophily means that these individuals interact mainly with each other, and the innovation does not "trickle down" to non-elites. Rogers (1983) reports that this could have some benefit because a high-status opinion leader might be an improper role model for someone of lower status. Homophilous communication causes new ideas to spread horizontally, rather than vertically, within a system and acts to slow down the rate of diffusion. Gaps can form between adopters and non-adopters and information about the best uses of an innovation is likely to spread slowly (Rogers, et al, 1985).

When a certain degree of heterophily occurs, followers tend to look toward opinion leaders who are perceived as a bit more technically competent than themselves. Seeking direction from these near-peer opinion leaders allows innovations to percolate slowly through the structure of a social system (Rogers, 1983).

Measurement of opinion leadership. Rogers (1983) describes four main methods of measuring opinion leadership and diffusion network links, which have been used in past research. These are:

1) Sociometric method - asks respondents whom they sought, or might seek, for information or advice about an innovation.
2) Informants' ratings method - asks essential people about the communication networks in a system.
3) Self-designating techniques - asks respondents to indicate the tendency for others to regard them as influential.
4) Observations - an investigator identifies and records the communication behavior in a system.

The role of the opinion leader is to help reduce uncertainty about an innovation for his or her followers, and, if the opinion leader adopts an idea too quickly, or becomes too innovative, the followers may begin to doubt the opinion leaders' judgment.

Social learning theory. The basic premise of social learning theory is that an individual learns from another by means of observational modeling. The individual does not actually need to experience a verbal exchange of information in order for the individual's behavior to be influenced by the model. Individuals do not passively absorb standards of behavior. They model their behavior after evaluating what others prescribe and model in the same circumstance (Bandura, 1977). Rogers (1983) contrasts social learning and diffusion by noting that "both theories seek to explain how individuals change their overt behavior as a result of communication with another individual" (p.

305). Results of case studies on diffusion of the microcomputer in schools reveals that the lack of a reward system to encourage adoption hampers the normal spread of computer innovation from person to person. This has caused teachers to have to learn to use the computer on their own rather than by modeling what their peers have done (Rogers, 1985).

Change Agents

A change agent is one who influences clients' innovation decisions in a direction deemed desirable by a change agency (Rogers, 1983). Change agents are generally professionally trained and are heterophilous from their typical clients. Change agents must advocate for, and empathize with, the adopters (Dalton, 1989). Their main role is to facilitate the flow of innovations from a change agency to an audience of clients. For this to be effective innovations must be selected to match the clients' needs and problems (Rogers, 1983).

Rogers (1983) identifies seven roles for change agents. These are: 1) develop a need for change, 2) establish an information-exchange relationship with clients, 3) diagnose clients' problems, 4) create an intent to change in the client, 5) translate intent into action, 6) stabilize adoption and prevent discontinuance, and 7) achieve a terminal relationship by developing the clients' ability to be their own change agents.

The most important and difficult role for the change agent is diagnosing clients' needs. In the attempt to integrate computer-based technology in school settings, change agents typically hold workshops and "show and tell" demonstrations. A variety of opinion leaders, such as principals, consultants, and innovative teachers, has been persuasive in convincing a number of teachers to try new technology (Dalton, 1989). "Diffusion campaigns often fail because change agents are more innovation-minded than they are client-oriented" (Rogers, 1983, p. 319).

Types of Innovation-Decisions

Individual members of a system, or the entire social system, can adopt or reject an innovation. Rogers (1983) describes four types of innovation-decisions in which the choice may be made to adopt or reject an innovation. These are:

1) Optional innovation-decisions in which the choice is made by an individual independent of the decisions of other members of the system. It is generally expected that "innovations requiring an individual optional innovation-decision will be adopted more rapidly than when an innovation is adopted by an organization" (p. 233).

2) Collective innovation-decisions in which choices are made by consensus among the members of a system,

3) Authority innovation-decisions in which choices are made by a relatively few individuals in a system who possess power, status, or technical expertise, and

4) Contingent innovation-decisions in which choices to adopt or reject can only be made after a prior innovation-decision. Rogers (1983) gives the example here of the inability of a faculty member to choose to use a piece of computer-based equipment until the decision has been made by the school or department to purchase the equipment.

Teachers work in organizations and generally make collective and/or authority innovation-decisions (Rogers, 1983). Although true instructional innovations do exist, Dalton (1989) reports that a centralized authority, usually in response to external pressures, makes most adoption decisions. These external pressures range from parental and societal demands, to keeping up with what others are doing, to business and industry which are concerned about what potential workers are learning in schools. Case studies of nine schools by Rogers and others (1985) reveals that in about half the schools computers have been acquired for educational purposes largely due to pressure from gifting corporations, parents and students, not because of their potential for impacting the teaching/learning process.

Diffusion in Organizations

Early studies in diffusion of innovation in organizations were incomplete, over simplified, and reduced to the equivalent of an individual (Rogers, 1983). Many of these early studies depended upon how adequately data provided by chief executives represented the innovation behavior of the relevant members of the organization. Results of research on innovations of organizations are incapable of making gross statements about innovation adoption behavior (Downs & Mohr, 1976; Kimberly, 1981; Van de Ven, 1986). There was no way to determine how adequately these data truly represented the entire organization’s behavior concerning a technological innovation.

Damanpour (1988) cautions that a differentiation between types of innovations in an organization is necessary for gaining consistent results in the attempt to understand innovation adoption behavior. Administrative innovations involve organizational structure and administrative processes. Technical innovations pertain to products and services that are related to the basic work activity of the organization (Damanpour & Evan, 1984).

The size of an organization has consistently been found to be positively related to its innovativeness (Damanpour, 1988; Rogers, 1983). Rogers (1983) contends this is probably because size is a variable that is easily measured with a relatively high degree of precision and because size is probably a used as a surrogate measure when organizations seek reasons to try innovations.

Rogers (1983) and Damanpour (1988) describe the innovation process in organizations as one that occurs in two stages—initiation and implementation. Initiation is defined as all of the information gathering, conceptualizing, and planning for the adoption of an innovation, leading up to the decision to adopt (Rogers, 1983; Zaltman, Duncan & Holbek, 1973). The initiation stage is composed of two phases—agenda-setting and matching. In the agenda-setting phase, individuals in an organization identify an important problem and then seek an innovation as one means of coping with the problem (Damanpour, 1988; Rogers, 1983). This is in contrast to the arguments of March (1981) who states that organizations seem to be driven by solutions rather than problems. Organizations continuously scan for innovations and match any suitable innovation found with some pertinent problem.

The second phase of the innovation process in organizations, matching, allows the conceptual matching of the problem with the innovation in order to determine how well the innovation might solve the organization's problem. Studies by Brancheau and Wetherbe (1990) show that organizations must be aware of the user base for which a tool is both designed and purchased when the decision is made to adopt technology for use in the organization.

The decision to adopt marks the beginning of the second stage, implementation. Rogers (1983) describes this stage as the events, actions, and decisions involved in putting an innovation into use. The implementation stage is composed of three phases. The redefining/restructuring phase occurs when the innovation imported from outside of the organization gradually begins to lose its foreign character or is reinvented to accommodate the organization's needs. The next phase, clarifying, allows the organization to put the innovation into wider use gradually and the meaning of the new idea becomes clearer to the organization's members. In the final phase, routinizing, the regular activities of the organization incorporate the innovation and the innovation loses its separate identity.

Damanpour (1988) compares the dual-core model of innovation in organizations suggested by Daft in 1978 and the ambidextrous model suggested by Duncan in 1976. In the dual-core model the "organic" structural characteristics of low formalization, low centralization in decision-making, and high employee professionalism promotes the implementation of technical innovations and the initiation of administrative innovation. The ambidextrous model suggests the opposite: the "mechanistic" structural characteristics of high formalization, concentration of power, and low professionalism facilitate the initiation of administrative innovation and technical implementation. The two models agree that organic characteristics enhance initiation of technical innovations and mechanistic characteristics help the implementation of administrative innovation. Damanpour concludes that the two models are not united concerning the influence of structural characteristics on the initiation of administrative innovations or on the implementation of technical innovations (Table 2).

Table 2.

Types of innovation and stages of adoption.

	Types of Innovation	
	Administrative	Technical
Initiation	Mechanistic (Dual-core model) Organic (Ambidextrous model)	Organic
Implementation	Mechanistic	Organic (Dual-core model) Mechanistic (Ambidextrous model)
	Mechanistic Characteristics: 1. Low Professionalism 2. High Formalization 3. High Centralization	*Organic Characteristics:* 1. High Professionalism 2. Low Formalization 3. Low Centralization

Note. Source: Damanpour (1988, p. 555).

Green and Gilbert (1995) describe a four-stage "implementation cycle" in which information technology integration occurs in organizations. The cycle may take years, not weeks or months. Stage 0 begins with some planning, investigation, and experimentation of the technology. The organization recognizes that leading competition has already started to use the technology and some individuals recognize that they can do some of their work better and faster. A decision is made to permit small groups to go ahead and implement the technology. Stage 1 is characterized by several years of marked increase in planned capital investment for individual workers and a surprising increase in operating expenses to fund the new technology. The organization slowly begins to accomplish some tasks never before attempted and experiences a modest gain in the scale or scope of new activities. In Stage 2, costs and annual investments in technology stabilize while capacity continues to grow and new functions are developed and implemented. At this stage the organization might reject "automation" and/or leave the business that was being automated. The implementation cycle concludes with Stage 3 where the organization achieves new levels of efficiency and effectiveness. The organization is no longer in quite the same "business" it was in the beginning. The organization no longer pursues the old objectives and no longer works in the old way.

No one seriously considers abandoning the technology because it has become inconceivable to accomplish what is now being done without it.

Green and Gilbert (1995) note that information technology decisions of colleges and universities are more decentralized than in corporations, which makes the implementation cycles more complex. Educational organizations are likely to move through the stages even more slowly than industrial organization of the same size. They contend that most colleges and universities are somewhere in Stage 1 – spending money. With each major new technological innovation, institutions and departments must again cycle through the same stages. Higher education needs better metrics and models to measure the costs and benefits of technological innovations on instruction in order to move decisively into Stages 2 and 3. Infrastructure and limitations in user support are the central issues that prevent colleges and universities from reaching the last stages in the educational use of information technology.

<u>The Innovation-Development Process</u>

"The innovation-development process consists of all of the decision activities, and their impacts that occur from recognition of a need or problem, through research development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences" (Rogers, 1983, p. 135). Rogers notes that the most crucial decision in this process is the decision to begin diffusing the innovation to potential adopters. "Innovation gatekeeping intended to determine which innovations should be diffused is performed in a variety of ways by different organizations" (p. 144). "The National Diffusion Network of the U.S. Department of Education uses a standing committee (called the Joint Dissemination Review Panel) as a scientific jury to decide which new educational innovations shall be diffused after new teaching and learning ideas have been developed by local school personnel" (Rogers, 1983, p. 145).

Brancheau and Wetherbe (1990) note that an organization should expect a delay between adoption of technology and how to use the tool effectively. They state that it is important to recognize users who are likely to be laggards, so that intervention strategies, such as extended training, can be designed for them. The type of support early adopters receive from the organization in the use of technology can further alienate mainstream faculty who may not speak the "language", who may fear the risk associated with new technology, and who prefer to focus on the task at hand rather than the tools to address it (Geoghegan, 1995).

Throughout the years, educators and reformers have seized one technical innovation after another, seeing fabulous opportunities for better education in each. Today, there is a rush to purchase technology unlike any previous time (Cohen, 1988; Ely, 1995).

Educational Reform

"If we were to start from scratch, what would schools look like?" (Sarason, 1990, p. 164). Since World War II, America has spent billions of dollars on educational reform, yet we have little to show for it (Sarason, 1990). Reformers predicted technologies, such as television in the 1960s, teaching machines in the 1970s, and personal computers and videodiscs in the 1980s, would transform the classroom. Some new technologies have been widely used by educators; others used but not always as their sponsors had planned or hoped; and some have been generally ignored (Cohen, 1988).

One common theme that has run through the introduction of each new medium is that each one was an enhancement or enrichment of the teaching and learning process. They supplement other resources and are rarely integral to the process of teaching and learning. Teachers were never required to use these media (Ely, 1995).

Dr. Paul Mort, at Columbia University's Teachers College, completed much of the early work in educational diffusion studies (Mort, 1953-54; Mort & Cornell, 1941; Mort, Vincent & Newell, 1945). These studies found that schools that adapted the most easily to innovations were those where teachers were highly trained and where administrators provided support for adopting the innovation. Knowledge of the slowness with which innovation spreads through American school systems is essential; otherwise, a good innovation may be abandoned before it has had a chance to prove its effectiveness (Mort, 1960).

Rogers (1983) states that we should increase our understanding of the motivations for adopting an innovation by asking 'why' the innovation was adopted. To regard adoption of the innovation as rational and wise, and to classify rejection as irrational and stupid, is to fail to understand that individual innovation decisions are unique and distinctive. To be able to manage educational innovations more skillfully, we need to know more about why a particular innovation spreads rapidly or slowly, and why the innovation succeeded or failed (Miles, 1964).

Kahn (1995) states that systemic redesign of education is a complex change process and has various stages. He describes these four stages as:

1. Initiating the process of change,
2. Designing the new system,
3. Planning the implementation, which includes tryouts and pilot tests, and
4. Implementing the design and institutionalizing the change.

When an institution is involved in bringing about fundamental change in its system, individuals involved in the change process encounter numerous obstacles. Obstacles common to individuals involved in the change process are:

- Time constraints as the organization proceeds from the initiation stage to implementation.

- Fear of change.
- Lack of communication with stakeholders, mostly during the implementation stage.
- Lack of shared community values supporting the change, usually during the initiation and implementation stages.
- Lack of shared decision-making skills, which becomes more necessary toward the final stage.
- Lack of understanding the vision of the future system.
- Lack of understanding of the innovation.
- Lack of outside facilitation to persuade and "sell" the new system to the stakeholders.

<u>Social Organization and Influences on Use of Technology</u>

Sarason (1971) contends that the whole culture of the school is responsible for bringing about change in student/teacher relationships. Teachers, administration, school boards, and all those involved directly and indirectly with the educational institution must support the use of the innovation.

Anyone affected by change should have some voice in the formulation and implementation of that change. "Having little or no hands-on experience in schools is a very serious limitation on those with the responsibility to make recommendations for improving them" (Sarason, 1990, p. 24). However, being part of the system in no way guarantees that one understands the system in any comprehensive way.

Sarason (1990) describes a three-part approach for understanding major problems in the educational system. First, understand why a problem has become a problem. Second, understand the history of the problem and determine whether the problem has been cyclical or constant. Lastly, understand how the school problem relates to the larger social system. Believing that a major educational problem is only a "within system" problem distances those who share social responsibility for the problem. Educational reformers must understand the culture of the context in which the problem arose and in which they seek to intervene.

The rate of adoption of innovation is also the function of the social system—its orientation, its values and norm, its level of technology. Goldberg and Richards (1996) contend that "technology can be leveraged to change schools and their communities into learning organizations" (p. 6), but Kershaw (1996) warns that technology is seductive. It tempts people to focus on the <u>means</u> of change rather than the <u>end</u>, on the technology itself, rather than the people who will use it. When that happens, little meaningful change occurs.

The social climate and attitudes toward innovations play an important role in creating these changes (Mahatoo, 1985). Understanding the impact of computers in higher education means understanding this complex network of reciprocal relationships between people and situations; it means examining the use and impact of technology in context (Kozma & Johnson , 1991). Sarason (1990) includes teachers as part of this complex network by stating that if school design is to be primarily for the education of children, then it will fail. It must equally be for the education of our teachers. In order to use technology to support fundamental change in the organization, it needs to be integrated into all parts of the organization—from school governance, to assessment, to instruction.

Bair (1996) contends that the use of the computer in higher education is driven by financial concerns, rather than by a concern for the best use of technology. The physical presence of computers is a new powerful academic symbol and prospective students will choose a college by the technology they have available. Computer-based technology is one of the few symbols that can simultaneously signify both conservative status and a progressive spirit. The presence of computers sends a message that the university is modern and that the teaching and learning process is high quality when, in reality, it is the relationship between the students and faculty that is still the key factor in defining quality education.

The structure of the academic department is also changing as a result of the influence of technology. Many faculty are choosing to identify their colleagues more in terms of what technology they use to teach and how they pursue professional achievement, rather than by allegiance to traditional academic disciplines (Bair, 1996).

Patterns of Technology Use

Ognibene (1989) contends that schools are traditionally conservative institutions whose employees do not typically see rapid change as a virtue. When it comes to pedagogy, the teaching and learning process, education is a late adopter, or non-adopter, of major technologies (Tate, 1995). Cuban (1986) notes that "critics often have pointed out how vulnerable schools have been to shifts in educational fashions" (p.1). "For years educators searched for means of communicating knowledge in simple, inexpensive, and timely ways" (Cuban, 1986, p. 3).

Books. Cohen (1988) states that "books are the oldest new technology in education" (p. 233). Books are very flexible and are advertised as having many of the same virtues now attributed to computers. Students in the same class can study the same subject by reading very different books, thus permitting students to adapt their studies to differences in taste, talent, and time. If students are using the same book, they can each proceed at their own pace, flip back and forth to different sections of the book, carry it around, and study as time permits. Books can be used individually or in groups, published relatively inexpensively, and reused. Although educational reformers argued that schools could be improved by the then-novel practice of printing texts, the flexibility of the book has been virtually ignored and classrooms are still organized for whole-class lecture and recitation.

Television. Once thought to have potential for revolutionary effects on education, television has proven to be a poor fit in most cases. Cuban (1986) contends that television was forced upon teachers and its initial applications to the classroom were conceived, planned, and adopted by school boards and superintendents. Programs were not keyed to the curricula that teachers used and did not fit well into the school schedule. Innovators were more concerned about the development of the new technology than how to organize instruction to use the technology. He notes that the social organization of education has had an influence on the use of this medium. Younger students are not disciplined enough to be left alone with each other and a television set. Cuban states that the use of television has faired better in colleges and universities for large group instruction and in adult and continuing education programs to deliver decentralized instruction.

Teaching-machines. In the 1920's, Sidney L. Pressey designed several machines for automatic testing. Although the machines were the first to emphasize immediate feedback, they did not catch on in the educational setting because they went against the theoretical stance of learning and memory which were common at the time (Skinner, 1968). Skinner (1968) contends appropriate teaching machines should allow students to compose responses rather than select from a list of alternatives and should require complex behaviors from the students as they perform steps of considerable length. He contends teaching machines could be a labor-saving device which would simulate having a private tutor for each student.

Means and Olson (1994) contend that using the wrong model of teaching with technology caused the failure of early efforts to introduce teaching machines and computer-based instruction in schools. Early applications were an imperfect and incomplete match with the bulk of the curriculum. Technological innovations were not supposed to contribute to disorganization, but teachers have often felt they did just that.

Two types of software were common: computer-assisted instruction (CAI) which tended to focus narrowly on drill and practice of basic skills, and instructional games which presented more challenging material but only covered a small slice of the subject matter. Cohen (1988) contends CAI was problematic because computers were expensive, scarce, and relatively inflexible. Students could only use the machines on a turn-taking basis that added to classroom management problems. He also notes that CAI software had little effect on what most teachers did with most of their students for the majority of the school day.

James Kulik and his colleagues at the University of Michigan summarized the vast research about tutorial software, re-analyzing data from a large number of small studies in order to draw more general conclusions (Kulik & Kulik, 1991). Their basic finding was that this method results in a substantial improvement in learning outcomes and speed, perhaps around 20 percent or more on average. Such instruction works best in content areas, such as mathematics or grammar exercises, where the computer can tell the difference between a student's right answer and wrong answer. Few other teaching methods have demonstrated such consistently strong results as this type of self-paced instruction. Unfortunately, even the best computer-assisted instruction of this type often has not found a substantial number of users in higher education. Software intended for educational use often fades when the novelty value expires (Ehrmann, 1995).

Computers. Cuban (1986) outlined the cycle of initial enthusiasm, subsequent disappointment, and ultimate non-use of film, radio, and television in the classroom and saw little evidence to suggest that use of the microcomputer would be any different. “These technologies were diffused and stalled” (Ely, 1987, p. VIII-1). Kettinger (1991) contends the computer offers great promise for adding a new dimension to teaching; however, survey-based data about teachers’ use of technology shows that it is being used in very conservative and traditional ways. Over the past decade, the advice of “experts” in educational technology about how computers should be used has constantly changed—from BASIC programming, to generic applications, to integration with existing curricula, to telecommunication with the outside world (Becker, 1994).

Evaluative studies of technology in the classroom in the mid 1980s in California, England, and France have shown that computers and other new educational technologies were embraced initially as viable education reforms but lacked the sustained support necessary for their successful continuation. While the number of computers in the classroom between 1981 and 1987 grew from 18 percent to 95 percent, quality software, training, and support were lacking. The lack of these features kept the computer from becoming a major tool in the classroom (Rodamar & Rodamar, 1990).

In the 1980s, the use of a few computers for many students, or a special computer laboratory somewhere in the building, was contrary to many teachers’ view of the appropriate orderliness of instruction. Ognibene (1989) cites four apparent reasons for decreased enthusiasm for computers in the schools: (1) the conservatism of schools and teachers, (2) the problems of integrating technology easily in the classroom, (3) the feelings by teachers that computers are a threat to the interpersonal relationship with students, and (4) the lack of evidence from research that computers are effective in the teaching and learning process. Initiatives by United States political entrepreneurs to incorporate computer-based technology into the schools were often ad hoc, poorly integrated, and lacking in research, evaluation, and follow through (Rodamar and Rodamar, 1990).

In 1989, in preparation for a National Science Foundation project, the Center for Research in Mathematics and Science Education at North Carolina State University surveyed university faculty’s practices and attitudes toward using technological tools for undergraduate mathematics and science instruction. An analysis of the instructional methods used by these faculty revealed that 67 percent of the surveyed faculty seldom or never used the computer as a class demonstration tool. Although the results did not show the computer to be a heavily used tool in the classroom, 81percent of this sample agreed or strongly agreed that computer can do certain tasks which cannot be done easily on the board or overhead. Sixty-eight percent perceived that the computer will change the way they teach their subject, and 65 percent felt that their administration supports the use of computers in the classroom. Of the faculty surveyed, 60 percent felt that computer use increased student’s visualization ability and that calculating programs freed the student from computation, allowing them to explore concepts (Berenson & Stiff, 1989).

A recent survey of 250 colleges and universities taken by the American Association of University Professors showed that, while almost all of the schools provided e-mail and Internet access, less than 25 percent of the schools are currently using technology as a major component of classroom instruction (Elfin, 1996). The American Council on Education surveying 407 colleges and universities in 1995 found that 68 percent of the schools have plans to introduce more electronic technology into the classroom (Simons, 1996).

A review of the results of Green's 1997 Campus Computing Survey distributed to 1,623 chief academic computing officers at two- and four-year colleges and universities across the United States indicated that e-mail, the Internet, and multimedia are increasingly common components of the instructional experience for college students. The current emphasis is moving away from preparing students to use computers in their jobs and moving toward training them to use the computer as a tool for learning.

Green's survey revealed that "classrooms appear to be the 'last node' on campus networks…the proportion of classrooms with a network connection is about a third to a half below the level of 'wired' faculty offices" (Green, 1997, p. 5). The survey also indicated that 70% of U.S. colleges and universities fund most of their computer-based equipment with one-time budget allocations or special appropriations and have no strategic or financial plan for upgrading or maintaining this equipment.

Green's 1997 Campus Computing Survey also revealed that only 12% of colleges or universities provided recognition or reward for faculty efforts to use computer-based technology in instruction, although, over half of all institutions had instructional technology support centers and instructional development programs and were eager to see more and better use of technology in instruction.

Contributions of Computer-Based Technology

"One could argue that the principal contribution to education made thus far by the computer presence has been to force us to think through issues that themselves have nothing to do with computers" (Papert, 1987, p. 23). Based on a review of case study applications, it appears that the computer can add pedagogical value (Kettinger, 1991), and greater control over the learning process (Roach, 1997) when the right classroom situations exist. Reformed classrooms focus on student-centered learning (Kozma & Johnson, 1991; Radlick, 1994; Roach, 1997), rely on faculty as facilitators (Kozma & Johnson, 1991; Means & Olson, 1994; Roach, 1997), and allow analysis and synthesis of authentic, real world projects (Albright 1996; Goldberg & Richards, 1995; Johnson & Joscelyn, 1989; Kettinger 1991; Kozma & Johnson, 1991; Means & Olson, 1994; Radlick, 1994).

In the reformed classroom, work takes place in heterogeneous, collaborative groups (Goldberg & Richards, 1995; Kettinger 1991; Kozma & Johnson, 1991; Means & Olson, 1994), and encourages inferential thinking by allowing students to play "what-if"

(Johnson & Joscelyn, 1989). Students experience intensive computer-based qualitative analysis during classtime which allows more time for interpretation and discussion and visualization of numerous and complex images in a self-selected or programmable order (Kettinger, 1991).

Guardo and Rivinius (1995) recorded a discussion of faculty members of 12 four-year, private, residential colleges of liberal arts and sciences on the use of information technologies in teaching and learning. Faculty who were avid technology users said the use of computers led to better communication with their students and with colleagues at distant locations who were working on the same pedagogical or research problems, allowed students to conduct better research, and gave them easier access to vast databases. Faculty who were not avid technology users said that technology isolated students and sacrificed the close face-to-face faculty/student relationships that characterize small, residential colleges. Guardo and Rivinius (1995) also found that faculty members in mathematics, physics, psychology, computer science, and chemistry used technology more so than other disciplines.

Videotapes and overhead transparencies, when incorporated into conventional lectures, make little significant impact on the structure of the course. Newer technologies such as e-mail, listservs, and the Internet allow change that is more substantial in the course structure. Students are able to gather far more information for papers and presentations because it is so much more accessible (Guardo & Rivinius, 1995). Students are able to use the same tools as the scholars and gain experiences in scientific laboratories at a greatly reduced cost. The use of technology costs little when compared with the great learning experience most students gain (Albright, 1996).

In 1997, a report commissioned by the Software Publishers' Association and conducted by an independent educational technology consulting firm, Interactive Educational Systems Design, Inc., summarized educational technology research conducted from 1990 through 1995. The firm chose 176 best studies from an original set of more than 1,000. The report, used to provide software developers and publishers with research that will enable them to improve educational technology, concluded that technology is making a significant positive impact in education. Important findings in this study include:

- Educational technology has demonstrated a significant positive effect on achievement in all major subject areas in preschool through higher education.

- Educational technology has a positive effect on student attitudes toward learning. Students were more motivated to learn, had increased self-confidence, and better self-esteem when using computer-based instruction.

- Teachers are more effective after receiving extensive training in the integration of technology with the curriculum.

- Teachers benefit from a social network of other computer-using teachers at their school.

- Introducing technology into the learning environment makes learning more student-centered, encourages cooperative learning, and stimulates increased teacher/student interaction.

- Positive changes in the learning environment brought about by technology are more evolutionary than revolutionary.

- Courses, which used computer-based networks, increased student/student and student/teacher interaction, increased student/teacher interaction with lower-performing students, and did not decrease traditional forms of communication.

- On-line telecommunications between different geographic locations improved academic skills (Report on the Effectiveness of Technology in Schools, 95-96: Executive Summary).

<u>The Medium vs. the Message</u>

Ely (1987) contends the question should not be “Which technology is best?” but rather “How can learning be improved to help each individual become increasingly responsible for his or her own learning?” “It is the systematic design and use of hardware and software which determines the effectiveness, efficiency, and quality of instruction and learning” (Ely, p. 3). Clark (1983) concludes:

> Five decades of research suggests that there are no learning benefits to be gained from employing different media in instruction, regardless of the obviously attractive features or advertised superiority …Media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes change in our nutrition (p. 445, 450).

Kozma and Johnson (1991) argue that the particular technology used is irrelevant, but that it may be either well or poorly suited to support a specific teaching-learning method; they suggest that research be conducted on which technologies are best for supporting the best methods of teaching and learning. Ehrmann (1995) agrees with Clark, as well as Kozma and Johnson. However, he feels Clark’s message is the more important one. Too many observers assume that if they know what the “hardware” is, they know whether student learning will occur. They assume that if faculty get the hardware, they will easily, automatically, and quickly change their teaching tactics and course materials to take advantage of it. Thus, technology budgets usually include almost no money for helping faculty and staff upgrade their instructional programs.

Means and Olson (1994) note that research results from settings which couple computer-based technology with educational reform suggest that technology amplifies what teachers are able to do and what they expect from students. In these settings teachers see complex assignments as feasible, and technology appears to provide an entry point to content areas and inquiries that might otherwise be inaccessible. The use of computers appears to extend and enhance both report writing and data graphing beyond what students are normally able to produce. They seem to lend authenticity to school tasks resulting in projects that are more polished. Schoolwork seems more real and important, and the introduction of technology has given teachers the opportunity to become learners again. Computer-based technology also breaks down organizational barriers previously created by time and distance (Bair, 1996).

Ehrmann (1995) contends that “if you are headed in the wrong direction, technology won’t help you get to the right place” (p. 21). Technology plays an important role, but it is a supporting role. Technology does not improve learning on its own. Teaching must center on the teacher; technology is merely a tool (Day, 1996; Kettinger, 1991; Means & Olson, 1994). The computer is a tool for learning when:

- Educators invite the use of technology, not only to produce answers, but also to formulate new questions.

- Students grow as problem solvers by searching for the answers.

- Students are able to refine their strategies and to consider alternatives.

- Students are rewarded when they attempt to explain and describe what they have learned with technology.

- Students can reflect on the investigative process they have used to solidify and extend their understanding.

- The output generated by the computer brings out concepts and connections within student’s investigations.

- Students move through intuitive, informal, and formal levels of understanding and abstraction, using the computer as one of many tools in that evolution.

- Students learn to value the work of others, as well as their own.

- Students learn to value the processes used in problem solving and see the concepts and connections which will empower them to learn on their own (Day, 1996).

Technology Goals and Strategic Planning

Several organizational factors influence the adoption process, whether it is individual or collaborative. Case studies show that institutional support can speed the pace of change somewhat. Case studies also show that many early adopters developed their innovation from personal conviction and resourcefulness instead of in response to institutional support. Innovations that were most successful involved the participation of others and evolved out of identified organizational needs (Kozma & Johnson, 1991).

Few schools have developed resource allocation procedures that deal with the increased competition for budgeted dollars created by the perceived need for more and better technology (Bair, 1996). “With respect to educational uses of information technology, most institutions are already at the point of no return—but don’t know where they are going. Information technology is being adopted before the institution develops a clear vision of how to improve teaching and learning with technology” (Gilbert, 1997, p. 2). Schools must make decisions about allocating scarce dollars, time, and expertise between educational technology and other means of improving student outcomes and among alternative approaches to using technology. To make such decisions responsibly requires schools to incorporate a great diversity of information to develop a “vision” for using technology (Becker, 1994; Ernst, 1994; Gilbert, 1997; Razik & Nalbone, 1989; Roach, 1997). “This vision should be an overall, goal-oriented plan, to ensure that the college or university focuses its efforts and makes guided decisions” (Gilbert, 1997, p. 3). Technology is a means to an end, not an end in itself. It is only effective when it supports the overall educational vision, goals, and standards (Kershaw, 1996; Radlick, 1994). Planning for information technologies should be tied directly to a college’s overall goals and build on its traditions and values (Barboni, 1993).

Research, in 1992, by the College Entrance Examination Board and the Council of Independent Colleges reported that 81 percent of survey respondents have a campus strategic plan and 47 percent have an information technology plan. However, the study revealed that few campuses link their information technology plans to the campus strategic plans or to the budgeting process, and few update their technology plans on a regular basis. Very few schools linked their information technology plans and their overall campus planning process in any meaningful way. Only about 20 percent of the respondents reported updating their information plans regularly, which suggests that technology planning is episodic rather than ongoing. Only 17 percent reported linking this planning to the budgeting process (Barboni, 1993).

A case study of the Frank Paul and Open Charter School sites suggests the importance of getting broad agreement on a vision of what the school or organization wants to become. After developing a consistent set of instructional goals and practices, the incorporation technology should support these goals. Teachers will then have a motivation for learning how to use technology and a desire to learn how to best incorporate it into the teaching and learning process (U.S. Department of Education, 1995b).

Barriers to Effective Use of Computer-Based Technology

An authority innovation-decision can typically generate fear and anger on the part of the teacher. Innovative teachers can threaten the equilibrium and comfort of less innovative teachers in the school. Many teachers feel they need to be able to program the computer to be able to use it effectively. As a result, many teachers see computers as complicated, unmanageable tools that require too much effort to master, no matter how beneficial they might prove to be (Dalton, 1989).

Cuban (1986) states that in the 1920s and 1930s, film became a symbol of progressive teaching much like computers have today. The following list of obstacles blocked increased film use in classrooms:

- Teachers' lack of skills in using equipment and film
- Cost of films, equipment, and upkeep
- Inaccessibility of equipment when it is needed
- Finding and fitting the right film to the class (p.18)

This same list of obstacles is still mentioned in literature today as barriers to effective use of the computer in the classroom (Boettcher 1995; Brady, 1991; Ely, 1995; Fluck, 1996; Khan, 1995; Lever, 1992). Today, many teachers feel little real research has been conducted to determine the extent to which computers in the classroom are of value from either a teaching/learning or cost/benefit point of view (Kettinger, 1991).

Hirschbuhl and Faseyitan (1994) conducted a study to identify factors that determined whether faculty from six state universities in Ohio used the computer in their classroom instruction and course-related preparation. Findings indicated that the technical orientation of the faculty's discipline, plus their computer self-efficacy, belief in the usefulness of the computer, and general attitude toward computers are the significant predictors of adoption. The results showed no significant difference between computer adopters and non-adopters in their personal attributes of age, gender, rank, length of service, and research commitment. The most unexpected finding of the study was the negative relationship between adoption and incentives to encourage faculty to adopt computers. The researchers interpreted this to mean that schools are using inadequate or ineffective incentive schemes to promote the adoption of computers for instruction. It is also possible that faculty respond more to intrinsic, rather than extrinsic, motivation.

Faculty have had little or no training or experience with technologies, and the rapidity of technological development makes mastery a moving target. (Breivik & Jones, 1993). Case studies show that even after teachers' initial fear of getting involved with technology has been overcome, serious challenges remain in terms of providing enough technical support that teachers will not be discouraged by equipment failures or software behavior they do not understand. A general agreement among case study observers is that schools need to have on-site technical assistance available to provide help on demand. (Becker, 1994; U.S. Department of Education, 1995a). The data from the 1992 annual survey by the College Entrance Examination Board shows personnel support is sparse. Well over half the respondents reported less than four FTE (full-time equivalent) technical assistants per 1000 students for combined academic and administrative computer support (Barboni, 1993).

Faculty development issues. From school visits, Sarason (1990) counted on hearing two things from the faculty: (1) expressions of disappointment at the unwillingness or inability of the school setting to support faculty development, and (2) reports of the ways in which burdensome teaching loads and other duties over time erode satisfaction with teaching.

The "best" colleges and universities are those that place equal importance on the development of faculty and the development of students. If conditions exist where faculty can learn, change, and grow, there is a better chance faculty create and sustain those conditions for their students (Sarason, 1990). The learning of new skills and the acquiring of knowledge by faculty must be as supported as learning by students (Razik & Nalbone, 1989).

Green's (1997) Campus Computing Survey reveals schools are eager to see more and better use of technology in instruction but provide little recognition or reward for faculty efforts to do so. Green suggests this sends a message to faculty that they are expected to do more with technology but are expected to acquire the needed skills on their own time and in addition to their other professional responsibilities. "Colleges and universities that push for more technology in instruction but fail to recognize and promote the instructors who invest significant time and effort to integrate technology into their teaching and syllabus send a chilling message about the institutional commitment to its integration in instruction and scholarship" (p. 5). Tate (1996) agrees that "adapting a course to a new delivery medium, integrating technology into the pedagogy or designing a course to be consistent with good instructional design requires a huge investment of faculty time and effort" (p. 4).

Geoghegan (1995) suggests two strategies for gaining faculty support for the effective use of technology in education: (1) forming Teaching, Learning, and Technology Roundtables (TLTR) on campuses to foster communication and planning which includes all key campus stakeholders—especially faculty who are not early adopters, and (2) developing closer relations with disciplinary societies and finding ways of connecting their advancing work with information technology to efforts on individual campuses.

Displaying the applications of various information technologies to the teaching/learning process during on-campus professional development activities can be an effective way to introduce an innovation (Kershaw, 1996). In order for faculty to integrate successfully technology with teaching activities, they need time to engage in intellectual exploration, time spent both on their own and time spent in collaboration with peers experts (Becker, 1994).

Directions for Future Research

Ely (1995) contends that the glamour of technology engulfs many schools before they fully understanding what purpose it serves and the ultimate consequences of its adoption and use. Is the move to use technology because it is necessary or because it is possible? "What we really need to know is <u>why</u> technology is in the school and <u>how</u> it is being used, by whom, for what purpose, how often, and what <u>results</u> have occurred as a result of its use" (p. 3). He states that the answers are not in the technology itself, but in the people who decide about the purpose of its use, the way in which it is used, and the evaluation of the consequences of decisions made about the use of technology.

Early studies in the use of computers in the schools have tended to focus on counting hardware and software inventories and recent acquisitions (Becker, 1994; Ely, 1995). Knowing <u>how</u> computers are actually used is far more important than knowing what <u>quantity</u> has been purchased and <u>if</u> they are used (Becker, 1994; Kettinger, 1991). A study of teacher practices of using technology should focus on distinguishing the specific functions for technology—technology as a medium for information dissemination, as a tool for skill and competency building, and as infrastructure for communication links between the classroom and the outside world. One important issue is to understand the overall relationship between instructional reform and uses of technology.

The Flashlight Project (Ehrmann, 1997), currently under development, is a model for evaluating the impact of informational technology on teaching and learning. The Project is a means of assessing educational reasons for using technology and allows educators to work together in an attempt to improve teaching and learning with technology.

Becker (1994) suggests using limited samples rather than full-scale national surveys to gain understanding about the conditions for effective technology usage to develop instruction. The question is not whether technology "can" help instructional reform, but whether technology investments and use "do" result in changes or improvements in teachers' instructional practices and student learning and the types of changes they make.

<u>Summary of Literature</u>

The literature reviewed for this study began with general diffusion and adoption literature and general educational reform literature. Literature related more specifically to the use of computer-based technology in the curriculum was reviewed also. This literature examined both contributions of the use of computer-based technology to the teaching and learning process and barriers to its effective use.

Several national surveys have been conducted which summarize the computer-based technology available in schools. Green's (1997) Campus Computing Survey, now in its eighth year, is the largest continuing study focused on the use of information technology in American higher education. This survey focuses on the use of computing and information technology to support and enhance instruction and scholarship.

Becker's (1994) research, commissioned by the Office of Technology Assessment, primarily re-analyzed data from several other national surveys regarding the presence of information technologies and used data compiled by market research organizations that describe the technology resources of schools in the United States.

Literature reviewed details how an individual determines if an innovation is appropriate or has a relative advantage over other techniques for their situation before they adopt it (Rogers, 1962, 1983, 1995). Innovation literature also describes the difference between active rejection, where the individual considers adoption of an innovation but rejects it, and passive rejection, where the individual never actually considers using the innovation (Rogers, 1983). Rogers (1983) describes four types of innovation-decision in which the choice may be made to adopt or reject an innovation. Dalton (1989) and Sarason (1990) contend that in many educational settings the decision to adopt is forced by a centralized authority, many times in response to external pressures. Educational reform literature noted how teachers sometimes feel pressured to use an innovation. Many times that pressure came from people who had little hands-on experience in schools or from more innovative peers who had already begun using the innovation (Boone & Kurtz, 1995; Mahatoo, 1985; Rogers, 1983).

Research shows that the influence of a reward system has been shown to have both a positive and negative effect upon adoption of an innovation. This effect depends upon the reward offered (Hirschbuhl & Faseyitan, 1994; Rogers, 1983). Several articles reviewed mentioned the effect of change agents and opinion leaders upon the adoption process and how they can influence adoption (Dalton, 1989; Gilbert, 1997; Rogers, 1983).

Miles (1964) contends that to be able to manage education innovations more skillfully, we need to know more about why a particular innovation spreads rapidly or slowly, and why the innovation succeeded or failed. Research by Bair (1996) shows that an institution could be seen as more progressive and "state of the art" with the presence of computer-based technology. This could be used as a means of attracting students, regardless of whether the technology is used effectively.

The literature reviewed related to training and support issues in the use of computer-based technology shows that time usually passes between actual adoption of an innovation and its effective use. Organization should recognize users who are likely to be laggards, and design extended training for them if they want to encourage the use of the innovation (Brancheau & Wetherbe, 1990). Kahn (1995) describes obstacles common to individuals involved in the change process such as time constraints, fear, lack of understanding, and lack of ownership in the decision to use the innovation. Several authors mentioned the lack of or inadequate, technical support as a barrier to using technology and many specifically mentioned the barriers to using computer-based technology (Becker, 1994; Breivik & Johns, 1993; Green & Gilbert, 1995). Other barriers are often encountered as innovations are considered for adoption. Some of these included cost, scarcity of the equipment, inflexibility of the equipment, and lack of adequate understanding of the advantages of the innovation (Cohen, 1988; Cuban, 1986).

Much of the current literature strongly suggests tying the purchase and use of computer-based technology to the vision of the institution and to strategic and financial planning (Bair, 1996; Becker, 1994; Ernst, 1994;Gilbert, 1997; Kahn, 1995; Razik & Nalbone, 1989; Roach, 1997).

Other literature detailed more specific training issues. From school visits, Sarason (1990) stated that he could count on hearing faculty express disappointment at the unwillingness or inability of the school setting to support faculty development. It was noted that faculty need time to plan for the effective use of computer-based technology in the curriculum. One way to foster this would be with demonstrations of technology usage and collaboration with peers (Geoghegan, 1995). Teaching, Learning and Technology Roundtables promoted by the American Association of Higher Education have just been introduced to many of the ACA colleges (Gilbert, 1997). The purpose of the Roundtable is to promote discussion about effective uses of technology in the curriculum.

One of the on-going concerns of faculty is about the lack of quality software and hardware to meet their needs or their student needs or their inability to find the right hardware or software (Rodamar & Rodamar, 1990). Many faculty see technology as a threat to their standard teaching practices and are most comfortable teaching as they were taught (Ognibene, 1989). Other faculty are not comfortable with their current level of expertise and are even more insecure when they find many of their student know more than they do about the technology.

Faculty who are comfortable with the use of computer-based technology in their classrooms are beginning to see collaborative learning as an asset. Students can interact with each other as well as others, including experts in the field, across the world via the Internet (Goldberg & Richards, 1995; Kettinger, 1991; Kozma & Johnson, 1991; Means & Olson, 1994). Computer-based technology has been found to have both a positive and negative impact of student learning. Case studies have shown that the use of computers can lead to better communication and can enhance visual learning, but excessive use of e-mail and application packages has been related to lower GPA's in a study of 129 college freshmen (Rickman & Hubbard, 1993). The best results seem to occurs when the technology is perceived as a tool, plays a supporting role and is not expected to improve learning on its own (Ely, 1995).

Bair (1996) described the changes that occur in academic departments where faculty who are using technology begin to talk across departmental boundaries with those who are using similar technology or who have similar beliefs about its benefits rather than to only those within their department. Computer-based technology seems to be used more in certain disciplines such as math, science, psychology, and computer science

(Guardo & Rivinius, 1995). Ideas about how computers can be used in the classroom has constantly changed from programming, to generic applications, to integration with existing curricula, to telecommunication with the outside world. Their effective use continues to evolve (Becker, 1994).

The literature describes how better training for faculty and increasing their understanding of the benefits of computer-based technology as a tool could enhance the teaching and learning process. The Flashlight Project, currently under development, is a model for evaluating the impact of information technology on teaching and learning. It is a means of assessing educational reasons for using technology and allows educators to work together in an attempt to improve teaching and learning with technology (Ehrmann, 1997).

Literature, which gives recommendations for future research, suggests that we stop counting hardware and begin looking at WHY technology is in the schools, HOW it is being used, by whom, for what purpose, how often and with what results (Becker, 1994; Ely, 1990; Kettinger, 1991).

Several questions arise from the review of literature concerning the use of computer-based technology in the ACA liberal arts college and university setting. Questions for consideration are:

1. What computer-based technologies are currently being used by faculty in the ACA colleges and universities?

2. Why are faculty currently using or not using computer-based technology?

3. What types of training or resources do faculty think are most beneficial in learning to use computer-based technology?

4. Are the adequate support services being offered for faculty as they begin to incorporate computer-based technology into the curriculum?

5. What is the attitude of faculty about the use of computer-based technology in the college setting?

6. How do faculty anticipate using computer-based technology in the future?

Chapter 3

Methodology

The purpose of this descriptive study is to determine the extent to which computer-based technologies are being used by ACA faculty members, why these technologies are or are not beingused, and with what results. This descriptive study also sought to determine faculty attitudes about the use of computer-based technology and the support, resources, and training needed to use these technologies effectively.

This study was accomplished in two phases. Phase I was accomplished by the administration of a general usage computer survey to a random sampling of ACA faculty and all available Milligan College faculty. Course syllabi for Milligan College faculty were also reviewed. Phase I was used to determine what computer-based technologies are being used by faculty and with what frequency.

Phase II was accomplished with both in-depth interviews of selected Milligan College faculty and a review of the telephone logbook from the help desk of computer services at Milligan College. This phase investigated why the computer is or is not being used, and with what effectiveness. This phase also gathered information about support available for faculty in their attempts to use computer-based technology, the barriers they face, and the training they find effective. The telephone logbook was reviewed to study the types of problems faculty had and when those problems occurred.

Each of these phases will be described below using the following format: participants and setting, data sources and collection procedures, and data analysis.

Phase I

The purpose of Phase I of this study was to gather data about what computer-based technology are being used by ACA faculty and with what frequency. The study also gathered data about the computer platform predominantly used by faculty, the discipline in which the faculty currently teach, the number of years of teaching experience, and the number of years of experience in using technology in the classroom. This was accomplished by surveying a random sampling of ACA full-time faculty and all currently available Milligan College full-time faculty.

Participants and Setting – Phase I

The population for the ACA Technology Survey was 1,863 full-time faculty members of ACA colleges and universities. Telephone contact was made to each of the 33 ACA schools to obtain a list of names of full-time faculty members. E-mail addresses were obtained in two ways. The Internet site of each college was reviewed for a listing of faculty with e-mail addresses. If no such listing was found, the academic dean’s office of each ACA school was contacted by telephone to obtain e-mail addresses. These were either read over the telephone, faxed, e-mailed, or U. S. mailed. Transcripts of sample telephone conversations are found in Appendix B.

By random sample, six hundred full-time ACA faculty members were selected to receive the survey. The number chosen from each school was proportional to the individual colleges' representation in the total number of ACA faculty. All 59 currently available Milligan College faculty received the survey instrument.

Data Sources and Collection Procedures – Phase I

A brief general computer usage survey instrument, called the ACA Technology Survey, was used to determine the general frequency of use of computer-based technology in the ACA colleges and universities using a six-choice Likert scale (Appendix C). The response options for each of the six choices on the scale were: not available to me; available but never use; available but rarely use; use monthly, or nearly so; use weekly, or nearly so; use daily, or nearly so. The instrument was developed by reviewing questions from existing instruments, accepting suggestions from the director of the Technology Assistance Office, the director of the ACA, and the researcher's committee members.

Respondents were asked to enter the name of the school where they teach and their names. Names were used for tracking non-respondents only. All responses were treated confidentially.

Five hundred forty-six (91%) of six hundred ACA faculty members were sent an electronic message on April 20, 1998 that stated the purpose of the survey and listed an embedded URL giving the location of the survey instrument on the Internet.

On that same date, paper copies of the survey instrument were mailed to 54 (9%) of 600 faculty members in the sample for whom e-mail addresses were not available. A cover letter was included with the survey instrument that explained the purpose of the survey. A postage-paid envelope was included in the mailing. For follow-up purposes, the researcher asked each faculty member to put their names on either the e-mailed message or the paper copy.

Two U. S. mail copies were returned: one as undeliverable by the post office, and one marked by the receiver that he no longer taught at an ACA school. One e-mail message was returned by the receiver stating he had retired from teaching. Three new names were randomly chosen from those schools and survey forms were sent by U. S. mail or e-mail to new participants.

Between April 20, 1998 and April 25, 1998, a total of 142 e-mail messages were returned by the computer system as undeliverable. One hundred fifteen of these returns were because of incorrect e-mail addresses. The addresses were corrected and the messages sent again. The remaining 27 of the 142 undeliverable messages were returned because the recipient's names could not be recognized. Specific reasons, such as name changes due to marriage or divorce, were determined for three of these twenty-seven messages. The names were corrected and the messages sent again. The intended recipients for the remaining 24 messages were no longer employed by the school, in which case new names were chosen from the sample and the messages sent again. After this process, all 142 returned messages were sent again successfully to either the original recipient or a new recipient.

From the original mailing, 19 of the 54 questionnaires (33%) sent by U.S. mail were returned and 123 of the 546 questionnaires (23%) sent by e-mail were returned. Two weeks later, all non-respondents were sent a follow-up paper copy of the survey instrument with a cover letter that explained the purpose of the survey and listed the URL where the survey instrument could be completed on-line. From this follow-up mailing 138 participants (28%) replied by U. S. mail and 22 (5%) chose to reply electronically (Table 3). The final survey return rate for the study was 302 of 600 (50.3%) surveys returned.

Table 3

ACA survey responses.

ACA Faculty Survey Responses by Type of Response and Time of Mailing				
	Number Sent	Responses		
		U.S. Mail	E-mail	Totals
Initial distribution:				
Surveys U.S. mail	54	17	2	19
Surveys e-mail	546	n/a	123	123
Total	600			
Follow-up:				
Surveys U.S. mail	458	138	22	160
Total returned		155	147	302
Percentages		51%	49%	50.3%

The table in Appendix D shows the number and percent of responses returned from each school. The responses are broken down by type of return – U.S. mail or e-mail.

In order to compare the results of the ACA Technology Survey to Milligan College, all 59 currently available Milligan College full-time faculty received the questionaire. Of this 59, 20 were among those were randomly selected as part of the 600 to be representations of the larger ACA sample whose return rates are described above.

Since all Milligan College faculty have access to e-mail, the request to complete the questionnaire was sent electronically on April 21, 1998 with an embedded URL giving the location of the instrument on the web. The e-mailed message explained the purpose of the survey and offered the results of the study to those who requested them. For follow-up purposes, each faculty member was asked to put his or her name on the survey.

Within ten days, 37 of 59 (62.7%) responses were received.   After two weeks, a paper copy of the survey instrument was placed in the faculty mailboxes of 22 non-respondents along with a return envelope and the cover letter explaining the purpose of the survey. These faculty were asked to return the paper instrument to the researcher's mailbox or to complete the instrument electronically. Confidentiality was assured. Eleven of the twenty-two (50%) chose to respond by paper and two of the twenty-two (9%) chose to respond electronically. The final response rate for the Milligan College faculty was 50 of 59 (84.7%) instruments returned (Table 4).

Table 4

Milligan College survey responses.

Milligan Survey Responses by Type of Response and Time of Mailing				
	Number Sent	Responses		
		Mailbox	E-mail	Totals
Initial distribution:				
Surveys e-mail	59	n/a	37	37
Follow-up:				
Surveys Mailbox	22	11	2	13
Total returned		11	39	50
Percentages		22%	78%	84.7%

All currently available course syllabi for a two-semester period were inspected for indications of the use of computer-based technology in the classroom. Course syllabi for fall 1997 and spring 1998 semesters, on file in the academic dean’s office at Milligan College, were reviewed to determine what importance faculty gave to computer-based technology in designing their courses. Computer usage in the course syllabi fell into two distinct categories: those for classes that teach students to use and operate the computer and those for classes that use the computer as a medium of instruction.

A review of fall 1997 syllabi revealed that 19 of 193 (10%) syllabi mentioned some form of computer-based technology. Of those nineteen, six syllabi were for classes that teach students to use and operate the computer.

Before the spring 1998 semester began, faculty at Milligan College were invited to submit syllabi to the academic dean on diskette or via an e-mail attachment. A review of spring 1998 syllabi found that 174 paper copies and 31 electronic copies were received. Of the total 205 spring 1998 syllabi reviewed, 45 or 22% mentioned some form of computer-based technology. Of the forty-five that mentioned computers, seven syllabi were for classes that teach students to use and operate the computer.

<u>Data Analysis – Phase I</u>

Microsoft FrontPage 98 was used to create the on-line survey instrument. Responses were automatically captured in a database using a comma-delimited format. This database file was backed up daily for the first week, every other day for the next week, and weekly until June 5, 1998. The database file was converted to Microsoft Excel for analysis.

To check for multiple submissions of the survey form, survey responses were sorted by school and faculty name. Eight duplicates were found and removed from the data file. The duplicates were submitted electronically by clicking the ‘Submit’ button on the form more than once.

Paper responses were manually entered into a Microsoft Excel spreadsheet as they were received. The data base file and the manually entered file were merged for final analysis. Responses from Milligan College faculty were copied from the merged file into a separate file. The survey results were used to compare and contrast the similarities and differences between the two groups.

For clarity in describing the survey results, the Likert scale response ‘daily, or nearly so’ will be termed ‘daily’ in the presentation of the results and discussion. Likewise, the scale response ‘weekly, or nearly so’ and ‘monthly, or nearly so’ will been called ‘weekly’ and ‘monthly’, respectively. The other Likert scale responses remain the same.

The first research question asking what computer-based technology was being used was answered by using frequency tables which compare ACA faculty usage and Milligan College faculty usage. A table (Appendix E) depicting the frequency with which the mention of computer-based technology appears on the course syllabi was developed.

A pilot test of the survey instrument was conducted using three Milligan College faculty members. These faculty members taught in the business, history, and communications areas at Milligan College. The faculty members evaluated the survey’s readability and clarity. An interview followed with each after they answered the questions to determine if the questions had been interpreted clearly. Members of my doctoral committee also reviewed the survey instrument.

Phase II

The purpose of Phase II of this study was to determine why faculty are choosing to use computer-based technologies and with what effectiveness. Phase II also gathered information about technical support and resources available to faculty, training effectiveness, and future usage of computer-based technology. Phase II of this study was conducted by completing in-depth interviews with Milligan College faculty and by reviewing the telephone logbook compiled by the help desk of computer services at Milligan College.

Participants and Setting – Phase II

Eighteen Milligan College faculty members were invited to be interviewed about their use of computer-based technology and its effectiveness. Purposive sampling, rather than random sampling, was used to select these participants using several criteria: the departments represented, the expertise of the faculty in using computer-based technology as known by the researcher, and responses to the survey questions. Sixteen faculty accepted the invitation for the interview. Two of the faculty members who agreed to be interviewed had elected not to complete the survey form.

A one-hour appointment was scheduled with each of the interviewees between May 1, 1998 and June 3, 1998. Each interview lasted approximately 50-55 minutes. After the interview, an offer was made to assist the faculty member in solving any computer-related problems they might have encountered. Appendix F shows a list of the problems encountered and the resolution of those problems.

Data Sources and Collection Procedures – Phase II

In-depth interviews with Milligan College faculty were used, as a follow-up to the ACA Technology Survey, to determine more detailed information about what computer-based technology faculty use, why these technologies are or are not used, and with what results (Appendix G). The development of the interview questions was based on the review of related literature (Barboni, 1993; Ely, 1987; Ely, 1995; Geoghegan, 1995), a review of instruments already developed (Berenson & Stiff, 1989; Fougere, 1991; Green, 1997; Wiske, 1988), and the advice of the researcher's committee.

To assure accuracy of transcriptions, the interviews were audio-recorded with the consent of the interviewee. Notes were also made on paper while the interview was being conducted. All but one interviewee agreed to be audio-recorded.

The in-depth interviews conducted in this study examined the types of training, resources, and support services available to faculty, and investigated which activities faculty felt were most beneficial in learning to use computer-based technology. The study also examined faculty attitudes about the use of computer-based technology in the college and university setting and their anticipated future use of computer-based technology.

Two days following the interview, an e-mail message was sent to the faculty member thanking them for participating and inviting them to e-mail or call if they thought of anything else to add to the study.

Entries recorded in the telephone logbook by computer services staff of Milligan College were examined to determine the type of questions faculty were asking about using computers and the frequency with which those questions were being asked. The logbook contained the name of the person who called for assistance, the reasons for the call, the date and time the call occurred, and the length of the call in minutes.

Table 5 displays the manner in which the proposed research questions correspond to the survey, interview questions, and document analysis in this study.

Table 5

Relationship of research questions to methodology.

Research Question	**Methodology**
1. What technology is currently being used by faculty in the ACA colleges?	Survey and in-depth interview questions – Section I; course syllabi
2. Why are faculty currently using computer-based technology?	In-depth interview questions – Section II
3. What types of training and resources do faculty feel are most beneficial in learning to use computer-based technology?	In-depth interview questions – Section III
4. Are adequate support services being offered for faculty as they begin to incorporate technology into the curriculum?	In-depth interview questions – Section IV; telephone logbook
5. What is the attitude of faculty about the use of technology in the college setting?	In-depth interview questions – Section V
6. How do faculty anticipate using computer-based technology in the future?	In-depth interview questions – Section VI

Data Analysis – Phase II

A pilot test of the interview questions was conducted using two college faculty members. One was a faculty member in the business area at Milligan College. The other was from the College of Human Resources and Education at Virginia Tech. Questions which were not well phrased, clear, and of significant value were reworded or omitted. Members of my doctoral committee also reviewed the interview questions.

The interview results were transcribed using Microsoft Word into the same outline as the original interview questions. The responses were color coded for each area or discipline in which the faculty member primarily teaches. This allowed responses to be tracked across interview questions as well as within each individual interview question.

Interview responses were used to answer each of the research questions in Chapter 4 of this document. Since the main purpose in Phase II of this study was to determine why faculty are using or not using computer-based technology and with what effectiveness, specific numbers and percentages were not reported in many instances in the interview analysis in research questions 2 – 6. The Milligan College computer services help desk logbook was reviewed to determine the number of calls made to the help desk during a three-month period, along with the nature and the time of each call. Bar graphs were used to depict the day of the week and the time of day these calls occurred. Frequencies are tabulated for the most common calls made to the help desk.

Approval for this research was obtained through the Human Subjects Review process at Virginia Tech. Approval for this study was expedited with an exemption form since the study involved adults and did not entail intrusive methodologies.

Chapter 4

Results and Discussion

The first section of this chapter describes demographic data gathered from the survey instrument. Discussion in the second section is built around each of the six research questions. The first research question was investigated in Phase I of the study. In this phase survey responses from 302 full-time ACA faculty and 50 full-time Milligan College faculty, as well as Milligan College course syllabi, were analyzed to determine concerning what computer-based technologies are being used by faculty. Research questions 2 through 6 were investigated in Phase II of the study. In-depth interviews with 16 Milligan College faculty, and a review of the Milligan College help desk logbook, were used to answer the research questions concerning why computer-based technology is or is not being used, the attitude of faculty about using computers, training and support availability and preferences, and anticipated future use of computer-based technology by faculty.

Demographics

Forty-four percent (132 of 302) of the faculty surveyed used PC/DOS based machines and thirty percent (91 of 302) used Windows-based machines. Macintosh is the second most used platform (72 of 302, or 24%). One faculty member reported using a PC platform and a Macintosh platform equally. Only three (1%) faculty members reported using a Unix platform.

All Milligan College faculty responding to the survey use PC/DOS or Windows-based computers. Seventy-eight percent (39 of 50) reported using a PC with DOS while twenty-two percent (11 of 50) reported using a PC with Windows.

Teaching experience at the collegiate level ranged from less than one year to 47 years for the ACA faculty sample. The average length of teaching experience at the collegiate level was 16.3 years. The median for this group was 15 years of teaching experience. Milligan College faculty closely matched these numbers. They ranged from three to 47 years of teaching experience at the collegiate level, averaged 17.2 years of experience with a median of 16.5 years. In both the ACA faculty and the Milligan College faculty, the greatest percentage of faculty (22% each) had from six to ten years teaching experience.

Some discrepancy was evident in the question on the survey instrument concerning years of experience using technology in the classroom. Several respondents questioned whether the survey item meant technology in general or computer-based technology specifically. Unfortunately, the pilot tests did not reveal the vagueness of this question. As a possible result of this dual interpretation, several respondents (6%, 19 of 302, of the ACA faculty and 2%, 1 of 50, of the Milligan College faculty) left the question blank. However, the results do show that faculty in both groups have used technology for fewer years in the classroom than they have been teaching. Eleven percent (33 of 302) of the ACA faculty and twelve percent (6 of 50) of the Milligan College faculty have never used technology in the classroom. The greatest numbers of faculty in both groups have used technology in the classroom for six or less years. Table 6 shows a breakdown by years and a comparison of the two groups in the use of technology in the classroom.

Table 6

Technology use in the classroom.

TECHNOLOGY USE IN THE CLASSROOM		
Experience	**ACA Faculty**	**Milligan College Faculty**
	n = 302	n = 50
No use of technology	11%	12%
1 to 2 years	21%	18%
3 to 4 years	17%	30%
5 to 6 years	11%	16%
7 to 10 years	19%	8%
More than 6 years	15%	14%
No answer	6%	2%

ACA faculty have used technology in the classroom for an average of 6.4 years. Milligan College faculty averaged 6.1 years.

Areas of teaching expertise represented by the two groups varied across academic departments and areas of the campus. The largest representations were from humanities and math/science. Table 7 shows the breakdown of areas represented in the study.

Table 7

Areas of teaching expertise.

Areas of Teaching Expertise		
Area	**ACA Faculty**	**Milligan College Faculty**
	n = 302	n = 50
Behavioral /Social Science	11%	10%
Bible/Christian Ministries	4%	8%
Business/Information Systems	8%	8%
Communications	4%	8%
Health and Physical Education	4%	6%
Health Sciences	6%	12%
Humanities/Fine Arts/Languages	24%	26%
Math/Science/Computer Science	20%	14%
Teacher Education	11%	6%
Other or blank	7%	2%

Phase I – Research Question 1

1. What computer-based technologies are currently being used by faculty in the ACA colleges and universities?

Survey results of the computer-based technology currently used by ACA faculty and Milligan College faculty revealed little difference between the two groups. However, the results do show that faculty in both groups used some computer-based technologies frequently, others occasionally, and others rarely or not at all. The discussion that follows is categorized under the headings of frequently used technologies, occasionally used technologies, and rarely used technologies.

Computer-based technologies that were used daily or weekly by over half of the survey respondents were categorized as "frequently used". Where the majority of the respondents marked rarely used, never used, or not available were categorized as "rarely used" computer-based technologies. The remainder were categorized as "occasionally used" technologies. The discussion of what computer-based technologies are currently being used by faculty concludes with a review of indications of computer-based technology usage on course syllabi.

Frequently Used Technologies

Word processors, e-mail at school, and World Wide Web resources at school were the most frequently used computer-based technologies by both ACA faculty and Milligan College faculty. Interviews conducted with Milligan College faculty confirmed that these were the most used computer-based technologies by faculty for both administrative duties and classroom use.

Word processors were used daily by 87% (260 of 299) of ACA faculty and 92% (46 of 50) of Milligan College faculty. E-mail was used at school at least weekly by 90.7% (274 of 302) of ACA faculty and 100% (50 of 50) of Milligan College faculty. World Wide Web resources at school were used at least weekly by 66.4% (198 of 298) of ACA faculty and 75.6% (37 of 49) of Milligan College faculty (Table 8).

Table 8

Frequently used computer-based technologies.

Frequently Used Computer-based Technologies								
Computer technology	Group	n	Use Daily	Use Weekly	Use Monthly	Available, Rarely Use	Available, Never Use	Not Available
E-mail at school	ACA Sample	302	85.4%	5.3%	1.3%	3.0%	3.0%	2.0%
	Milligan	50	98.0%	2.0%	0.0%	0.0%	0.0%	0.0%
WWW at school	ACA Sample	298	36.9%	29.5%	14.8%	9.4%	7.0%	2.3%
	Milligan	49	32.7%	42.9%	12.2%	10.2%	2.0%	0.0%
Word processing software	ACA Sample	299	87.0%	7.7%	0.7%	1.3%	1.7%	1.7%
	Milligan	50	92.0%	4.0%	0.0%	2.0%	2.0%	0.0%

Occasionally Used Technologies

Occasionally used computer-based technologies were e-mail at home, Listservs, World Wide Web resources at home, other World Wide Web resources, spreadsheet software, database software, presentation software, and computer-based instruction.

The largest discrepancy between the reported usage by the two groups was in using a Listserv. Twenty-two percent (66 of 297) of ACA faculty used a Listerv daily while only four percent (2 of 48) of Milligan College faculty used it as often. Nine percent (26 of 297) of ACA faculty reported using a Listserv on a weekly basis as opposed to twenty-one percent (10 of 48) of Milligan College faculty.

ACA faculty reported a greater usage of spreadsheet software (21%, 64 of 300) on a daily basis than Milligan College faculty (8%, 4 of 50). However, Milligan College faculty used a spreadsheet more often on a weekly basis (26%, 13 of 50 vs. 16.7%, 50 of 300).

Database software, e-mail at home, World Wide Web resources at home, presentation software packages, and computer-based instruction were less frequently used. However, several Milligan College faculty mentioned the desire to use presentation software on a more regular basis. Table 9 shows the exact frequency of use of each of these technologies.

Table 9

Occasionally used computer-based technologies.

Occasionally Used Computer-based Technologies								
Computer technology	Group	n	Use Daily	Use Weekly	Use Monthly	Available, Rarely Use	Available, Never Use	Not Available
E-mail at home	ACA Sample	302	30.8%	14.6%	2.0%	3.6%	5.0%	44.0%
	Milligan	50	20.0%	14.0%	0.0%	4.0%	2.0%	60.0%
Listserv	ACA Sample	297	22.2%	8.8%	7.7%	25.6%	19.5%	16.2%
	Milligan	48	4.2%	20.8%	12.5%	25.0%	35.4%	2.1%
WWW at home	ACA Sample	300	20.3%	18.3%	8.0%	5.0%	4.7%	43.7%
	Milligan	50	10.0%	20.0%	6.0%	4.0%	0.0%	60.0%
Other WWW resources	ACA Sample	295	10.8%	13.2%	11.5%	27.8%	22.4%	14.2%
	Milligan	50	2.0%	14.0%	13.0%	36.0%	30.0%	6.0%
Spreadsheet software	ACA Sample	300	21.3%	16.7%	14.0%	23.0%	21.7%	3.3%
	Milligan	50	8.0%	26.0%	18.0%	22.0%	26.0%	0.0%
Database software	ACA Sample	295	10.2%	9.5%	17.3%	29.5%	29.5%	4.1%
	Milligan	50	4.0%	8.0%	20.0%	28.0%	36.0%	4.0%
Presentation software	ACA Sample	299	4.3%	11.7%	12.7%	27.8%	30.4%	13.0%
	Milligan	49	2.0%	12.2%	12.2%	30.6%	32.7%	10.2%
Computer-based instruction	ACA Sample	295	4.4%	8.5%	14.2%	21.0%	27.8%	24.1%
	Milligan	47	2.1%	10.6%	23.4%	17.0%	23.4%	23.4%

Rarely Used Technologies

The largest percentage of ACA faculty and Milligan College faculty reported not having authoring software, a digital camera, a scanner for optical character recognition, or a scanner for graphic reproduction available to them. Distance learning, video conferencing, web editing software, and desktop publishing were also rarely used or not available to faculty (Table 10).

Table 10

Rarely used computer-based technologies.

Rarely Used Computer-based Technologies								
Computer technology	Group	n	Use Daily	Use Weekly	Use Monthly	Available, Rarely Use	Available, Never Use	Not Available
Web editing software	ACA Sample	297	2.7%	7.1%	7.1%	17.2%	44.8%	21.2%
	Milligan	48	2.0%	6.0%	6.0%	25.0%	54.0%	6.0%
Distance Learning	ACA Sample	297	1.3%	2.0%	2.4%	9.8%	38.7%	45.8%
	Milligan	46	0.0%	0.0%	6.5%	13.0%	45.7%	34.8%
Desktop Publishing	ACA Sample	293	5.5%	4.8%	14.3%	21.8%	35.5%	18.1%
	Milligan	49	6.1%	6.1%	12.2%	12.2%	51.0%	12.2%
Authoring software	ACA Sample	289	1.0%	1.0%	3.5%	7.6%	35.6%	51.2%
	Milligan	44	0.0%	2.3%	2.3%	6.8%	40.9%	47.7%
Digital camera	ACA Sample	294	2.0%	2.0%	4.8%	11.9%	22.1%	57.1%
	Milligan	49	0.0%	2.0%	4.1%	0.0%	28.6%	65.3%
Scanner for OCR	ACA Sample	294	1.0%	6.5%	12.6%	16.0%	28.9%	35.0%
	Milligan	48	0.0%	0.0%	8.3%	8.3%	41.7%	41.7%
Scanner for graphics	ACA Sample	298	2.0%	7.4%	10.4%	17.1%	31.5%	31.5%
	Milligan	47	0.0%	4.3%	10.6%	8.5%	38.3%	38.3%
Video Conferencing	ACA Sample	293	0.3%	0.0%	1.4%	6.1%	24.9%	67.2%
	Milligan	49	0.0%	0.0%	0.0%	4.1%	24.5%	71.4%

Course Syllabi

A review of course syllabi on file in the academic dean's office at Milligan College found e-mail, word processors and the World Wide Web were most commonly mentioned on syllabi. Several faculty listed an e-mail address on their syllabi in the section for contact information and office hours. Areas such as computer information systems, music, nursing, education, communications, psychology, and art taught students to use computer hardware and software as tools in their respective fields. Areas such as Christian Ministries, Bible, business, nursing, philosophy, and religion used the computer as a medium of instruction with simulations and drill and practice software. They used the Internet as a reference with web sites created by faculty members and other professionals in the field for student use. Other areas such as math, humanities, geography, and psychology used the computer for research and data analysis.

Faculty listed software packages used in their specific teaching discipline on the survey form. A compiled list of these packages by discipline and platform used is in Appendix H. Interviews conducted with sixteen Milligan College faculty provided some insight about why these technologies are or are not being used.

Phase II – Research Questions 2 - 6

The findings which are reported in research questions 2 through 6 are the opinions of the 16 Milligan College faculty who were interviewed and not those of the researcher. In instances where the exact number of interviewees who responded in a certain way are not indicated, the word "few" will be used to indicate between 2 and 6 faculty responded the same way and the word "some" will be used to indicate between 7 and 15 faculty responded the same way.

2. Why are faculty currently using or not using computer-based technology?

Interviews revealed that computer-based technology is being used in several ways on the Milligan College campus by faculty for administrative and course design purposes, and by students as part of course requirements. Word processors, e-mail at school, and the Internet were most frequently mentioned during interviews as technologies being used by faculty and students. Listservs, presentation software, graphing calculators, spreadsheets, simulations, drill and practice software, test-generating software, music software, and modeling software were also mentioned. The effectiveness of using computer-based technology and reasons for not using it were discussed. A discussion of the use of each of these computer-based technologies follows.

Word Processors

All faculty interviewed used word processors to type tests and class assignments. Faculty who once questioned the security of documents stored on an electronic medium have begun to see the benefits of the medium. They readily admitted that at one time they were afraid of losing documents they had stored on an electronic medium. They feared they would not be able to find the document again or that a hardware/software failure would make the file inaccessible. Faculty were also afraid students would be able to gain illegal access into the campus computer network and tamper with or steal class test files which were stored electronically. All faculty interviewed felt the benefits of using a word processor for creating test files and class assignments outweighed these initial fears. Faculty felt they were more willing to update test files and class assignments because editing was easier. Lectures, which were effective in previous semesters, could be updated easily and used again. Multiple tests and assignments could be created easily. Special word processor software generated symbols, fonts, and vocabulary lists for areas such as math and foreign language.

All faculty encouraged, and in some cases required, term and research papers to be typed using a word processor. They stated that typed papers were easier to read and had a better appearance than handwritten ones. Faculty also noted that some students were more willing to edit their documents before final submission. Students who wait until the evening before the due date to type their papers did little rewriting and editing. Faculty had mixed feeling about student use of the spell checking and thesaurus features available on most word processors. For the most part, student work tended to be free of spelling errors, but faculty noted that students relied too heavily on the grammar checker without proofreading their own work. Errors such as transposed numbers in dates and misused words occurred frequently. A few faculty also expressed a concern that the use of an electronic thesaurus led students to choose words that were inappropriate in the context of their writing. One faculty member also expressed a concern that the use of a word processor led students to copy text directly from books rather than reading and summarizing the content of what they read before typing.

E-mail

E-mail has been the greatest enhancement to communication across campus and off campus for many faculty. All faculty interviewed used e-mail to correspond with colleagues on campus. Some faculty noted that the ability to correspond with those off campus who mentor, supervise, and employ student interns has been a great timesaver. Messages were no longer limited to a normal workday; messages were sent early in the morning or late in the evening without having to wait for offices to open or students to awaken. A few faculty used e-mail to send documents and grade sheets to their colleagues for review or completion in team teaching situations.

All faculty agreed that e-mail enhanced correspondence with students, colleagues, and administration. Some faculty stated that they invited students to correspond with them by e-mail and listed both their school and home e-mail addresses on their course syllabi and business cards. A few faculty e-mailed assignment sheets to students so valuable class time was not wasted in distributing them. Assignment sheets were also e-mailed to students who were unable to attend class. A few faculty used e-mail to report problems in assignments given to students or flaws in technical equipment students were asked to use. Both traditional students and independent study students have been invited to submit assignments to faculty members by e-mail. Fewer meeting times were needed for students who were completing work independently; but faculty noted that they missed the ability to read students' expressions and the chance to quiz them for understanding that they had in face-to-face meetings. A few faculty noted that e-mailing assignments saved time in classes where hands-on instruction was used. Time that would have been used for printing completed assignments was used for instruction.

A few faculty communicated with graduates, prospective students, and their parents about career options, course requirements, and campus visits via e-mail. Some faculty noted that communication was enhanced with prospective employers in other states and countries and with colleagues at other schools. Interview times were easily arranged, resumes were submitted electronically, and ideas for enhancing courses were exchanged.

Internet

Some faculty were experimenting with ways to use the Internet effectively. A few faculty felt the wealth of information available was wonderful, but saw no use for it in their classes. Faculty who were using the Internet were using web sites to supplement what was in the textbooks, to update facts and figures they used in their lectures, and to create their own course web pages. The advantages of using the Internet were that current information was quickly available, time spent in traveling to the library was saved, and resources were available that were otherwise unobtainable.

A few faculty were creating web pages for specific classes. Faculty stated that these pages contained the class syllabus that was updated quickly and easily or built as the class progressed. New readings were added to the course requirements and placed on the web page for immediate access by students. When students were required to help maintain the web pages, they gained experience finding and evaluating sites on the web and writing annotations about those they found. When students became involved in this manner it took the pressure off the faculty member to supply all of the course material and the course evolved from the interests and experience of the students. A few faculty stated they have found a lot of quality information on the Internet and have used course syllabi and readings that have been published on the Internet in their own classes.

An ACA funded project led to the creation of a web page that allowed students to submit drafts of papers for a cooperative on-line writing lab (COWL). Students communicated with tutors and had access to additional on-line writing resources through the web page. The effectiveness of this venture is yet to be determined. A few faculty required students to maintain electronic professional development portfolios of their completed course work and credentials. The purpose of this was to aid students in the job-hunting process and to allow them to share their accomplishments with each other.

Some faculty sent students to Internet sites to complete homework assignments. Timely articles could be placed in students' hands quickly. Students were also required to use the Internet for research. Faculty noted that students were getting better at finding quality information on the Internet and were able to discriminate between good sites and poor sites. Sites written from the original author's perspective allowed the student to garner the expert's experience. A few faculty felt they must search for and review the content of each site before their students access them. They found searching the web very time consuming and as a result they limited student use of the Internet. A few faculty found that many web sites published in textbooks and Internet training tutorials were not reliable. Many sites changed their web addresses by the time the student tried to access them. This was a frustration to both the student and the instructor.

Listservs

A few faculty have experimented with using Listservs in their classes for on-going discussion among students and the faculty member. These faculty reported them to be effective in opening lines of communication with shyer or more introverted students. Listservs also allowed discussions to continue outside of class. One faculty member contemplated using a student Listserv rather than requiring students to share a journal but decided the Listserv would not enhance communication. In this instance, the faculty member felt the Listserv was cumbersome and the spontaneity of writing in the journal would be lost. A few faculty expressed a desire to try using a Listserv for their class, but had not done so because of uncertainty about how to set one up.

Presentation Software

Presentation software was being used more frequently among both faculty and students. Some faculty allowed students to use presentation software for oral reports. Faculty who have used presentation software for their lectures stated that the process of creating a presentation with software forced them to organize their thoughts and to think more clearly about the points they wanted to emphasize in their lectures. It also allowed them to create automatically a professional looking document, which they would not be able to do otherwise. They hoped their students found this same benefit.

In large classrooms, the larger fonts available in presentation software can be seen more easily than writing on a chalkboard or whiteboard. Some faculty felt presentation software saved class time by reducing the amount of text that must be written on the chalkboard. A few preferred to pace their lectures by writing on the chalkboard and avoided using presentation software. Faculty noted students seemed to like having visuals in front of them and they were able to take notes more efficiently. With the use of presentation software, students were not as compelled to try to write down everything that the instructor said. The important points could be copied from the presentation slides. However, some faculty felt that students who placed in their notes more of the lecture than just what is on the presentation slide gained more knowledge about the subject matter and did better on tests. Faculty stated that they would avoid using presentation software when they felt it would not be effective, but student's today seemed visually oriented and the presentation seemed to aid their comprehension of the subject matter.

Education faculty felt using presentation software to display a few lines at a time has been beneficial in teaching young children. It forced them to keep up and kept them focused. The faculty member planned the lecture by controlling how many lines or words appeared at one time. By making each paragraph a different color, faculty found that younger students could more easily keep pace with their reading.

Graphing Calculators and Data Analysis

One faculty member used graphing calculators and some used data analysis software. Graphing calculators gave a visual display which helped students better understand the processes and the outcomes of the calculations. Students completed fewer pencil-paper calculations but gained a better comprehension of the concepts. Graphing calculators allowed students to work with more complicated programs supplied by the instructor than they could write themselves in the time allotted.

Data analysis software has made statistical analysis of research and questionnaire results possible within a class period. Without the software the instructor graded mathematical computations rather than assisted students in interpreting the results. Faculty found that students became more interested in the subject matter when they found the computer could do most of the work. They felt students were more willing to pursue fields where mathematics was involved because the computer could perform the computations for them. Students who are more reserved and distant seemed to become more engaged in the learning process.

Simulations and Spreadsheets

A few faculty are using simulations and spreadsheet software. Simulations and spreadsheet software allowed students to play ‘what-if’ with the computer using relevant scenarios. This software, used in the instructional setting, allowed for quick analysis of decisions made by the student and presented immediate results. Students seemed to care more about learning when they saw how the results might apply directly to themselves or their group project. Students ran multiple scenarios and analyzed the results of each. Faculty built on those results to enhance lectures. Analysis of simulation results led to competition in the classroom between groups of students. This enhanced learning and made it more fun and interesting.

A few faculty used spreadsheet software for grade keeping, area budget control, and inventory. Faculty quickly averaged and printed grades for students. Advising worksheets were set up using spreadsheet software so credit hours, course enrollment, and graduation dates could be monitored.

Test-taking Simulations

A few faculty were using test-taking simulations in the classroom which allowed students to practice taking tests. Faculty reported that this improved test-taking skill and critical thinking. It also assisted students with the logic of how to study and prepare for test taking and licensure examinations which are computer generated. Faculty felt students who had worked with this type of software had a distinct advantage over students who had not used it. Faculty felt this was valuable to students and encouraged them to use it by making it a part of class evaluations. Results of its effectiveness have yet to be determined.

Drill and Practice Software

Drill and practice software allowed students to repeat topics or units until mastery was gained. A few faculty made this type of software available to their students. Faculty noted students who were not comfortable using the computer found this software cumbersome, but commented that drill and practice software helped students learn. Faculty noted that the scope of this software was limited or fixated on only certain units of each course. To be truly effective, faculty felt drill and practice software should be expanded to include units for entire courses.

Test-generating Software

A few faculty used test-generating software. This saved faculty time and energy because test questions were randomly generated. Multiple tests could be generated automatically. A few faculty were frustrated by the installation procedures of test banks and others were frustrated by the lack of ability to print computer-generated tests on network printers. Two faculty members interviewed preferred to create their own tests because they could match the tests to what they specifically taught.

Music Software

Specialized music software assisted with the transcription of notes into music. Using computers in music has had the same effect as going from handwritten text to a word processor. The entire score did not need to be retyped when editing was needed. Students seemed more willing to make small changes because they did not have to recopy the entire piece.

Music students traditionally practiced by themselves but performed together. Computer technology allowed them to practice with different instrument accompaniments and different voices. Different combinations of musical styles could be put together and students could quickly practice and perform a great variety of music or create unique music of their own. Creativity was enhanced and students were able to work with other groups as their accompanists.

Because of a decrease in the number of music majors, students have been accepted into the program who have had very little formal training in the area. Computer technology offered them a look at 21st century musicianship and encouraged them to learn aspects of music they might not consider as exciting or important, such as arranging a classical piece and other parts to go with it.

One disadvantage of using computer technology in the music area was that social interaction that sometimes occurred in group practices was no longer necessary. Students who performed together were often more motivated because they did not want to let their peers down. Other people were no longer needed in the practice sessions and sometimes in the performances.

Modeling Software

Modeling software used in science classes allowed multi-dimensional models to be displayed on a computer screen during lectures. This gave students visual input and increased interest in and understanding of the topic. During a lecture, the instructor manipulated a model on the chalkboard while leaving a static model on the computer screen and visa versa. Students compared the differences between the changed model and the unchanged model.

Effectiveness of Computer-based Technology

Faculty gave only anecdotal evidence that the use of the computer in the classroom was effective. As of yet, they had no proof that using the computer will enhance student learning or improve their grades. They felt it made learning more fun and that students were more motivated to participate in class activities. Informal data gathered by faculty on course evaluations showed that computer usage and learning to use computers effectively was well received by students. Students reported they felt they performed better on tests because of web sites that came with the textbooks and practice software available to them.

Eleven of the sixteen faculty interviewed used computers with their students because they wanted to help prepare their students for jobs in the 21st century. Faculty noted that computers are becoming a part of everyday life and students must know how to operate the hardware and software that is common to their specific field of study, as well as the technology they might encounter elsewhere. Some of these faculty found using computer-based technology a challenge and pushed themselves to learn to use it and to get their students involved. They gained personal satisfaction from doing this.

Faculty who attempted to use computers in their classes felt that computer-based technology should be adapted to the existing curriculum and used as a tool to enhance and support that curriculum. Faculty wanted to use the computer because it was effective for the task, not just because the computer was available. They were challenged by how to meld computers and instruction together so that it became constructive and instructive.

Reasons for Avoiding Computer-based Technology

A few faculty were not convinced they want to use the computer more in their classrooms. They were not sure the benefits were worth the expense incurred. A few others felt teaching was based on building trust through human interaction with the students and have not seen that computers can help with that. One faculty member found using the computer to interact with students was cumbersome and broke up the interaction between students in the class. Some faculty felt using the computer in the classroom was risky because they were unsure whether the hardware and software would work correctly.

A few faculty admitted they were afraid of the computer, were not confident using it, and feared they would break it. These faculty were hesitant to follow instructions sent by computer services staff for upgrading software on their office computers and, therefore, were left using older, outdated software. These faculty also admitted computer terminology and the way the computer operated confused them. The ability to multi-task on the computer perplexed faculty who preferred to perform and complete one task before beginning another.

Because upgrading hardware and software was not a high priority for many faculty, they got behind without meaning to or without really knowing they were behind other faculty in the skills they possessed and the software they used. One faculty member admitted being too close to retirement to deal with learning new ways of delivering instruction.

3. What types of training or resources do faculty think are most beneficial in learning to use computer-based technology?

All of the faculty interviewed considered themselves self-taught in the use of computers because formal computer courses were not available when they attended school or the skills they learned in formal classes were somewhat outdated. Some of these faculty have been able to keep their skills updated by obtaining newer versions of the same software and working to learn how to use it.

Faculty relied on three main sources of training: hour-long classes taught on campus by computer services staff, ACA workshops, and workshops offered by local universities. Interviews revealed types of training faculty felt were most effective and why some faculty did not attend training sessions.

<u>On-campus Classes</u>

On-campus classes offered free of charge to Milligan College administration, faculty, and staff have been very effective for teaching faculty how to use general-purpose software available on campus such as operating systems, word processors, presentation software, and spreadsheets. These classes have placed little or no emphasis on using the computer as a tool for learning in the classroom. A few faculty stated that the one-hour time period is not enough time to get into the subject matter while other faculty stated that one hour is all the time they could spare. Lack of time due to heavy teaching loads and multiple committee assignments was the most commonly mentioned reason for not attending on-campus classes.

ACA Workshops

The Technology Assistance Project Office at Virginia Polytechnic Institute and State University currently holds periodic training sessions in the use of computer-based technologies for faculty in ACA colleges and universities. Normally held during the summer months, these workshops have been effective as a means of introducing faculty to both general-purpose and discipline-specific software. The chance to meet faculty from other ACA schools who taught in the same discipline was mentioned as very beneficial by those faculty who attended. Uninterrupted and dedicated time to work on specific projects was also beneficial. The casualness of the workshops made a good learning environment where faculty could interact with their colleagues from other schools and workshop trainers for longer periods of time. Faculty who attended these workshops enjoyed learning to use technologies they did not yet have available on the Milligan College campus. One faculty member was frustrated by the fact that newly learned skills could not be practiced at Milligan College because of the unavailability of the software.

ACA workshops were not available for faculty outside the fine arts and humanities areas. Five of the sixteen faculty interviewed were not eligible for funding for these workshops. All five of these faculty expressed a desire to attend similar workshops and stated they would welcome the opportunity to receive similar training and a chance to meet faculty who taught in the same discipline.

Some faculty expressed an intent to attend the First Annual ACA Technology Summit in October, 1998. This Summit will provide an opportunity for faculty members who are using technology in the classroom to demonstrate the ways it enhances instruction. Although only ACA faculty in the Arts and Sciences disciplines were eligible for financial support to offset the cost of registration and lodging, faculty in other disciplines hoped to attend at their own expense.

University Workshops

Workshops held at local universities have been an effective means of training for learning to use software, but faculty had little interaction with colleagues from schools which were similar to those in which they teach. Time to attend and participation cost were stated as reasons faculty did not attend more of these workshops.

Training Preferences

On-campus classes, ACA workshops, and university workshops usually offered hands-on, one person-per-computer training. Faculty felt this was very beneficial. The varied skill levels of the participants in the class were seen as a problem. More experienced students felt the need to help their less experienced colleagues, which caused them to miss some of the class content. Classes, which were advertised for intermediate and advanced users, lost valuable instruction time attempting to bring less experienced users up to speed. A few faculty had training before they had the actual software available for use on a daily basis. Lack of software on which to practice and the time lapse between learning to use the software and actually having it available for regular use was a frustration to a few faculty.

A few faculty expressed a desire to see examples of an instructor actually using a specific software package in a content area in a specific course for a specific time period. Mathematics faculty found demonstrations such as presentation software ineffective for their instructional needs. One faculty member admitted having difficulty seeing a general overview of software and applying it to a specific teaching situation. Some faculty preferred to learn in other ways such as working with the software on their own or using the manuals which came with the software packages.

A few faculty, who were more intimidated by technology, chose not to attend on-campus classes, ACA workshops, or university workshops because they were afraid they would not understand what was going on in the workshop. They were afraid it would be obvious they did not know what they were doing. They also felt they would only leave the workshop more frustrated by their lack of computer skills. One of these faculty members preferred hands-on, one-on-one instruction.

All but two of the faculty interviewed had attended at least one of the three Teaching, Learning, and Technology Roundtable (TLTR) discussions which have been held on campus for the past two semesters (fall 1997 and spring 1998). Time was mentioned most often as a reason for not attending these sessions. Faculty reported these TLTR discussions gave them an awareness of the technology available of campus and an insight into how other faculty are using this technology. In addition to demonstrations and conversations, faculty expressed a desire to begin discussions about WHY computer-based technology is being used, what are its strengths and weaknesses, and when it is best to use or not use it. Faculty wanted to look at specific ways to enhance the curriculum with the tools available rather than shape the curriculum around the tool just because it is accessible.

A few faculty felt intimidated by their lack of understanding of the terminology used in TLTR discussions. Others were surprised to learn who was, and who was not, using computer-based technology in their classrooms. One faculty member expressed a concern that the discussions were promoting the use of technology without looking at why we are choosing to use it.

Faculty reported printed media such as magazines, newsletters, and professional journals were used most often to learn what technology was being used in their specific fields and how it was being used. Professional conferences have also been beneficial sources for training and for finding out what others are doing. One faculty member spoke at conferences as a means of forcing himself to stay current through personal research. Faculty noted that national conferences where they could have greater contact with experts in their fields were too expensive for them to attend. Regional and local conferences were more cost effective.

4. Are adequate support services being offered for faculty as they begin to incorporate computer-based technology into the curriculum?

There were barriers to incorporating computer-based technology into the current curriculum. Lack of support could create a significant barrier for faculty in their use of technology. Faculty must have psychological support, people support, financial support, and technical support in order to get computer-based technology into the classroom (Boettcher, 1995). Interviews with Milligan College faculty and a review of the computer services help desk logbook gathered data about each of these issues.

People and Psychological Support

All but one faculty member felt they had support from college administration in their attempts to use computer-based technology. These faculty realized that limited funds were available and that the campus had many needs. They also felt their colleagues were supportive of their efforts to use computers. Faculty who were most intimidated by computers felt some of their peers understood their intimidation about the computer while others pushed them to use it. A few faculty, who taught in areas where there were small numbers of faculty, felt they had no close colleagues from whom to draw support, that their courses were quiet different from others, and that they had no one with whom to interact. Some have interacted with colleagues from other schools only to find they had different types of technology available to them and they really did not have a common ground on which to base discussions and draw support. The faculty member who did not feel administrative or peer support contended that equipment was purchased and not maintained or upgraded in a timely manner.

Some faculty felt textbook publishing companies were supporting faculty use of computer-based technology by supplying ancillary materials on CD-ROM for both student and faculty use. Faculty who have used these materials felt they were well written and that the quality continued to improve. Many of the CD’s were supplied free of charge if the textbook was adopted. CD’s which must be purchased were sometimes expensive because not enough students were enrolled in the class to qualify for a price break on the number of CD’s and textbooks ordered. One of the barriers to using these materials was the lack of availability of CD-ROM drives for both faculty and students.

Except for CD-ROM drive availability, most faculty reported the computers in their office and the technical support available to them were adequate to meet their current needs. Many areas had upgraded faculty computers with money budgeted for their specific area rather than wait for computer services to upgrade them. Some areas had more money available to use for this purpose than other areas.

Pressure to Use Computers

All faculty reported they felt no pressure from administration or colleagues to use computers, but a few were feeling pressure from external sources. Accrediting agencies and review boards wanted evidence that computer-based technology was being used in the curriculum. Some faculty felt pressure from the subject area in general and felt they were cheating the students if technology was not used.

<u>Barriers to Incorporating Computer-based Technology</u>

Two barriers mentioned by faculty in every interview were lack of time to learn how to incorporate the computer into the curriculum and lack of computer availability in the classroom.

Time. All faculty interviewed contended some released time from teaching assignments and committee obligations would be the most beneficial incentive they could be offered for attempting to incorporate computer-based technology into the curriculum. This would allow them extra time to explore the uses and effectiveness of technology and develop effective ways to use computer-based technology in their classes.

A few faculty mentioned they would like to have an instructional design center or workroom where they could work without interruption and where technical support was immediately available to them. All but two faculty members felt they would serve well as the content experts for designing computer applications, but would need technical assistance to complete the task; others expressed no desire to design software. Some faculty found turnaround time to get software on the campus network was a problem. They wanted to have technical support dedicated to installing and removing academic software and helping faculty work out problems encountered in using hardware and software for the first time. These faculty wanted to have technical support immediately available when they attempted to use the computer in the classroom. Faculty were uncertain what to do when the computer failed or when software did not work as expected. Class periods, which were 50 to 80 minutes long, did not permit them to wait for technical support to arrive.

Equipped classrooms. Presently only large lecture halls and classrooms dedicated to specific purposes have computer equipment available. Some faculty wanted to have computer technology available in smaller classrooms and to have the ability to use it on a more regular basis. Faculty who have used computer technology in their classrooms found that just rotating occasionally into an equipped classroom was not sufficient to meet their needs. A few faculty have had problems scheduling their classes in computer labs for only a few days because of competing classes.

Faculty who have used the computer technology available in the classrooms report being frustrated by the changes they see when moving their presentation from room to room. A presentation that was readable on one projection system may not be readable on another due to changes made in background and foreground colors by the projection equipment and the lighting of the room. Faculty found they must get their presentations ready early and test them on the projection system they planed to use to be guaranteed their presentation will be readable. Although this was a solution to the problem, it was not always possible because of time conflicts with scheduling equipment and classrooms.

Financial Support

All faculty felt the college needed to develop a plan for upgrading computer technology on campus in a consistent, fair manner for both faculty and student use. They understood that computer technology was expensive and felt a long-range financial plan should be developed for upgrading and purchasing computers. They also felt their training and technical support needs would increase, as computer technology became available in more classrooms. They also felt technical support was needed outside of the normal 8-to-5 workday. A few faculty offer classes as early as 6 a.m. and as late as 9 p.m. These faculty had no one to call during these hours if they had computer-related problems.

Technical Support

Telephone logbook reports of Milligan College for March, April, and May of 1998 revealed that faculty called the computer services help desk for many different reasons. Computer services staff categorized the reasons as follows:

- software problems with error messages
- help with particular software program
- hardware problems with error messages
- telecommunications problems
- registration for an upcoming on-campus class
- unknown
- other

During March, 104 calls were made to the help desk by faculty. The average length of time to resolve the problem was 3.7 minutes. In April, the help desk answered 108 calls, which averaged 5.40 minutes in length. May reports showed 65 calls were made by faculty to the help desk. The average call took 4.06 minutes to resolve. The majority of these 65 calls occurred during the first two weeks of May because the semester ended on May 15.

Fifty percent (52 of 104) of the calls during March, thirty-one percent (33 of 108) during April, and thirty-four percent (22 of 65) during May were for assistance in using specific computer programs such as Microsoft Outlook, Microsoft Word, Microsoft Excel, or for assistance with activities related to logging on to the computer network. Thirteen percent (14 of 104), thirty-one percent (33 of 108), and twenty-two percent (14 of 65), during March, April and May, respectively, were because of an error message received in association with using a specific software package or the computer network.

A graph of the days the calls occurred reveals that most calls were placed on Monday and Tuesday (Figure 2). One call during May was recorded in the logbook as having occurred on Sunday, but the help desk does not normally offer services on Sunday.

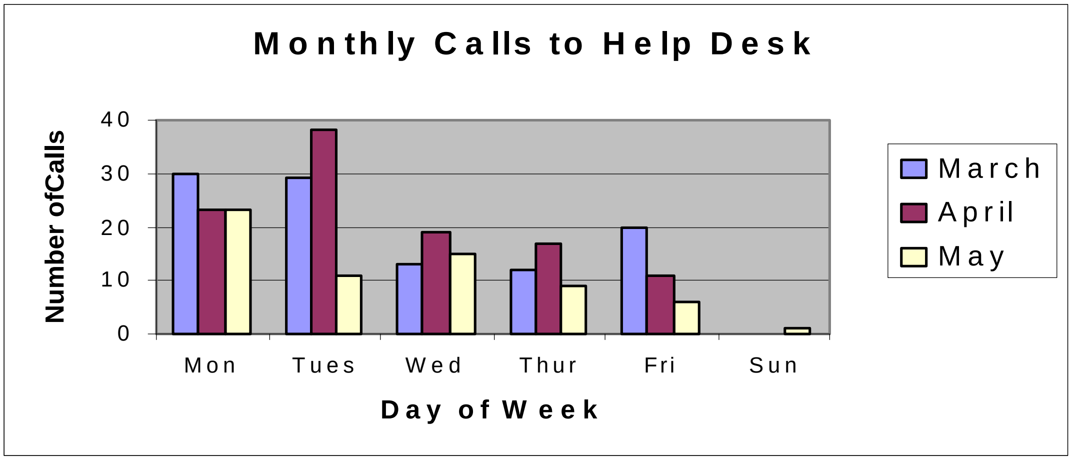

Figure 2. Monthly calls to help desk.

Thirty of the fifty-nine faculty (50.8%) used in this study called the help desk each month during March, April, and May. The number of calls by each faculty member ranged from one call within the three-month period to 37 calls during the 3-month period.

An analysis of the time of day faculty normally called the help desk, revealed that calls were made throughout the day with peaks at 9:00, 10:00, and 11:00 in the mornings. Usage also peaked at 1:45, 2:30, and 3:00 in the afternoons. The help desk was closed during lunch, before 8:00 a.m., after 5:00 p.m., and on weekends, but an answering machine was available and calls were returned as soon as possible (Figure 3).

During in-depth interviews, faculty contended that the Milligan College help desk was very beneficial in assisting them with their use of computer-based technology in their offices but they preferred to have more immediate and personal assistance in using the computer in the actual classroom setting.

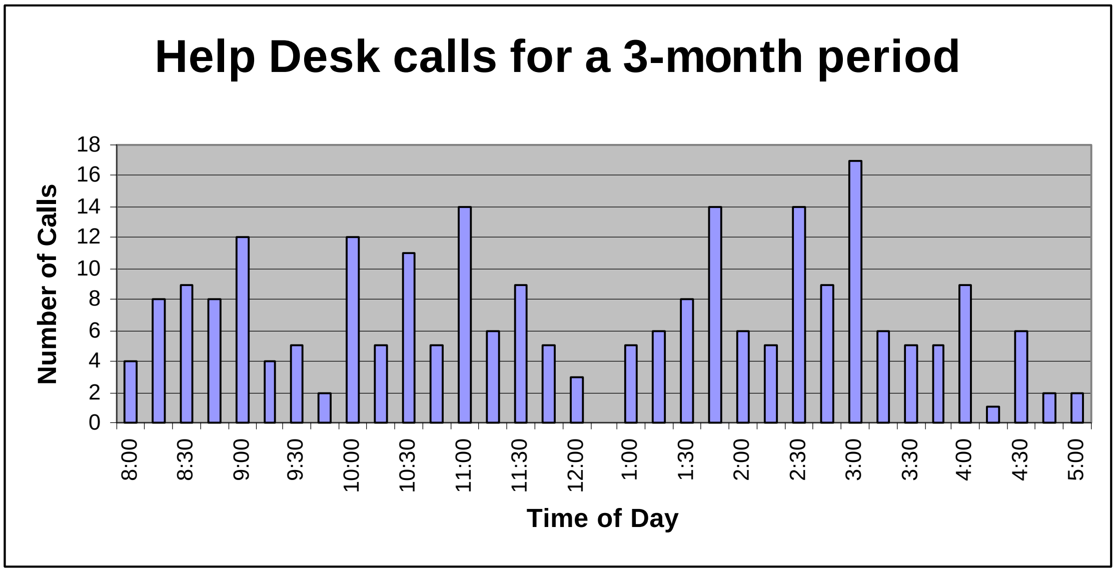

Figure 3. Help desk calls made for a 3-month period by time of day.

5. What is the attitude of the college faculty about the use of computer-based technology in the college setting?

Faculty felt computer-based technology had an impact on students, on faculty, and on the school. Interviews with faculty revealed that the use of the computer in the classroom could add more practical day-to-day relevancy to what was taught. They also felt they had access to more information if students asked questions which they could not answer. Some faculty felt the use of the computer for preparing lectures allowed them to rearrange the order of presentations in a manner different from the textbook which made them to feel more comfortable with the flow and content of the class. They also organized and updated their lecture notes more quickly.

Impact on Students

Some faculty contended the availability of computer technology made students more active in the teaching and learning process. They felt they could ask students to do deeper thinking activities rather than just pencil-paper activities. Complex course content was easier to cover with the aid of the computer to perform time-consuming statistical analysis. A few faculty felt so strongly about the benefits and importance of computer-based technology usage in their specific curriculum, they purchased hardware and software with their own money for use in their studios and offices. In several instances, students also used this hardware and software.

Faculty felt the computer has had both a positive and negative impact on students. A few felt e-mail for personal use and game playing took up valuable time students could use for studying or more productive tasks. They felt some students were not aware that some material on the Internet was unreliable or that copyright policies were easily violated.

Faculty found more students who were comfortable with the computer and, therefore, felt the need to model its appropriate uses. Some have found that student interest seemed to increase as more classes began to use technology. A few others found the computer was not a motivator because it was not real to the students and students who were not already motivated to learn would not be motivated to learn with the computer. Simulations were perceived by some students as only make believe and did not deal with real human situations.

Collaboration

Simulations, used as part of team projects, created more collaboration and cooperative effort within the team of students. Competition between groups created more motivation on the part of the student to perform well. Faculty thought some students became more responsible for their own learning with access to a computer and quality software.

Course Development

A few faculty reported using technology to enhance existing courses as well as for the creation of new courses due to the availability of computer technology on the campus. Most of the new courses were spin-offs from existing courses in order to take advantage of more advanced features of technology. A few faculty found new roles as consultants for students who were completing class projects for area businesses. Many times the completion of one project led to a commitment to complete new project where the expertise of the faculty was needed.

Communication

The use of e-mail to communicate with faculty within departments made it easier to schedule meetings and pass information. Faculty who used e-mail regularly for communication were frustrated that some of their colleagues did not use it. They felt some faculty were missing important information because of their choice not to use the computer. Once faculty realized the effectiveness of the computer, they were frustrated when other faculty refused to use it. Faculty found many students did not use e-mail regularly and remained uninformed about class and campus activities. Some faculty required students in their classes to check their e-mail regularly and held them responsible for messages and assignments that were sent to them. They found that their wording must be more carefully chosen in e-mail messages and computer assignment sheets because there was a greater chance to misinterpret the meaning of the message.

Access to Computer-based Technology

For the most part, faculty felt computer resources were distributed equitably throughout the departments on campus. They felt, however, that upgrades and new software should be made available to those who could justify their need. Some faculty expressed a desire to have budgeted money distributed between departments so that each department was responsible for maintaining its own computers and purchasing its own software.

Faculty felt students had equal access to the computer if they lived on campus but questioned whether students who lived off campus and non-traditional students had equal access. A few faculty extended due dates for computer-related assignments because they felt some off-campus students could not obtain easy access to a computer or that computer labs were not located in buildings which were easily accessible by students. A few departments have purchased computers and dedicated them to student use. Other departments have not had the financial means to do this.

. Eight of the sixteen faculty interviewed preferred not to play a larger role in how the decisions were made concerning which hardware and software to purchase. They would like, however, to have more time to interact with their colleagues and exchange ideas about how to use computer-based technology effectively in the classroom. They felt computers should be used by all students, in courses where they were effective, and as a regular supplement to enhance the content of that course.

Impact on Faculty

Although faculty continually sought ways to use the computer more effectively, they felt teaching with the computer was more difficult because they must cope with changes and uncertainties in their classes. A few faculty felt students were beyond their level of expertise with computer skills and compensated for this by inviting students to become the instructors and demonstrate what they knew for the class. Others used this as a challenge to motivate themselves to learn more and worked together with the students to enhance their own skills. One faculty member was truly intimidated by the fact that students were sometimes more proficient with the computer and avoided using it in the presence of students because of this intimidation.

Impact on the School

Ten of sixteen faculty thought the school’s ability to attract quality students depended upon prospective student’s seeing computer technology being used in the classroom and on the campus. Others thought the computer technology available on campus was an added attraction to students, but did not have a significant impact on their decision to attend the school. One faculty member felt the students would want to see the same technology in the classroom that they would see in their job.

6. How do faculty anticipate using computer-based technology in the future?

Most faculty planned to integrate more computer-based technology into their courses in the future due to anticipated availability of computers in classrooms. Faculty expressed a desire to use more presentation software in their lectures and more Internet-related activities.

Presentation Software

When equipped classrooms became more readily available, faculty planned to use presentation software more frequently in their classes. Many publishing companies were furnishing instructional CD-ROMs as ancillary materials available with textbook adoption. Faculty planned to encourage their students to use presentation software when possible because they felt it focused the delivery of their presentation and kept the attention of the other students.

Internet

Faculty wanted to use the Internet to review with students web sites that contained content related to their courses. Education faculty wanted to critique, with a class of students, lesson plans found on-line or pull quality ideas from web sites to demonstrate to students how to create their own lesson plans. Lesson plans, when compared with on-line state competencies, could be revised to meet those competencies.

Faculty wanted to gain more experience searching the Internet for information. They wanted to be able to provide quality sites to their students and to people in the local community. They also wanted to create web pages with current articles attached for students to read.

Some faculty planned to require students in writing classes to submit thesis statements and rough drafts by e-mail to the instructor for review. Peer reviews of writing assignments will be conducted on-line by way of a Listserv. This will allow students not only to critique each other's work, but will allow those comments to be printed for later review. Faculty hoped this review method would encourage students to offer more constructive comments about each other's work. They also hoped students would devote more time and effort to writing because they knew their peers would be reading it.

Faculty readily admitted that to do these things effectively they must know more about how to use the computer. They will have to spend more time looking for web-based resources and making judgements about whether those resources are beneficial. They will also have to teach students how to evaluate these resources.

Discipline-specific software

Faculty were pleased with the software available for their specific disciplines. Some faculty would like to play a role in designing software for classroom use. Most of those faculty stated they would need training in order to do this effectively. Some faculty expressed a desire to be a content expert who worked with a technical person to design software. Examples given of the software they would design were ones where visual and audio simulation could create live action scenarios or where experts in the field could be found discussing a topic relevant to a particular subject. Faculty called these ‘quick field trips’ where true-life settings could quickly be displayed for the student without ever leaving the classroom.

Compelling Reasons to Use Computer-based Technology

Faculty agreed students needed to learn appropriate ways to use the computer as a tool. They needed to learn the situations where it works and was appropriate and where it did not work and was not appropriate. To assist students in this endeavor, faculty felt they must model the process. Access to information and preparation of the students for the workplace were given as compelling reasons to use the computer in the classroom.

Reasons to Avoid Computer-based Technology

Computers should not be used when they separate or isolate people from talking to each other, or when it was an inappropriate tool to use for the particular situation. There must be a viable reason to use the computer and it should not interfere with our ability to interact with each other on a personal level or to learn and teach in an effective, efficient manner.

Chapter 5

Summary and Dissemination

A review of the literature suggested that computer-based technology was rapidly spreading across college campuses. Faculty face many barriers in the adoption and effective use of this technology.

This study assessed the use of computer-based technology on ACA campuses, why it is or is not used, and with what results. It also determined some of the barriers faculty in the ACA institutions face in their attempts to use computer-based technology in the classroom and solutions to overcoming these barriers. Some insight was gained into the possible future uses of the computer by faculty for both administrative purposes and in the classroom. This chapter will review the impact of the study, the possible uses of the results of the study, and recommendations for further study.

Impact of the Study

This study revealed that e-mail at school, Internet at school, and word processing are used daily by a majority of ACA faculty and that multimedia will be increasingly used as classrooms become equipped for this purpose. E-mail at home, listservs, spreadsheet software, database software, presentation software, and computer-based instruction were occasionally used by ACA faculty at the present time. Faculty expressed a desire to use more presentation software in their classes and to have their student model that practice. They also expressed a desire to use a listserv more frequently, but were uncertain about how to set one up. Other computer-based technologies were rarely used although they were available to faculty in many instances. Interviews with Milligan College faculty suggested that faculty are still uncertain about how to use computer-based technology effectively and find peer interaction and discipline-specific workshops an effective means of alleviating that uncertainty.

Interviews also revealed a desire for a strategic or financial plan for purchasing, upgrading and maintaining computer-based equipment. Milligan College faculty felt strongly about using computers in their classrooms because of the access to information and preparation of students for the workplace. Faculty questioned whether off-campus and non-traditional students had the same access to the computer for completion of assignments as traditional students. Because of this concern, off-campus and non-traditional students were occasionally given fewer computer assignments and/or extended due dates.

Interviews with Milligan College faculty revealed adequate technical support for use of the computer in their offices, but little support for use of the computer in the instructional setting. An instructional design center or a formal instructional development program was not available to Milligan College faculty. Milligan College faculty expressed a desire for this type of assistance and released time from heavy teaching and committee loads to explore the effective uses of computer-based technology in the classroom.

Faculty outside the arts and sciences areas of the college expressed a desire for training and workshop opportunities equal to those currently offered by the ACA to arts and science faculty.

<u>Possible Use of Results</u>

All ACA schools could use this study to gain some understanding of the types of computer-based technology in use on ACA campuses and why it is or is not being used. Insight can also be gained about the barriers faculty face in the use of computer-based technology, and the anticipated future uses of the computer in the teaching and learning process.

While research in this study only encompasses the schools in the Appalachian College Association, the survey form and in-depth interview questions could be used by any school to assess the extent of computer-based usage on their campuses and faculty attitudes toward its effectiveness.

Faculty listed the lack of availability of computer-based technology in the classroom as the number one barrier to its effective use in the teaching and learning process. The results of this study could be used as justification to work toward increasing the availability of computer technology in the classrooms.

Faculty expressed a concern that off-campus and non-traditional students did not have the same access to the computer as traditional students. Perhaps computer access available to off-campus and non-traditional students should be evaluated.

Technology involves constant updating of hardware and software, and therefore constant updating of skills in using hardware and software. How well school systems address this issue will have a direct impact on how well technology is utilized. The results of this study could be used to justify additional training programs for faculty with differing skill levels and additional personnel dedicated to assisting faculty with using technology in the classroom. The study could also be used as justification for allowing faculty released time to research the effectiveness of computer-based technology as part of the normal teaching load.

Faculty expressed a need to have increased technical support available to them as they begin to use more computer-based technology in the classroom. The growth of computer usage should be monitored and additional support personnel should be added in proportion to this growth.

Comments on the Study

Several interesting comments were included with the returned surveys and e-mail messages. These comments included such items as:

- "I just want to know if I'm in line with everyone else"
- "I would prefer to deal with students who could read and write and were less computer literate."
- "I'm not clear how to use some computer-based technology in the classroom."
- "I'm glad you are doing this study"

In-depth interviews revealed that some faculty rely on a secretary to use the computer to perform administrative duties for them. If the same or similar tasks needed to be performed in the classroom, faculty would need training to do it themselves or a technical support person to do it for them.

Some respondents expressed a desire to have a "Don't know if this is available or not" and/or a "Don't know what this is" category on the Likert scale choices. Many current computer-based technologies are still very new to many faculty.

Sending surveys via e-mail created some unique problems that would not have had to be addressed if all surveys had been sent via U. S. mail. E-mail addresses require very precise addressing. Surveys with typographical errors or misspelled names and addresses would possibly have been deliverable by U. S. mail. By e-mail they were returned as undeliverable.

Several schools listed generic formats for faculty e-mail addresses such as FirstInitialLastName. Faculty who were listed in the college catalog as Elizabeth Smith might use the nickname "Beth" and the e-mail address BSmith rather than ESmith. Hyphenated first names or last names created some confusion about how to match the generic format.

Many retired faculty were still allowed accessed to school e-mail addresses. Surveys could easily be delivered to retired faculty who were not comfortable completing it because they were no longer in the classroom. E-mail addressed to faculty members who were no longer employed by the institution was returned as undeliverable by the computer because accounts had been cancelled. In many instances, when using the U. S. mail, campus mailrooms could place the survey in the mailboxes of replacement faculty members.

Recommendations for Further Study

This study could be replicated in schools that are struggling to overcome the barriers in using computers effectively on their campuses. Faculty are just beginning to move from using the computer as an administrative tool to the classroom as a tool for learning. The survey instrument could be used to determine what computer-based technologies are being used and with what frequency. Interview questions could be adapted to gather data about why these technologies are or are not being used, their effectiveness in the teaching and learning process, and the barriers faculty face in using these technologies. Currently faculty can only give anecdotal evidence that the use of the computer is effective. Future studies could be designed to evaluate the true effectiveness of computer-based technology in the teaching and learning process.

Dissemination of Results

In addition to normal dissemination of dissertation results, the findings of this research will be shared with the director of the Appalachian College Association, the director of fellowships and grants of the ACA, the director of the Technology Assistance Projects office, and others whom they recommend.

One hundred-five ACA faculty who served as survey participants requested the results of the survey. Eighty-seven requested the results on the survey form; eighteen requested them by e-mail. A copy of the results will be mailed to each of these faculty.

The results will also be presented at the First Annual ACA Technology Summit in Knoxville, TN, in October 1998. This major conference is of interest to all faculty members and administrative persons who are interested in learning more about successful instructional technology innovations being used in the classrooms of ACA institutions and comparable institutions elsewhere.

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Appendix A: ACA Member Colleges

ACA SCHOOLS	
Kentucky	**West Virginia**
Alice Lloyd College	Alderson-Broaddus College
Berea College	Bethany College
Campbellsville University	Davis & Elkins College
Cumberland College	Ohio Valley College
Kentucky Christian College	University of Charleston
Lindsey Wilson College	West Virginia Wesleyan College
Pikeville College	Wheeling Jesuit College
Union College	
	Virginia
North Carolina	Bluefield College
Lees-McRae College	Emory & Henry College
Mars Hill College	Ferrum College
Montreat College	Virginia Intermont College
Warren Wilson College	
Tennessee	
Bryan College	
Carson-Newman College	
King College	
Lee University	
Lincoln Memorial University	
Maryville College	
Milligan College	
Tennessee Wesleyan College	
Tusculum College	
University of the South	

Appendix B: Correspondence

B.1 Request for faculty names and addresses

Hello, I am a faculty member at Milligan College in Tennessee and a doctoral student at Virginia Tech. As a part of my research for my dissertation, I would like to contact your faculty about their use of computer-based technology.

Does your college catalog list the names and titles of your faculty members?

[If yes] Could you please send me a copy of the catalog or a listing of your faculty members and their titles? My address is Carolyn Carter, P. O. Box 500, Milligan College, Milligan College, TN 37682. Thank you very much. Goodbye.

[If no] Do you have a listing of your full-time faculty members that you could send me? My address is Carolyn Carter, P. O. Box 500, Milligan College, Milligan College, TN 37682. Thank you very much. Goodbye.

B.2 Request for faculty e-mail addresses

Hello, I am a faculty member at Milligan College in Tennessee and would like to correspond with some of your faculty by e-mail. Do they have the capability to receive e-mail?

I have the name of your faculty; do their e-mail addresses follow a standard pattern at your school?

[If yes] What is that pattern? *[Write it down]*. Thank you very much.

[If no] Do you have a list of faculty e-mail addresses that you could send me?

[If yes] Could you mail them to this address*:* Carolyn Carter, P. O. Box 500, Milligan College, Milligan College, TN 37682

[If no] Can your faculty be reached by mail? At what address?

Thank you very much.

Appendix C: Survey Instrument

ACA FACULTY TECHNOLOGY SURVEY

Please respond to the following questions (1-19) pertaining to current use of computer-based technology on Appalachian College Association campuses by using the following scale:

(1) Not available to me
(2) Available but never use
(3) Available but rarely use
(4) Use monthly, or nearly so
(5) Use weekly, or nearly so
(6) Use daily, or nearly so

How often do you use the following technologies?

	1	2	3	4	5	6
1. E-mail at school?						
2. E-mail at home?						
3. A listserv?						
4. WWW resources at school?						
5. WWW resources at home?						
6. Other Internet resources (telnet, ftp, etc)?						
7. A word processor?						
8. A spreadsheet program?						
9. A database program?						
10. Presentation software?						
11. A web page editor?						
12. Distance learning?						
13. Desktop publishing?						
14. An authoring package						
15. Computer-based instruction?						
16. A digital camera?						
17. A scanner for OCR?						
18. A scanner for graphics?						
19. Video conferencing?						

20. Other software used? Please list below:
____

21. Which platform do you predominantly use at school?
(1) Macintosh
(2) PC with DOS
(3) PC with Windows
(4) UNIX based

22. Which of the following most closely describes your area of expertise?
(1) Behavioral and Social Science
(2) Bible and Christian Ministries
(3) Business/Computer Information Systems
(4) Communications
(5) Health and Physical Education
(5) Health Sciences
(6) Humanities/Fine Arts/Foreign Language
(7) Mathematics/Science/Computer Science
(8) Teacher Education
(10) Other

23. How many years of teaching experience have you had at the collegiate level? __________

24. How many years of experience have you had with using technology in the classroom? __________

25. Please enter the name of your school ____________________________
26. Please enter your name _______________________________________
This is for tracking non-respondents only. Your answers will be kept confidential.
Would you like a copy of the results of this survey ______ yes ______ no

Appendix D: Responses by School or University

Responses by School or University							
	Total	U.S. Mail		E-mail		Total	
College or University	Sent	Replied	Percent	Replied	Percent	Replied	Percent
Alderson-Broaddus College	19	10	53%	4	21%	14	74%
Alice Lloyd College	5	2	40%	0	0%	2	40%
Berea College	40	16	40%	4	10%	20	50%
Bethany College	19	6	32%	3	16%	9	47%
Bluefield College	13	2	15%	7	54%	9	69%
Bryan College	10	6	60%	1	10%	7	70%
Campbellsville College	17	4	24%	5	29%	9	53%
Carson-Newman College	35	9	26%	11	31%	20	57%
Cumberland College	25	3	12%	10	40%	13	52%
Davis & Elkins College	17	5	29%	4	24%	9	53%
Emory and Henry College	17	1	6%	4	24%	5	29%
Ferrum College	21	3	14%	4	19%	7	33%
Kentucky Christian College	10	3	30%	2	20%	5	50%
King College	12	2	17%	0	0%	2	17%
Lee University	27	4	15%	7	26%	11	41%
Lees-McRae College	9	0	0%	4	44%	4	44%
Lincoln Memorial University	25	4	16%	13	52%	16	68%
Lindsey Wilson College	14	3	21%	3	21%	6	43%
Mars Hill College	23	1	4%	6	26%	7	30%
Maryville College	16	9	56%	0	0%	9	56%
Milligan College	20	6	30%	13	65%	18	95%
Montreat College	12	4	33%	3	25%	7	58%
Ohio Valley College	6	2	33%	1	17%	3	50%
Pikeville College	16	3	19%	2	13%	5	31%
Tennessee Wesleyan College	9	5	56%	0	0%	5	56%
Tusculum College	14	5	36%	1	7%	6	43%
Union College	18	3	17%	7	39%	10	56%
University of Charleston	21	5	24%	3	14%	8	38%
University of the South	34	10	29%	5	15%	15	44%
Virginia Intermont College	11	1	9%	4	36%	5	45%
Warren Wilson College	14	3	21%	5	36%	8	57%
West Virginia Wesleyan College	27	5	19%	8	30%	15	48%
Wheeling Jesuit University	24	9	38%	3	13%	12	50%
no name/no school	0	1	0%	0	0%	1	0%
TOTALS	**600**	**155**	**51%**	**147**	**49%**	**302**	**50.3%**

Appendix E: Syllabi Reviewed

		SPRING 98 - PAPER		SPRING 98 - ON DISK		FALL 97 – PAPER	
Area	Dept	**Number reviewed**	**Indicated computer usage**	**Number reviewed**	**Indicated computer usage**	**Number reviewed**	**Indicated computer usage**
Biblical Learning	Bible	10	1			11	0
	Church Ministry	4	3			3	0
Performing, Visual, and Communicative Learning	Art	7	1			4	0
	Communications	7	4	5	2	8	3
	Music	8	1			16	0
	Theatre Arts	2	0			4	0
Humanities	English	0	0	1	0	5	0
	Foreign Language	5	0			5	0
	Greek	2	0			0	0
	Humanities	6	2			5	1
Professional Learning - Business	Accounting	4	2			4	1
	CIS	7	7			6	6
	Business Admin.	9	2			8	3
	Economics	1	0			4	0
	Legal Assistant	2	0			2	0
Professional Learning – Education	Education	13	10	3	0	23	1
	Exercise Science and Physical Education	11	0	6	1	13	1
Nursing	Nursing	18	3			20	2
Scientific Learning	Biology	9	0	7	0	8	0
	Chemistry	3	0	3	0	6	0
	Math	11	1	1	0	13	0
	Physics	2	0	2	0	2	0
Social Learning	Geography	1	1	1	0	1	0
	History	7	0			7	0
	Philosophy	1	1			1	1
	Political Science	2	0			3	0
	Psychology	15	2	1	1	8	0
	Sociology	7	0	1	0	3	0
	Totals	174	41	31	4	193	19
Percent of spring '98 on disk which indicate computer usage		15%					
Percent of total spring '98 (paper and electronic) mentioning computer usage		22%	**Percent of spring '98 courses mentioning computers other than courses which teach computer usage**				19%
Percent of fall '97 mentioning computer usage		10%	**Percent in fall '97 courses mentioning computers other than courses which teach computer usage**				7%
Courses which teach students to use the computer, as indicated by syllabi		*7*	*7*	*1*	*1*	*6*	*6*

Appendix F: Computer-related Problems Resolved after the Interview Process

One faculty member was uncertain about how to edit a file attached to an e-mail message and return it to the original sender. I asked a colleague across the hall to send her a message with an attachment and I worked with her to edit it and return it to her colleague.

One faculty member could not access his web page files on the computer network. I located the directory he needed access to and asked the computer services staff to grant him access to that directory.

Two faculty members inquired about how to set up a Listserv for their fall classes. I gave them a contact name of the computer services staff member who could set up the Listserv and described to them the procedure for subscribing to the list.

One faculty member and I discussed a problem he was having with saving a file using HTMLWriter to create web pages. I shared with him how I had resolved the same problem in designing my own web files.

One faculty member needed help converting a WordPerfect document to Microsoft Word. She then needed to append the converted document to an existing Microsoft Word document.

One faculty member was frustrated by attempted failures to install a testing package sent by a publishing company. We discussed what might be causing the problems and agreed to set a time to install the package. A specific date has not been determined.

One faculty member needed assistance to organize and copy all files from her hard drive to floppy disks. I worked with her to make folders for each specific course she teaches and move the folders to floppy disks.

One faculty member needed assistance in getting a PowerPoint presentation from a hard drive to a floppy. The presentation was too large to fit on one floppy. I suggested that she use the “Pack and Go” menu option in PowerPoint to put the presentation on multiple floppy disks.

One faculty member had not yet completed the instruction sent by computer services to install Microsoft Outlook on his computer. I offered to help him complete the steps when he got ready to do so.

Five faculty members were frustrated by not having access to a CD-ROM drive for both their own personal use and for student use. Computer services has since been able to upgrade some of those computers. I explained to the faculty members how computer services could install some CD’s on the network drive and the faculty could actually access them from there rather than using a CD-ROM drive on their own computer. We discussed legal and ethics issues concerned with this.

One faculty member did not have access to print on a convenient network printer. I assisted her in installing a connection to a printer across the hall from her office.

Appendix G: In-Depth Interview Questions

I want to ask you a series of questions about what computer-based technologies you use, why you do or don't use them, the impact you feel they have on teaching and learning, and your feelings about technical support and professional development.

I. What computer-based technologies are faculty currently using?

1. Do you use computers in your teaching or in your school-related activities?
   - How would you describe your classroom use of computers?
     - Are you a nonuser, an occasional user, a moderate user, or an extensive user?

2. (skip for non-users) How do you use computers in your classes?

   a. Type of use?
      - Drill and practice or tutorials?
      - Simulations and games?
      - Exploration and problem solving?
      - Word processing or some other application?
      - Communication or collaboration?
      - Programming?

   b. What kinds of software do you use?
   c. Do you use computers located in a lab, or as a demonstration device with the whole class?
   c. How often do you use the computers with a class?
   d. Do you make assignments for which your students would need to use a computer outside of class?
      - How often?

3. (skip for non-users) Has the way you design your courses changed with your use of computer-based technology?
   - If so, how?

4. Do you use computers outside of class?
   (skip for non-users) For school-related work? (preparing class activities? For record keeping?)
   Do you use computer for tasks unrelated to your teaching?
   -other professional activities?
   - personal use?

II. Why are faculty currently using or not using computer-based technology?

1. Could you tell me why you do, or do not use, computers in your classes, or why you do not use them more extensively?

   - Is time a factor?
   - Is it a matter of personal preference?
   - Is it a matter of facilities or software?
   - Is it a matter of training?
   - Is the technology too complicated or intimidating?
   - Lack of support?

2. (skip for non-users) Why do you use computers in your teaching?
   - Could you begin with personal reasons?
   - Student related reasons?

     - To expose them to the latest technology?

     - To help them learn better?

     - As a student motivator?

2. (skip for nonusers) Have your students been able to perform tasks with computers that would not have been easily done otherwise?
   - If so, what type of tasks?

III. What types of training or resources do faculty think are most beneficial in learning to use computer-based technology?

1. Have you had training in the use of computers?
   If not, are you self-taught?
   If yes, could you give some details about your training?
   - Where was the training?
   - Who paid for the training?
   - Why did you participate?
   - What was the training like? (presentation, hands-on)
   - How long did the training last?

2. Was the training adequate?

   - What were its strengths and weaknesses?
   - What were the most important features of the training? (instructor competence, hands-on, follow-up?)
   - In your opinion, was the training relevant to your teaching?
   - Was the training relevant to other tasks you perform as a professional? (Advising? grade-keeping? communicating with colleagues?)

3. Have you participated in any of the ACA workshops?
   - If not, why?

   Do you feel those have been effective? In what way?

4. Have you participated in the Teaching, Learning, and Technology Roundtable discussions?
   - If not, why?

   Do you feel those have been effective?
   - If not, why?

5. What other information sources do you use to find out about ways to use technology in your area?
   - Conferences?
   - Magazines?
   - Lectures?
   - Workshops?
   - Demonstrations?

Are these effective? Why or why not?

IV. Are adequate support services offered for faculty as they begin to incorporate computer-based technology into the curriculum?

1. Do you feel support from administration for using the computer?
    - Support from other faculty?
    - Support from publishing companies?

2. Do you feel pressure from administrators to use the computer?
    - Pressure from other faculty?
    - Pressure from publishing companies?

3. Have you received any help in scheduling computer use or in integrating computers into the curriculum?
    - Who offered this help?

    - Do you meet, formally or informally, with other faculty to discuss computer use?
    - Have you been offered rewards for knowing about and using the computer in the curriculum? (Released time, compensation, grants)?
    - Do you feel rewards are, or could be, effective?
    - What types of rewards would be most effective for you?

4. What support would you like that is not now available to you?
    - (for non users and occasional users) Is there some support that is not now available to you that might tempt you to use computers, or to use them more extensively?

5. Are the computer and peripherals on your desk or in your area adequate for your needs?
    - If not, how could they be improved?

6. What barriers have you experienced in attempting to incorporate technology into your classes?
    - What would help you overcome these barriers?

V. What is the attitude of the college faculty about the use of computer-based technology?

1. (skip for nonusers) Has the presence of computers changed your teaching in any way?

   - What difference has the computer made in your teaching?
     - In your teaching style?
     - In your role as an instructor?
     - In your role as an advisor?
     - In the content of what you teach?

2. (skip for non-users) Has your use of computers changed over time?
     - How?

3. (skip for non-users) Has your attitude towards computers changed as you have gained more experience?
     - In what way?

4. In your opinion, is teaching easier or more difficult with a computer?

5. Do you ever feel students are beyond your level of expertise with computer skills?
     - If so, does this bother you?

         - How do you compensate for this difference?

6. Do you think computers have had an impact on students?
   - On how they learn?
   - On the quality of their work?
   - On student motivation?
   - On the relationship among the students in the classroom?
   - On the relationship between you and your students?

7. Do you think the computer makes students more responsible for their own learning?

8. Do you think it is possible to use computer-based technology and still maintain close interaction between faculty and students?

9. Do you think the computer has had an effect on the curriculum?
     - Have new courses been created?
     - Have the goals and content of traditional courses changed?
     - Have you had difficulties integrating software into your curriculum?

10. Has your (use/limited use/nonuse) of computers changed your relationship with other faculty?

    - Has the introduction of computers created divisions in your department or area between “those who do” and “those who don’t” use them)?
    - Do computers enhance communication? If so, how?

11. (skip for nonusers) Has the introduction of computers into your classes made teaching more exciting, challenging, frustrating, overwhelming?
    - How?

12. (skip for nonusers) Has your use of computers led to new roles outside the classroom? (trainer, consultant, developer?) What are these roles?

13. Are computers or computer resources distributed equitably through the departments?

    - Do you feel all students have equal access to the computer?
    - Are computers taking scarce resources away from other important areas?
        - Can you describe these areas?
    - As a faculty member, are you satisfied with how decisions are made concerning how much money is spent on computer hardware?
    - On computer software?
    - On training?
    - On how computers are used, how they are integrated into the curriculum?
    - Would you like to play a larger role in making decisions about how much money is spent on computers, and how they are used?

14. Ideally, how do you think computers should be used?

    - Used by all students or only certain groups of students?
    - Integrated into the entire curriculum or restricted to specific subjects?
    - Used regularly or only as a supplement from time to time?

15. Do you think the school’s ability to attract quality students depends upon our use of technology in the classroom?

VI. How do faculty anticipate using computer-based technology in the future?

1. How do you see your use of the computer changing in the future?
   - How will it change your role as the teacher?

2. How do you see your student's use of the computer changing in the future?
   - How will the computer change the traditional role of the student?
   - How can we help students learn to use tools that might be required for survival in the future?

3. Is software available for your specific discipline that you do not have but would like to have?
   - Which software is that?
   - What does it do?

4. Would you like to play a role in designing software for classroom use?
   - Would you need training in order to do this?
   - If so, where would you prefer to get this training?

5. If you were to design a software program for use in your classroom, what would it do?

6. What is the most compelling reason for using computers in the classroom?

   For not using them?

Is there anything I have not asked you that you would like to say about computer-based technology?

Thanks so much for making time to talk to me.

Appendix H: Software used by ACA faculty

Software Used by ACA Faculty		
Teaching Expertise	**Software**	**Platform**
Behavioral and Social Science	PhotoShop, PowerPoint, Excel	PC
	MicroCase Statistical Analysis, SPSS, Crunch 4	PC
	ChiWriter, Bible Companion Series, Logos	PC
	HyperCard, Perseus, Library catalog	Unix
	historical simulations - specific names not listed	PC
	text-generating package - specific names not listed	PC
Bible and Christian Ministries	Word Perfect	PC
	Meeting Maker	Mac
	The Business Strategy Game	PC
	Legal CD-ROMs - specific names not listed	PC
Business and Computer Information Systems	PageMaker, Printshop	PC
	Quicken, TurboTax, Bible Software	PC
	MS Visual C++; various utility software	PC
	Keyboarding, Testing - specific name not listed	PC
	The Business Strategy Game, SAS, Listrel	PC
	Legal CD-ROMs - specific names not listed	PC
	Adobe Photo Deluxe, OmniPage Pro 8.0	PC
	photo editing software - specific name not listed,	PC
	SPSS, Course-specific software from publishers	PC
	Individualized Instruction - specific software not listed	PC
Communications	PageMaker 6.5, PhotoShop 4.0, Media 100	PC
Health and PE	SPSS, PEAK movement analysis	PC
	Publisher 97, PageMaker	PC
	Quicken, Exploring Statistics, Quattro Pro	PC
Health Sciences	CD videos for classes - specific names not listed	PC
Humanities, Fine Arts, and Foreign Language	PhotoShop Canvas	Mac
	Deadalus	PC
	Word, WordPerfect, Eudora,	PC
	Finale Music Notation	PC
	Adobe PhotoDeluxe, JPEG View, Newswatcher	Mac
	BibleSoft -- PC Bible; Automap Road Atlas	PC
	EndNotes	Mac
	MIDI Scan; SongSelect	PC
	Ami Pro; Freelance Graphics; Cakewalk	PC
	MasterTrax Pro; Corel Draw 7	PC
	Atajo, Système-D	PC

Software Used by ACA Faculty		
Teaching Expertise	**Software**	**Platform**
Mathematics	Derive, Minitab, JMPIN, CBS statistics	PC
	Management Scientist	PC
	MacSpartan, Mathcad, Mathematica	Mac
	SysStat, StatuQuest, Adobe Acrobat	PC
	AutoCADLT	PC
	Maple, Gaussian 94, Web server software	Mac
	Geometer's Sketchpad	PC
	SigmaStat, Ecobeaker	PC
	Statdisk	PC
	Gaussian	Unix
Science	Molecular modeling, biochemistry packages	PC
	Cardiocomp, Explorations in Cell Biology and Genetics	PC
	Virtual Physiology Lab	PC
	Identibacter interactus	PC
	Greetings Workshop, Muscle Contraction	PC
	ADAM Interactive Physiology Module	PC
	Netter's Interactive Atlas of Human Anatomy	PC
	ChemDraw, Hyperchem	PC
	textbook software - chemistry, physical science	PC
Computer Science	Compilers (Pascal, C++)	MAC
	Microsoft Office Products, Word, Excel, PowerPoint	PC & MAC
	Print Shop, Now Up to date, Now Content, Sam, Norton Utilities	MAC
	Access, PhotoShop, Visual Basic, Corel Draw, OmniPage Pro	PC
	Director 5	PC
	Linux Suite, XVScan	Unix
	geographic information system, UNIX OS	PC
	various simulation programs - specific names not listed	PC
	Drawing and Painting Programs - specific names not listed	PC
Teacher Education	Finale Music Notation	PC & MAC
	Claris, Gradebook, HyperStudio, PowerPoint	MAC
	Word Cruncher	PC
	Microsoft Office, Norton Utilities	PC
	Software for K-12 education - specific names not listed	MAC
	Educational software:(Carmen Sandiego, Calculus, Algebra	PC
	Statistical analysis software - specific names not listed	PC
Other	Autocad, Mastercam, Softlogic	PC
	Microsoft Project	PC
	Delta Kappa Gamma Membership Package	PC
	Music Programs - specific names not listed	PC

VITA

CAROLYN WALSH CARTER

P.O. Box 500
Milligan College
Milligan College, TN 37682

Phone:	(423) 743-0011 (home)	Born:	January 27, 1955
	(423) 461-8670 (office)	Spouse:	Milton (b.6/24/54)
fax:	(423) 461-8677		
e-mail:	cwcarter@milligan.edu		

EDUCATIONAL BACKGROUND:

Virginia Polytechnic Institute and State University, Blacksburg, VA
Degree: Ph.D., 1998
Instructional Systems Development
Department of Teaching and Learning

University of Evansville, Evansville, IN
Degree: M.S.C.S.E., 1990
Computer Science Education
Department of Computer Science

East Tennessee State University, Johnson City, TN
Degree: M.A., 1980
Business Education
College of Business

East Tennessee State University, Johnson City, TN
Degree: B.S., 1977
Business Education
College of Business

TEACHING EXPERIENCE:

1984-present	Milligan College, Milligan College, TN, Associate Professor of Computer Science; Chair, Area of Professional Learning, 1993-1996
1978-1984	Virginia High School, Bristol, VA, Instructor of Business Education

TEACHING SPECIALTIES:

Systems Analysis and Design
Systems Project Management
Computer Applications (Windows and DOS based)
Systems Documentation
Programming Languages (BASIC, Pascal, C)
Desktop Publishing
Various Office Administration Courses

SOFTWARE PROFICIENCY:

FrontPage 98	Microsoft Office 97
Microsoft Word 2.0, 6.0 for Windows 3.1	Microsoft Excel 5.0 for Windows 3.1
Microsoft PowerPoint 2.0	Microsoft Windows 3.1, 3.11, 95
WordPerfect 5.0, 5.1 for DOS	Lotus 1.2.3 v 2.4 for DOS
TimeLine	Harvard Total Project Manager
Visible Analyst Workbench	Excelerator

COURSES IN MAJOR FIELD:

Programming Languages
- Unix and C
- Comparative Programming Languages
- Introduction to Computer Science (Pascal)
- Assembly Language
- Data/File Structures

Computing Theory
- Theory of Programming
- Computer Organization
- Computer Systems

Systems Development
- Systems Analysis
- Using CASE Tools

Curriculum Development
- Undergraduate Computing Curriculum

PUBLICATIONS:

Walsh, Carolyn. "Computer Education - Training the Faculty." *The Invoice - A Journal of the Tennessee Business Education Association*. Fall, 1989.

Walsh, Carolyn and Barbara Plumblee. "Teaching Microcomputer Applications - Part II." *Proceedings of the Association of Small Computer Users in Education*. Summer, 1991.

Walsh, Carolyn and Barbara Plumblee. "Teaching Microcomputer Applications." *Proceedings of the Association of Small Computer Users in Education*. Summer, 1990.

CONFERENCE PRESENTATIONS:

"Using Visual Aids in Computer Applications Classes." International Visual Literacy Conference, October, 1996.

"Teaching Microcomputer Applications." Association of Small Computer Users in Education. Summer, 1990.

"Teaching Microcomputer Applications - Part II." Association of Small Computer Users in Education. Summer, 1991.

COMMITTEE ASSIGNMENTS:

Strategic Planning Committee, Chair, 1995 -1996
Academic Committee, 1994 - 1996
Tenure and Promotion Committee, 1995 - 1996
Computer Applications Committee, Secretary, 1984 - 1996
Budget Committee, 1995
Legal Assistant Advisory Committee, 1988 - 1995
Admissions Committee, 1986 -1988

CONVENTION/ WORKSHOP ATTENDANCE:

Mid-South Instructional Technology Conference, 1994, 1995, 1997
Association for Educational in Communications and Technology, 1997
International Visual Literacy Conference, 1996
Association of Small Computer Users in Education, 1988-1993, 1995, 1997
Association for Applied Interactive Multimedia, 1996
Data Communications and Networking, 1995
Internet Skill Development Seminar, 1995
Network Troubleshooting Conference, 1994
Southeastern Small College Computing Consortium, 1988 -1995
Council of Independent Colleges, Information Technology Seminar, 1993
Tennessee Business Education Association 1984 -1989
Caber Systems Desktop Publishing Workshop, 1989
American Association for Paralegal Education Conference, 1989
Various ETSU Workshops and Demonstrations, 1987-1989
Southern Business Education Association 1986 -1988
Excelerator Users Conference, 1988
Eastern Small College Computing Conference, 1986
Various IBM Workshops and Demonstrations, 1985 -1986

HONORS, CERTIFICATES & PROFESSIONAL AFFILIATIONS:

Phi Kappa Phi
Outstanding Young Women of America, 1988
Tennessee Professional Teaching Certificate
Virginia Professional Teaching Certificate
Delta Kappa Gamma Society International
Phi Delta Kappa Professional Fraternity
Southern Association of Colleges and Schools, Committee Member, 1982, 1992
National Business Education Association
Tennessee Business Education Association, executive and administrative board member