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Diffusion of a telecommunication and computing innovation at Waldorf College

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Diffusion of a telecommunication and computing innovation at Waldorf College

by

Daniel Herbert Hanson

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Education (Curriculum and Instructional Technology)

Major Professor: Michael R. Simonson

Iowa State University

Ames, Iowa

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For the Graduate College
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CHAPTER 1. INTRODUCTION

Information technology use has increased dramatically on college campuses in recent years. There is expanded use of the computer, the Internet, and the World Wide Web (Green, 1995). Some individuals think that these technologies have had an immense impact on education (Welsh, 1997). Others feel that while technology has transformed much of society, there has been very little change in education (Odvard & Kinnaman, 1994). Despite these differing views, there is agreement that technology "obligates" education to make dramatic changes (Odvard & Kinnaman, 1994, p. 92).

Vast improvement of two technologies are at the heart of this educational change. Both advances in computer technology and network technology provide capabilities never before available in education. These new computer and network environments allow educators to rethink the teaching and learning process and could reform the way in which education is practiced.

For the potential of computer and network environments to be realized in education, change must occur. Dede as reported by O’Neil (1995), stated that technology can be used to enable new models of teaching and learning. These models would not be possible without using the potential of new technology. The changes made available by this technology will be influenced by both educational organizations and the individuals within the organizations. Educational organizations that can adopt quickly to change will be leaders in the application of new technologies to improve learning. An individual’s ability to use technology to improve learning will be influenced both by their ability to adopt new ideas (Rogers, 1995), and the anxiety they experience in the use of the new technology (Overbaugh & Reed, 1992).

In the fall of 1996 Waldorf College, a small college with a focus on the liberal arts, began providing laptop computers to all of its freshmen students. Waldorf College is located in Forest City, Iowa and offers primarily associate of arts degrees with a few select bachelor of arts degrees taught in a three-year format. In addition to the laptop computers, the residence halls were wired to provide access to the campus network and the Internet. The following fall, both sophomore and freshman students were furnished with laptop computers. This study investigated the impact of these activities on freshmen students at the college. The study of the adoption of these new technologies by students, and how this new environment impacted learning was thought important to provide insight for other institutions of higher education that seek to move into this new learning environment.

In chapter one an overview of the issues related to the study of this new learning environment at Waldorf College is given. To provide a framework for evaluating computer and network use, a discussion of network learning, computer learning and their impact on restructuring
education is included. In addition, the use of technology in higher education is addressed to give background for the project. A discussion of organizational and individual innovativeness provides insight into the diffusion of innovations among individuals and within organizations; and an overview of the impact of computer anxiety on computer use develops a framework for studying computer anxiety in students. Chapter one continues with a statement of the research problem, a description of the purpose of the study, the research questions, a definition of terms, and a chapter summary.

**Background for the Study**

**Network learning**

Tens of thousands of networks are connected to the Internet with millions of people using the Internet worldwide on a daily basis (Ackermann, 1995). At the same time, the number of Internet users continues to grow dramatically (Carmona, 1996). “Regional, national, and local ‘information infrastructures’ are developing that enhance our abilities to sense and act and learn across barriers of distance and time” (Dede, 1996, p. 25). Many schools, colleges, and universities are taking advantage of the interactive communication provided by this expanding environment, that allows teachers and learners to access both educational resources and programs from anywhere in the world at any time (Riel & Harasim, 1994). This new educational environment where time and place have lost their importance provides many new educational opportunities (Warnock, 1996) and represents a new learning paradigm which was called “network learning” by Harasim (1994, p. 978).

This type of learning provides a “unique combination of place-independent, asynchronous interaction among groups of people linked by networks” which “enables new educational approaches and new sets of learning outcomes” (Riel & Harasim, 1994, p. 92). “Computers and communication technology are changing the nature of education” (Riel & Harasim, 1994, p. 91). Communication and ease of information access are at the heart of this new learning environment (Welsh, 1997) (Warnock, 1996).

The educational implications for network learning environments appear to be significant. However, research into this new learning approach was limited. Riel and Harasim (1994) stated that “Claims of success, as well as failure, in the use of this new technology focus attention on the need for more research on the structure of social groups, the coordination of activities, and the educational outcomes of these efforts” (p 91). Berenfeld (1996) called this new learning environment an infosphere and reinforced Riel and Harasim’s concern for additional research when he asks, “Do we have any evidence that bringing classrooms to the infosphere can justify the great effort that doing so
will take?” (p. 78). Berenfeld suggested that there is only limited research into educational uses of network learning. Investigating student network use at Waldorf College provided meaningful information about the potential of this new network learning environment.

Computer learning

Computers, the most prevalent form of technology in schools, have increased impressively in numbers used in education in recent years (Green, 1996). This implementation of computers in education is viewed as being innovative and as a way to improve education (Campoy, 1992). It is assumed that schools must be up-to-date by embracing new computer technology to be effective (Ely, 1995). Studies have shown that students can learn effectively from computers. (Salomon & Gardner, 1986) However recently researchers no longer look at the computer as the variable for study. Instead, the focus is on instructional approaches used with the computer and on the computer environments that most effectively support learning (Thompson, Simonson, Hargrave, 1996).

These instructional strategies or approaches for computer use have been categorized in a variety of ways. Taylor (1980) and Simonson and Thompson (1997) focused on the role of the computer and the design of educational software in the development of their taxonomies of computer use in education. Taylor suggested that computer use in education can be broken into the categories of tool, tutor, and tutee. Simonson and Thompson (1997) included the categories of drill and practice, tutor, simulation, problem solving and tool in their taxonomy of computer use in education. Thomas and Boysen (1984) focused on the learning goal and the role of the student when learning with a computer in the development of their taxonomy. They included the categories of experiencing, informing, reinforcing, integrating, and utilizing. The categories proposed for computer use in education encompassed traditional computer uses, but also provided a vision for ways to improve learning through enhanced use of computers.

Many educators have seen a need to progress from the traditional uses of computers in education to implementations of computers that develop cognitive and metacognitive thinking strategies. Papert in the second edition of his book Mindstorms (1993) provided a vision for this type of use of computers in education. Papert envisioned computer “microworlds” as “interactive learning environments in which prerequisites are built into the system and where learners can become active, constructing architects of their own learning” (p. 122). These computer microworlds provide students with an environment in which they can “relate what is new to what they already know”, “play” with the concepts and test and revise their own theories. Jonassen (1996) also suggested that there needs to be a “significant departure from traditional approaches to using
computers in schools” (p. 3). Jonassen’s vision was that computers could be used as a “cognitive tool for accessing information and interpreting and organizing personal knowledge” (p. 3). While Papert’s and Jonassen’s visions differed in scope and focus, they both suggested a change from traditional uses of computers in education.

The approaches to using computers in education as categorized above suggest a wide variety of implementations. In addition, the visions of Papert and Jonassen suggest new strategies and goals for the use of computers in education. Determining the strategies being used with computers in education and students’ perceptions of learning in a setting in which college freshmen have laptop computers and Internet access gives insight into the effectiveness of learning in this environment. At the same time, insight into the extent to which the vision for computers in education is being fulfilled was provided.

Restructuring education and technology

In 1938 John Dewey noted that in the past the chief business of education was to transmit the worked out knowledge of the past to a new generation. According to Dewey this essentialist approach to education no longer meets the needs of society (Dewey, 1938). Dewey’s views have been challenged over the years, however, currently many educators support Dewey’s premise that education must be restructured to meet the current and future needs of society (Darling-Hammond, 1995; Campoy, 1992; Newman, 1992; Means, 1994). This restructured educational environment would result in learner-centered and learner-directed classrooms in which students and teachers would actively explore complex environments and participate in authentic activities (Murphy, et al., 1997).

The use of technology in the educational restructuring movement is a matter of some debate (Newman, 1992). Many educators feel that technology will play a critical role in providing the learner-centered educational environments needed for reform (Campoy, 1992), (Means, 1994). However, too often technology in schools focuses on administrative types of tasks or is used to “entrench existing structures and practices.” (Kinnaman, 1995). Many times technology is used to master basic skills and knowledge instead of more “complex problem-solving, decision-making, and value judgments” (Campoy, 1992). These types of implementations have led to studies that find that technology alone does not impact student achievement or produce change (Pearlman, 1989).

Educational institutions are being challenged concerning their use of technology resources. It is not known if the investment in technology will be used to improve and transform education or whether it will simply automatize the current educational system. Dede, as reported by O’Neil
(1995), stated that if technology is “used to enable new models of teaching and learning, models that can’t be implemented without technology, then I think it’ll have a major impact on schools.” The research of the widespread use of laptops and Internet access in an institution of higher education provides valuable information about the impact of technology on the restructuring of education.

**Technology in higher education**

While technology has had a major impact throughout society, its presence in higher education would not be considered to be “widespread or significant” (Spotts and Bowman, 1995, p. 57). Teaching and learning in higher education continues to take place as it has for centuries through the use of the printed page and lecture as the primary sources for learning. Institutions of higher education are traditionally conservative and adopt new ideas gradually (Spotts and Bowman, 1995). However, higher education is being challenged to face a new environment in which technology reduces the need for time and place dependent instruction, where multimedia provides an alternative to the printed page and where student access to information changes the role of the professor (Warnock, 1996).

Technology has a great “potential to provoke fundamental change in our system of higher education” (Wulf, 1995, p. 46). Change will require a reconsideration and a redefinition of the mission of institutions of higher learning. (Wulf, 1995). World-wide networks that facilitate communication across disciplines, geographic boundaries and age levels will alter the way in which education is practiced. This communication will also challenge the assumptions about time and place in higher education (Howard-Vital, 1995), (Wulf, 1995). The role of the faculty member as the primary source of information will be changed as students are given access to information sources around the world (Howard-Vital, 1995). Student expertise with the use of technology may be more advanced than their professors, changing the professor-student relationship (Spotts & Bowman, 1995), (Guaro & Rivinus, 1995). Higher education is just beginning to address the implications of these new technologies. (Wulf, 1995).

The liberal arts institutions of higher education will likely approach the use of technologies from a unique perspective. While all institutions of higher education are concerned with teaching, the primary role of the faculty member at private liberal arts institutions is to teach rather than research. This focus will impact how technology is used in a liberal arts setting. Guardo and Rivinus, (1995) stated that the following guiding principles will be followed as technology is implemented in liberal arts institutions:
• Educational goals will be stressed over technological goals.
• Education needs to remain a relational process involving human interaction.
• Faculty members serving as role models need to continue to be central to the learning process.
• Technology can change teaching and learning by expanding the resources available (pp 24-25).

Wulf (1995) felt that small colleges will be strengthened by the use of technology. He stated that small colleges will be "empowered to provide a broad curriculum through telelocation while retaining the intimacy so valued in our small liberal arts institutions (p. 51)." This view was supported by Guardo and Rivinius, (1995) when they suggested that "the liberal arts and technology can enrich each other without doing violence to traditional values and relevance" (p. 27, 1995).

The potential for the use of technology in higher education is immense. However, to realize this vision, individuals and institutions "need first to understand the reality of the present situation" (Spotts and Bowman, 1995). The study of an early implementation of computer and network technology in a small liberal arts institution can help other liberal arts institutions plan for this new and quickly emerging educational environment.

Diffusion of innovations

If network and computer technology strategies are going to reform liberal arts higher education many changes will need to occur. In the past, innovations in education have been slow to be adopted with actual implementation resulting in limited use of the innovation (Waldrop & Adams, 1988). This reticence or failure in the adoption of even obviously advantageous innovations was not uncommon (Rogers, 1995; Fine, 1984). To effectively use advantageous technological innovations with students, liberal arts colleges will need to understand the diffusion of innovation process among these students.

Diffusion of innovation theory overview

Rogers (1995) defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Rogers stated that "an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption." (p. 11). The process by which individuals make decisions concerning adoption or rejection of an innovation is an "information-seeking and information-processing activity in which the individual is motivated to reduce uncertainty about the advantages and disadvantages of the innovation" (Rogers, 1995, p. 14). The innovation decision process is "the process through which an
individual passes from first knowledge of an innovation to forming an attitude toward use of the new idea, and to confirmation of this decision” (Rogers, 1995, p. 20). Studies have found that as members of a social system adopt an innovation, the diffusion begins slowly with a few individuals and then accelerates as more and more individuals adopt the innovation. Finally the diffusion rate drops off as fewer and fewer individuals remain to adopt the innovation (Rogers, 1995).

**Personal Innovativeness**

Rogers categorized the innovativeness of individuals by their relative earliness in adopting new ideas compared to others. Rogers identified five adopter categories as innovators, early adopters, early majority, late majority, and laggards with innovators being the quickest to adopt and laggards being the slowest to adopt. Rogers then described the attributes that typify individuals in each of the categories. For example innovators were described as “venturesome”, highly interested in new ideas, and “cosmopolite in their social relationships. (Rogers, 1995, p. 263). Laggards were described as “traditional” with almost no communication outside their local environment (Rogers, 1995, p. 265).

Understanding student willingness to adopt to new technologies and the factors that influence that decision can provide insight into the innovativeness of liberal arts students.

**Organizational innovativeness**

For technology to be used effectively by students in liberal arts institutions of higher education, the educational organization must first adopt the innovation. While the diffusion of innovations in organizations is similar to the diffusion of innovation in individuals, it is much more complex (Rogers, 1995). Factors that influence organizational innovation include size, individual leadership characteristics, structure of the organization and external characteristics of the organization (Rogers, 1995). An understanding of the factors that influence the diffusion process within an organization is necessary for the management of the process (Gurbaxani, 1990). Studying how students perceive organizational innovativeness can be valuable as institutions seek to manage the implementation of innovations.

**Innovativeness and technology use in education**

Both individual and organizational innovativeness impact the use of technology in education. Use of technology in education by individuals can be influenced by personal variables such as locus of control, attitude toward computers and technology, motivation, and self-competence (Marcinkiewicz, 1994). Use of technology by educational organizations can be influenced by characteristics such as social status as an academic institution and institutional size (Gurbaxani, 1990). In many organizations the introduction of computer-related technologies has failed (Rogers,
1995). Studying the diffusion of computer-related technology among college students in liberal arts educational setting can provide insight into effective ways to implement technology effectively in this environment.

**Computer anxiety**

Computer anxiety is defined as “the fear or apprehension felt by individuals when they use computers or when they consider the possibility of computer utilization.” (Simonson, Maurer, Montag-Torardi, Witaker, 1987, p.238). According to Maurer and Simonson (1984) a computer anxious person exhibits the follow characteristics:

1. avoidance of computers, and the area where they were located;
2. excessive caution when using computers;
3. negative remarks toward computers and computing;
4. attempts to shorten periods when computers were being used.

Overbaugh and Reed (1992) stated that overcoming computer anxiety is the first step in the effective use of computer based technology to improve learning. This was supported by Häkkinen (1995) who stated that anxiety about computers lowers their efficient use. Overbaugh and Reed (1992) found that experience with computer technology over time reduced anxiety. Kolehmainen’s (1992) study supported Overbaugh and Reed’s conclusion. Kolehmainen stated that computer anxiety is harmful for learning effective use of computers and found that “computer anxiety is reduced because of increased knowledge and experience.” (Kolehmainen, 1992, p. 6). Determining computer anxiety levels of students in this study both before extensive use of laptop computers and network learning and again after several months of experience in this environment provided insight into the diffusion process and the impact of computer anxiety on this process.

**Statement of the Problem**

In the fall of 1996 and in the fall of 1997, Waldorf College began providing its students with laptop computers and network access in the residence halls. While it was one of only a few institutions to provide this opportunity and unique in that it is a small predominantly two-year college with a focus on the liberal arts, many other schools at this time were considering similar technology initiatives. These schools hoped that efforts of this type would have a positive impact on the academic community. How easily available network access and laptop computer resources would be used; and whether they would significantly change or restructure educational environments was not understood.
At the same time it was unknown how students would adjust to and use these technologies. It was not known how personal innovativeness, institutional innovativeness, and computer anxiety would relate to this experience of using technology. A study to investigate this new educational environment in a small liberal arts college and student technology use in this environment was thought to provide insight for schools considering these types of technology initiatives.

Purpose of the Study

The purpose of this study was to provide a comprehensive, in-depth description of the new learning environment provided by easily available network access and computer resources. This study’s results could help other schools implement similar technology projects more effectively and could also provide the background for further study of the use of this type of technology to improve education in higher education.

To develop a usable description, it was necessary to determine how computer and network technology were used to assist in learning at Waldorf College and to ascertain student perceptions about this use. Additionally, it was necessary to determine how the characteristics of personal innovativeness, organizational innovativeness and computer anxiety impacted student use of the network and computer technology. Student reports of technology use patterns and their reflections on its effectiveness were collected. In addition, student perceptions of institutional innovativeness, individual innovativeness and computer anxiety were examined. How these characteristics affected use patterns and diffusion of these innovations was explored. This information was then combined into a description that could be useful to other institutions of higher education.

Research Questions

The following research questions provided direction for the study:

1. What are the computer and network use patterns of Waldorf College freshmen?
2. Are Waldorf College freshmen required to use computer and network technology to complete course work and do they consider this technology use to be a valuable learning experience?
3. How do individual innovativeness and perceptions of organizational innovativeness relate to student use of new technology resources?
4. What influence does computer anxiety have on student use of technology and does computer anxiety decrease through experience with the technology?
5. How do personal innovativeness, organizational innovativeness and computer anxiety relate to one another?
6. What are the differences in use patterns, perceptions of organizational innovativeness, individual innovativeness, and computer anxiety between entering and experienced students?

**Definition of Terms**

**Diffusion**

“Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995, p. 5). This definition given by Rogers will be used in the discussion of diffusion of technological innovation in this study.

**Entering Students**

In this study entering students will refer to the freshmen who entered Waldorf College in the fall of 1997 and who were surveyed before they had the opportunity to use the technology at the college extensively.

**Experienced Students**

For the purposes of this study freshmen who entered Waldorf College in the fall of 1996 and who were surveyed after they had used the technology at the college for one school year will be called experienced students.

**Computer Anxiety**

Simonson, Maurer, Montag-Torardi, Witaker (1987) defined computer anxiety as “the fear or apprehension felt by individuals when they use computers or when they consider the possibility of computer utilization” (p. 238).

**Internet**

“The Internet is a collection of local, regional, and national computer networks that are linked together to exchange data and distribute processing tasks” (Parsons & Oja, 1996, p. 7-4).

**Innovation**

Rogers (1995) stated that an innovation is “an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” (P. 11).

**Network Learning**

Network learning was defined by Reil and Harasim (1994) as a “unique combination of place-independent, asynchronous interaction among groups of people linked by networks” which “enables new educational approaches and new sets of learning outcomes” (p. 92).
World Wide Web

The World Wide Web is “a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents” (Parsons & OJA, 1996, p. 7-17).

Summary

Effective strategies for the use of computer and network technology have the potential to significantly impact higher education. These technologies may help educators rethink the teaching and learning process, resulting in educational reform. On the other hand, expensive technology may do no more than automate the current educational system. It is important to study innovative use of technology in higher education to evaluate the extent to which the vision for its use is being realized.

If computing power and network access are viewed as integral parts of a new learning environment, the study of their diffusion in higher education can aid in the educational restructuring process. Understanding the issues faced as individual students adopt new technology for educational purposes can assist other institutions in the implementation of similar programs.

The purpose of this study was to determine the relationships, and how they change over time, between student perceptions of institutional innovativeness, individual innovativeness and computer anxiety and the diffusion of technologies among students at Waldorf College. An additional purpose was to provide an in-depth description of the learning environment provided by easily available computer and network resources in liberal arts higher education. Chapter two will review the literature related to this study. This review will include literature about liberal arts colleges, technology use in education, diffusion of innovations and computer anxiety.
CHAPTER 2. LITERATURE REVIEW

Introduction

In the fall of 1996 Waldorf College, a small institution with approximately 550 students, began providing all of its full time freshmen students laptop computers and access to the campus network and the Internet from their rooms in the residence halls. Again in the fall of 1997, entering freshmen and returning sophomores were provided with laptop computers and network and Internet access. The students were not involved in the decision to implement this plan. This study looked at student computer and network use patterns and student perceptions of the effectiveness for improving learning of these new technologies. It investigated the impact of this top-down innovation on student perceptions of individual and organizational innovativeness. It also looked at one factor, computer anxiety, that could impede the use by students of this technology.

In this chapter literature that discusses the unique role and recent changes in the role of small liberal arts colleges is reviewed. In addition, to provide a background for understanding the diffusion of laptop and network technology at Waldorf College, literature that discusses the evolving role of technology in education is discussed. This review includes brief discussions of both network and computer learning. Literature related to the characteristics of organizations such as Waldorf College and how they adapt to change is discussed. This is followed by a review of the literature covering individual responses to the diffusion of innovations within an organization. Finally a look at the literature pertaining to computer anxiety and how this might inhibit the use of this technology is given.

The Role of the Liberal Arts College

Liberal arts colleges have a strong tradition in the United States. They developed as part of an emerging nation to support democracy. "The liberal arts college began here as a religious school. In it, the arts of the free citizen - the liberal arts - were subsumed under the religious mission not only of the school but of the society as a whole." (Gerety, 1995, p. 2b). These colleges developed a unique approach to higher education based on their emphasis on undergraduate education, their religious roots, and their belief in good teaching above all else (Breneman, 1990). Through the late nineteenth century, liberal arts colleges defined higher education with nearly 7 out of every 10 undergraduates attending liberal arts colleges (Zemsky, 1995). This dominance began to be challenged as large public and private universities that offered graduate and professional programs, as well as undergraduate programs, emerged (Gerety, 1995). In the following section literature is
reviewed that provides insight into the unique characteristics of liberal arts education. This is followed by a section that discusses the changing role of the liberal arts college.

**The unique characteristics of liberal arts education**

Liberal arts institutions provide a unique approach to education. Zemsky (1995) described liberal arts colleges as "residential, devoted to instruction in a broad curriculum of the arts and sciences" and "designed as a place of growth and experimentation for the young" (p. 2A). Breneman (1990), provided additional characteristics that distinguish liberal arts colleges. He stated that they focus on undergraduate education exclusively and emphasize good teaching above all else. They enroll small numbers of traditional age full-time students who live on campus enabling the development of a sense of community. They focus on liberal education rather than professional training, and the fact that they are private allows them to "inform their mission" with "certain values" (p. 3). These colleges are committed to quality teaching of undergraduates as their primary mission (Zemsky, 1995). These characteristics define the liberal arts institutions.

**The changing role of the liberal arts college**

*Why changes are occurring in the liberal arts colleges*

The higher education environment has changed considerably since the time when 7 out of 10 students in higher education attended liberal arts colleges. Now liberal arts colleges educate only a small percentage of those studying beyond high school (Zemsky, 1995). The literature revealed many reasons for this change. However, changing economic circumstances have been the greatest challenge to liberal arts institutions (Breneman, 1990). These financial challenges come in a variety of forms. Hotchkiss (1995), summarized the key financial challenges to liberal arts institutions as high tuition, escalating financial aid and intense competition for qualified students. Zemsky (1995) stated that there is a "growing gap between the values inherent in a liberal education and the values of a society increasingly preoccupied with immediate returns" (p. 3a). Less students and parents value the unique educational opportunities offered by the liberal arts institutions. This lack of appreciation for a liberal arts education combined with high tuition have caused many parents and students to seek out less expensive options that lead directly to promising jobs and professional careers. At the same time the very nature of liberal arts colleges makes it difficult for them to view the student as a customer or consumer which would enable them to effectively market the liberal arts education. Students and parents as consumers want to be assured that their substantial investment in a liberal education will prove worthwhile (Zemsky, 1995).
While economic challenges were reported as the major reason for changes in the liberal arts colleges, threats to the highly valued liberal arts learning community have also been noted. Zemsky (1995) stated that the attempt of the liberal arts college to see itself as a distinct, self-contained unit is an outdated notion. The liberal arts college is no longer the sole conveyor of knowledge, but must interact with ideas and scholars around the world. The small size and isolation of campuses can serve to discourage the diverse student body desired for effective exchange of ideas and discussion in a liberal education. At the same time many faculty members now have spouses who work and live at a distance from campuses. These factors restrict their ability to participate in the campus community. 

What changes are being made?

A need for change in liberal arts colleges, brought on by societal and economic challenges, was noted by several sources. The Great Lakes Colleges Association (1994) stated that “the strategies of the past are insufficient for the present and inadequate for the future” (p. 3). Hotchkess (1995) suggested that “the issue is not whether educators are going to reshape private liberal arts education, but rather when and to what degree” (p. 20). Liberal arts colleges are exploring a variety of new approaches to fulfill their mission. Many have begun to offer both graduate and professional degrees which diverges from the true liberal arts mission. Breneman (1990) stated that these institutions have become small universities. Other liberal arts colleges have chosen to limit the number of programs that they offer allowing for a more targeted market strategy to reduce expenses. Some colleges have developed partnerships to share resources reducing the cost of low enrollment courses (Hotchkiss, 1995). Most have developed sophisticated marketing programs to reach out to prospective students. In these marketing efforts many schools stress a commitment to the traditional liberal arts value of quality faculty and teaching. At the same time financial aid programs have been revised to attract top quality students (Zemsky, 1995; Great Lakes Colleges Association, 1994).

While technology has not been a traditional part of the liberal arts education, recently it has been seen as one way to effectively improve liberal arts education and to make this education more attractive to perspective students. Guardio and Rivinius (1995), in a discussion of technology in the liberal arts, concluded that “the liberal arts and technology can enrich each other without doing violence to traditional values and relevance (p. 27). Sisson (1995) proposed that liberal arts colleges must put more energy into the use of learning technologies. He stated that becoming leaders in the use of technology for learning could make the liberal arts colleges more competitive for students and would take advantage of the liberal arts colleges’ understanding and commitment to undergraduate education. Smith (1994), argued that technology skills are a necessity for the liberal arts experience.
He stated that "no self-respecting scholar can do serious work today without using an array of high-tech tools" (p. 26). He concluded that technology skills would enhance, not inhibit, the liberal arts focus on critical thinking and value judgments. Technology enabled connection to the outside world was also noted as an advantage to liberal arts colleges. Wulf (1995) envisioned "small colleges being empowered to provide a broad curriculum through telelocation while retaining the intimacy so valued in our small liberal arts institutions" (p. 51).

Is preservation of liberal arts colleges important?

Changes in liberal arts colleges are inevitable and have resulted in redefinition of the mission of the liberal arts colleges. However, in most cases these changes have not destroyed the traditional values of the liberal arts institution. The literature suggested that maintaining this liberal arts tradition is very important to American higher education. Breneman (1990) stated that one of the strengths of American higher education has been its diversity. Loss of the liberal arts approach to education would significantly reduce this diversity. Zemsky (1995) suggested stronger reasons for the survival of the liberal arts institution. He stated that the liberal arts institutions have served as an example of exemplary undergraduate education for all of higher education. At the same time he suggested that in a world of change, the liberal arts broad-based, analytical approach to education is especially needed. Failure to maintain the liberal arts approach to thinking and learning in a changing world would be detrimental to all of higher education. This proposition is supported by Synodinos (1995) when he stated that "no single discipline is sufficient to foster the breadth of understanding and thought needed to be effective in today's world" (p. 7B). Maintaining the liberal arts approach to education is important to the future of American higher education.

Summary of the role of the liberal arts college

The liberal arts institutions' unique approach to education has focused on undergraduate education that takes place in a community in which faculty and students live and learn together. The curriculum is broad-based, stresses critical thinking, and focuses on the development of values. Quality teaching and interaction between students and teachers are at the heart of the liberal arts education. This approach to education has been challenged as parents and students seek more specific education that will lead to employment. Liberal arts colleges are challenged financially as more and more students chose less expensive options. These colleges have explored a variety of alternatives to compete in today's higher education environment. Use of technology to support the traditional liberal arts educational experience has been one approach explored. Preservation of liberal arts education is important for American higher education. The focus on undergraduate teaching can
be used as an example for other institutions of higher education. The literature reviewed above provides the background for the study of technology use to improve liberal arts education and attract students in a small college.

**Technology Use in Education**

As small liberal arts colleges explore new ways to fulfill their educational missions, they are also challenged by the expanding use of technology in education. This challenge comes not only from the change in the role of the liberal arts institution, but also from rapid advancement in both computer and networking technology. These advances provide resources and capabilities never before available to educators. The part these technologies will play in the evolving role of the liberal arts institution is still being defined. In this section literature is reviewed that looks at the role of computers and networks in education. Then literature is examined that looks at trends in the use of technology in higher education, technology trends in small liberal arts colleges, and trends in the use of laptop computers in higher education.

**The role of computer and network technology in education**

Evolution and development of technology has transformed much of society over the last 50 years. Education is also undergoing change as a result of this technological development. Driving this change is a steady improvement of the technology in five key areas. These areas include: "increased processing speed, greater memory capacity, miniaturization, decreased cost, and increased ease of use" (Odvard & Kinnaman, 1994, p. 92). Improvement in each of these areas is leading to a convergence of computer, communication, and television technologies. This convergence will provide educators with capabilities for technological environments such as global telecommunications, networked real-time hypermedia, and powerful microworlds never before available in education (Odvard & Kinnaman, 1994). It is suggested that this technology will bring about fundamental changes in higher education. In the following two sections material is reviewed that provides both a vision and a framework for categorizing the role of computer and network utilization in education.

**Computer learning**

The rapid growth in the power and availability of computers in higher education has caused considerable discussion about the role of the computer in education (Spotts & Bowman, 1995). While it has been shown that students can learn effectively from computers (Salomon & Gardner, 1986), the focus of recent research has been on the instructional approaches in the use of the computer and on the computer environments that support learning, rather than on the computer itself.
Taylor (1980) categorized computer use in education as:

1. Tutor - The computer, that has been programmed by experts in a subject, presents information, the student responds, the computer evaluates the response and then determines what to present next.

2. Tool - The computer is used by the student to help them accomplish a task. An example of this would include using the computer to assist in the writing process through the use of a word processing.

3. Tutee - As a tutee the computer is tutored by the student. For this to happen the student must learn to communicate to the computer. Students gain better understanding of their own thinking by programming the computer.

Simonson and Thompson (1997) expanded on Taylor's taxonomy of educational uses of the computer. Their categories are as follows:

1. Drill and practice - The computer presents a problem for students to respond to, then gives immediate feedback and advances to another appropriate problem.

2. Tutor - As described above the computer tutors the student.

3. Simulation - The computer models some reality allowing the student to experience the reality through the computer.

4. Problem solving - Using the computer for problem solving is similar to using it for simulation. The computer allows students to manipulate the environment and receive feedback.

5. Tool - As described above the computer is used as a tool to assist the student in the completion of a task.

Thomas and Boysen (1984) focused on the learner's role and the learning goal in the process of learning with computers. They provided the following taxonomy for educational activities with computers.

1. Experiencing - The computer models a concept or a subject area allowing students to experience the concept before it is formally presented. The experience sets the stage for more formal instruction.

2. Informing - The computer provides an instructional experience giving initial formal exposure to a topic or concept. This could be considered similar to a tutorial.
3. Reinforcing - The computer provides reinforcement of specific learning objectives after formal instruction. Using the computer for drill and practice would be considered a form of reinforcement.

4. Integrating - Integrating activities provide the opportunity for the student to "apply previous learning to new situations as well as to associate previously unconnected ideas." (p. 16).

5. Utilizing - Concepts and processes that have been learned can be incorporated into a computer program and used as a tool by the student.

Recent trends in the use of computers in education focus on uses of the computer that develop cognitive and metacognitive thinking strategies in students (Jonassen, 1996; Papert, 1993). Jonassen (1996) suggested that using the computer as a tool can assist in the development of cognitive and metacognitive thinking strategies. Papert (1993) suggested that computer microworlds can mirror student thinking, allowing them to test and debug their own thought processes. This use of the computer for the development of metacognitive skills is evolving. Finding effective ways to utilize this approach will continue to challenge educators throughout higher education.

*Network learning*

The Internet, World Wide Web resources and the number of Internet and Web users are expanding rapidly (Ackermann, 1995; Carmona, 1996). In higher education, professors, graduate students and undergraduate students are taking advantage of this expanding environment to access information and to communicate with others (Roiger, 1995). This emerging educational climate represents a new learning paradigm: network learning (Harasim, 1994). Network learning provides a "unique combination of place-independent, asynchronous interaction among groups of people linked by networks" and "enables new educational approaches and new sets of learning outcomes." (Riel & Harasim, 1994, p. 92). The educational features and potentials of this new network learning environment have been categorized and described in a variety of ways.

Dede (1996) described four educational uses enabled by network learning. They are listed and described below:

1. Knowledge webs - Dede stated that "knowledge webs enable distributed access to experts, archival resources, authentic environments, and shared investigations" (p. 25). Through network learning students and teachers can access experts not normally available to them. In addition, they are able to use search engines to navigate through large amounts of
archival resources. Both of these features enable shared investigations and connection to authentic environments outside of the classroom.

2. Virtual Communities - Virtual communities “provide support for people who share common joys and trials” (Dede, 1996, p. 26). Dede sees these communities as providing opportunities for isolated students to receive feedback as they struggle to make sense of complex data. He also sees them as a way to involve families in their children’s education and for providing peer tutoring opportunities.

3. Synthetic Environments - Synthetic environments can extend a student’s experiences beyond what is encountered in the real world. Simulations can allow students to interact with models of reality to provide insight into the concepts and workings of the environment.

4. Sensory Immersion - Improved high performance computing and communications environments will enable learners to experience “sensory immersion” in artificial realities. Using computerized clothing and a head mounted display the student will feel the inside of an environment rather than viewing it from a computer monitor. “Using sensory immersion to present abstract, symbolic data in tangible form is a powerful means of attaining insights into real world phenomena” (Dede, 1996, p. 28).

Riel and Harasim (1994) organized the characteristics of the new network learning environment into the two categories of collaborative learning and information network retrieval. Collaborative learning was further divided into the following capabilities:

1. **Cross-classroom collaborations** link geographically diverse classrooms for information exchange and group activities.

2. **Teleapprenticeships** (apprenticeships, mentorships) are arrangements in which students communicate with experts or with others who have agreed to serve as mentors.

3. **Telepresence** - Network capabilities can be used to bring students to places geographically separate from the classroom. This allows students to “look over the shoulders” of researchers around the globe.

4. **Professional development** - Networking resources can be used by teachers to exchange professional ideas with others and participate in professional organizations on-line.

5. **On-line course delivery** - Networks are used to deliver both credit and non-credit courses. Typically, these are university-based courses targeted for adult students.
6. Distance network teaching has been revitalized by network learning. Computer conferencing encourages student interaction and collaborative learning. These strategies have not been easily available to the distance educator in the past. Information network retrieval was the second category used to describe the network learning environment suggested by Riel and Harasim (1994). This category was divided into the following:

1. **Data base and archived information** access is provided by network resources. Network interfaces allow for seamless connections among computers and networks world-wide.

2. **Human information sources** - Many people make themselves available on networks as information providers. They will respond to requests for information or advice (1994). Berenfeld (1996) identified the new network learning environment as an “infosphere”. He proposed five general educational functions of the infosphere:

   1. **Tele-access** is the use of on-line resources to tap into information around the world. Berenfeld indicates that this type of information is “real-world oriented” and nearly unlimited.

   2. **Virtual Publishing** provided by World Wide Web capabilities gives all classrooms the option to publish. This allows them to develop multimedia documents that reach audiences beyond their own communities. This again provides students with an authentic activity.

   3. **Tele-presence** - Berenfeld’s tele-presence category is similar to the category of the same name proposed by Riel and Harasim. He suggested that students can experience events at remote sites such as ecological disasters or experiments.

   4. **Telementoring** - “With telecommunications, mentoring becomes a rich and viable teaching option. Many sites on the Internet, such as professional groups and bulletin boards, are responsive to student inquiries. By serving as mentors, scientists and scholars can answer questions and provide classrooms with resources beyond textbooks and the individual teacher’s expertise.” (p. 79).

   5. **Tele-sharing** enabled by e-mail, chat groups and bulletin boards allows the communication of “resources, ideas, experiences, data and findings.” (p. 76). In this environment of cooperative learning and sharing students are challenged to think analytically as they compare information.

The educational features and potentials suggested by the authors above, ranged from simple e-mail communication to Dede’s vision for artificial realities. However, all of the envisioned
potentials for network learning included two common themes: easy access to data bases and archived resources, and improved and accessible communication with others. This included communication between students and other students, teachers and students, experts and teachers and students, mentors and students, and between classrooms. This vision of communicating, sharing, accessing, experiential learning, and authentic learning as facilitated by computers and networks suggested a new approach to education. This new learning environment may be especially advantageous to small liberal arts institutions, however the impact it will have on these colleges is still evolving

**Trends in the use of technology in higher education**

While much of society has been significantly impacted by technological advancements, higher education has been slower to utilize new technology. Institutions of higher education have traditionally been conservative and adapt more slowly, with the lecture and the printed page still the primary sources of learning (Spotts & Bowman, 1995). Tate (1995) stated that higher education was a late adopter of these major technologies. Higher education is being challenged to redefine its approach to teaching and learning by the advantages provided by both computer and network learning (Wulf, 1995). Recent trends in technology use on campuses indicate that institutions of higher education are beginning to address the changes encouraged by these new technologies. In the following section literature is reviewed that illustrates the trend to adopt new technologies on campus. It includes statistical information about campus computer and network facilities and some studies that indicate an interest in this growth.

A comprehensive look at trends in the use of computer and network technology on college and university campuses was provided by Green's (1996) and Green's (1995) National Survey of Desktop Computing and Information Technology in Higher Education. A variety of descriptive statistics related to computer technology were reported. Almost 10% of all institutions required or strongly recommended microcomputer ownership for all of its students. This was up from 6.5% the preceding year. When compared to public institutions, a higher percentage of private institutions, required or strongly recommended computer ownership for all students. Of the schools that required or strongly recommended computer ownership, over 25% recommended laptop computers. This was up over 5% from the 1995 study. Other information related to computer access on campus indicated that computers are more available to students and faculty. In 1996 there were 5.8 students per computer on all of the campuses, while in 1995 there 6.5 students per computer. Private institutions were significantly lower than public institutions in the number of students per computer. In 1996, approximately 32% of students and 55% of faculty in higher education had their own computer. This
was a slight increase over the approximately 30% for students and 53.5% for faculty reported in 1995. These statistics demonstrate a significant and growing presence of computers in higher education.

According to Greens' studies, network access has also increased across the nation's campuses. For example approximately 94% of all campuses had access to the Internet in 1996 compared to 90% in 1995. The 1996 survey also showed that 67% of undergraduates had access to the Internet compared to 60% in 1995. Almost 85% of campuses had a campus network backbone, compared to 76% in 1995, indicating significant growth. It is interesting to note that public institutions led private in both Internet access and campus-wide network backbone implementation. Access in student dormitories has also increased significantly. In 1995, 25% of all institutions had network access in the dormitories, while in 1996 approximately 40% of campuses reported network access in the dormitories. This notable growth in access in student dormitories is one indication of the trend to provide greater access to students.

Beyond hardware issues, Green (1996) reported on issues related to the integration of the technology on campuses. Green noted that integration of technology into instruction and the related issue of user support were the two most important information technology issues facing higher education. Green's data indicated that rising demands from students, and demand created by the evolving technology, have placed additional pressure on institutions of higher education to integrate this technology into instruction. Some indication of this increased demand included use of e-mail, presentation handouts, multimedia, and World Wide Web materials. Green reported that the percentage of college classes that use electronic mail rose from 20 to 25% and the percentage using presentation handouts rose from 15% in 1994 to 28% in 1996. Use of multimedia rose from 4% in 1994 to 12% in 1996, and use of World Wide Web resources grew from around 3% in 1994 to 9% in 1996. While these areas showed significant growth, two areas displayed little or no growth. It was interesting to note that use of commercial courseware and use of simulations showed almost no growth from 1995 to 1996.

A variety of research has looked at the increased use of technology in higher education, which was demonstrated by Green's descriptive studies. For example Spotts and Bowman (1995), conducted a study that demonstrated an interest in increased technology use on campuses of higher education. The purpose of their study was to investigate university faculty members' level of experience and knowledge in instructional technology. To conduct the study a survey was developed and sent to 696 full and part-time faculty members at Western Michigan University. Three hundred
and six of the surveys were returned. Faculty reported levels of technology knowledge and experience were similar. Word processing was ranked as the computer application that faculty members had the most experience with. Seventy-three percent of faculty reported good to expert experience with word processing. This was followed by spreadsheets with 34% of the faculty indicating good to expert experience. Thirty-one percent of the faculty reported good to expert experience with statistical computing and 31% also indicated good to expert experience with electronic mail. Other technology reported for which faculty reported good to expert experience were as follows: computer-assisted instruction at 18%, computer conferencing at 13%, presentation software at 12% and finally multimedia at 8%.

This study also asked faculty to report which technologies were used in teaching. Word processing was used at least weekly in teaching by 55% of the faculty surveyed. Other technology reported to be used at least once a week for teaching were as follows: computer spreadsheets at 19%; electronic mail at 16%; computer assisted instruction at 13%; and statistical computing at 12%. Computer conferencing, presentation software and multimedia were used once a week for instruction by less than 10% of the faculty. While use of technology in teaching was not high, except for word processing, 65% of faculty rated instructional technology as important to critically important to their teaching. However, only 42% reported that it was moderately to highly likely that they would use a new instructional technology this year. While they viewed technology as important to their teaching, many would not immediately use a new instructional technology.

As reported by Green (1996), use of computer and network technology is increasing on college and university campuses. The study by Spotts and Bowman (1995) gave some indication of how the technology is being used and the extent of this use on the college and university campus. These studies pointed to the trend of increased use of technology in higher education.

**Trends in liberal arts colleges**

The interest in bringing technology to the campus goes beyond the large universities. Small liberal arts colleges are also looking to technology as a way to improve education and to fulfill their unique role in higher education. Green’s (1996) descriptive study found private colleges leading universities in technology use in several areas. Green found that more private institutions required or strongly recommended computer ownership and that there was a lower student to computer ratio at the private colleges when compared to public universities. Green also found that more private institutions had network access in the dormitories. Greater computer and network access on the
private liberal arts college campuses is an indication of the growing trend to use technology in these environments.

While there is a growing trend in the use of technology in higher education, small liberal arts colleges will differ in their use of technology from large public universities. Guardo and Rivinius (1995) reported on the efforts of the Great Lakes Colleges Association to address technology in the liberal arts. Members of the Great Lakes Colleges Association are 12 four-year, private, residential colleges of liberal arts and sciences. A limited survey of faculty technology initiatives was conducted among the 12 member institutions of the association. Faculty members were asked in a newsletter to submit reports on their projects, and additional faculty projects were suggested by academic deans and directors of computer services. Guardo and Rivinius observed that while there were a few more initiatives in math, physics, psychology, computer science and chemistry, all disciplines were represented in the projects. It was also noted that almost all faculty involved in technology projects were using e-mail and bulletin boards for communication. The authors provided several examples of individual projects focusing in areas ranging from music to chemistry. They summarized the efforts by stating, “there is a vibrant and growing dedication of faculty members’ time, energy, and interest in reshaping their teaching and curriculum to foster student learning through the use of technology” (p.25). Liberal arts colleges are recognizing the potentials offered by increased technology in higher education.

Barboni (1993) studied the use of information technologies in independent, liberal arts colleges. Barboni’s findings again indicated an interest in the implementation of technology in private liberal arts colleges. Barboni’s study was sponsored by the Council of Independent Colleges (CIC). A survey form was returned by 119 out of the 311 CIC members. A variety of information was gathered ranging from information about strategic technology plans to information about computers available to students.

Barboni found that students attending the private colleges in the study had significantly more computer access than students at public institutions. Barboni noted that this difference appeared to be growing. The difference was still evident in Green’s 1996 study. Barboni also noted that his research found a trend to place computers in the residence halls of private liberal arts institutions. Green also noted this trend in 1996.

In reporting faculty access to computers Barboni stated that only 23% of the institutions reported that three-quarters of their faculty had exclusive access to a microcomputer. This appears to be an area in which there has been considerable growth since Barboni’s 1993 study. Green (1996)
found that approximately 60% of faculty members at all four-year private institutions had access to their own computer. Another area of growth between 1993 and 1996 was shown in a report of access to the Internet. In Barboni's (1993) study 27% of the institutions had access to the Internet. In Green's 1996 study, over 93% of the institutions had access to the Internet. Barboni stated that the Internet access may be especially beneficial to the small liberal arts college by providing access to vast quantities of information and individuals around the world.

In Barboni's 1993 study it was found that three-quarters of the responding schools had at least some of their faculty using computer software in the classroom. Approximately half indicated that between and 29% of their faculty used computers in the classroom and about 12% indicated more than half their faculty did. It is quite likely that a more recent study of these institutions would show much greater integration of the computer into the classroom. While Barboni's 1993 report is dated in its information it provided evidence of growth and interest in the use of technology, specifically, in the liberal arts colleges.

Recent literature has provided information about work being done at small liberal arts institutions. This has indicated current interest in the use of technology at small liberal arts institutions. For example Gettysburg College, a small Lutheran residential liberal arts college of 2,000 students located in Gettysburg, Pennsylvania, began a program using the World Wide Web to foster collaborative learning among its freshmen. (Wagner & Wilson, 1995). The goals of the program were to promote "a mastery of basic library and computer skills, a familiarity with Internet resources, a focus on technology, and an integration of this technology into the classroom and the residence hall experience" (p. 184).

Teams of freshmen students chose and researched a theme and then developed Web pages to support their findings. They were encouraged to include graphics, sound, personal reflections and links to other pages of interest. While there were some problems with student training and support in the development of Web pages, the program was considered a success. Students developed extensive computer skills, became adept at searching the Internet for resources, and used e-mail extensively to communicate with team members. Wager and Wilson suggested that the goal of integrating technology in the classroom and residence hall experience had been achieved.

Another example of recent literature focusing on technology use in small liberal arts colleges, was a reported by Greenhalgh (1997) on the use of the Internet at Georgian Court College in Lakewood, New Jersey. Georgian Court College had limited technical and financial resources until recent years. Federal, state, and corporate grant money allowed recent expansion which
included connection to the Internet, establishment of a multimedia lab and computers for full time faculty members. Approximately 25 workshops were held with faculty members grouped into the workshops based on their past computer experience. Follow-up workshops were developed that concentrated specifically on using the Internet in the classroom. Greenhalgh reported that the training and the technology have had a significant impact on the campus with technology applications beginning to be integrated into a variety of courses. Specific projects in using the Internet in the classroom were developed for several courses including Research Methods in Social Work, Introduction to Teaching, Aquatic Biology, Conservation Ecology, Principles of Ecology, and a course in meteorology.

One final example of the recent interest in technology at small liberal arts colleges was reported by Karayan and Crowe (1997) at California Lutheran University in Thousand Oaks, California. California Lutheran is a liberal arts institution of 1200 undergraduate students. The campus was completely networked with individual residence hall rooms having network connections (California Lutheran University Home Page, 1997). All students and faculty were given e-mail and Internet access.

Karayan and Crowe's study on student perceptions of electronic discussion groups again illustrated a growing interest in technology use on liberal arts campuses. The purpose of the study was to determine if student behaviors changed as a result of their participation in an electronic discussion group. They believed that "the convenience of interaction, the provision for different kinds of learning, and the opportunity to 'think through writing' would be evidenced in changes in student behaviors" (p. 70). In the fall of 1996 electronic discussion groups were required as part of the course work for eight professors. Ninety-six students in these courses were surveyed. The surveys asked students to compare their behavior using electronic discussion groups to their behavior in a traditional classroom. They were asked to respond as either more likely, less likely or no difference to behaviors such as "Ask a teacher a question". Because the surveys were administered in class, all the surveys were returned.

The study found that for the most part electronic discussion groups encouraged desired behaviors or made no difference. For example, 42% of students said they would be more likely to ask a teacher a question using electronic discussion groups. Fifty-two percent indicated it made no difference and only 6% stated they would be less likely to ask a question. Fifty-seven percent of the students said they would be more likely to answer a teacher-asked question with electronic discussion groups. Thirteen percent said they would be less likely and 30% said it would make no
difference. When asked about developing positive relationships with peers 59% of the students indicated that they would be more likely with electronic discussion groups. Thirty-four percent said it made no difference and 7% said they would be less likely. This study again illustrated a strong interest in computer and network technology on liberal arts college campuses.

Computer and network technology are playing an increasing role in the liberal arts colleges. Guardo and Rivinius (1995) discussed efforts made at liberal arts colleges to incorporate the use of technology into their curriculums while at the same time maintaining the unique role these colleges play in higher education. Barboni (1993) and Green (1996) gave descriptive information that showed the growth in technology and integration of technology on these liberal arts college campuses. The examples that discussed technology initiatives at Gettysburg College, Georgian Court College and California Lutheran University provided further evidence of the growth in technology in liberal arts institutions. Liberal arts colleges are looking to technology to fulfill their unique, yet changing missions.

Trends in the use of laptop computers in higher education

As reported by Green (1996), use of computer and network technology has been increasing on college and university campuses. As seen in the studies reviewed in the previous section, there was also increased interest in technology use on the campuses of liberal arts institutions. While literature about increased technology use in higher education was readily available, there was very little literature about providing students with laptop computers. Most of the literature related to laptop use was located through electronic sources. The review of the literature that follows, provides an overview of a trend to provide students with laptop computer resources that is just beginning in higher education.

The University of Minnesota in Crookston was one of the first institutions to begin providing students with laptop computers. The University of Minnesota in Crookston is a public university that is approximately 25% residential. In 1992 they began to make the transition from a two-year community college to a university offering technical baccalaureate programs. As part of this initiative, they began offering all full time students laptop computers in the fall of 1993. Full time faculty were also given laptop computers. At the same time classrooms, labs, the library, and the residence halls were wired and connected to the campus network. All students were required to take a course called Introduction to Information Technology which gave students instruction in the use of the computer, application software and Internet access. An Instructional Technology Center was
developed to support faculty development, teaching, and research. (University of Minnesota. Crookston Home Page, 1997; Sargeant, 1997; Morken, 1997)

A descriptive study of the impact of the laptop computers at the University of Minnesota Crookston was conducted by Sargeant (1997). The survey was administered to all students enrolled in a second period class at the institution. The study found that almost 9 out of 10 students reported benefits associated with using laptop computers. Ninety-three percent of students surveyed felt that the laptop computers helped build career skills. Eighty-five percent agreed that the computers helped improve their information gathering skills. Seventy-five percent reported an increase in the amount and quality of learning, while 78% felt the computers enhanced their ability to learn. The study also reported on student use patterns. E-mail was the most popular application with 82% of the students using e-mail. Other highly used applications included writing papers, completing assignments and entertainment.

A descriptive study of faculty perceptions was also conducted by Sargeant (1997). Faculty members completed a survey form that asked them to assess the impact of the laptop initiative. Ninety-one percent of the faculty felt that the laptop computers expanded learning opportunities for students and 88% felt they expanded communication between faculty and students. Sixty-eight percent felt the laptop computers improved flexibility in class assignments. While specific changes were not noted, 78% of faculty members felt the laptop environment changed their teaching method. The highest use of the laptops computers by faculty was reported as word processing at 99%. E-mail was next at 96% while 56% of the faculty reported using their laptops for presentations. These results along with the results of the student survey indicated extensive use of the network and laptop computers at the University of Minnesota, Crookston.

Another institution that has begun to provide students with laptop computers is Valley City State University of Valley City, North Dakota, an institution of 1,100 students (Valley City State University Home Page, 1997). In the spring of 1996 all full-time faculty were given notebook computers, with all full time students receiving laptops in the fall of 1996. During this period of technology growth, the campus network was expanded, a help desk was created, faculty received technology training, and 17 classrooms were renovated into multimedia classrooms. This technology has been integrated into courses in all disciplines offered on the campus.

Holleque, a Professor of Education and Psychology at Valley City State University, administered surveys at both the beginning and the end of the fall 1996 semester to 128 students who were enrolled in General Psychology. Almost all of the students were incoming traditional age
freshmen. Students were positive about having their own computers. Ninety-two percent reported either a mostly positive attitude or entirely positive attitude about having their own computer. At the beginning of the semester 39% of the students indicated some apprehensive about using their computers. At the end of the semester students indicating apprehensive had dropped to 2%.

Students also reported an increase in computer, e-mail and Internet knowledge. At the beginning of the semester 69% of the students indicated some, very much or a great deal of knowledge about computers. By the end of the semester 99% of the students were in one of these three categories concerning computer knowledge. There was even greater growth in reported e-mail and Internet knowledge. At the beginning of the semester 36% indicated some, very much or a great deal of knowledge of the Internet. At the end of the semester 98% of the students chose one of these three categories. E-mail knowledge growth was similar growing from 37% reporting some, very much or a great deal of knowledge to 98% at the end of the semester.

Students were also asked to report their anticipated use of their computers at the beginning of the semester and actual use at the end of the semester. Fifty-four percent anticipated that they would often or very often use their notebook computers on a daily basis. In contrast, by the end of the semester 84% reported often or very often daily use of their notebook computers. Students quite accurately predicted in-class computer use. Eighty-three anticipated that they would use them occasionally, often, or very often. Actual use reported at the end of the semester reported that 86% of the students used the computers either occasionally, often, or very often during class time. While 82% of the students anticipated that they would use their computers outside the classroom for course work at least occasionally, 90% of the students reported at least occasional use for course work outside the classroom (Valley City State University Home Page, 1997).

Along with the University of Minnesota, Crookston and Valley City State University in North Dakota, a few other institutions of higher education were beginning to provide laptop or notebook computers to their students. Some provided the computers for only certain majors. For example Acadia University of Nova Scotia provided laptops for students majoring in business administration, computer science and physics in the 1996-1997 school year. (Acadia University Home Page). Columbus State Community College provided laptops for accounting, health, and information technology majors. (Valley City State University Home Page). Other institutions have phased in distribution of laptops for students over time. Wake Forest University conducted a pilot laptop project during the 1995/1996 school year. During the 1996 and 1997 school year their 925 freshmen were provided with laptops. In the 1999/2000 school year all of their students will be
supplied with laptop computers (Wake Forest University Home Page). Northwest Missouri State University has also begun to phase in laptop access for faculty and students. A pilot of 90 students and 15 faculty was initiated during the 1995/1996 school year. This was increased to 350 students and 75 faculty during the 1996/1997 school year. This phased in program will eventually grow to include all students and faculty (Valley City State University Home Page).

There are a limited number of small liberal arts colleges the have begun to provide students with laptop computers. Sacred Heart University a small Catholic institution located in Fairfield, Connecticut provided approximately 550 of its new students with laptop computers during the 1995/1996 school year. This program continued providing laptops the following school year for all new students. (Sacred Heart University Home Page, 1997). Houghton College, a liberal arts college of the Wesleyan Church with approximately 1,200 students, planned to provide students with laptop computer access during the 1997/1998 school year. They have also enhanced their campus network and provided network access in dorm rooms (Houghton College Home Page).

Based on the available literature, the trend to provide students access to laptop computers has just begun. The University of Minnesota in Crookston was one of the first institutions to develop a program of widespread distribution of laptops to faculty and students. Other institutions have also begun laptop computer programs. Some provide laptops for only certain majors, while others have begun to phase laptop distribution to students over a period of several years. Laptop computers programs for students in liberal arts colleges were limited. Studies on the implementation of these laptop initiatives were limited with only two descriptive studies located. These studies indicated students were very positive about the use of the laptops and that the laptops were used extensively. Both student and faculty perceptions indicated that it was felt that the laptop computers expanded and improved the learning environment.

Technology use in education summary

The literature related to the use of technology in education reviewed in this section suggested that advances in both communication and computer technology are providing educators with capabilities never before available. It was suggested that both computers and communication technology can be used in a variety of ways to enhance education. Recent trends in the use of computers in education have focused on instructional strategies and on developing cognitive and metacognitive thinking strategies. Potentials for network communication have centered around ease of access to large amounts of data and improved and accessible communication with others. Higher
education has been challenged to redefine its approach to both teaching and learning by the capabilities offered by computer and network learning.

The literature suggested that there is a growing presence of computers and network access in higher education. More institutions are requiring or strongly recommending computer ownership and the number of students per computer on the college campus is decreasing. Private institutions have the lowest student to computer ratio and more often require computer ownership than public institutions. Almost 95% of all campuses have Internet access. Campus networks are growing with network access in dormitories increasing the most rapidly in recent years. Along with the growth in the availability of computer and network resources, integration of these resources into higher education has also increased. There has been increased use of e-mail, presentation handouts, multimedia and World Wide Web materials in college campuses in recent years.

Research reviewed in this study showed an increased interest in the use of technology in higher education in both public and small liberal arts institutions. Example studies that looked at attitude toward technology use, and faculty knowledge of and experience with technology illustrated increased interest in the use of technology in higher education. The research indicated that liberal arts colleges are also recognizing the potentials offered by technology in education. The study by Guardo and Rivinius (1995) examined the liberal arts institutions' unique approach to using technology in education. Studies at Gettysburg College, Georgian Court College and California Lutheran University demonstrated current interest in the use of technology at small liberal institutions.

While there were many indications of increased interest and increased availability of technology in higher education, access to laptop computer resources have been much more limited. Only a few institutions have developed a laptop computer program for their students. Most of these are larger public institutions with only two small liberal arts colleges indicating laptop programs. A study of the impact and issues of laptop and network use by students at a small liberal arts college will provide valuable information about the process and educational effectiveness of such a program.

**Diffusion of Innovations**

As the unique role of small liberal arts colleges evolves to meet the demands of society and as emerging educational technologies are implemented, change is inevitable. As early as 1975, Sieber noted that change in education is accelerated by the "explosion of knowledge and expansion of the knowledge industry" (p. 75). Since this time, the rapid advancement of computer and network technology have only increased the demand on education to adapt to this new environment (Odvard
In this section, literature is reviewed that provides theory, concepts, and terminology for diffusion of innovation research. In addition, literature pertaining to both organizational and personal innovativeness is reviewed.

**Diffusion of innovation theory**

Literature that discussed the diffusion of innovations is prevalent. Rogers' comprehensive study of the diffusion of innovation process, summarized in his 1995 book, *Diffusion of Innovations, 4th edition* and its previous editions, has been frequently cited by researchers studying the diffusion of innovations (Abou-Daga & Herring, 1995; Baldridge & Deal, 1975; Car. 1985; Gurbaxani, 1990; Granovetter, 1978; Kovel-Jarbe, 1996; Walton, 1987). His definitions, descriptions of the diffusion of innovation elements, adopter categories, and terminology have dominated the literature’s discussion of the diffusion of innovations. For this reason, Rogers' (1995) theory has been summarized and used as the basis for the discussion of the diffusion of innovations in this study.

Rogers (1995) described an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (p. 11). Rogers defined diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Rogers identified the four key elements of diffusion as “the innovation, communication channels, time, and the social system” (p.10). Each of these elements can be found in every diffusion of innovation research project. According to Rogers (1995), the innovation-decision process is the “process through which an individual passes from first knowledge of an innovation to forming an attitude toward use of the new idea, and to confirmation of this decision” (Rogers, 1995, p. 20). The five main steps of this process included “knowledge, persuasion, decision, implementation and confirmation” (p. 20).

The degree to “which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system” was called innovativeness (Rogers, 1995, p. 22). Rogers used 5 classifications to categorize the innovativeness of individuals or other units of adoption. They included innovators, early adopters, early majority, late majority and laggards. Innovators have the shortest innovation-decision process while laggards have the longest. Innovators were described as “venturesome” and always interested in new ideas. Early adopters are highly respected and an integral part of their community. They are looked to by their peers for advice and information. Rogers described the early majority group as “deliberate” (1995, p. 264). They typically deliberate for a period of time before adopting a new idea. The late majority individuals or units are
“skeptical” and cautious about new innovations. They do not adopt new ideas until most others in the community have adopted them. Finally laggards were described by Rogers as “traditional”. Typically they have almost no outside contact and make decisions based on the past. They often have very limited resources which they are not willing or unable to risk. They are the last to adopt a new idea.

Using Rogers definitions and concepts as a base, the following review of the literature has been broken into two main sections. In the first section literature related to innovativeness in organizations is reviewed. In the second section innovativeness as it related to individuals discussed

Organizational innovativeness

The ability of an educational organization to adapt to change is becoming increasingly important in the new learning environment provided by computer and network technology. While much diffusion of innovations research has focused on the individual, an individual often cannot adopt an innovation until the organization has first adopted it (Baldridge & Deal, 1975: Rogers, 1995). An organization was defined as “a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labor” (Rogers, 1995, p. 375).

Attributes of an organization included predetermined goals, prescribed roles, authority structure, rules and regulations, and informal patterns (Rogers, 1995).

Research on the organizational diffusion process initially distinguished between the characteristics of highly innovative organizations versus less innovative organizations by looking at a large sample of organizations (Baldridge & Deal, 1975; Walton, 1987). This approach treated entire organizations as a unit of analysis in the same way that research on innovative individuals treated the individual. Because only low relationships between organizational characteristics and innovativeness were found, later research on organizational innovativeness focused on specific innovation processes within an organization (Rogers, 1995). This review of the literature on organizational innovativeness has included a section that covered organizational characteristics and a section that looked at the innovation process within the organization. This look at the literature dealing with organizational innovativeness provided insight into both the types of liberal arts institutions that have the capability to quickly adopt new technological learning environments, and effective innovation processes that may be used within these institutions.

Characteristics of organizations

Rogers (1995) suggested several organizational characteristics that impact innovativeness. In a discussion of the literature dealing with the characteristics of innovative organizations, he stated that the size of an organization is related to innovativeness. The larger the organization, the more
innovative the organization will be. He stated that the variable, size, may actually represent hidden variables such as organizational resources and employee expertise. According to Rogers, other organizational characteristics related to innovativeness were centralization, complexity, formalization, interconnectedness and organizational slack. Centralization is the "degree to which power and control in a system are concentrated in the hands of a few individuals" (p. 379). Studies have shown that the higher the degree of centralization, the less innovative the organization (Rogers, 1995; Hage & Aiken, 1970). Complexity of an organization "is measured not only by the number of occupations but also by the extensiveness of training and intricacy of tasks performed" (Hage & Aiken, 1970, p. 17). Complex organizations provide an environment in which many ideas are presented, but in which it may be difficult to reach consensus in implementing them (Rogers, 1995). Formalization implies the presence of rules and guidelines. Highly formalized organizations have a large number of rules and regulations (Hage & Aiken, 1970) which inhibit introduction of new ideas, but assist in the implementation of innovations. (Rogers, 1995). Interconnectedness is the degree to which units within an organization are linked by interpersonal networks. The greater the interconnectedness, the greater the opportunity for the sharing of ideas. This greater interconnectedness is associated with more innovative organizations in the literature (Rogers, 1995). Rogers final organizational characteristic was identified as organizational slack. This is the amount of uncommitted resources available to use in experimenting with new ideas. The more resources available, the greater the organizational innovativeness.

Research on organizational characteristics

The following review of the literature related to organizational characteristics includes one study of K-12 educational organizations and three studies in higher education. Baldridge (1975), reported on a study sponsored by the Stanford Center for Research and Development in Teaching, that investigated what characteristics distinguished highly innovative organizations from less innovative ones. Twenty schools were randomly selected in seven school districts in the San Francisco Bay Area. Data about each school were collected by looking at district records and interviewing superintendents, principals and teachers at the schools. Researchers categorized schools as innovative based on the number of innovations adopted. They also developed school profiles indicating specific characteristics of each school. Significant findings indicated that "a large, complex organization with a changing, heterogeneous environment is likely to be more innovative than a small, simple organization with a relatively stable homogeneous environment" (Baldridge, 1975, p. 171). It is interesting to note that Baldridge's suggestions for additional research
focused on the implementation phase or process of innovation rather than characteristics of the organization.

There was some literature that focused on organizational characteristics of institutions of higher education and innovation. Dennison and Behnke (1993) investigated the relationship between organizational characteristics and institutional innovativeness in Canada’s community colleges. Administrators from 15 of Canada’s community colleges were interviewed to provide a list of innovative projects at their institutions. The number of innovative projects at a college was divided by the full time enrollment to give an innovativeness quotient which was then used to rank the 15 colleges in order of their innovativeness. This quotient was correlated with several institutional characteristics. Several weak relationships were found. For example institutions with more support personnel tended to be more innovative. At the same time it was found that the more centralized the authority in an organization, the less innovative was the institution and the less chance employees had for professional interaction with outside organizations.

Rude (1994) also studied institutions of higher education. Rude looked at Iowa community college institutional characteristics and their relationship to perceived institutional distance education innovativeness using the Iowa Communications Network (ICN). Distance education leaders on each campus completed a Community College Information Survey which provided institutional characteristic information about budget, enrollment, types of student served, graduation data, and distance education information. They also completed a Distance Education Survey which was a revision of Hurt & Teigens’ (1977) Perceived Organizational Innovativeness Scale. The results of Rude’s study were interesting. Only one institutional characteristic was related significantly with institutional innovativeness. The longer the group of respondents from a college had worked at the college, the more innovative the college was perceived. The fact that no other significant relationships were found supported Rogers (1995) conclusion that research on organizational characteristics has found only low relationships between these characteristics and organizational innovativeness.

Swiczewicz (1990) also looked at innovation and organizational characteristics of institutions of higher education. A portion of this study looked specifically at how institutional characteristics related to their innovativeness in the use of experiential credit. A survey form was administered to 500 institutions to determine the extent to which credit was awarded for experiential learning and to gather demographic characteristics about the institutions such as size, type, location and institutional control (private or public). Sixty percent of the selected institutions completed the
surveys. As suggested by Rogers (1995) and as shown in Rude’s (1994) study there was little relationship established between innovativeness in this study and organizational characteristics. In fact Swiczewicz found no significant relationship between institutional size, type of institution, or public versus private control and innovativeness.

*The innovation process in organizations*

As indicated in the review of literature on innovation and organizational characteristics, and as suggested by Rogers (1995), there was a need to change the focus of innovation research of organizations from characteristics of organizations to the process of innovation in organizations. Rogers stated that two problems have emerged in studies on organizational characteristics. First, low relationships have been found between organizational characteristics and innovativeness. Second, most studies on the characteristics of an organization are based on data provided by the chief executive of the organization. This was the case in several of the studies reviewed in the previous section. Rogers suggested that data gathered in this way may not be truly representative of the organization. Rogers recommended that more meaningful results would be obtained by studying the process of innovation in a single organization over time.

Studying the innovation process in organizations involves identifying “the main sequence of decisions, actions, and events in this process. Rogers proposed that the innovation process typically consists of five stages. “Agenda-setting” occurs when “a general organizational problem that may create a perceived need for an innovation is defined” (Rogers, 1995, p.391). The second stage, “matching” was defined as the stage in the innovation process in which “a problem from the organization’s agenda is fit with an innovation, and this match is planned and designed (p. 394). “Redefining/Restructuring occurs when the innovation is re-invented to accommodate the organization’s needs and structure” and “when the organization’s structure is modified to fit with the innovation” (p. 394). “Clarifying” was the fourth stage in the innovation process. It occurs when “the innovation is put into more widespread use in an organization, so that the meaning of the new idea gradually becomes clearer to the organization’s members” (p. 399). The final stage according to Rogers was “routinizing”. Routinizing occurs “when the innovation has become incorporated into the regular activities of the organization, and the innovation loses its separate identity” and the innovation process is complete (p. 399).

*Research on the innovation process in organizations*

Orlikowski’s (1992) study of technology in organizations is one example of research that looked at the innovation process in organizations. Orlikowski suggested that technology is not an
objective and external force that affects organizational structure. Instead, Orlikowski proposed, it is the product of the interaction of people within the organization as they establish its meaning through discussion. Orlikowski investigated the use of information technology at a large software consulting firm. After conducting an ethnographic study involving observations and interviews several conclusions about the diffusion process within organizations were drawn. Orlikowski suggested that human choice and organizational design interact to influence the development, maintenance and use of technologies within organizations. This focus on the interaction of the innovation, individuals, and the organization is a study of the redefining/restructuring stage of the innovation process described by Rogers.

Attewell’s (1992) study on technology diffusion and organizational learning is another example of research that focused on the diffusion process. Attewell suggested that adoption of new computer applications into an organization was not just a matter of purchasing hardware and software, but required considerable skill within the organization. Using market surveys, on-site interviews and company policies, Attewell looked at how firms used outside service agencies to provide the expertise needed as technological innovations were first adopted. Attewell then studied the process of developing skill and support for the technology in-house. It was found that early in the computerization process service bureaus, help lines, users groups, and consultants “removed a large part of the burden of knowledge acquisition from the backs of potential users, and enabled a relatively complex technology to diffuse rapidly into firms that initially lacked expert knowledge and did not employ in-house specialists” (p. 9). Later in the process, it was observed a trend from in-house administration of centralized computing systems to decentralized computing within business. Attewell concluded that knowledge barriers must be lowered for computer technology to be diffused in organizations. This study was another example of research that focused on Roger’s (1995) redefining/restructuring stage of the innovation process in organizations. As computer technology was implemented in the organization, the organization’s structure was modified by hiring outside assistance or developing in-house expertise to support the innovation.

Another example of a study of the innovation process was a study by Gurbaxani (1990) in which the growth in the use of BITNET over time was evaluated. BITNET was a telecommunications network begun in 1981 that linked academic institutions in the United States and foreign countries. This study found that BITNET use began slowly with a few institutions and then accelerated as more and more institutions adopted its use. Finally the diffusion rate dropped off as fewer and fewer institutions remained to adopt the innovation.
According to Gurbaxani, there were key points in the innovation process. Specifically, he found that the initiators of BITNET set the agenda by recognizing the collaborative nature of academic work and then matched this need to an innovation - an academic computing network. This resulted in successful implementation of the first two stages of Rogers'(1995) innovation process in organizations. Gurbaxani also found that the early adopters of BITNET fit Rogers' categorization of early adopters. As premier academic institutions they actively searched for “ways to support their research endeavors” (p. 74) and they had a high tolerance for uncertainty.

Organizational innovativeness summary

The literature reviewed on organizational innovativeness was broken into research on organizational characteristics and research on the innovation process. As the studies on organizational characteristics have shown, it has been difficult to establish strong relationships between characteristics and innovativeness. However these studies have provided a useful framework in the research of innovativeness in organizations. Characteristics of organizations that were found to be related to innovativeness were institution size, complexity, heterogeneous or homogenous environment, number of support personnel, organizational centralization and community cohesiveness. Studies on the innovation process have been more prevalent in recent years.

The research on the innovation process reviewed in this study showed that the adoption of an innovation in an organization is a complex process that involves interaction of the innovation with individuals, knowledge of individuals, skill base of the organization and organizational structure. It also showed that a need must be determined and then matched with an innovation for the innovation to be successful. The study of organizational diffusion of innovations has provided the theoretical background for research on the diffusion of laptop and network technology at a small liberal arts college.

Personal innovativeness

A major area in the study of the diffusion of innovations has traditionally focused on the attributes of individuals and their innovativeness. Much of the early innovativeness research was of this type. It was not until later that diffusion of innovation research began to focus on organizations and the fact that in many cases individuals could not adopt an innovation without the organization first endorsing it (Rogers, 1995; Baldridge & Deal, 1975). This was the case in this study at Waldorf College in which it was decided to provide laptop computers and residence hall Internet access for its students.
In the following section literature is reviewed that deals with individual innovativeness. Much of the literature referred to Rogers' (1995) adopter categories. Rogers has summarized research related to the different characteristics of the adopter categories he proposes. He grouped these summaries into characteristics related to socioeconomic status, personality values and communication behavior.

Socioeconomically, early adopters were reported to differ from late adopters in a number of ways. For example, early adopters had more years of formal education and were more likely to be literate than late adopters. In addition, early adopters were wealthier, had a higher social status and typically came from larger organizational units than later adopters. Rogers found that normally age of an individual did not relate to a person's adopter category.

The personality characteristics of the adopter categories were also studied. Some of the findings indicated that early adopters had a greater ability to deal with abstraction, were better able to cope with uncertainty, were less dogmatic and had a more favorable attitude toward change than late adopters. These personality characteristics positioned them to more quickly adopt new ideas. (Rogers, 1995)

The communication behavior of early adopters also differed from later adopters. Early adopters participated more socially, had more social interconnections and had developed more communication connections outside of the local community than late adopters. In addition, early adopters more actively sought information about new ideas, had a greater exposure to mass media communication channels and had more contact with change agents and new ideas than later adopters. These connections to new ideas, other innovators and information supported the innovator in adopting new ideas.

The literature reviewed below includes studies of personal factors and how they impact innovativeness. They were all conducted in an educational setting, with the participants being either undergraduates, university faculty members, high school or elementary school teachers. The last two studies in this section treated innovativeness as a variable that could be used to predict computer use. Research on personal innovativeness

Goldsmith and Nugent (1984), hypothesized that cognitive complexity and innovativeness were positively correlated. Cognitive complexity referred "to the number and sophistication of cognitive structures used by the individual in evaluation and judgment" (p. 432). They stated that finding a positive relationship between cognitive complexity and innovativeness would indicate a difference in information-processing ability between individuals, giving more cognitively complex
individuals the ability to more readily see the advantages of an innovation and better resolve incompatibilities between the old and the new.

Goldsmith and Nugent completed two studies. In the first study 106 undergraduate students completed the Hurt, Joseph, and Cook (1977) Innovativeness Scale and the Leavitt and Walton (1975) Open Processing Scale to measure innovativeness. To measure cognitive complexity, the Rep Test (Bieri, 1966) was used. A second study of 94 undergraduates was conducted. Again the Hurt, Joseph and Cook (1977) and Bieri (1966) measures of innovativeness were used. However, this time the Role Category Questionnaire (Crockett, 1975) was used to measure cognitive complexity. No significant relationships were found between cognitive complexity and innovativeness in either study.

Carr (1985) conducted of study of 400 randomly selected Florida vocational educators. One of her research questions was to determine if age, inservice training hours earned, college credit hours earned teaching experience, and professional affiliation were related to attitude toward innovativeness. Another question looked at whether sex, level taught, and degree held impacted the tendency to be innovativeness and flexible. It was found that there was a significant relationship between both inservice hours earned and the number of organizational memberships and a favorable attitude toward innovation in individuals. No relationship was found between attitude toward innovation and age, college credit hours, or teaching experience.

Carr also found that there was no difference in the tendency to be flexible and innovative between males and females. There were significant differences reported between the levels of education taught. Community college teachers were found to be more flexible and innovative than high school teachers. In addition it was found that level of education significantly impacted the tendency to be flexible and innovative. Those with doctorate degrees had the tendency to be the more flexible and innovative and those with less than a bachelor's degree had scores that indicated the least tendency to be flexible and innovative.

Rude-Parkins, Baugh and Petrosko (1993) investigated the personality types of high school teachers who successfully adopted technology and helped others learn to use it. A portion of the study looked specifically at the relationship between personality type and innovativeness. In the study 12 teachers in each of 24 high schools were given 60 hours of technology training. The teachers were expected to use the technology to teach their students and were also expected to share their expertise with other teachers through demonstrations, assistance and in-service sessions. Early in the training these teachers were given the Myers Briggs Type Indicator to identify underlying
personality traits. At the end of the year teachers were categorized according to adoption level. The results of this study found no significant difference between the adopter level and the personality indicator. In other words, adoption level was not “significantly different for Extrovert compared to Introvert, Sensing to iNtuiting, Thinking to Feeling, or Judging to Perceiving” p. 52). Personality type did not appear to be related to levels of adoption in this study.

Parry and Wharton (1995) investigated the factors that influenced adoption of electronic networking among faculty at a mid-sized university. While they did not use Rogers’ adopter categories they did investigate the variables that impacted the use of this innovation. Specifically they were interested in how academic rank, discipline, years of experience, age, and gender impacted frequency of network use, types of use, and general feelings of expertise in using networks. Parry and Wharton found, that gender was not a good indicator of adoption of electronic networking features. There was some indication that “older faculty use networks with lesser frequency and breadth compared to younger faculty, and they feel less secure with the technology” (p. 463). Despite this finding, they suggested that age was only a minor predictor. It was found that the field of occupation was the strongest predictor of network use, breadth of use and indications of self-assurance. In this study faculty from the school of science and engineering made significantly more use of network potentials than faculty from the school of business. Their conclusion was that despite the fact that there is significant differences in the way that people adopt technology, these differences disappeared when the variable of educational field or field of occupation was added.

Marcinkiewicz and Grabowski (1992) and Marcinkiewicz (1995) conducted related studies that looked at innovativeness as a personalogical variable. In a variation from the previous research reviewed, both of these studies looked at innovativeness as a personalogical variable and evaluated whether this personality attribute predicted computer use. This related directly to the study that was conducted at Waldorf College.

Marcinkiewicz and Grabowski (1992) studied 167 preservice elementary education undergraduates. It was hypothesized that age, gender, experience with computers, innovativeness, teacher locus of control, perceived self-competence in computer use and perceived relevance of computers to teachers could predict expected use of computers in teaching. The portion of this study related to innovativeness evaluated whether innovativeness was related to expected computer use. The Hurt, Joseph, and Cook (1977) Innovativeness Scale was used to determine adopter categories of the students. To measure expected computer use a questionnaire gathered information about levels of
expected use including expected utilization and integration of computers in the classroom. In this study innovativeness was not found to be predictive of expected computer use.

In a follow-up study Marcinkiewicz (1995), conducted research with practicing teachers and compared his results to the preservice group in the preceding study. The study compared levels of computer use by practicing teachers with expected levels of use by preservice teachers. One hundred and seventy practicing teachers completed surveys that indicated their level of computer use, self-competence in the use of computers, perceived relevance of computers to teaching, teacher locus of control, and innovativeness. Only teachers who had computers available for classroom use were included in the study. The Hurt, Joseph, and Cook (1977) Innovativeness Scale was used to place teachers into adopter categories. In contrast to the study of preservice teachers’ expected use of computers, this study found that innovativeness was a significant predictor of teacher use of the computer in the classroom. This supported the suggested relationship between willingness to change and computer use.

*Personal innovativeness summary*

The literature reviewed in this section on personal innovativeness in many cases supported the findings of the previous research reviewed by Rogers (1995). Neither age nor gender were found to be good predictors of innovativeness. Educational level, involvement in outside organizations, continuing education, and occupation or field of study were found to be predictors of innovativeness. The studies by Goldsmith and Nugent (1984) and Rude-Parkins, Baugh and Petrosko (1993), in which relationships between personal characteristics and innovativeness were not established, provided suggestions for improved additional studies. This suggested the need for additional research in this area. The final two studies reviewed in this section shifted from relating innovativeness and personality characteristics to determining if innovativeness predicts adoption. This was similar to the study at Waldorf College which measured perceptions of student innovativeness and then compared that measure to computer and network use patterns.

*Computer Anxiety*

The introduction of laptop computers and campus-wide network access for students at Waldorf College was planned by the Waldorf administration without formal student input into the decision. Individual students within the context of the organization then decided how they would utilize this technology. While there was much support for the use of this technology, individual factors such as user experience, sense of control, coping strategies, and personal characteristics could have impeded its use (Kolehmainen, 1992). Student computer anxiety was another factor that could
have inhibited effective utilization of laptop computers and campus-wide networking. Overbaugh and Reed (1992) stated that overcoming computer anxiety is the first step in the effective use of computer based technology to improve learning. Koilehmainen (1992) noted that it is “important to reduce computer anxiety, because it is harmful for learning and effective use of computers” (p. 5). This section reviewed definitions of computer anxiety and then looked at recent studies related to computer anxiety and its impact on computer and network use.

**Computer anxiety defined**

Computer anxiety is a construct used to describe the human-computer-interaction. Definitions of computer anxiety in the literature focused on the emotions connected to this interaction. Koilehmainen (1992) defined computer anxiety as “a fear or a prejudice, which appears when one is using computer technology or when he is thinking about the consequences of the use” (p. 5). Hӓkkinen (1995), defined computer anxiety as “the hesitance and fear that is typical of people who are unfamiliar with computers” (p. 144). Simonson, Maurer, Montag-Torardi, Witaker (1987) defined computer anxiety as “the fear or apprehension felt by individuals when they use computers or when they consider the possibility of computer utilization” (p. 238). Maurer and Simonson (1984) reported that a computer anxious person demonstrates the following characteristics:

1. avoidance of computers, and the area where they were located;
2. excessive caution when using computers;
3. negative remarks toward computers and computing;
4. attempts to shorten period when computers were being used.

Research indicated that anxiety consists of two parts. Trait anxiety is a fairly stable condition related to an individuals personality. State anxiety is situational and can change with time (Hӓkkinen, 1995). Koilehmainen (1992) noted that while there are connections between trait and state anxiety, computer anxiety is typically considered to be state anxiety. Research has supported the categorization of computer anxiety as state anxiety in which the condition is temporary. One indication of this was the connection in the literature between computer anxiety and experience with computers. It was frequently found that as experience with computers increases, computer anxiety decreases (Hӓkkinen, 1995). This suggested that computer anxiety is not stable, but can change with situations and time.

Computer anxiety was considered to be a negative emotion connected to the human-computer-interaction. A related construct noted in the literature is computer self-efficacy which focuses on the degree of positive feeling toward human-computer-interaction. Self-efficacy was
defined as "the belief in one's ability to execute successfully a certain course of behavior" (Busch, 1995, p. 147). Measuring this construct would focus on a person's belief about, and confidence in, their ability to interact with computers.

**Research on computer anxiety**

The research reviewed related to computer anxiety included two studies on computer experience and computer anxiety, a study on learning styles and computer anxiety, a study on course structure and anxiety, and a study on computer anxiety and telecommunications.

Overbaugh and Reed (1992) looked at the computer anxiety of 20 graduate students enrolled in an introductory computer course and 15 graduate students enrolled in a content-specific course. Each of the courses was 16 weeks in length. The introductory course studied basic computer applications, BASIC programming and readings on the use of computers in education. The content-specific course focused on the use of computers in specific content areas such as computers in biology and computers in mathematics. The results of the study indicated that computer anxiety decreased significantly from before the classes began to after the courses for both the students in the introductory course and the students in the content-specific course. This suggested that computer anxiety decreases with increased experience with computers even if that experience differs.

Häkkinen (1995), of the University of Joensuu in Finland, conducted a related study to determine if the experience received from a computer course reduced computer anxiety. Häkkinen also looked at the impact of the course on student attitude towards computers. Twenty-nine first-year education students, enrolled in a computer course, were the subjects for the study. Häkkinen found that the course significantly reduced computer anxiety. Because most students had no experience with computers before the course, she concluded that experience with computers was the main factor in reducing computer anxiety. Häkkinen recommended that every effort should be made to provide computer experience to eliminate the detrimental effects of computer anxiety.

Bohlin and Hunt (1995) conducted a study to determine the impact computer course structure had on students' computer anxiety, confidence, and attitudes. This study advanced the studies on computer anxiety and computer experience by looking at specific attributes of computer experiences and their relationship to computer anxiety. The attributes of computer experience investigated included the number of weeks a course met, and the number of meetings per week.

Three hundred and eighty-one pre-service and in-service education majors enrolled in 16 different sections of an introduction to computer class were the subjects for the study. Bohlin and Hunt found that length of the course and frequency of the class meeting had a significant impact on
the computer anxiety. Students who participated in long courses had a significantly greater reduction in their anxiety toward computers, and a greater increase in confidence in using computers, liking of computers and perceptions of usefulness of computers than those enrolled in short courses. Students who were enrolled in courses that met frequently also had a greater reduction in their anxiety toward computers, and a greater increase in confidence in using computers, liking of computers, and perceptions of usefulness of computers than students in low frequency courses. Computer anxiety decreased the most for students enrolled in courses that met frequently and met for the entire 16 week period. This study suggested that computer experience that is frequent for an extended period of time is best at reducing computer anxiety.

Ayersman and Reed, (1996) conducted a study that again looked at the impact of computer experience and the type of experience on computer anxiety. However, it also considered the effect of gender on programming proficiency, and the effect of learning styles on computer anxiety. The purpose of their study was to “a) determine whether computer anxiety decreases following programming instruction, b) analyze possible differences in computer anxiety reduction by individual learning style, c) examine programming performance scores in relation to individual learning style, and d) determine whether gender is a distinguishing factor when viewing computer anxiety and performance measures” (p. 150).

Fifty-eight undergraduate education majors completed a computer awareness module that covered computer programming, computer architecture and the uses of computers in education. Twenty seven of these students voluntarily participated in the study. Ayersman and Reed found a significant decrease in computer anxiety following the completion of the computer module. This finding is similar to the findings in previous studies in which increased computer experience reduced computer anxiety. No significant differences were found in computer anxiety levels and learning styles. In the measure of programming performance, females significantly outperformed the males. An additional finding of this study was that students who participated in the module over a four week period had a significantly lower computer anxiety score than those who took the course in a intensive one-day format. This supported the finding by Bohlin and Hunt (1995) that computer experience spread over time is more effective in reducing computer anxiety than an intensive short experience.

Harris and Grandgenett (1996) looked at the impact anxieties and demographics had on telecomputing activity of educators. Rather then investigating how computer anxiety changed as a result of computer experience, they investigated the correlation that anxiety and individual demographics had to telecomputing activity. They measured computer anxiety, writing apprehension
and oral communication apprehension. They also gathered information on age, teaching experience, telecomputing experience, gender, professional specialty and teaching level.

A simple random sample of 300 Texas Education Network users were surveyed. Network use statistics were then obtained from the Texas Education Network for the participants. Network use for the participants during the twelve-month period was relatively high. The average number of logins per participant was 189 with the average number of hours reported on-line over 42 hours. Of the three apprehension variables, only writing apprehension significantly related to total network logins and total on-line time. The more apprehensive the individual was, the less likely they were to login and/or spend time on the network. There was no significant relationship between computer anxiety and network use. This lack of significant relationship between computer anxiety and network use may be related to network experience. Of those participating in the survey, 70% had two or more years of telecomputing experience. In fact the study found that there was a significant positive relationship between telecomputing experience and network use. Previous research reviewed has suggested that as experience increases, computer anxiety decreases. Most of the participants in this study were experienced network users.

In summary, this study found that only writing apprehension and telecomputing experience were significantly related to network use. The other variables studied such as age, teaching experience, gender, professional specialty, teaching level, computer anxiety, and oral communication apprehension did not impact network use.

**Computer anxiety summary**

Definitions of computer anxiety focused on the negative emotions associated with the human-computer-interaction. These negative emotions, described as computer anxiety, were considered to be a type of anxiety called state anxiety. This implied that these emotions are not stable and could change with time. The literature noted that overcoming computer anxiety has become very important for both learning and for professional success.

Many of the studies associated with computer anxiety have looked at the impact some type of computer experience has on anxiety. The studies by Overbaugh and Reed (1992) and Häkkinen (1995) were typical examples of this type of study. Both found that computer experience reduced computer anxiety. While the studies by Bohlin and Hunt (1995) and Ayersman and Reed (1996) focused on other variables, their findings also indicated that increased experience with computers reduced anxiety. The research indicated that almost any computer experience reduced computer anxiety. However two of the studies found that spreading the computer experience over a longer
period of time and increasing the frequency of the experience was the most effective way to reduce computer anxiety. The study conducted by Harris and Grandgenett (1996) found no relationship between computer anxiety and use of network resources. Because the participants in the study were, for the most part, experienced computer users, computer anxiety may not have been a factor in the study. A study looking at network use by inexperienced computer users quite possible would have found a correlation between network use and computer anxiety. The study conducted at Waldorf College considered the impact of a school year's access to laptop computers and network access had on computer anxiety. It also examined the effect computer anxiety had on technology use.

Summary

This chapter provided a review of literature pertaining to a variety of variables in this study. Because Waldorf College, the college studied in this research, is a small institution with a focus on the liberal arts, research on the changing role of liberal arts colleges was reviewed. To provide background for the study of laptop and network use at Waldorf College, a variety of literature was studied. This included literature about the role of computer and network technology in education, literature that showed trends in the use of technology in higher education, literature that looked at technology trends in liberal arts colleges and trends in the use of laptop computers in higher education. This literature review also included a summary of research on organizational and individual innovativeness. This literature was provided to give a framework for studying the diffusion of laptop and network technology among students at Waldorf College. Finally literature that related to computer anxiety was reviewed, because this study investigated the impact of computer anxiety on laptop and network use, and how computer anxiety changed as experience with these technologies was developed. This comprehensive review of the research on the variables associated with the introduction, diffusion, and student use of laptop computers and network technology at a small liberal arts college helped in the design of this study. Chapter three discusses this design then the methods used.
CHAPTER 3. METHODOLOGY

Introduction

The methodology used for this study is described in this chapter. The purpose of the study was to provide a description of the network and laptop computer use patterns of college students and to examine the diffusion process. Both survey and focus group data were gathered from freshmen college students who had laptop computer and network access in their places of residence.

The study was conducted at Waldorf College, a two-year private institution of approximately 550 students located in Forest City, Iowa. While most of Waldorf's students are enrolled in associate of arts programs, the college does offer several select bachelor of arts programs. Waldorf College began providing laptop computers to all of its freshmen students in the fall of 1996 and continued this program for the freshmen in the fall of 1997. At the same time the college's residence halls were wired to provide network access to the campus network and the Internet. This chapter contains a section that describes the participants. This is followed by a section that discusses the instruments used and another that describes the collection of the data. An overview of how the data was treated is then given. This is followed by a chapter summary.

Participants

The subjects who participated in the first phase of this study were the 281 Waldorf freshmen enrolled in freshmen English sections during the spring semester of the 1996-97 school year. Because enrollment in an English section in the spring semester was a requirement at Waldorf College, this included almost the entire freshmen class. Twenty-eight of these 281 freshmen also participated in follow-up focus group discussions which consisted of three groups of 7, 9 and 12 freshmen. At the beginning of the year, the 1996-1997 class of freshmen at Waldorf College consisted of 292 full-time day students. A few additional enrollments and excellent retention resulted in 281 freshmen enrolled in the spring 1997 semester. Of the 292 students who began the school year, 111 were women and 181 were men. Approximately 64% of these students were from Iowa, 15% from Minnesota, and 13% were international students. The average composite ACT score for this group of freshmen was 20.0. This compared to a national average for this class of 20.9. This group of students who were surveyed after using the technology for a school year is called "experienced students" for the purposes of this study.

The second phase of this study included the 270 freshmen who participated in freshmen orientation sessions reserved for the administration of the Waldorf College laptop Survey (WCLS). The orientation sessions were part of a three-day required orientation for freshmen in the fall of
1997. While 302 full-time day students entered Waldorf College in the fall, only 270 attended the sessions reserved for the administration of the WCLS. Twenty-four of these students participated in focus group discussions the following week. Three groups of 10, 6 and 8 students respectively made up these focus groups. Of the 302 entering freshmen, 172 were male and 130. Approximately 66% of these students were from Iowa, 20% from Minnesota and 8% were international students. While the national average composite ACT score for fall 1997 freshmen was 21.0, the Waldorf College freshmen composite ACT score was 20.2. This group of students who were surveyed as they entered Waldorf in the fall of their freshmen year is called “entering students” in this study.

**Instruments**

The Waldorf College Laptop Survey (WCLS; Appendix A) consisted of six parts. The first part collected demographic information, the second measured previous technology experience, the third focused on student use of the technology at Waldorf College, the fourth examined perceived organizational innovation, the fifth determined individual student innovativeness, and the sixth measured computer anxiety. Focus group questions were also developed for use in the small-group follow-up discussions.

**Part I**

Part I of the WCLS gathered demographic data about the student participants. It requested information about gender, age, state or country of high school graduation, size of graduating class, whether their family owned a computer, and the impact providing laptop computer and Internet access had on their decision to attend Waldorf College.

**Part II**

Part II was a short section with items that asked students to report on their previous computer and network experience. Responses were scored on a five-point Likert scale where 1=No experience to 5=extensive experience. The instrument asked students to indicate their level of experience with computers, word processing, spreadsheets, databases, e-mail and the World Wide Web.

**Part III**

Part III of the WCLS was designed to gather information about student technology-use patterns and perceptions about its effectiveness for learning. The first 17 questions of this section asked students to respond by checking one blank for each statement. For example, they were asked to indicate whether they used or anticipated they would use their computer never, monthly, weekly, bi-weekly, once a day or several times a day. The last 12 questions of this section asked students to rate their level of agreement with statements about technology use at Waldorf College. Responses were
scored on a seven-point Likert scale, where 1=strongly disagree to 7=strongly agree. This section of the WCLS was modified slightly for administration to the fall 1997 freshmen. This was necessary because freshmen surveyed in the spring of 1997 had used their laptop computers for an entire school year. Freshman surveyed in the fall of 1997 were surveyed the week that they received their computers. Questions were modified to ask how students anticipated they would use computers or Internet resources.

Parts I, II, and III of the WCLS were developed in several stages. First, other research studies that examined computer and/or Internet use in education were reviewed. Ideas were taken from (Chen and Brown, 1994; Gallo and Horton, 1994; and Green, 1996). Three faculty members from the Department of Curriculum and Instruction at Iowa State University, with specialization in instructional technology, reviewed the draft instrument and provided input, and revisions were made. Two members of the Waldorf College Academic Computing staff also completed the questionnaire and suggested changes. Finally, 12 sophomore students who had access to computer and network resources at Waldorf College completed a pilot test of the WCLS and made suggestions for clarification in Parts I, II, and III.

**Part IV**

Part IV was developed to measure perceived organizational innovativeness. It consisted of 25 items based on Hurt and Teigens’ (1977) Perceived Organizational Innovativeness Scale (PORGI). Responses required use of a seven-point Likert scale ranging from 1=strongly agree to 7=strongly disagree. These responses were totaled with higher scores indicating a higher level of perceived organizational innovativeness. The split-half reliability calculated by Hurt and Teigen (1977) was .96. Construct validity was evaluated by comparing the results of the PORGI to the theoretical distribution of innovativeness proposed by Rogers and Shoemaker (1971). The PORGI’s percentage of organizations in each adopter category was similar to Rogers and Shoemaker theory of this distribution.

**Part V**

Part V of the WCLS measured individual innovativeness of the students at Waldorf College. It included 20 items based on the Innovativeness Scale developed by Hurt, Joseph and Cook (1977). A Likert scale that ranged from 1=strongly agree to 7=strongly disagree was used to score the student responses. Hurt, et al.(1977) calculated a reliability coefficient of .89. The results of the Innovative Scale placed individuals into the five adopter categories with a distribution very similar to
Rogers and Shoemaker's (1971) theory of individual innovativeness. This suggested that there was high construct validity for the Innovativeness Scale.

Part VI

Part VI of the WCLS was designed to measure computer anxiety of the students at Waldorf College. The Computer Opinion Survey (Mauer & Simonson, 1984; Simonson, Mauer, Montag-Torardi, & Whitaker, 1987), employed a six-point Likert scale to evaluate computer anxiety. The instrument asked students to indicate their level of agreement with 26 statements that reflected their levels of anxiety about computer use (Simonson et al., 1987) calculated A reliability of .94 using the Cronbach alpha method. Using a test-retest method reliability was found to be .90. To determine validity, results of the instrument were correlated with the State-Trait Anxiety Index (Spielberg, 1970). A significant correlation was found.

Focus Group Questions

Questions (Appendix B) used in directing the follow-up focus group discussions were developed to gather qualitative data that further investigated the use of computer and network use at Waldorf College by students. The questions were designed to progress from questions that encouraged student involvement, to questions that probed more deeply into thoughts and perceptions about computer and network use at the College. Six questions were developed and revised. Input in developing and revising these questions was received from three faculty members in the Department of Curriculum and Instruction at Iowa State University, with specialization in instructional technology, and from two members of the academic computing department at Waldorf College.

Administration of Instrument

The WCLS was administered to two different groups. The first group was the experienced students who completed the survey in the Spring of 1997 after they had used the laptop computer and network technology at Waldorf College for two semesters. The second group was the fall 1997 entering students who completed the survey when they entered Waldorf College in the fall before they had an opportunity to use the technology at Waldorf College. Three focus group sessions were conducted for a subgroup of each of these freshmen classes. These discussions were conducted within a week or two after completion of the WCLS.

Selection of participants

The methods used to select the participants in this study were straight forward. Because it was a requirement that all freshmen take a first and second semester English course, the WCLS was administered to all freshmen English sections at Waldorf College in the spring of 1997. Two hundred
and twenty-five surveys were completed with 216 found to be usable. The total number of experienced students available to complete the survey in the spring of 1997 was 281. Seventy-seven percent of this total returned usable surveys. Subjects who did not return surveys were absent from class the day the WCLS was administered. In addition, in one or two cases, the English professor did not require the survey to be completed in class and asked that they be completed and returned later. Not all students returned completed questionnaires.

The entering students who completed the fall 1997 WCLS survey included 270 of the 302 Waldorf College 1997 full-time freshmen. The 89% completion rate did not include 31 students who chose to skip the orientation sessions scheduled for the completion of the survey. One student chose not to complete the survey after being given instructions for its completion.

Participants in both the Spring 1997 and Fall 1997 focus groups were selected randomly. Using lists of students, systematic random sampling was used to select an invitation list to participate in the focus discussion groups. In the spring of 1997, 57 students were randomly selected and invited to participate. Forty-nine percent, or 28, students actually participated in the discussions. In the fall of 1997 51 students were randomly selected and invited to participate in focus groups. Twenty-four, or 47%, of the invited students participated in the discussions.

Procedures

The WCLS was administered to all freshmen English sections at the college in the spring of 1997 to collect data from the experienced students who had used computer and network technology for a year. After receiving permission from the Academic Dean at Waldorf College and receiving permission from the Human Subjects Committee at Iowa State University, a meeting was scheduled with the English department. At this meeting the faculty members of the department agreed to administer the survey to each section of freshmen English classes. Closer to the actual administration of the WCLS, another meeting was held to discuss the procedure for the survey administration. An outline of points to cover in introducing the survey to students was reviewed and faculty members agreed to allow approximately 30 minutes for the completion of the WCLS. While almost all of the surveys were completed and collected during class time, one professor allowed her students to complete the survey outside of class and return it the next class period. Surveys were administered over a one and one-half week time span because individual faculty members determined administration time based on their class syllabi.

To collect data from the entering students in the fall of 1997, the surveys were administered before the beginning of classes during the fall technology orientation sessions. Students had been
issued their computers and had network access, but had not completed training in their use. A sixty-
minute block of time was reserved for completion of the survey. The researcher administered the
survey sessions and the WCLS was completed and returned during this block of time.

The procedure used for organizing and conducting focus groups was the same for both the
experienced students in the spring 1997 and the entering students in the fall 1997. After participants
had been systematically selected, they were invited to attend the hour-long focus group by both e-
mail and regular campus mail. This invitation asked them to respond by e-mail, phone or in person
indicating their intent to attend or not attend. To encourage attendance, pizza and soda were offered
for all who agreed to participate. Students who did not respond were sent an e-mail follow-up
inviting them to attend again. The day of the focus group discussion, participants were sent a final
reminder.

Focus groups were conducted in a lounge in the college’s Campus Center facility. An
Academic Computing staff member served as recorder for the sessions. The sessions were recorded
on tape and then transcribed for evaluation. After a brief introduction by the researcher, a group of
questions were presented to the students. They were encouraged to discuss the questions among
themselves. The researcher led the discussions but did not participate in them.

**Treatment of Data**

**Analysis of survey data**

Results of the WCLS were evaluated with some surveys discarded because they were not
completed. The data from the remaining surveys were then entered into a Statistical Package for the
Social Science (SPSS) database. Frequencies provided demographic and descriptive information as
well as computer use patterns for each of the two freshmen classes in the study.

A perceived organization innovativeness was calculated using responses from the
Perceived Organizational Innovativeness Scale. Questions had been positively and negatively
worded, so negatively worded items were reversed before the perceived organization innovativeness
was calculated. Higher scores indicated a higher level of perceived organizational innovativeness.

A perceived individual innovativeness was also calculated using the results of the
administration of the Innovativeness Scale. Negatively worded items were reversed and then a total
was calculated. Higher scores indicated higher levels of individual innovativeness.

A computer anxiety score was calculated from the results of the Computer Opinion Survey.
Because the scoring had been reversed to match the format of previous sections of the survey, the
positively worded items were reversed and a computer anxiety index was calculated by summing the responses. The higher the score, the greater was the computer anxiety of the student.

Selected tests of inference were used to determine significant differences between groups or use patterns of the students and related variables, such as computer anxiety or personal innovativeness. Correlations and t-tests were used to determine relationships and differences between computer use patterns, demographics, computer anxiety scores, individual innovativeness scores and perceived organizational innovativeness.

Analysis of focus group data

Data from the focus group discussions were evaluated by the researcher. The text of the recorder's summary of each discussion was reviewed to find themes related to technology use and perceptions of its effectiveness. The transcript of each discussion group was also evaluated to determine if additional themes would emerge. Themes and related issues were placed into broad categories on paper as the discussion group summaries and transcripts were read. These were rearranged and organized to develop conclusions for the focus groups.

Summary

This chapter reviewed the background data collected about the participants, instrument design, administration of the instrument and treatment of the data. The Waldorf College Laptop Survey was developed to gather information about student demographics, previous technology experience and use patterns of this technology. Data were gathered using this WCLS with all experienced students who had used laptop computer and network technology for the 1996-1997 school year at Waldorf College. The survey was also used to gather data from entering students before they had an opportunity to use the technology in the fall of 1997. Focus groups were used to gather more in-depth information from a subgroup of each research group. Descriptive statistics and frequencies were used to report demographics, previous computer experience and technology use patterns. Correlations were used to look at relationships between variables in the study, and selected inferential statistics were used to determine differences between the two freshmen groups who participated in the study. The results of this analysis are recorded in Chapter IV.
CHAPTER 4. RESULTS

Introduction

Two methods were used to collect information for this research study. The Waldorf College Laptop Survey (WCLS) was used to gather data about student demographics, past computer experience, technology use patterns, perceptions of effectiveness of technology for learning, perceived organizational innovativeness, individual innovativeness, and computer anxiety. Focus group discussions were used to look in-depth at student technology use patterns and perceptions about effectiveness of technology for learning. The surveys and focus group discussions were conducted in the spring of 1997 with students who had used laptop computer and network technology for one school year. For the purposes of this study this group is called "experienced students." In the fall of 1997, information from the surveys and focus groups was collected from entering freshmen that had not had an opportunity to use the technology extensively. This group is called "entering students." This chapter will present the results of these data gathering activities.

First demographics and past technology experience data gathered from the WCLS will be presented. This will be followed by a discussion of the results as they pertain to the research questions, including results from both the WCLS and the focus groups. Finally, a brief look at how two students use technology at Waldorf College will be given.

Research Results

Demographics

Experienced students (Spring 1997)

A summary of the demographic results is shown in Table 1. Of the 216 freshmen that completed the WCLS in the spring of 1997, 58%, or 125, were males and 42%, or 91, were females. Ages ranged from 16 to 50 with only one student reporting an age greater than 26. A mean age of just over 19 and a mode of 19 indicated that traditional-age students dominated this class.

One hundred and thirty-eight, or 64%, of the students graduated from high schools in Iowa and 33, or 15%, graduated from schools in Minnesota. Twenty-eight, or 13%, of the 216 students were from other countries. The remaining 16 students were from other states, primarily from the Midwest. One student did not report high school graduation location.

The majority of the students in the study graduated from small high schools with almost 75% graduating in classes less than 200. Forty-one, or 19%, had graduation class sizes less than 50. Seventy-five, or just below 35%, had a graduation class between 50 and 100. Twenty-four, or 11%, reported graduation class sizes between 100 and 150. Approximately 9%, or 20 of the students,
## Table 1 - Student demographic information

<table>
<thead>
<tr>
<th></th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Completed Surveys</td>
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</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>151</td>
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</tr>
<tr>
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</tr>
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<td></td>
</tr>
<tr>
<td>Age (Mean = 18.68)</td>
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<td></td>
</tr>
<tr>
<td>16-17</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>18</td>
<td>173</td>
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</tr>
<tr>
<td>19</td>
<td>74</td>
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</tr>
<tr>
<td>20</td>
<td>5</td>
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</tr>
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<td>2</td>
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</tr>
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<td>23-24</td>
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</tr>
<tr>
<td>25-26</td>
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<td>Over 30</td>
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<td>.6</td>
</tr>
<tr>
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</tr>
<tr>
<td>Graduation Location</td>
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</tr>
<tr>
<td>Iowa</td>
<td>177</td>
<td>65.6</td>
</tr>
<tr>
<td>Minnesota</td>
<td>55</td>
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<td>Graduation Class Size (Mean = 3.18)</td>
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</tr>
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<td>1 = &lt;50</td>
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<td>22.6</td>
</tr>
<tr>
<td>2 = 50-100</td>
<td>96</td>
<td>36.2</td>
</tr>
<tr>
<td>3 = 101-150</td>
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<td>15.9</td>
</tr>
<tr>
<td>4 = 151-200</td>
<td>12</td>
<td>4.5</td>
</tr>
<tr>
<td>5 = 201-250</td>
<td>13</td>
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</tr>
<tr>
<td>6 = 251-300</td>
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<td>7 = 301-35</td>
<td>8</td>
<td>3.0</td>
</tr>
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<td>8 = 351-400</td>
<td>6</td>
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<tr>
<td>9 = 401-450</td>
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<td>10 = &gt;450</td>
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</tr>
<tr>
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</tr>
<tr>
<td>No</td>
<td>70</td>
<td>25.9</td>
</tr>
<tr>
<td>Impact of the Availability of Laptop Computer on the decision to Attend Waldorf</td>
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<td></td>
</tr>
<tr>
<td>Major Reason</td>
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<tr>
<td>One of Several Reasons</td>
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<td>73.7</td>
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<td>No Impact</td>
<td>59</td>
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</tr>
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</tr>
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</table>
reported a graduation class size between 151 and 200. The remaining 56 students, or approximately 25%, reported graduation class sizes in categories that ranged from 201 to greater than 450. Of the students who reported graduation class size categories greater than 200, 15, or almost 7%, of all of the students reported class sizes greater than 450.

The majority of the students who completed the survey indicated that their family had owned a computer before they came to Waldorf College. One hundred and twenty-nine, or almost 60%, indicated computer ownership while 87, or approximately 40%, reported that their families did not own computers. When asked to indicate the impact providing laptop computers and Internet access had on their decision to attend Waldorf College, 12, or almost 6%, indicated it was the major reason they chose Waldorf College. One hundred and forty-five, or 77%, reported that it was one of several reasons that they chose Waldorf College and 59, or approximately 27%, indicated that it had no impact on their decision.

**Entering students (Fall 1997)**

The 270 entering freshmen, that completed the WCLS in the fall of 1997, were similar to the experienced students who completed the survey in the spring of 1997. About 56%, or 151 students, were male. One hundred and eighteen, or almost 44%, were female. The mean age was just under 19 for the fall group, which was slightly lower than the mean age for the experienced student group. This would be expected given that the experienced group reported their ages at the end of their freshman year, while the entering student group reported their ages at the beginning of the year. About 64%, or 173 students, reported that they were 18 years of age. Seventy-four students, or about 27%, were 19 years old. Only two students reported ages of over 30, with the remaining ages ranging from 16 to 25. A large majority of the entering freshmen in the fall of 1997 came from small high schools. Approximately 79% had graduating classes of 200 or less. Almost 9% came from high schools with graduating classes between 200 and 300 students. Six percent of the students came from high schools with graduating classes greater than 450.

The entering freshmen in the fall of 1997 were predominantly from Iowa and Minnesota. Almost 66%, or 177, of the students graduated from high school in Iowa. Fifty-five, or approximately 20%, of the students were from Minnesota. Seventeen students reported that they were from one of 14 states other than Iowa and Minnesota. Twenty-one students, or almost 8%, of the entering freshmen reported that they were from other countries.

A higher percentage of entering students in the fall of 1997 indicated that their families owned a computer than the experienced students in the spring of 1997. Approximately 74%, or 200,
of the fall 1997 entering freshmen indicated that their families had owned computers. When asked to report the impact the availability of laptop computers and Internet access had on their decision to attend Waldorf college, only 11, or about 4%, said it was the major reason that they chose Waldorf college. One hundred and ninety-nine, or almost 74%, stated that it was one of several reasons that they chose Waldorf College. Fifty-nine, or about 22%, of the students said that it had no impact on their decision.

Past technology experience

Experienced students (Spring 1997)

Table 2 summarizes the results related to past technology experience. In the spring of 1997, student self-reported experience before coming to Waldorf College varied. On a five-point scale, with five indicating extensive experience and one indicating no experience, students reported a fairly high average experience level with computers of 3.52. The mode for experience with computers was 3. Previous experience reported with word processing was also high. The average experience was 3.51 and the mode was 4. The average of reported experience with spreadsheets dropped to 2.68 with the mode being 3. Database experience was also lower than computer and word processing experience. An average experience of 2.68 and a mode of 3 were found for database experience. The areas with the least reported experience were related to network use. The World Wide Web experience average was 2.36 while the mode was 1. The e-mail experience average was the lowest at 2.24 with a mode of 1. Using each technology experience area discussed above, an average technology experience indicator was calculated. The previous experience average for all technology use was 2.81 for the experienced students surveyed in the spring.

Entering students (Fall 1997)

In the fall of 1997 entering students reported previous experience levels with technology similar to the spring 1997 freshmen. Using the five-point scale described in the above section, students again indicated a fairly high past experience with computers, with an average of 3.46 on the five-point scale. Previous experience with word processing was similar with an average of 3.50, while the average of reported previous experience with spreadsheets was 2.64. The average of database experience was 2.54. There was an increase in reported previous technology experience with network related technologies. Both e-mail and World Wide Web experience before coming to Waldorf College increased. The average e-mail experience was reported as 2.66, up from 2.24 for the experienced students surveyed in the spring. World Wide Web experience increased from an average of 2.36 for the experienced students in the spring of 1997 to an average of 3.06 for the entering
<table>
<thead>
<tr>
<th>Technology</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Computers</td>
<td>(Mean = 3.46)</td>
<td></td>
</tr>
<tr>
<td>3= Some experience</td>
<td>121</td>
<td>44.8</td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>103</td>
<td>38.1</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>23</td>
<td>8.5</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>16</td>
<td>5.9</td>
</tr>
<tr>
<td>1= No experience</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>Word Processing</td>
<td>(Mean = 3.50)</td>
<td></td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>106</td>
<td>39.3</td>
</tr>
<tr>
<td>3= Some experience</td>
<td>105</td>
<td>38.9</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>31</td>
<td>11.5</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>18</td>
<td>6.7</td>
</tr>
<tr>
<td>1= No experience</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>(Mean = 2.64)</td>
<td></td>
</tr>
<tr>
<td>3= Some experience</td>
<td>98</td>
<td>36.3</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>80</td>
<td>29.6</td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>44</td>
<td>16.3</td>
</tr>
<tr>
<td>1= No experience</td>
<td>38</td>
<td>14.1</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>Data Base</td>
<td>(Mean = 2.54)</td>
<td></td>
</tr>
<tr>
<td>3= Some experience</td>
<td>104</td>
<td>38.5</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>65</td>
<td>24.1</td>
</tr>
<tr>
<td>1= No experience</td>
<td>54</td>
<td>20.0</td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>39</td>
<td>14.4</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>E-mail</td>
<td>(Mean = 2.66)</td>
<td></td>
</tr>
<tr>
<td>1= No experience</td>
<td>74</td>
<td>27.4</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>52</td>
<td>19.3</td>
</tr>
<tr>
<td>3= Some experience</td>
<td>62</td>
<td>23.0</td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>52</td>
<td>19.3</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>28</td>
<td>10.4</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>(Mean = 3.06)</td>
<td></td>
</tr>
<tr>
<td>1= No experience</td>
<td>38</td>
<td>14.1</td>
</tr>
<tr>
<td>2= Very little experience</td>
<td>47</td>
<td>17.4</td>
</tr>
<tr>
<td>3= Some experience</td>
<td>82</td>
<td>30.4</td>
</tr>
<tr>
<td>4= A lot of experience</td>
<td>64</td>
<td>23.7</td>
</tr>
<tr>
<td>5= Extensive experience</td>
<td>37</td>
<td>13.7</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>.7</td>
</tr>
</tbody>
</table>

Average Experience Indicator 2.98
(Average of all reported technology experience)
students surveyed in the fall of 1997. An experience average was calculated for the entering students based on their fall 1997 surveys. With the increase in network technology experience, the average technology experiences indicator increased to 2.98.

In the fall 1997 focus group discussions, entering students were asked to discuss their experience with computer technology and the Internet in high school. They commented briefly about the use of computers and the use of e-mail. The topic of Internet use and access generated much more interest and discussion.

Comments about experience with the computer in high school related most often to its use for word processing. About one half of these comments indicated that students frequently word processed papers and projects. For example one student said that students in his school had no trouble getting access to a computer and that they did all of their assignments using the computer. Another student said they were required to use the computer for writing. The other half of the students stated that computers were hard to gain access to and that they did very little with them. One student speculated that they had written, at most, five papers using the computer during high school. Other noted uses for the computer included use in typing classes, programming classes, math classes, and for desk top publishing. Often students indicated that their high schools provided access to both Intel based computers and Macintosh computers.

Strong interest in the use of World Wide Web resources was indicated during extensive discussion about its availability and use in the high schools. The majority of the students expressed frustration from the lack of access or restricted access in their high schools. For example, one student reported that his school had only two computers hooked up to the Internet. This student said it was hard to find time to use one of these connections and they said they received no training on its use. Another freshmen also reported two Internet connections in the high school and stated that he had no experience with Web based resources. Many other students reported small numbers of Internet connections in their schools ranging, from two to eight Internet connections. There was also frustration expressed with how access to Internet based resources was controlled. Some students said that they needed to find a teacher willing to monitor their Internet use before they were allowed to use it. Others complained about extensive rules for its use or extremely slow Internet connections. Some students reported that entire labs had Internet access, but they still had very little experience with Web resources because classes on computer applications usually occupied the labs.

While some students indicated a frustration with the lack of access to World Wide Web resources, several reported good access and availability. One student said that they had close to 90
computers with Internet access. Another student noted that their school had easy access to the Internet and that they were trained in its use. The student noted that many of their assignments were based around the Internet. Another stated that they were encouraged to use the Internet for literature projects and to gather a variety of information. These examples illustrate that some students entering Waldorf College had extensive experience with Internet based resources. However the majority of entering freshmen were frustrated with their prior limited access to Internet resources.

Discussion about e-mail experience before coming to Waldorf College was limited. While several students noted some restricted access to e-mail in their high schools, many had not had an opportunity to have their own e-mail account and very little discussion was generated concerning its use.

Research Questions

Question 1: What are the computer and network use patterns of Waldorf College freshmen?

Frequency of use: experienced students

In the spring of 1997, experienced students completing the WCLS reported frequent use of computer and network technology during their year at Waldorf College. Table 3 summarizes this use. The survey instrument provided the following choices for frequency of use: never, monthly, weekly, bi-weekly, once a day, and several times a day. Almost 84% of the students surveyed used their laptop computer several times a day. Another 10% used it daily giving a total of 94% of students whom used their computer daily or several times a day.

E-mail was also frequently used with approximately 95% of the students using e-mail daily or several times a day. Of these almost 78% used their e-mail several times a day and about 17% used their e-mail once a day.

Use of the World Wide Web was less frequent than use of e-mail and laptop computers. About 21% of the spring 1997 students used the World Wide Web several times a day and 25% used the Web once a day. About 18% used the Web bi-weekly and approximately 22% indicated weekly use of the Web. Thirteen percent reported that they used the World Wide Web monthly or never.

An average frequency of technology use was calculated by averaging the laptop computer, e-mail, and World Wide Web use. This average was based on assigning a 1 to reported use of “never” up to a 6 for reported use averages of “several times a day”. The average frequency of technology use for the experienced students in the spring of 1997 was 5.19 indicating very high frequency of technology use among this group of students.
Table 3 - Frequency of technology use

<table>
<thead>
<tr>
<th>How often do you use:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Laptop Computer</td>
<td>(mean = 5.68)</td>
<td></td>
</tr>
<tr>
<td>1=never</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2=monthly</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>3=weekly</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>4=bi-weekly</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>5=once a day</td>
<td>55</td>
<td>20.4</td>
</tr>
<tr>
<td>6=several times a day</td>
<td>203</td>
<td>75.2</td>
</tr>
<tr>
<td>E-mail</td>
<td>(mean = 4.96)</td>
<td></td>
</tr>
<tr>
<td>1=never</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>2=monthly</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>3=weekly</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>4=bi-weekly</td>
<td>39</td>
<td>14.4</td>
</tr>
<tr>
<td>5=once a day</td>
<td>93</td>
<td>34.4</td>
</tr>
<tr>
<td>6=several times a day</td>
<td>105</td>
<td>38.9</td>
</tr>
<tr>
<td>missing</td>
<td>I</td>
<td>.5</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>(mean = 4.60)</td>
<td></td>
</tr>
<tr>
<td>1=never</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>2=monthly</td>
<td>7</td>
<td>2.6</td>
</tr>
<tr>
<td>3=weekly</td>
<td>52</td>
<td>19.3</td>
</tr>
<tr>
<td>4=bi-weekly</td>
<td>44</td>
<td>16.3</td>
</tr>
<tr>
<td>5=once a day</td>
<td>89</td>
<td>33.0</td>
</tr>
<tr>
<td>6=several times a day</td>
<td>74</td>
<td>27.4</td>
</tr>
<tr>
<td>missing</td>
<td>1</td>
<td>.4</td>
</tr>
</tbody>
</table>

Average Frequency of Technology Use 5.08 5.19

Results from the focus group discussions with the experienced students in the spring of 1997 supported the survey results on frequency of technology use reported in the WCLS. Student comments indicated that most students used their computers several times a day. However, the majority of the focus group discussion comments revealed that much of the frequency of technology use centered about the sending and receiving of e-mail. Comments such as “I use e-mail constantly”, “I’m an e-mail addict”, and “I check my e-mail first thing in the morning” were pervasive in student comments about frequency of technology use. Students also mentioned Web surfing as a common daily form of entertainment and occasionally as a way to find information for a class.

Expected frequency of use: Entering students

Entering students, in the fall 1997 semester, were asked on the WCLS to estimate the expected frequency of their use of the computer, e-mail and the World Wide Web for the upcoming
school year. Approximately 75% of the students expected to use their computers several times a day. An additional 12% of the entering students expected that they would use their computers once a day. These estimates of frequency use are similar to the actual uses reported by the experienced students in the spring of 1997.

The entering students underestimated the frequency that they would use their e-mail. Only 73% expected that they would check their e-mail once a day or several times a day. Almost 95% of the experienced students reported that they had checked their e-mail once a day or several times a day.

The entering students overestimated the frequency that they would use the World Wide Web. Approximately 60% felt that they would use Web resources once a day or several times a day. In reality, only 47% of the experienced students reported that they had used the World Wide Web once a day or several times a day.

A frequency of expected technology use average was calculated for the entering students by averaging the expected laptop computer, e-mail, and World Wide Web frequency of use. The average expected frequency of use, calculated using the fall 1997 surveys, was slightly lower at 5.08.

Focus group comments of entering freshmen in the fall of 1997 suggested that the frequency of computer use in high school was much less than their expected use in college. These focus group comments implied that many high school students do not use computers on a daily basis and many rarely used e-mail or Web based resources.

In what ways was technology used? (Experienced Students)

The experienced students in the spring of 1997 indicated on the WCLS that they used laptop computers the most for course work. One hundred and nineteen, or 55%, indicated course work as their primary use for their laptop. Almost 24%, or 51 students, reported that they used their laptop the most for entertainment. Forty-one, or 19%, noted that they used their computer the most for personal work. (see Table 4)

The World Wide Web was used the most for entertainment by 105, or about 47%, of the experienced students. This was followed by 72, or 33%, of the students who reported that they used the World Wide Web the most for course work and 27, or 12.5%, who indicated that they used the World Wide Web the most for personal work. Twelve students indicated that they did not use the World Wide Web or did not respond to this question.

The majority of the experienced students in the spring of 1997, or almost 55%, indicated that they used e-mail the most to communicate with friends off the Waldorf campus. About 36% recorded
Table 4 - In what ways did students use technology?

<table>
<thead>
<tr>
<th></th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>I use my laptop computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the most for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>course work</td>
<td>191</td>
<td>70.7</td>
</tr>
<tr>
<td>entertainment</td>
<td>16</td>
<td>5.9</td>
</tr>
<tr>
<td>personal work</td>
<td>55</td>
<td>20.4</td>
</tr>
<tr>
<td>I do not use laptop</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>missing</td>
<td>7</td>
<td>2.6</td>
</tr>
<tr>
<td>I use the WWW the most for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>course work</td>
<td>146</td>
<td>54.1</td>
</tr>
<tr>
<td>entertainment</td>
<td>83</td>
<td>30.7</td>
</tr>
<tr>
<td>personal work</td>
<td>32</td>
<td>11.9</td>
</tr>
<tr>
<td>I do not use WWW</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>missing</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>I use the e-mail the most to communicate with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>faculty or staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at Waldorf</td>
<td>14</td>
<td>5.2</td>
</tr>
<tr>
<td>friends at Waldorf</td>
<td>29</td>
<td>10.7</td>
</tr>
<tr>
<td>friends off campus</td>
<td>172</td>
<td>63.7</td>
</tr>
<tr>
<td>family</td>
<td>46</td>
<td>17.0</td>
</tr>
<tr>
<td>I do not use e-mail</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>missing</td>
<td>6</td>
<td>2.2</td>
</tr>
</tbody>
</table>

that they used e-mail the most to communicate with friends on the Waldorf Campus. Six percent reported that they used e-mail the most to communicate with family and about 4% noted that they used e-mail the most to communicate with faculty or staff at Waldorf.

Results from the spring 1997 focus group discussions with experienced students, supported the WCLS findings concerning the ways technology was used. The majority of comments related to laptop computer use centered about classroom applications. The statement, "I do all of my writing, even first drafts, on the computer," is an example of the types of comments related to computer use. During these focus group discussions, students suggested that they used the WWW the most for entertainment. This entertainment included participating in chat rooms, general net surfing or looking for information related to their favorite sports team or rock band. While entertainment was the most frequently mentioned use of the WWW, students also noted that they used the Web occasionally for research. E-mail to friends off campus was mentioned frequently when discussing e-mail use. Student comments indicated that they used e-mail on a daily basis to maintain contact, without running up a phone bill, with friends on other campuses or at home.
In what ways was it expected that technology would be used? (Entering students)

The expected use of computers indicated by the entering freshmen in the fall of 1997 was
different than the reported use of the experienced students. A higher percentage of entering freshmen
in the fall of 1997 anticipated that they would use their laptop computers the most for course work.
Over 70%, or 191 students, said they expected they would use their computer the most for course
work. A much smaller percentage expected that they would use their computer for entertainment.
Just under 6%, or 16 students, felt they would use their computer the most for entertainment. Fifty-
five, or just over 20%, expected that they would use their computers the most for personal work (see
Table 4).

Expected use of the World Wide Web as indicated by the entering students at Waldorf
College in the fall of 1997 was quite a bit different than the actual use reported by the experienced
students. One hundred and forty-six, or just over 54%, of the entering students anticipated that they
would use the Web the most for course work. Only 31%, or 83, students expected to use the World
Wide Web the most for entertainment. About 12% of the entering freshmen expected that they would
use the Web the most for personal work. Ten students did not think that they would use the World
Wide Web.

Students just entering Waldorf expected that they would use e-mail the most to communicate
with friends off campus. Almost 64% felt that they would use e-mail the most to communicate with
friends on other campuses. Only 11%, or 78 students, expected that they would use e-mail the most
to communicate the most with friends on campus. This was less then the actual use reported by the
experienced students 1997, indicating more on-campus communication to friends than had been
expected. Forty-six students, or 17% of the entering students thought they would use e-mail the most
to communicate with family and 14 students felt they would use e-mail the most to communicate
with faculty or staff at Waldorf.

As reported by the entering students in the fall 1997 focus groups, high school use of
technology was similar in some ways to its use at Waldorf. Comments suggested that computer use
in high schools centered about word processing for course assignments. Discussion about use of Web
resources in high schools would indicate that most students were restricted to using the web for
course work. However, several students who did not have these restrictions in high school, noted that
they used the web for entertainment by chatting on-line or by surfing for fun. The limited use of e-
mail in high schools reported in the focus groups did not appear to have any direct application to
course work.
What computer applications did students use? (Experienced students)

In the spring of 1997 experienced students indicated on the WCLS that they used a variety of computer applications. Table 5 summarizes these uses. As might be suggested by previous data, e-mail was used by many students. Two hundred and eleven, or almost 98% of the students, reported that they used e-mail. Word processing was used by almost 90%, or 193, of the students and web search software was used by 188, or 87%, of the students. Almost 82% of the experienced students reported that they had used entertainment software. Thirty-three percent, or 71 students, indicated that they had used data base software while 66, or almost 31%, noted that they had used presentation software. Multimedia software was used by 63, or 29%, of the students and 59, or 27%, of the students indicated that they had used course specific software. Approximately 19%, or 42, of the students reported that they used desktop publishing and about 18% recorded that they used programming software. No one reported that they did not use computer applications. Unfortunately, spreadsheet software was omitted from the spring 1997 survey.

The spring 1997 focus group discussion comments reinforced the findings from the WCLS. Most students suggested that they used e-mail and word processing the most. Other computer applications mentioned in the focus group discussions included web search software, spreadsheets, databases, programming languages and presentation software.

What computer applications did students expect to use? (Entering students)

Students in the fall of 1997 anticipated that they would use a wide range of computer application software. Two hundred and fifty-seven, or over 95%, of the entering students expected to use e-mail. This was followed by word processing with 248, or almost 92%, of the students expecting to use word processing. Eighty-seven percent, or 236 of the students, expected to conduct Web searches; and approximately 84%, or 226 students, expected to use computer entertainment software. Fifty-five percent, or 149, of the students expected to use both course specific software and data base software. Approximately 41%, or 112, of the students anticipated that they would use both multimedia software and presentation software. Thirty-seven percent, or 102, of the entering students expected that they would use spreadsheets and 34%, or 92 students, expected that they would use desktop publishing software. Over 28%, or 77, of the entering students felt that they would use programming languages. It interesting to note that with the exception of e-mail, more students anticipated that they would use the application software than was actually reported used by the experienced students.
Table 5 - What computer applications did students use?

<table>
<thead>
<tr>
<th>Check all the computer applications below that you use:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Computer Entertainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>226</td>
<td>83.7</td>
</tr>
<tr>
<td>no</td>
<td>44</td>
<td>16.3</td>
</tr>
<tr>
<td>Course Specific Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>149</td>
<td>55.2</td>
</tr>
<tr>
<td>no</td>
<td>121</td>
<td>44.8</td>
</tr>
<tr>
<td>Data Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>149</td>
<td>55.2</td>
</tr>
<tr>
<td>no</td>
<td>121</td>
<td>44.8</td>
</tr>
<tr>
<td>Desktop Publishing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>92</td>
<td>34.1</td>
</tr>
<tr>
<td>no</td>
<td>178</td>
<td>65.9</td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>257</td>
<td>95.2</td>
</tr>
<tr>
<td>no</td>
<td>13</td>
<td>4.8</td>
</tr>
<tr>
<td>Multimedia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>112</td>
<td>41.5</td>
</tr>
<tr>
<td>no</td>
<td>158</td>
<td>58.5</td>
</tr>
<tr>
<td>Presentation Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>111</td>
<td>41.1</td>
</tr>
<tr>
<td>no</td>
<td>159</td>
<td>58.9</td>
</tr>
<tr>
<td>Programming Languages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>77</td>
<td>28.5</td>
</tr>
<tr>
<td>no</td>
<td>193</td>
<td>71.5</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>102</td>
<td>37.8</td>
</tr>
<tr>
<td>No</td>
<td>168</td>
<td>62.2</td>
</tr>
<tr>
<td>Web Search</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>236</td>
<td>87.4</td>
</tr>
<tr>
<td>no</td>
<td>34</td>
<td>12.6</td>
</tr>
<tr>
<td>Word Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>248</td>
<td>91.9</td>
</tr>
<tr>
<td>no</td>
<td>22</td>
<td>8.1</td>
</tr>
<tr>
<td>I Do Not Use Computer Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>no</td>
<td>269</td>
<td>99.6</td>
</tr>
</tbody>
</table>

What computer application did students use the most? (Experienced students)

When asked to indicate the software application that they used the most, the experienced students in the spring of 1997 overwhelming selected e-mail. Table 6 summarizes this information. One hundred and five, or almost 49%, of the students selected e-mail as the computer application
that they used the most. Word processing was the next highest computer application selected as the most used. Approximately 28% of the students, or 61 students, used word processing the most. While e-mail and word processing were by far selected the most frequently as the computer application used the most, several other applications were also indicated. Eight students reported that they used Web search software the most. Seven students chose computer entertainment as the most used application. Four students used course specific software the most. Data base software, desktop publishing, multimedia, and programming were other computer applications selected as the most used by at least one student. Twenty-one students did not respond to this question.

As noted earlier, focus group comments indicated that students used e-mail the most of any computer application. In fact student comments would indicate that most checked or sent e-mail several times a day. Word processing was also frequently mentioned as being used on a daily basis.

### Table 6 - Computer application used the most

<table>
<thead>
<tr>
<th>Application</th>
<th>Frequency</th>
<th>Percent</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>42</td>
<td>15.6</td>
<td>105</td>
<td>48.6</td>
</tr>
<tr>
<td>Word processing</td>
<td>137</td>
<td>50.7</td>
<td>61</td>
<td>28.2</td>
</tr>
<tr>
<td>Web search</td>
<td>13</td>
<td>4.8</td>
<td>8</td>
<td>3.7</td>
</tr>
<tr>
<td>Computer entertainment</td>
<td>8</td>
<td>3.0</td>
<td>7</td>
<td>3.2</td>
</tr>
<tr>
<td>Course specific software</td>
<td>7</td>
<td>2.6</td>
<td>4</td>
<td>1.9</td>
</tr>
<tr>
<td>Programming</td>
<td>6</td>
<td>2.2</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>Data base</td>
<td>3</td>
<td>1.1</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>Desktop publishing</td>
<td>3</td>
<td>1.1</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>1.1</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>Multimedia</td>
<td>4</td>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Missing</td>
<td>44</td>
<td>16.3</td>
<td>21</td>
<td>9.7</td>
</tr>
</tbody>
</table>

**What computer application did students expect to use the most? (Entering students)**

Expectations for the software that they would use the most for incoming students were similar to the reported results from the experienced students. There was one major exception. One hundred and thirty-seven incoming entering students, or over 50%, expected that they would use word processing the most. Only 42, or almost 16%, expected that they would use e-mail the most. In contrast, almost 50% of the experienced students selected e-mail as the software that they used the most and word processing was second at below 30%. Other software that students expected to use when they began Waldorf in the fall were Web search software, computer entertainment, course
specific software, programming, data bases, desktop publishing and multimedia. Forty-four students did not answer this question on the survey.

**Question 2: Are Waldorf College freshmen required to use computer and network technology to complete course work and do they consider this technology use to be a valuable learning experience?**

*Is technology required for course work? (Experienced students)*

In the spring of 1997, experienced students were given four choices on the WCLS indicating their perceptions about the required use of technology in the classroom. Table 7 summarizes their responses. These choices included the following: none of my classes, at least one class, several of my classes, and all of my classes. When asked to report the number of classes in which computer use had been required, students selected "several of my classes" the most frequently. This was selected by 143 students, or approximately 66% of the students. Fifty-one, or almost 24%, indicated that the computer had been required for at least one class. Fourteen students stated that the computer had been required for all of their classes, while 8 reported that it had been required for none of their classes.

Experienced students in the spring of 1997 reported that required use of e-mail was much less than required computer use. One hundred and two, or 47%, of the students indicated that e-mail was not required for any class. Approximately 37%, or 79 students, stated that e-mail was required

**Table 7 - Technology required for course work**

<table>
<thead>
<tr>
<th>Technology required for:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Computer required for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>at least one class</td>
<td>28</td>
<td>10.4</td>
</tr>
<tr>
<td>several of my classes</td>
<td>160</td>
<td>59.2</td>
</tr>
<tr>
<td>all of my classes</td>
<td>82</td>
<td>30.4</td>
</tr>
<tr>
<td>E-mail required for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>37</td>
<td>13.8</td>
</tr>
<tr>
<td>at least one class</td>
<td>139</td>
<td>51.7</td>
</tr>
<tr>
<td>several of my classes</td>
<td>83</td>
<td>30.9</td>
</tr>
<tr>
<td>all of my classes</td>
<td>10</td>
<td>3.7</td>
</tr>
<tr>
<td>WWW resources required for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>at least one class</td>
<td>95</td>
<td>35.3</td>
</tr>
<tr>
<td>several of my classes</td>
<td>135</td>
<td>50.2</td>
</tr>
<tr>
<td>all of my classes</td>
<td>33</td>
<td>12.3</td>
</tr>
</tbody>
</table>
for at least one class. Thirty-four students, or approximately 16%, noted that e-mail was required for several of their classes. Only one student reported that e-mail was required for all of their classes.

The students in the spring of 1997 indicated that more classes required World Wide Web resources than e-mail. Almost 43%, or 92 students, reported that World Wide Web Resources were required for at least one class. Eighty-six students, or almost 40%, indicated that World Wide Web resources were required for several of their classes. Thirty-five students said Web resources were required for none of their classes, while only 3 students stated Web resources were required for all of their classes.

Spring 1997 focus group discussions with experienced students provided additional insight into how computers were required for use in course work. Comments indicated that using the computer for word processing and spell checking papers was a campus-wide requirement. In several cases word processing was also used for writing the answers to essay-types of exams. In addition, science courses such as chemistry and biology required the use of spreadsheets for charting and graphing data. It was not clear whether presentation software was required for speech class, but several students mentioned that they had used this type of software in making speeches. Comments also indicated that, as might be expected, using the computer was required for courses that studied the computer and computer software. This included courses that covered computer applications and programming.

The focus group discussions revealed that e-mail was not required in as many courses as was the general use of the computer. Students did indicate that they used e-mail to communicate to their professors. Much of this communication consisted of asking questions relating to a course or explaining the need to be absent from class for illness or other commitments. At least one English professor required that their students participate on a weekly basis in an e-mail discussion, pertaining to course topics, with the rest of the class.

While the WCLS results indicated that close to 84% of the students felt that World Wide Web resources were required for at least one or more of their classes, focus group comments did not include many examples of this required use. Most of the comments related to World Wide Web use implied that students used it as a research tool without being required to do so by faculty. However one student indicated that in one of their classes the teacher provided two or three web site addresses for each topic they were studying.
Will technology be required for course work? (Entering students)

Students entering Waldorf in the fall of 1997 expected that computers would be required in more classes than the experienced group reported. One hundred and sixty students, or almost 60%, expected that computers would be required in several of their classes. Thirty percent, or 82 students, expected that computers would be required in all of their classes and 28 students expected that computers would be required in at least one of their classes.

The entering students surveyed in the fall of 1997 anticipated a greater use of e-mail than was reported by the experienced students. One hundred and thirty-nine students, or almost 52%, expected that e-mail would be required for at least one class. Eighty-three students, or almost 31%, expected that e-mail would be required in several of their classes; and 10 students felt that e-mail would be required in all of their classes. Thirty-seven students expected that e-mail would not be required for any of their classes.

The entering freshmen in the fall of 1997 expected a greater use of World Wide Web resources than indicated by the experienced students. One hundred and thirty-five students, or just over 50%, expected that Web resources would be required for several of their classes. Ninety-five, or 35%, of the students expected that Web resources would be required for at least one class; and 33 students expected that they would be required for all of their classes. Only 6 students did not think Web resources would be required for any of their classes.

In the fall 1997 focus groups most of the incoming freshmen suggested that technology had not been widely required for the completion of course work in high school. Only two or three students commented that it had been a requirement to word-process their papers. Only one said that they had been required to use the World Wide Web to find resources and two more said that teachers had suggested that they use Web resources for research. One student reported that teachers would not let them use the Web for research. E-mail was never mentioned in the focus group discussions as a requirement for the completion of course work in high school.

Is technology important for learning? (Experienced students)

In the spring of 1997, 157 experienced students indicated that computers were important for learning in several or all of their classes. Of these 34, or approximately 16%, reported that computers were important for learning in all of their classes, while 123, or 57%, stated that computers were important for learning in several of their classes. Fifty-two students, or 24%, noted that computers were important for learning in at least one class, while only 6 students indicated that computers were important for learning in none of their classes (see Table 8).
Table 8 - Importance of technology for learning

<table>
<thead>
<tr>
<th></th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Computers have been important for learning in:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>at least one class</td>
<td>26</td>
<td>9.7</td>
</tr>
<tr>
<td>several of my classes</td>
<td>129</td>
<td>48.1</td>
</tr>
<tr>
<td>all of my classes</td>
<td>111</td>
<td>41.4</td>
</tr>
<tr>
<td>E-mail has been important for learning in:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>at least one class</td>
<td>56</td>
<td>20.9</td>
</tr>
<tr>
<td>several of my classes</td>
<td>144</td>
<td>53.7</td>
</tr>
<tr>
<td>all of my classes</td>
<td>64</td>
<td>23.9</td>
</tr>
<tr>
<td>WWW resources have been important for learning in:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>none of my classes</td>
<td>20</td>
<td>7.4</td>
</tr>
<tr>
<td>at least one class</td>
<td>126</td>
<td>46.7</td>
</tr>
<tr>
<td>several of my classes</td>
<td>103</td>
<td>38.1</td>
</tr>
<tr>
<td>all of my classes</td>
<td>21</td>
<td>7.8</td>
</tr>
</tbody>
</table>

As reported by the experienced freshmen, e-mail was considered to be important for classroom learning by fewer students than the use of computers. Only 3 students felt e-mail was important for learning in all of their classes; and only 38 students or approximately 18% indicated that e-mail was important for learning in several of their classes. Seventy-eight, or 36 students, reported that e-mail was important in at least one class. Forty-five percent, or 97, students responded that e-mail was important for learning in none of their classes.

About 43%, or 93 experienced students, from the spring 1997 freshmen class viewed World Wide Web resources as important for learning in several of their classes. Approximately 41%, or 87 students stated that Web resources were important for learning in at least one class. Eighteen students, or 8% of the students, felt that Web resources were not important for learning in any class. Only 16 students or about 7% of the student reported that Web resources were important for all of their classes.

The spring 1997 focus group discussions with experienced students did not provide a great deal of additional understanding into how students viewed the importance of technology for learning. Most of the comments in the focus groups related to improved efficiency in writing with a word processor and computer. One student commented that for learning about computers, computer
applications and programming, having a computer was extremely important. This student said that, “you learn so much more about computers because you have 24 hour access to them.” Student use of e-mail and the WWW suggested that they consider these tools to be important for learning even if they were not required for a class. One student noted that they looked up articles on the Web on nutrition and motivation for a coaching class, while another found biology articles on the Web. Another student found a Web summary of a book they were reading and another found valuable statistics about drunk driving for a paper they were preparing. One student used e-mail to contact their high school Spanish teacher for assistance and information for a project that they were preparing. Another conducted an e-mail interview for a paper that was being prepared.

*Will technology be important for learning? (Entering Students)*

Entering students in the fall of 1997 expected that computers would be important for learning in many of their classes. Almost 90% expected that computers would be important for learning in several of their classes or all of their classes. Twenty-six students, or about 10%, expected that computers would be important for learning in at least one class and only two students expected that they would not be important in any class.

Students entering Waldorf anticipated that e-mail would be more important than the reported use by the experienced students in the spring of 1997. Only 4 students expected that e-mail would be important for learning in none of their classes. Fifty-six students, or almost 21%, believed that e-mail would be important for learning in at least one class. Almost 24%, or 64 students, expected that e-mail would be important for learning in all of their classes. One hundred and forty-four students, or 54%, expected that e-mail would be important for learning in several of their classes.

When students entered Waldorf College in the fall of 1997, their expectations for the importance of the World Wide Web for learning were similar to the values reported by the experienced students. One hundred and twenty-six students, or almost 47%, expected that World Wide Web resources would be important for learning in at least one class. One hundred and three students, or 38%, expected that Web resources would be important for learning in several of their classes. Twenty-one students expected that Web resources would be important for all of their classes; and 20 students expected that Web resources would important for learning in none of their classes.

*Is technology used effectively by faculty for instruction, homework and communication? (Experienced students)*

In the spring of 1997, 118, or approximately 55%, of the experienced students felt that computers had been used effectively for instruction in at least one of their classes (see Table 9).
Approximately 32%, or 69 students, felt that computers had been used effectively for instruction in several of their classes. Twenty-three students felt that computers had not been used effectively for instruction in any of their classes. Only 6 students reported that computers had been used effectively for instruction in all of their classes.

Table 9 - Effectiveness of technology use in courses

<table>
<thead>
<tr>
<th>Computer used effectively for instruction in:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>none of my classes</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>at least one class</td>
<td>86</td>
<td>32.0</td>
</tr>
<tr>
<td>several of my classes</td>
<td>137</td>
<td>51.0</td>
</tr>
<tr>
<td>all of my classes</td>
<td>42</td>
<td>15.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computers used effectively for homework in:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>none of my classes</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>at least one class</td>
<td>55</td>
<td>20.4</td>
</tr>
<tr>
<td>several of my classes</td>
<td>156</td>
<td>57.8</td>
</tr>
<tr>
<td>all of my classes</td>
<td>56</td>
<td>20.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-mail used effectively by the professor for communication in:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>none of my classes</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>at least one class</td>
<td>89</td>
<td>33.1</td>
</tr>
<tr>
<td>several of my classes</td>
<td>142</td>
<td>52.8</td>
</tr>
<tr>
<td>all of my classes</td>
<td>34</td>
<td>12.6</td>
</tr>
</tbody>
</table>

When asked to report the number of classes in which computers were used effectively for homework, 104 of the experienced students, or 48%, reported that they were used effectively in several of their classes. Eighty-six, or almost 40%, of the students noted that computers were used effectively for homework in at least one class. Sixteen students felt that computers were not used effectively for homework in any of their classes, while only 10 students stated that computers were used effectively for homework in all of their classes.

Many experienced students reported in the spring 1997 survey that e-mail had been used effectively for communication by their professors. One hundred and six students, or 49%, felt that e-mail had been effective for communication in several of their classes. Seventy-four, or 34%, noted that e-mail had been used effectively by the professor for communication in at least one class.
Twenty-eight students reported that e-mail had not been used effectively for communication in any of their classes; and 8 students stated that e-mail had been used effectively in all of their classes.

Experienced student focus group discussion results provided some details about the effective ways faculty used technology to support learning. Several students noted that professors had used presentation software for course lectures and had printed out the notes in advance for students to use during class. Comments also indicated that faculty had allowed students to word process tests. To support homework, students indicated a variety of ways in which faculty used the technology. One faculty member put course requirements, assignments, and examples on a common network drive available to all students. Another put solutions and answers to problems on a Web page and an English professor provided related web sites for each topic that was being studied.

Comments about the use of e-mail for faculty communication with students were common. For example: One member of the faculty e-mailed students, before a test, with suggestions on problems to try and topics to study before the exam. Another faculty would send students questions by e-mail and require e-mail responses to the questions. One faculty member requested course feedback via e-mail and then discussed the suggestions and comments during the next class period. As mentioned earlier in this chapter, one English professor conducted on-line class discussions with her classes. Several students noted better communication with faculty. One said that they e-mailed papers to their professors and received feedback more quickly. Another said that they could easily get help from professors via e-mail.

While the experienced students provided several examples of effective uses of technology, they also had some suggestions for faculty. Several students suggested that all exams be taken using word processing. Other comments addressed a larger issue. In discussing classroom use of the laptop computers one student said, “You would think they (professors) would make use of them (laptops) since we have one”. Several students supported this viewpoint noting that they had only rarely been required to bring their computer to class. They simply felt that faculty in class should use the computers more than they were being used. Another stated that it would be good for faculty to demonstrate computer use more often. Several students also indicated that they thought that faculty could use the Web more effectively. They suggested that faculty become more aware of Web based resources and provide Web addresses related to topics that were being discussed. Several students also felt that faculty should place course materials on Web sites for ease of access. One student thought that web sites could provide suggestion boxes for students to provide feedback to faculty.
Experienced students in the focus groups were also asked to comment on faculty comfort level with computers. Most students, who commented, characterized faculty as comfortable and competent with computers and computer technology. For example, one student said, "All my teachers are pretty comfortable with it" (technology). Others mentioned that some faculty members offered to help with technology related problems in their offices. However, some students felt that a few faculty were still using older software than the new computers provided and that some teachers were "scared of it" (technology).

Will technology be used effectively by faculty for instruction, homework and communication? (Entering students)

Students entering Waldorf in the fall of 1997 expected that computers would be used effectively in more classes than the spring freshmen reported. Almost 67% expected that computers would be used effectively for instruction in several or all of their classes. Eighty-six entering students, or 32% expected that computers would be used effectively in at least one class. Only 4 students expected that computers would be used effectively for instruction in none of their classes.

The entering students expected more effective use of computers for homework than was reported by the experienced students. Almost 58%, or 156 students, expected that computers would be used effectively for homework in several of their classes. Almost 21% expected that computers would be used effectively for homework in all of their classes; and 20% expected that computers would be used effectively for homework in at least one class. Only 3 students expected that computers would be used effectively for homework in none of their classes.

Most students entering Waldorf in the fall of 1997 expected that e-mail would be used effectively for communication by professors. Over 65% expected that e-mail would be used effectively by the professor for communication in several of their classes or all of their classes. Thirty-three percent, or 89 of the students, expected that e-mail would be used effectively in at least one class. Only 4 students did not feel that e-mail would be used effectively in any of their classes.

When the entering students in the fall 1997 focus groups were asked to discuss how teachers used technology to support learning in their high schools, responses varied. Several students said that only the librarian, the media specialist, the computer applications teacher and the typing teacher used the technology. Others said there was one or two teachers who presented using presentation software. A few students mentioned the efforts to integrate computers in many areas. One said there was an attempt to integrate technology use into every class. For example most teachers required that at least a few resources for a research project be Web based. Another student mentioned that they used
computers in drafting, art, and music. Another student noted using the Web, during election time, to look up election progress and information about candidates as an example.

While there was some discussion about integration of computers into the high school classroom by incoming students, more of the student comments concentrated on their views of how prepared to use technology their high school teachers were. These comments were divided into one group that noted how unprepared their teachers were and another group that noted the effort teachers were making to learn and use technology. Based on these focus group comments it appeared that some districts are well behind others in providing teachers with technology training opportunities. One group of the comments about inadequate teacher preparation, focused on their teachers' lack of experience and understanding of computers and the Internet. For example one student stated, "Our teachers just weren't educated enough to teach us about it." Another said that their teachers were afraid of the technology and thought students should do things the old fashioned way.

The group of comments that focused on teacher efforts to learn and incorporate technology in education suggested that some districts are making progress in developing their teachers. Many students commented that they knew their teachers had taken classes in the use of technology. Quite a few said that their teachers were making significant efforts to use the technology. Comments about efforts to use technology in education included an indication that many districts hold technology training session, some hold meetings to discuss the integration of technology into the classroom, and some districts help teachers purchase their own computers.

Is technology changing the way in which students learn? (Experienced students)

In the spring of 1997, a high percentage of the experienced students who completed the WCLS felt that computers and Internet technology were changing the way in which they learned (see Table 10). On a scale, in which 1 indicated "strongly disagree" and 7 indicated "strongly agree", over 82%, or 178 of the students, either moderately agreed, agreed or strongly agreed with the statement, "Having computer resources is changing the way in which I learn." Of this 178 students, 33 moderately agreed, 77 agreed, and 68 strongly agreed. Twenty-one, or about 10%, of the students were undecided, with only 16, or about 7.5% either moderately disagreeing, disagreeing or strongly disagreeing.

When asked to respond on the same seven point scale about Internet and World Wide Web access, 68, or about 32%, of the experienced students agreed that having Internet and WWW access was changing the way in which they learned. Fifty-five, or about 26%, of the students strongly agreed that having Internet and WWW access was changing the way in which they learned. Thirty-
Table 10 - Technology is changing the way in which students learn: student perceptions

<table>
<thead>
<tr>
<th>Computers are changing the way in which I learn:</th>
<th>Entering Students Fall 97</th>
<th>Experienced Students Spring 97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>1=Strongly Disagree</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>2=Disagree</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>3=Moderately Disagree</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>4=Undecided</td>
<td>28</td>
<td>10.4</td>
</tr>
<tr>
<td>5=Moderately Agree</td>
<td>56</td>
<td>20.8</td>
</tr>
<tr>
<td>6=Agree</td>
<td>100</td>
<td>37.2</td>
</tr>
<tr>
<td>7=Strongly Agree</td>
<td>76</td>
<td>28.3</td>
</tr>
</tbody>
</table>

Internet and WWW are changing the way in which I learn:

| Frequency | Percent | Frequency | Percent |
| 1=Strongly Disagree | 1 | .4 | 4 | 1.9 |
| 2=Disagree | 2 | .7 | 8 | 3.7 |
| 3=Moderately Disagree | 8 | 3.0 | 8 | 3.7 |
| 4=Undecided | 31 | 11.5 | 37 | 17.1 |
| 5=Moderately Agree | 53 | 19.6 | 36 | 16.7 |
| 6=Agree | 94 | 34.8 | 68 | 31.5 |
| 7=Strongly Agree | 81 | 30.0 | 55 | 25.5 |

Average indicator of student perceptions of how technology was changing the way in which they learn

| mean =5.745 | mean = 5.54 |

six students moderately agreed and 37 were undecided. Only 20, or approximately 7% of the students moderately disagreed, disagreed, or strongly disagreed that Internet and WWW access were changing the way in which they learned.

An average of the experienced students' responses to the two items that stated that the computer and Internet and WWW resources were changing the way in which students learned, was calculated. This average was based on assigning a 1 to responses of "strongly disagree" up to a 7 for responses of "strongly agree". It provided an indication of student perceptions of how technology (computer, Internet and Web access) was changing the way in which they learn. The average indicator was 5.54 for the experienced students, indicating between moderate agreement and agreement to statements suggesting that technology was changing the way in which the students learned.

When experienced students in the spring 1997 focus groups were asked to discuss whether having a computer and e-mail and Internet access was changing the way in which they learned, most
answers were related to the convenience of having this technology available. For example one student said, "I can work on my papers whenever I want without waiting to get access in a lab." Another stated that "you can do research even after the library closes". Several noted that because of these conveniences they put off assignments longer, because they could work in their room whenever they would like and as late as they would like. These thoughts, related to the convenience provided by the technology, were the main focus of the students in the discussion groups when asked if technology was changing the way in which they learned.

Further examination of all of the experienced student focus group discussion comments, suggested that student learning was changing as a result of technology in ways that the students themselves had not yet recognized. For example one student noted that when he participated in the writing of a group paper for English class, the group found hundreds of related papers on the Internet. Another noted that when they were doing research on an author on the Web, they participated in an on-line discussion with another person who was also doing research on the author. One student noted that he had looked at more articles pertaining to his topic of research on the Web then he could have found in the Waldorf library. Another student kept track, through the Web, of the job postings and position announcements in companies that he was interested in eventually finding employment. These examples of student access to additional resources would have been difficult for students to experience without access to the technology provided at Waldorf College.

*Will technology change the way in which students learn? (Entering students)*

In the fall of 1997, entering students reported similar responses to the experienced students. Eighty-six percent of the freshmen moderately agreed, agreed, or strongly agreed with the statement, "Having computer resources available will change the way in which I learn." This included 100 students, or 37%, who agreed with this statement, 76 students, or 28%, who strongly agreed, and 56 students, or almost 21%, that moderately agreed. Twenty-eight students, or a little over 10%, were undecided. Only 9 students moderately disagreed, disagreed, or strongly disagreed with this statement.

Entering student responses to the statement, "Internet and WWW will change the way in which I learn, were similar to what was reported by the experienced students who had been at Waldorf College for a school year. About 35%, or 94 students, agreed with the statement. Thirty percent, or 81 students, strongly agreed with about 20% moderately agreeing. Thirty students, or about 12%, were undecided. Only 11 students moderately disagreed, disagreed, or strongly disagreed that the Internet and WWW would change the way in which they learned.
A mean was also calculated for the entering students' responses to the two items that stated that the computer and Internet and WWW resources were changing the way in which students learned. The average was 5.745 for the entering students. This indicates between moderate agreement and agreement to statements suggesting that technology would change the way in which the students learned.

Entering students in the fall of 1997 commented on whether technology was changing the way they learned based on their high school experiences. These focus group comments were somewhat different from the responses found on the WCLS. About one half of the comments indicated that students felt that technology had no affect on the way they learned. For example, one student felt that the Web was too distracting and designed primarily for entertainment. Another student felt that technology use could not be applied to many subjects. The other half of the comments suggested that students felt that technology was changing the way in which they learned. However, these comments focused more on improved convenience in learning. For example, several students stated that writing and revising go much more quickly using word processing. Another noted that it is much easier to find sources for research when using the Web. One did suggest that they thought differently about writing when they used word processing.

Is technology changing the types of papers and projects students prepare? (Experienced students)

In the spring of 1997, a large percentage of the experienced students stated that they believed that having computer resources available improved the types of projects and papers that they prepared for course work (see Table 11). Ninety-seven students, or approximately 45%, strongly agreed that computer resources improved papers and projects. Sixty-eight, or 32%, agreed and 32, or almost 15%, moderately agreed with this statement. Fourteen students were undecided and only 5 students moderately disagreed or disagreed that computer resources improved papers and projects for course work.

A high percentage of the experienced students also agreed that Internet and World Wide Web access improved papers and projects that they prepared for course work. Seventy-two students strongly agreed that having the Internet and WWW access improves the types of projects and papers that they prepare for course work. One hundred and four either agreed or moderately agreed. Twenty-eight students were undecided. Only 12 students, or slightly less than 6% moderately disagreed, disagreed, or strongly disagreed that having Internet and WWW access improved the types of projects and papers that they prepared for course work.
Table 11 - Technology is improving course papers and projects: student perceptions

<table>
<thead>
<tr>
<th></th>
<th>Entering Students Fall '97</th>
<th>Experienced Students Spring '97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Computers improve papers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and projects for course work:</td>
<td>(mean = 6.06)</td>
<td></td>
</tr>
<tr>
<td>1=Strongly Disagree</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>2=Disagree</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>3=Moderately Disagree</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>4=Undecided</td>
<td>17</td>
<td>6.3</td>
</tr>
<tr>
<td>5=Moderately Agree</td>
<td>41</td>
<td>15.2</td>
</tr>
<tr>
<td>6=Agree</td>
<td>92</td>
<td>34.1</td>
</tr>
<tr>
<td>7=Strongly Agree</td>
<td>114</td>
<td>42.2</td>
</tr>
</tbody>
</table>

Access to Internet and WWW resources improves papers and projects for course work: (mean = 5.89) (mean = 5.68)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=Strongly Disagree</td>
<td>1</td>
<td>.4</td>
<td>1</td>
<td>.5</td>
</tr>
<tr>
<td>2=Disagree</td>
<td>3</td>
<td>1.1</td>
<td>6</td>
<td>2.8</td>
</tr>
<tr>
<td>3=Moderately Disagree</td>
<td>4</td>
<td>1.5</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>4=Undecided</td>
<td>21</td>
<td>7.8</td>
<td>28</td>
<td>13.0</td>
</tr>
<tr>
<td>5=Moderately Agree</td>
<td>50</td>
<td>18.5</td>
<td>41</td>
<td>19.0</td>
</tr>
<tr>
<td>6=Agree</td>
<td>101</td>
<td>37.4</td>
<td>63</td>
<td>29.2</td>
</tr>
<tr>
<td>7=Strongly Agree</td>
<td>90</td>
<td>33.3</td>
<td>72</td>
<td>33.3</td>
</tr>
</tbody>
</table>

Average indicator of students perceptions of technology improving papers and projects. mean = 5.98 mean = 5.89

An average indicator of student perceptions of the impact of technology for improving papers and projects was calculated based on the responses to the two statements discussed above. This average was 5.89 for the experienced students suggesting that they moderately agreed to agreed that technology use improved the papers and projects they prepared for course work.

Will technology change the types of papers and projects students prepare? (Entering students)

The entering students in the fall of 1997 had responses similar to the experienced freshmen. Forty-two percent, or 114 students, strongly agreed that having computers would improve the types of projects and papers they prepared for course work. Thirty-four percent, or 92 students agreed, while 41 students moderately agreed. Seventeen students were undecided; and only 6 students moderately disagreed, disagreed, or strongly disagreed.

Entering student responses in the fall of 1997 were similar to the responses of the experienced students. Thirty-three percent, or 90 students, strongly agreed that access to Internet and WWW resources would improve papers and projects for course work. One hundred and one students,
or 37%, agreed, while 50 students or about 18% moderately agreed. Twenty-one students or about 8%, were undecided as to whether these technology resources would improve papers and projects. Eight students moderately disagreed, disagreed, or strongly disagreed that papers and projects would be improved.

An average of 5.98 was calculated for the two questions related to using technology to improve papers and projects for the entering students. This would suggest that these entering students agreed that technology availability would improve the types of reports and papers that they prepared for course work.

**Question 3: How does perceived individual innovativeness and perceptions of organizational innovativeness impact student use of new technology resources?**

*Organizational innovativeness*

In the spring 1997, 213 experienced students completed the 25 item Perceived Organizational Innovativeness Scale. (see Table 12). They responded with a 1 to indicate "strongly disagree" to a 7 to indicate "strongly agree" to statements about Waldorf College. The scale was developed so that the higher the score, the more innovative the institution was perceived. The lowest possible score would be 25 with the highest score being 185. The lowest score reported in the spring survey was 43 with the highest being 182. The average was just over 111 with the standard deviation being just over 19.

Two hundred and sixty-seven entering freshmen in the fall of 1997 completed the same Perceived Organizational Innovativeness Scale as did the experienced students. The lowest score

<table>
<thead>
<tr>
<th>Table 12 - Perceived organizational innovativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>Experienced Students</strong></td>
</tr>
<tr>
<td>213</td>
</tr>
<tr>
<td><strong>Entering Students</strong></td>
</tr>
<tr>
<td>267</td>
</tr>
<tr>
<td><strong>Population Mean</strong></td>
</tr>
<tr>
<td>1213</td>
</tr>
</tbody>
</table>

*Students surveyed in the spring of 1997 after a school year of technology use, ^Students surveyed in the fall of 1997 as they entered Waldorf College, ^Mean population score developed through research by Partin and Simonson (1997) of the Technology Research in Education Group*
reported was 75, while the highest score was one 164. The average was over 121 and the standard deviation was almost 18.

**Individual innovativeness**

In the spring of 1997, 209 experienced students completed the individual innovativeness scale. Students were asked to respond by selecting from 1, for “strongly disagree”, to 7 for “strongly agree” to each of 20 statements. The higher the score, the more the students viewed themselves as innovative. The lowest score reported was 70 with the highest being 140. The average was just over 99 with the standard deviation being just under 15 (see Table 13).

<table>
<thead>
<tr>
<th>Table 13 - Perceived individual innovativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Experienced Students*</td>
</tr>
<tr>
<td>Entering Students*</td>
</tr>
<tr>
<td>Population Mean*</td>
</tr>
</tbody>
</table>

*Students surveyed in the spring of 1997 after a school year of technology use, “Students surveyed in the fall of 1997 as they entered Waldorf College, ‘Mean population score developed through research by Partin and Simonson (1997) of the Technology Research in Education Group

In the spring of 1997, 209 experienced students completed the individual innovativeness scale. The highest score reported was 164 and the lowest score was 65. The average was over 121 and the standard deviation was almost 18.

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<table>
<thead>
<tr>
<th>Table 13 - Perceived individual innovativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Experienced Students*</td>
</tr>
<tr>
<td>Entering Students*</td>
</tr>
<tr>
<td>Population Mean*</td>
</tr>
</tbody>
</table>

*Students surveyed in the spring of 1997 after a school year of technology use, “Students surveyed in the fall of 1997 as they entered Waldorf College, ‘Mean population score developed through research by Partin and Simonson (1997) of the Technology Research in Education Group

In the fall of 1997, 269 entering students completed the individual innovativeness scale. The highest score reported was 134 and the lowest score was 65. The mean was just under 97.

**Relationships (Experienced students)**

The perceived organizational innovativeness scores and the perceived individual innovativeness scores of experienced students were used for correlation with several other variables. They were correlated with the average frequency of technology use, the average indicator of student perceptions of how technology was changing the way in which they learned, and the average indicator of student perceptions of technology for improving papers and projects. The results are shown in Table 14.

No significant relationship was found between perceived organizational innovativeness and the average frequency of technology use (r=.04). There were significant positive relationships found between perceived organizational innovativeness and the average indicator of student perceptions of how technology was changing the way in which they learned (r=.35) and the average indicator of student perceptions of technology for improving papers and projects (r=.29). This suggests that
Table 14 – Experienced student correlation coefficients

<table>
<thead>
<tr>
<th>PORGI*</th>
<th>IS</th>
<th>CAIN</th>
<th>Frequency</th>
<th>Changing</th>
<th>Improving</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS b</td>
<td>.33**</td>
<td>IS</td>
<td>CAIN</td>
<td>Frequency</td>
<td>Changing</td>
</tr>
<tr>
<td>CAIN*</td>
<td>-30**</td>
<td>-51**</td>
<td>Frequency</td>
<td>Changing</td>
<td>Improving</td>
</tr>
<tr>
<td>Frequency</td>
<td>.04</td>
<td>.02</td>
<td>-.26**</td>
<td>-16**</td>
<td>-16**</td>
</tr>
<tr>
<td>Changing</td>
<td>.35**</td>
<td>.36**</td>
<td>-.44**</td>
<td>.38**</td>
<td>.38**</td>
</tr>
<tr>
<td>Improving</td>
<td>.29**</td>
<td>.39**</td>
<td>-.52**</td>
<td>.29**</td>
<td>.63**</td>
</tr>
<tr>
<td>Experience</td>
<td>.16*</td>
<td>.15**</td>
<td>-.14*</td>
<td>-.05</td>
<td>-.04</td>
</tr>
</tbody>
</table>

* p < .05
** p < .01

*Perceived organizational innovativeness score, †Individual innovativeness score, ‘Computer anxiety index, ^Average frequency of technology use, *Average indicator of student perceptions of how technology was changing the way in which they learn, †Average indicator of student perceptions of technology for improving projects and papers, ‡Average technology experience indicator.

experienced students in the spring of 1997, who rated the college higher on the innovativeness scales, more often agreed that technology was changing the way in which they learned and was improving the types of projects and papers they prepared.

With the experienced student scores, no significant relationship was found between individual innovativeness and the average frequency of technology use (.02). Significant positive relationships were found between perceived individual innovativeness and the average indicator of student perceptions of how technology was changing the way in which they learned (r=.36) and the average indicator of student perceptions of technology for improving papers and projects (r=.39). Students who rated themselves higher on the individual innovativeness scale more often agreed that technology was changing the way in which they learned and was improving the types of papers and projects they prepared.

Relationships (Entering students)

Correlations were also made using perceived organizational innovativeness scores and perceived individual innovativeness scores of the entering students. These scores were correlated with the expected average frequency of technology use, the expected average indicator of student perceptions of how technology was changing the way in which they learned, and the expected average indicator of student perceptions of technology for improving papers and projects. These results are shown in Table 15.

In the entering student surveys, significant positive correlation was found between perceived organizational innovativeness and each of the variables being tested. This would suggest that students entering Waldorf in the fall of 1997, who rated the college higher on the organizational
innovativeness scale, expected that they would more frequently use the technology available \((r = .17)\). It would also suggest that this group of students more often agreed that technology would change the way in which they learned \((r = .22)\); and that technology would improve the types of projects and papers they prepared then those who rated the college lower on the innovativeness scale \((r = .33)\).

### Table 15 – Entering student correlation coefficients

<table>
<thead>
<tr>
<th></th>
<th>PORGI(^a)</th>
<th>IS</th>
<th>CAIN(^c)</th>
<th>Frequency</th>
<th>Changing</th>
<th>Improving</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS(^b)</td>
<td>.51**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAIN(^c)</td>
<td>-.49**</td>
<td>-.53**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency(^d)</td>
<td>.17**</td>
<td>.27**</td>
<td>-.30**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing(^e)</td>
<td>.22**</td>
<td>.33**</td>
<td>-.33**</td>
<td>.38**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improving(^f)</td>
<td>.33**</td>
<td>.38**</td>
<td>-.44**</td>
<td>.38**</td>
<td>.64**</td>
<td></td>
</tr>
<tr>
<td>Experience(^g)</td>
<td>.14*</td>
<td>.17**</td>
<td>-.30**</td>
<td>.31**</td>
<td>.14*</td>
<td>.20**</td>
</tr>
</tbody>
</table>

* \(p < .05\)

** \(p < .01\)

\(^a\)Perceived organizational innovativeness score, \(^b\)Individual innovativeness score, \(^c\)Computer anxiety index, \(^d\)Average frequency of technology use, \(^e\)Average indicator of student perceptions of how technology was changing the way in which they learn, \(^f\)Average indicator of student perceptions of technology for improving projects and papers, \(^g\)Average technology experience indicator.

Significant positive relationships were also found between the individual innovativeness scores and each of these variables. This would indicate that students who rated themselves as more innovative expected that they would use the technology more frequently \((r = .27)\); and more often agreed that technology would change the way in which they learned \((r = .33)\) and that use of technology would improve the types of papers and projects that they prepared \((r = .38)\).

**Question 4: What influence does computer anxiety have on student use of technology and does computer anxiety decrease through experience with the technology?**

Two hundred and nine experienced students completed computer anxiety surveys in the spring of 1997. Students were asked to respond to 26 statements by selecting one of six responses. The responses ranged from 1 for strongly disagree to 6 for strongly agree. Lower scores indicated lower computer anxiety of the student. The lowest score was 26, while the highest score was 118. The mean, for the students, was just below 53 and the standard deviation was just over 21 (see Table 16).

Two hundred and sixty-eight entering students completed the Computer Anxiety Survey in the fall of 1997. The minimum score was 26 with the maximum being 117. The mean for the incoming freshmen was just over 57 with the standard deviation just over 20.
The computer anxiety scores of the experienced students were correlated with scores for average frequency of technology use, which averaged the student frequency of use of the laptop, e-mail, and the WWW (see Table 14). A significant negative relationship was found suggesting that as computer anxiety scores decreased, frequency of use increased \((r=-.26)\). The computer anxiety scores were also correlated with the average of the students’ reported previous experience with computers, word processing, spreadsheets, databases, e-mail, and the WWW. Again a significant negative relationship was found indicating that as computer anxiety scores decreased, the reported previous technology experience increased \((r=-.14)\).

### Table 16 - Computer anxiety index

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experienced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students(^a)</td>
<td>209</td>
<td>26</td>
<td>118</td>
<td>52.67</td>
<td>21.10</td>
</tr>
<tr>
<td>Entering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students(^b)</td>
<td>268</td>
<td>26</td>
<td>117</td>
<td>57.16</td>
<td>20.33</td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean(^c)</td>
<td>651</td>
<td>26</td>
<td>151</td>
<td>47.33</td>
<td>17.34</td>
</tr>
</tbody>
</table>

\(^a\)Students surveyed in the spring of 1997 after a school year of technology use, \(^b\)Students surveyed in the fall of 1997 as they entered Waldorf College, \(^c\)Mean population score developed through research by Partin and Simonson (1997) of the Technology Research in Education Group

Computer anxiety scores for the entering students were also correlated with the expected frequency of use average and the previous experience with technology average (see Table 15). A significant negative relationship was found between computer anxiety scores and each of these constructs. As computer anxiety increased, previous technology experience decreased \((r=-.30)\); and expected frequency of use decreased \((r=-.30)\).

**Question 5: How do personal innovativeness, organizational innovativeness and computer anxiety relate to one another?**

To determine relationships between personal innovativeness, organizational innovativeness and computer anxiety several correlations were calculated. This included looking at a correlation between individual innovativeness scores and organizational innovativeness scores. With both the experienced students \((r=.33)\) and the entering students \((r=.51)\), significant positive relationships between the two innovativeness scores were found. This suggests that students who ranked themselves higher for individual innovativeness also ranked the college higher on the organizational innovativeness scale (see Tables 14 and 15).
In the spring of 1997 significant negative correlation was found between computer anxiety and each of the innovativeness scores. For experienced students, as computer anxiety scores increased, innovativeness scores decreased ($r = -.51$ for individual innovativeness; and $r = -.30$ for organizational innovativeness). This was also the case with the entering students in the fall of 1997, with negative correlation found between computer anxiety scores and both individual innovativeness scores ($r = -.53$) and organizational innovativeness scores ($r = -.49$) (see Tables 14 and 15). For both groups of students high computer anxiety was related to low innovativeness scores.

**Question 6: What are the differences in use patterns, perceptions of organizational innovativeness, individual innovativeness, and computer anxiety between entering and experienced students?**

**Use patterns**

When comparing the anticipated computer and network use patterns of entering students with the reported computer and network use patterns of experienced students differences were found. While the actual frequency of computer use by experienced students was very similar to the anticipated use of entering students, there were differences in reported and anticipated uses of both the World Wide Web and e-mail. Experienced students reported a greater use of e-mail than the entering students anticipated. On a scale where 1 indicated that they never used the technology to 6 which indicated that they used the technology several times a day, the entering students anticipated average use of e-mail was 4.96, suggesting that they expected to use e-mail just under once a day (see Table 3). Experienced students’ reported mean of frequency of use for e-mail was 5.68, indicating that they actually checked their e-mail between once a day and several times a day. A difference was also found between the actual frequency of World Wide Web use and the anticipated frequency of use. Entering students anticipated that they would use the Web just below once a day (mean = 4.60), while the experienced students reported they actually used the Web just over twice a week (mean = 4.17).

There were also some differences between entering and experienced students concerning how the technology would be used. Just under 71% of the entering students expected that they would use their computer the most for course work, while only 55% of the experienced students reported that they used their computers the most for course work (see Table 4). Over 23% of these experienced students reported that they used their computer the most for entertainment. Just below 6% of the entering students expected to use their computer the most for entertainment. Entering
students expected to use their computers more for academic purposes than the experienced students reported.

The anticipated use of the World Wide Web also differed from the reported use of the Web by experienced students. Over 54% of the entering students expected that they would use the Web the most for course work, with 31% anticipating that they would use the Web the most for entertainment (see Table 4). In contrast almost 50% of the experienced students said that they used the Web the most for entertainment, with only 33% reporting that they used the Web the most for course work.

Students entering Waldorf College in the fall of 1997 underestimated the extent to which they would use e-mail to communicate with friends on the Waldorf campus. Just below 11% anticipated that they would use e-mail the most to communicate with friends on the Waldorf campus (see Table 4). Approximately 33% of the experienced students reported that they used e-mail the most to communicate with friends on the Waldorf campus. Just below 52% of these experienced students noted that they used e-mail the most to communicate with friends off campus. Almost 64% of the entering students anticipated that they would use e-mail the most to communicate with friends off campus.

Another difference between entering and experienced student use of technology at Waldorf College related to the reported and anticipated computer application used the most. Over 50% of the entering students anticipated that they would use word processing the most (see Table 6). In contrast, only 28% of the experienced students reported that they used word processing the most. Almost 50% of these experienced students reported that they used e-mail the most, while only 16% of the entering students anticipated that they would use e-mail the most.

Students who entered Waldorf College in the fall of 1997 anticipated greater required use of technology for course work than was reported. Almost 90% of the entering students expected that computers would be required for several of their classes or all of their classes (see Table 7). Only 73% of the experienced students reported that computers were required for all or several of their classes. This trend was also found for e-mail and World Wide Web use. Almost 35% of the entering students anticipated that e-mail would be required for several or all of their classes, while only 16% of the experienced students reported that this was the case. Almost 63% of the entering freshmen anticipated that they would be required to use Web resources for several or all of their courses. Only 41% of the experienced students reported that they were required to use Web resources for several or all of their classes.
Entering students also anticipated that Waldorf College faculty members would more often make effective use of the technology to support instruction than experienced students reported. Almost 67% of these entering freshmen anticipated that faculty would use the computer effectively for instruction in several or all of their classes (see Table 9). Just under 35% of the experienced students reported that computers had been used effectively for instruction in several or all of their classes. Almost 79% of the entering students expected that computers would be used effectively for homework in several or all of their classes. In contrast only 53% of the experienced students reported effective use of computers for homework in several or all of their classes. There was less difference in expected and reported use of e-mail for communication with the professors. Sixty-five percent of the entering students expected that e-mail would be used effectively by their professors for communication in several or all of their classes. Only 53% of the experienced students reported that this was the case.

Organizational innovativeness

Entering and experienced students had differing perceptions about the innovativeness of Waldorf College. An independent t-test found that there was a significant difference between the means (experienced = 111.56; entering = 121.64) on the Perceived Organizational Innovativeness Scale of the two groups in the study (t = -5.93, df = 478, p <.01) Entering students perceived Waldorf College as more innovative than the experienced students who had been at Waldorf for a school year. Each group was then compared to a mean population score (113.14) developed through research by Partin and Simonson (1997) of the Technology Research in Education Group (see Table 12). There was no significant difference (t = -1.19, df = 212) between the spring 1997 freshmen, who had used the computer and network technology for a school year, and the established population mean. There was a significant difference between the fall 1997 incoming freshmen and the population mean (t = 7.86, df = 266, p <.01).

Individual innovativeness

The scores of the two groups of students on the individual innovativeness scale were not significantly different (t = 1.82, df = 476). However, both groups of students rated themselves lower than the population mean established by Partin and Simonson (1997)(see Table 13). There was a significant difference between the mean of the experienced freshmen (mean = 99.04) and the population mean (mean = 108.01) (t= -8.70, df = 208, p <.01). A significant difference was also found between the mean of the entering students (mean = 96.66) and the population mean. (t = -13.70, df = 268, p <.01).
Computer anxiety

Significant differences were found when comparing scores on the computer anxiety index between the two groups of students and the population mean established by Partin and Simonson (1997) of the Technology in Education Research Group (see Table 16). There was a significant difference between the computer anxiety mean of the entering student group (mean = 57.16) and the spring group (mean = 52.67) \((t = -2.36, df = 476, p < .02)\). A significant difference was also found between the experienced student group and the population mean (47.33) \((t = 3.666, df = 209, p < .01)\), and the entering students and the population mean \((t = 7.92, df = 267, p < .01)\).

Additional Analysis

Technology is a big part of any day for a student at Waldorf College. The following is a brief summary of how two students, Jay and Mandy, used technology at Waldorf College.

Jay

For Jay the biggest technology use was e-mail. Either he or his roommate left e-mail "up" all day so that it could be checked periodically. Jay said that he checked his e-mail over twenty times a day. He communicated via e-mail daily with his parents in Iowa and his brother in Arizona. He e-mailed frequently to other students on the Waldorf campus and also kept in touch with friends at other colleges and universities.

When asked about academic uses of the technology, Jay noted that he frequently used word processing for journals and papers. He kept journals for both English and biology classes and wrote papers for a variety of subjects. He used the Web on a regular basis to gather information for both speeches and papers. Because he was enrolled in a computer programming course he often spent time using his computer to solve programming problems.

In addition to academic uses, Jay used the web to find information. He searched the Web to both look for a summer job and to shop for a car. He also used the Web to investigate colleges and universities to transfer to for his final years of college.

Entertainment was a big part of how Jay used technology at Waldorf College. The site that he visited the most on the Web was ESPN’s Sportzone. He listened to both music and NBA games via the Web while he was studying. He played games a couple of times a week and on occasion participated in a chat line. Jay had integrated the technology into many areas of his life.

Mandy

Mandy also used technology frequently as a student at Waldorf College. Usually each morning she left for class a little early to print out papers she had worked on the night before. Her
academic uses of the technology included word processing papers and journals and using the Web for research. Sometimes she took notes in class using her laptop computer.

Mandy did not normally check her e-mail until after her first classes each day. While she did not check her e-mail as soon as she got up in the morning, she frequently checked her mail and communicated with friends both on and off the Waldorf campus on a daily basis. Mandy also enjoyed using the technology for entertainment. She often surfed the web, participated in chat lines, and played solitaire. While Mandy had not integrated the technology into as many areas of her life as Jay had, it was still a regular part of her life at Waldorf College.

Summary

Data were gathered from both surveys and focus groups for this study. Participants were two freshmen classes at Waldorf College. Data were gathered in the spring of 1997 from the experienced students after they had used laptop computer and network technology for one school year. Data were gathered again in the fall of 1997 from the entering freshmen class before they had the opportunity to use the laptop computers and network technology extensively. Data from the Waldorf College Laptop Survey (WCLS) were gathered to measure perceived organizational innovativeness, individual innovativeness and computer anxiety; and to describe student demographics, past technology experience and student use patterns. Data were compared to identify relationships between variables and summarized to describe the use of technology at Waldorf College.

Students at Waldorf College used the computer and network resources extensively. E-mail and word processing were the most used computer applications. Computers were used the most for course work while the World Wide Web was used the most for entertainment. Students felt that computers and network resources were used effectively by the faculty and felt that these resources were changing the way in which they learned. Students just entering Waldorf College anticipated that they would use the computer and network technology extensively and that it would be used effectively by the faculty.

Some interesting results were found when looking at student perceived individual and organizational innovativeness scores. Both entering and experienced students scored themselves significantly lower than established norms on the individual innovativeness scales. However, the entering students scored Waldorf College as significantly more innovative than a population mean established by Partin and Simonson (1997). Significant positive relationships were found between entering students’ individual innovativeness and perceived organizational innovativeness scores and expected frequency of technology use.
Computer anxiety scores for both the entering and experienced students were significantly higher than the established norms. However the experienced students computer anxiety scores were significantly lower than the entering students' scores. Significant negative relationships were found between computer anxiety scores and both frequency of technology use and past experience.

Chapter V will discuss the results as they relate to the research questions identified for this study. Conclusions and recommendations for future research will be presented.
CHAPTER 5. CONCLUSIONS

One purpose of this study was to provide an investigation and a description of the new learning environment provided by easily available computer and network resources in a small institution of higher education. Information was gathered about student computer and network use patterns in this environment. This included information about the frequency of technology use and the ways in which it was used by students. In addition, students were asked to report the extent to which they were required to use the new technologies for course work and their perceptions on its effectiveness for learning. A second purpose of this study was to determine the relationships, and how they changed over time, between student perceptions of institutional innovativeness, individual innovativeness and computer anxiety and the diffusion of the new technologies among students in a small liberal arts college.

The following six research questions were used to direct the study:

1. What are the computer and network use patterns of Waldorf College freshmen?
2. Are Waldorf College freshmen required to use computer and network technology to complete course work and do they consider this technology use to be a valuable learning experience?
3. How do individual innovativeness and perceptions of organizational innovativeness relate to student use of new technology resources?
4. What influence does computer anxiety have on student use of technology and does computer anxiety decrease through experience with the technology?
5. How do personal innovativeness, organizational innovativeness and computer anxiety relate to one another?
6. What are the differences in use patterns, perceptions of organizational innovativeness, individual innovativeness, and computer anxiety between entering and experienced students?

This chapter will first include a comparison of the two freshmen classes that participated in the study. This will be followed by a discussion and comparison of the groups' innovativeness scores and their computer anxiety scores. These scores will also be compared to population scores gathered in previous studies. Following this discussion of innovativeness and computer anxiety will be a discussion and summary of technology use patterns by Waldorf College freshmen. This will be accompanied by recommendations for implementation of laptop and network technology on a college campus and suggestions for future research.
Conclusions and Discussion of Results

Two groups of students participated in this study. Data were collected in the spring of 1997 from freshmen who had experienced the laptop and computer technology for one school year at Waldorf College. These freshmen are referred to as "experienced students" in this study. Data were collected from the second group of freshmen as they entered Waldorf College in the fall of 1997. These students had not yet used the technology-rich environment at the college extensively. They are referred as "entering students".

The two groups of students involved in this study were similar in many ways. The percentage of males and females was almost the same for the two classes. Between 56 and 58% were males and between 42 and 44% female. The two classes were dominated by traditional age students with the average age of the entering freshmen just under 19; and the average age of the experienced students in the spring of their freshmen year just over 19. Between 66 and 63% of the students in both classes graduated from schools in Iowa. For each of the groups, the state with the next largest number of students was Minnesota.

Both classes had a fairly large number of international students. However, international students entering Waldorf in the Fall of 1997 represented just under 8% of the students; while in the spring international students comprised 13% of the class. A large majority of the students in these two groups graduated from small high schools. Approximately 75% of the experienced students graduated with senior classes of 200 or less. Seventy-nine percent of the entering students graduated with a class of 200 or less.

The two groups of students who participated in this study reported many similarities in previous experience with computer and network technology before coming to Waldorf College. The ratings of their previous experience with computers, word processing, spreadsheets and data bases were almost identical. Both groups indicated that they had the most experience with computers used for word processing. Most had limited experience with spreadsheets and databases. However there was a difference in the reported experience with network technology. The group that was surveyed in the spring of 1997 and who had entered Waldorf College in the fall of 1996 had less previous experience with e-mail and World Wide Web resources than the freshmen entering in the fall of 1997. The largest difference was in additional experience with the World Wide Web.

In addition, to the increased experience with network based technologies of the entering freshmen class, there were some other differences. Almost 75% of the entering freshmen indicated that their family owned a computer, while the experienced students indicated that just under 60% of
their families owned a computer. A higher percentage of entering students also indicated that the laptop computers were a factor in their decision to attend Waldorf College than the experienced students. It is very likely that the students entering Waldorf in the fall of 1997 had heard more about the laptop computer initiative than students who entered in the fall of 1996. This may have attracted more students who felt that it was important to have laptop computers and network capabilities available to them. Although the entering freshmen had not had the opportunity to use the campus technology to any great extent before the data were gathered, the technology had already been integrated into the campus culture in this second year of the campus network and laptop computer project; and second-year students were using the technology upon their arrival on campus. This would have created a different environment for this entering freshmen group than the group the year before experienced.

Despite the differences discussed in the above paragraph, there are many indications that these two groups of students were very similar in the gender make-up of their class, the age of their students, the size and locations of their high schools and their previous technology experience. Because they are similar, it is valid to discuss differences in the scores on the organizational innovativeness scale, individual innovativeness scale and the computer anxiety index between the two groups of students. These differences give insight into the impact the use for a school year of laptop computers and network technology had on the students.

Comparisons

Perceived organizational innovativeness of the two groups

When conducting this study, it was expected that Waldorf College would be perceived as an innovative institution as the result of its technology program. It was also anticipated that both entering students' and experienced students' would share similar positive perceptions about the college's innovativeness. The study found a significant difference between how the organization was perceived, with entering students rating the organization as more innovative (mean = 121.64) than experienced students (mean = 111.56).

There are several possible explanations for this result. Perhaps it is simply an indication that the public relations program at the college was successful at influencing incoming students. This finding may also indicate that Waldorf College did not meet student expectations for the use of the new technology resulting in a decreased perception about its innovativeness as the year progressed. This premise could be supported by the findings in this study that showed that incoming students
anticipated greater use of the technology for academic purposes than the experienced students reported.

Another possibility could be that incoming students rated the institution higher on the innovativeness scale for reasons other than, or in addition to, the technology program at Waldorf. Rogers (1995) suggested that complex organizations in which many ideas are present and organizations in which there is greater interconnectedness between individuals are perceived as more innovative. In some ways this describes the beginning of the year in a small college. Everything is new and exciting as students meet a variety of other students and faculty with different ideas and backgrounds through orientation activities. This newness of ideas and experiences pervades every part of their lives as they adjust to living away from home for the first time. This may have attributed to higher perceptions of organizational innovativeness for the entering students. By the time the experienced students were asked to give their perceptions at the end of the school year the newness had worn off.

Possibility the decline in the student perceptions about Waldorf College's innovativeness may relate to the size of the institution and even the size of the town in which the college is located. A key predictor of organizational innovativeness according to Rogers (1995) is the size of the organization, with larger organizations typically found to be more innovative. Perhaps the innovative use of the technology at Waldorf College could not offset the smallness of the college or the town.

Perhaps, by the end of the school year, the laptop computers and Internet access were no longer considered innovative. This study shows that the technology had become an integral part of the students' lives. These students used it on a daily basis in a variety of ways. In addition, because all freshmen had access to this technology it was no longer considered unique or perhaps innovative by the end of the school year.

Perceived organizational innovativeness and the standardized group

As would have been expected, a significant differences was also found between a standardized population score for organizational innovativeness established by Partin and Simonson (1997) and the entering students. The entering students in the fall of 1997 perceived Waldorf College as significantly more innovative (mean = 121.64) than the established population mean (mean = 113.14). The experienced students perceptions were slightly lower (mean = 111.56) than the population mean. This difference was not significant.

The fact that the entering students perceived the innovativeness of the organization as significantly higher than the population mean could be attributed to the innovative technology
program at the college. However, it might also be related to the newness of the college experience and/or the public relations program of the college as discussed above. The fact that experienced students scored slightly lower than the population mean could be explained by some of the same arguments used above. For example, the use of the technology may have become so common place that it was no longer considered innovative; and perhaps the smallness of the institution and the size of the town offset the use of the technology.

The population (mean = 113.14) for the perceived organizational scale established by Partin and Simonson was derived from a study of approximately 1,200 teachers, principals and media specialists. In 1977 Hurt and Teigen established a population mean (mean = 98) for this same innovativeness scale with approximately 400 public school teachers and administrators. Compared to the Hurt and Teigen norm, the college was perceived as significantly more innovative by both groups of students. Given the technology initiatives, this is what would have been expected. The fact that these norms are significantly different, and that they do not represent college students may suggest a need for further research in this area.

*Individual innovativeness of the two groups*

Before this study began it was thought that possibly the exposure of the students to this innovation of technology could result in their perceiving themselves as more innovative. There was a slight increase in how entering students perceived their innovativeness (mean = 96.66) compared to how experienced students perceived their innovativeness (mean = 99.04). However, the fact that this increase was not statistically significant prevents drawing any conclusions about the impact this technology experience had on students’ perceptions of their innovativeness. Perhaps further research is needed to determine if the increase in perceptions of individual innovativeness can be related to experience with an innovation.

*Individual innovativeness and the standardized group*

Significant differences were found between the mean scores of each of the two groups of participants and a standardized individual innovativeness score developed by Partin and Simonson (1997) (mean = 108.01). Both of the student groups perceived themselves as significantly less innovative than the Partin and Simonson population mean.

There may be several reasons for these findings. Rogers (1995) has found that more innovative individuals come from large organizational units and have more connections outside their communities. This study found that a very high percentage of Waldorf College students came from small schools which are normally found in small towns. Many entering freshmen had not yet had the
opportunity to develop connections outside of their small communities. The experienced freshmen had expanded their connections to some extent by moving on to college, but were still located in a small school in a small town.

Rogers (1995) also found that individuals who were more innovative had more years of formal education and were wealthier. Obviously, these groups of freshmen had not had extensive years of formal education. In addition, many Waldorf College students come from families who do not have extensive college experience and whose incomes would place them in the middle class in society. According to Rogers (1995) this is a group that would not be expected to rate as high on the personal innovativeness scale.

Computer anxiety of the two groups

Research has suggested that as individuals gained more experience with computers, their computer anxiety declined (Overbaugh and Reed, 1992). It was expected that as students gained experience with technology at Waldorf College, their computer anxiety scores would decrease. There was a significant decrease in computer anxiety scores from the entering freshmen (mean = 57.16) with less technology experience to the scores of the experienced freshmen (mean = 52.67). It appears that the extensive experience with technology at Waldorf College was related to a decrease in the computer anxiety experienced.

Computer anxiety and the standardized group

A surprising finding in this study was that both the student groups had computer anxiety scores that were significantly higher than a norm (47.33) established by Partin and Simonson (1997). This norm was established in two studies of a total of approximately 650 teachers. It would have been expected that students who grew up with computer technology would have been less anxious in the use of computers than a group of teachers.

Relationships

Organizational innovativeness and individual innovativeness

It would be expected that there would be a relationship between how individuals perceived an organization's innovativeness and how they perceived their own innovativeness. At Waldorf College you would expect that innovative students would be attracted to an innovative college. Both student groups had significant positive relationships between their perceived individual innovativeness scores and their perceived organizational innovativeness scores. The experienced group had a lower relationship ($r=.33$) than the entering group ($r=.51$). However, in this study, students who rated themselves as more innovative also perceived the College as more innovative.
Innovativeness and average frequency of use

Hurt and Teigen (1977) found that as both organizational and individual innovativeness increased participation in the innovation-decision process increased. It was expected that there would be similar findings at Waldorf College and that students who rated the college and themselves as more innovative would more frequently use the technology available. This was not the case in this study. Using average frequency of technology use as an indicator of participation in the innovation, there were no significant relationships between the organizational and individual innovativeness scores and the average frequency of technology use by the experienced students. Entering students' average expected frequency of technology use had a small, significant relationship with the individual innovativeness scores (r = .27) and organizational innovativeness scores (r = .17).

The lack of significant relationship between the innovativeness scores and the frequency of use by the experienced students may indicate that, because of the extensive use of the technology by these students, the innovation-decision process was no longer a factor in the use of the technology. The technology innovation had been almost completely diffused long before the end of the school year. Rogers (1995) defined an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” (p. 11). Laptop computers and Internet access were no longer considered innovative or new. Even students who did not rate themselves or the organization as especially innovative were using the technology frequently.

The very small significant relationships between incoming students' average expected frequency of technology use and the two innovativeness scores indicates that students who viewed themselves as more innovative and the college as more innovative expected that they would use the technology more frequently. At this point the laptops and the network technology were still considered innovative and the individual and organizational innovativeness scores gave some indication of their expected use. However, these relationships are probably too small to carry any great weight in evaluating the situation at Waldorf College.

Computer anxiety and innovativeness

It was expected at the beginning of this study that computer anxiety and both of the innovativeness measures would have some relationship. It was anticipated that individuals who rated themselves and/or the organization as more innovative would have lower computer anxiety scores. Strong significant relationships were found in this study.

A strong significant negative relationship (r = -.51) was found between experienced students' individual innovativeness scores and computer anxiety. A similar strong significant negative
relationship ($r = -.53$) was also found between computer anxiety and the entering students' individual innovativeness scores. This provides evidence of the validity of these two instruments. For the two student groups higher individual innovativeness was related to lower computer anxiety. This could possibly be because the more innovative individuals had taken greater advantage of previous computer opportunities. As has been noted earlier, greater experience with computers relates to lower computer anxiety (Overbaugh & Reed, 1992).

Significant strong relationships were also found between computer anxiety and student perceptions of organizational innovativeness. Entering students' scores on the organizational innovativeness scale were negatively related to computer anxiety ($r = -.49$). A lower, but significant negative relationship was also found between experienced students' organizational innovativeness scores and computer anxiety ($r = -.30$). In general, students who considered the organization as more innovative had lower computer anxiety. According to Rogers (1995), innovative individuals are always interested in experimenting with new ideas. In the situation at Waldorf College it might be expected that students who felt positive about Waldorf's technology initiative would also have lower computer anxiety.

**Computer anxiety and average frequency of use**

It was expected at the beginning of this study that students who had a lower computer anxiety would more often use the technology at Waldorf College. Some of the characteristics of computer anxious students according to Maurer and Simonson (1984) were that they would avoid computers and attempt to shorten the period of time that computers are used. If this is the case, then Waldorf students who are more computer anxious will use the technology less frequently than other students. Significant negative relationships were found in this study indicating that this was the case. Experienced students' average frequency of computer use was negatively related to their computer anxiety scores ($r = -.26$). A significant negative relationship was also found between entering students' expected average frequency of technology use and their computer anxiety scores ($r = -.30$). While neither of these correlations is high, they do suggest that computer anxiety has a relationship to frequency of technology use.

**Computer anxiety and average technology experience**

Because experience with computers has been related to computer anxiety in previous studies, it was felt that in this study students with lower computer anxiety would have greater experience with technology prior to attending Waldorf College. Entering students in the fall of 1997 had a significant negative relationship between their previous technology experience and their computer
anxiety scores \( (r = -0.30) \). Those with more technology experience had lower computer anxiety scores. The experienced freshmen had a much lower, but still significant relationship between their prior experience average and their computer anxiety scores \( (r = -0.14) \). This extremely low correlation might be expected. The experienced students had a school year of extensive experience with computer technology, which would out-weigh any technology experience prior to attending Waldorf College.

**Computer and network use patterns**

To provide a description of a new learning environment provided by readily available computer and network resources it was necessary to determine the use patterns of freshmen students at Waldorf College. This description will be useful to many other institutions that are considering similar expansions of computer and network resources on their campuses. At Waldorf College, students were given minimal training in the use of word processing and e-mail and Internet access when they received their computers in the fall. Despite this minimal training, students used both computers and network resources extensively. Students will use technology resources available to them in ways that are meaningful and pertinent to them.

**Frequency of use**

College students who are given access to computer and network technology resources will use it extensively. At Waldorf College most students used their computers and network connections several times each day. E-mail was used the most frequently, followed by the use of computers for word processing. Most students checked their e-mail several times a day and word processed papers on a regular basis. World Wide Web resources were accessed by students several times a week. The frequency of computer and network use appeared to be considerably more at Waldorf College than the frequency of use in high school. The use of e-mail is especially noteworthy given the fact that most students had very little experience with e-mail before coming to Waldorf. It suggests that college students will quickly learn and often use technologies that are relevant and available to them.

Entering students in the fall of 1997 anticipated that they would use their computers and network connections on a daily basis. These students underestimated the extent to which they would use e-mail and they overestimated the extent to which they would use the World Wide Web. Because students had limited previous experience with e-mail, they were perhaps unaware of the extent to which it could be used to maintain contact with friends on and off the Waldorf campus. The fact that the World Wide Web was used less frequently than anticipated is most likely a reflection on the faculty at Waldorf. While most faculty were comfortable using the Web, most had not had the
opportunity to think, to any great extent, about the ways it could be used to support learning in their classes.

_In what ways is technology used?_

At Waldorf College, students used their computers the most for completing course work. In most cases this involved word processing papers or projects. Many students also used spreadsheets for graphing lab results in science courses. Students used the Web the most for enjoyment rather than course work. Because Waldorf College is located in a small town with few opportunities for entertainment, the Web was noted as a popular source of entertainment for many students. While students used the Web the most for entertainment, many students also used the Web as a source for gathering information needed for course work. E-mail was used predominantly to communicate and socialize with friends both on and off the Waldorf campus. E-mail was used occasionally to communicate with Waldorf professors. The use of technology by Waldorf College students has become a natural part of several facets of their lives. It was used for course work, entertainment, and socialization.

Students just entering Waldorf College had high expectations for the use of computers and the Web for course work. A higher percentage of entering students than experienced students expected that they would use their computers the most for course work. The difference was even greater when entering students were asked to share their expectations for the use of Web resources. Experienced students reported the most common use of the Web as entertainment, while a high percentage of incoming students expected to use the Web the most for course work. The fact that these expectations were not realized may again be related to the fact that Waldorf College faculty did not have significant time or opportunities to develop applications of these technologies to support their courses. This would be especially true the first year of the technology initiative that was evaluated by the experienced students.

Expectations for e-mail uses were similar, in that both entering and experienced students anticipated that they would use e-mail the most to communicate with friends. However, the entering students underestimated the extent to which they would communicate with friends on the Waldorf campus.

_Is technology required for course work?_

Students in this study felt that computers were necessary for the completion of their course work during their freshmen year at Waldorf College. The study did not distinguish whether faculty members required computer use or whether it was the students' opinion that computers were a
necessity. Most students also noted that Web resources were required for at least one class. E-mail, as reported by the students, was not required in most instances for course work.

When they arrived at Waldorf College, entering students expected greater use of the technology for course work than was reported by the experienced students. These greater expectations were reported for computer use, World Wide Web use and e-mail use. The fact that these expectations were not met may again be related to the fact that they were evaluating the first year of this program and faculty had not had many opportunities to contemplate effective uses to support their courses. In high school most of these students had not been required on a regular basis to use technology resources to complete course work.

Technology uses related to course work included campus-wide use of computers for word processing of papers. Several science courses required the use of spreadsheets for charting and graphing data. As would be expected, computer use was required for courses that covered programming and computer applications. Web resource use did not appear to be a requirement of the Waldorf faculty, but many students found it important when conducting research. While there was little required use of e-mail for courses, students did report that one teacher required them to participate in an on-line e-mail discussion.

**Perceptions about effectiveness for learning**

Probably the most important question in this study pertains to the effectiveness of these technologies to enhance learning. There are many variables that determine the effectiveness of using these technologies to improve learning, but the development by faculty of a vision for effective technology use is the most important. This study gathered information from students rather than faculty. From a student perspective, the technology resources provided by Waldorf College were both important for learning and changed the way in which they learned.

A vision for restructuring education through the use of technology was shared in chapters one and two of this study. Dede, (O'Neil, 1995), briefly summarized the potential impact of technology in education. Dede stated that if technology is “used to enable new models of teaching and learning, models that can’t be implemented without technology, then I think it’ll have a major impact” on education. It does not appear that this vision has been realized in this study. While faculty received some training in basic computer applications, there had been little effort to develop a vision for the educational use of the technology provided on the Waldorf campus. The hindrance in the development of this vision reflects the nature of liberal arts colleges.
Teaching is the primary role of the faculty. At a small liberal arts college, class loads are typically high and faculty are expected to take an extensive role in campus activities and faculty committees. This leaves little or no time for outside research or thinking about technology use. Despite this, it does appear that some faculty have begun to explore new approaches to learning through the use of technology with their students. Perhaps it is unfair to expect that a small liberal arts college like Waldorf could have realized a vision for technology use that has not been achieved on other college campuses.

Is technology important for learning?

The experienced students felt that technology was important for learning at Waldorf College. Most reported that computers were important for learning in many of their classes. A large number of students also felt that World Wide Web resources were important for learning. Fewer students felt that e-mail was important for learning in their classes. Over half did not feel it was important for learning in any class. It is interesting to note that the computer application used the most (e-mail) was considered to be the least important for learning.

The entering students in the fall of 1997 expected that computers and e-mail would be important for learning in more classes than were reported by the experienced students. Expectations for World Wide Web were similar to the reported use. Higher student expectations again suggest a lack opportunity to develop a vision for technology use by the Waldorf faculty.

Is technology used effectively by faculty?

Generally, students felt that faculty at Waldorf used the technology effectively. They felt that the Waldorf faculty were better prepared, in most cases, to use the technology than their high school teachers had been. Given the fact that Waldorf faculty had not had extensive training, the reality that they had easy access to computer and network technology probably set them apart from the high school teachers. The student perspective about effective use of technology by faculty was limited by the fact that they have not studied the ways in which computers are used in education and had not thought deeply about educational computer use. Most students felt that computers had been used effectively by the faculty for both instruction and homework, however students felt that computers had been used effectively for homework in more classes. Most students also reported that e-mail had been used effectively by the professor for communication in at least one class during the year. Despite the fact that experienced students reported effective use of technology by the Waldorf faculty, entering students had slightly higher expectations for its effectiveness.
Specific uses by faculty of computers for instruction included the use of presentation software for course lectures. Use for homework included putting course materials on a Web page or a common network drive, requiring that papers be word processed and providing web pages for reference. Use of e-mail for course related communication included use by faculty who requested course feedback via e-mail, students who asked faculty questions about course assignments and conducting on-line class discussions.

Is technology changing the way in which students learn?

Both experienced students and entering students responded similarly to questions about how technology was changing the way in which they learned. A high percentage of students felt that computer and network technology was changing or would change the way in which they learn. Even more felt that this technology was improving or would improve the types of papers and projects that they prepared for course work. While this large number of students felt that technology was changing or would change the way in which they learned, follow-up focus group discussions showed that the student interpretation, of how technology changes the way in which they learn, was limited primarily to convenience in learning. Their comments did not suggest that they thought about topics more deeply, or that their cognitive processes had changed, or that they thought more about their own thought processes. Instead laptop computers and network access provided the convenience of around-the-clock access to technology resources. One student said that he waited to do his papers until much later because he had his computer and the Internet available to him all the time. Another said that they could do research even after the library closes.

While student understanding of the potential of technology for changing the way in which they learned was limited, there were some indications that the technology had opened up new approaches to learning. A few students participated in academic related discussions on the Internet. Others conducted interviews with professionals in their field of interest via e-mail, while another kept up on his profession of interest by looking at Web pages of businesses that he hoped to work for. These are limited examples of using technology to make education more authentic. They occurred as a result of student initiative rather than faculty vision. A vision by the faculty for developing new approaches to learning using technology could provide many new opportunities for learning for college students.
Recommendations

In this section recommendations for integration of laptop and network technology into small liberal arts college environments will be provided. This will be followed by recommendations for further research related to innovativeness, computer anxiety, and technology use in higher education.

Integration of laptop computers and network technology

Students

This study has shown that students will extensively use basic computer technology that is both available and relevant to them. In this study this included computer applications such as word processing, e-mail, and World Wide Web search software. These basic computer applications had immediate relevance to the students and diffused quickly throughout the student body. By the end of the year they were not considered to be innovative. Other computer applications such as spreadsheets, data bases and presentation software were not as widely used.

To assist students in the development of technology skills it is recommended that early in the school year they be given brief training in the use of e-mail and web search software. Because students will find their own uses for these applications, extensive training is not needed. However, resource people should be available to assist with problems or to assist as students experiment with advanced features.

Students should also be given word processing training and resources. A manual that has basic word processing tasks should be made available. If possible they should receive an introduction to the use of the manual and the steps to begin word processing. Ideally, this would be followed by a practical use of the word processor with support provided for its use. For example, at Waldorf College, students are required to complete an essay as part of their academic orientation. Staff members are available during several periods in which students work on their essays. Support is also available in computer labs in the evenings.

Learning some of the less-used application software, such as presentation software or spreadsheets, will be likely to occur if students find a practical application for its use. For this reason it is recommended that schools encourage faculty, who teach courses where these software packages apply, to incorporate the use of the software into a class project. This may require some initial training in the software use and support from a technology center while students work on the projects. Students can be an excellent resource in assisting other students and may be employed to provide support.
While there are benefits to students becoming skilled in basic computer applications, the vision for the use of technology to change the way in which students learn is not realized. This vision, which was discussed earlier in this study, can only be achieved through the development of a college’s faculty. Liberal college faculty are in a unique position. Because of their heavy teaching loads they have very little time to experiment with or even think about the use of technology to improve learning. At the same time, because their primary role is teaching, they are uniquely qualified to find effective technology applications for their classrooms. For these faculty members to effectively develop new approaches to learning they will need training, learning opportunities, time and support.

Training for faculty members in basic computer applications and network technology will give them confidence in the use of computers and may help them to begin to think about new ways to improve learning in their courses. It is recommended that this training be provided in small groups at times convenient for faculty. As much as possible projects for these training sessions should be generated by the faculty attending the sessions. Resource materials for the sessions should be developed as a reference for faculty.

At the same time that technology training is being provided, faculty should also have opportunities to discuss ways in which technology can be used to improve education. These discussions would encompass everything from theories about how students learn with technology to the sharing of successful technology applications. It is recommended that colleges schedule monthly faculty discussions about the effective use of technology. Several times a year, guest speakers on the instructional uses of technology could be invited to challenge faculty with new ideas. Faculty should also be encouraged, through the college’s faculty development program, to attend technology conferences and enroll in graduate courses dealing with educational technology.

One of the biggest restrictions for liberal arts college faculties is time. Opportunities to experiment with or develop new uses for technology in the classroom need to be provided. It is recommended that colleges provide interested faculty with release time to work on technology projects. In addition, summer stipends could be made available to encourage the development of educational applications for the classroom.

For faculty to use technology to improve learning in the classroom, an effective support system must be in place. This would include a technology staff that would be available to support project development and implementation. Ideally, at least one member of this staff would have
instructional technology training. Students could be an effective part of this support staff. Faculty also need support in terms of funding for hardware and software. These efforts would have a major impact on the use of technology in the liberal arts college environment and would improve the educational opportunities for their students.

**Future research**

There were some unexpected results from this study. For example students did not perceive the organization to be as innovative at the end of the school year as they did at the beginning of the year. While there was a slight increase in perceptions of individual innovativeness after the use of technology by the students, the increase was not significant. In addition, their perceptions of their own innovativeness were below norms established in other studies and their computer anxiety scores were higher than norms arrived at in previous studies. Because of the homogeneous nature of the student body at Waldorf College, a similar study in a larger institution with a more diverse student body could provide interesting comparison data. A new study, along with the results of this study, could also provide valuable data in developing new norms that included college student scores for the innovativeness and the computer anxiety scales.

While this study gave some insight into the diffusion of innovation of technology among college students, case study research following four to five entering students through a school year or a semester could provide useful information about the innovation-decision process. This could also give some indication of the types of communication patterns developed among these students as they adopt the technology.

This study showed that technology diffused quickly throughout the student body at Waldorf College. Using the information about student technology use patterns, as well as innovativeness and computer anxiety scores, a similar study with faculty could provide insight into how they adapt to the use of technology. This study could be followed by case study research with a small group of faculty at liberal arts colleges. These case studies along with faculty use patterns, computer anxiety scores, and innovativeness scores could provide insight into effective ways to work with faculty in the development of new approaches to teaching and learning by liberal arts college faculty.

**Summary**

There were two main purposes identified in this study. One was to provide a description of the new learning environment provided by easily available computer and network resources in a small liberal arts college. The other was to determine the relationships and how they might change over time between student perceptions of institutional innovativeness, individual innovativeness and
computer anxiety and the diffusion of computer and network technology among students in a small liberal arts college.

Participants in the study were two groups of Waldorf students. Data were gathered from one group of students after they had experienced the laptop computer and network technology for one school year at Waldorf College. Data were gathered from a second group of students as they entered the College and before they had used the available technology extensively. The same two methods were used to gather data from each group of students. The WCLS was used to gather data about student demographics, past computer experience, technology use patterns, perceptions of effectiveness of technology for learning, perceived organizational innovativeness, individual innovativeness, and computer anxiety. Focus group discussion were used to provide a more in-depth look at student use patterns and perceptions about the effectiveness of technology for learning. Data were summarized to provide a description of the environment and were compared and correlated to identify relationships among variables.

It was found that entering students perceived Waldorf College as significantly more innovative than an established norm and more innovative than did experienced students. Waldorf students perceived themselves as significantly less innovative than the norm with experienced students and entering students perceptions not significantly different. Computer anxiety of experienced students was significantly less than entering students. Students made extensive use of the technology at Waldorf College. They found it valuable for completing their course work and felt it improved the way in which they learned.

Interesting outcomes of this study include:

- At the time of the study, colleges with extensive computer and network technology were considered as innovative by entering students.
- Computer and network technology use will diffuse quickly through the student bodies of liberal arts colleges.
- Lower computer anxiety relates to greater use of computer and network technology.
- Computer anxiety decreases with experience with computer and network technology.
- College students are prepared and expect to use technology for educational purposes.
- College students integrate technology use that is relevant to them into many areas of their lives.
- Computer and network technology provides small liberal arts college students with valuable connections to the outside world.
• While small liberal arts college students use computer and network technology a great deal for course work, they also find it valuable for entertainment.
• Students find educational applications for the use of technology even when use is not required by college faculty.
• Students view computer and network technology use as changing the way in which they learn, however they restrict this view to convenience and accessibility in learning.
• Students do not have the experience or background to determine if the vision for technology use has been met.
• Without additional support and resources, most faculty at small liberal arts colleges do not have the opportunity to develop a vision for the use of technology to improve learning in their courses.
• Without a vision, technology will likely be used to support traditional learning paradigms.

The results from this study can provide guidance for educational institutions that plan extensive implementation of computer and network technology. It may be especially useful for small liberal arts colleges. These results show that the use of technology resources will diffuse quickly and will be used extensively among college-age students. With initial training and support students are prepared and expect to use technology extensively to support learning in higher education.
APPENDIX A. WALDORF COLLEGE LAPTOP COMPUTER SURVEY
Waldorf College
Laptop Computer and Internet Survey

Please respond to the following questions. All responses will be kept confidential.

Part I
Demographics

(check only one response for each question)

1. What is your gender? □ M □ F

2. Please enter your age _____ OR check if you are over 30 □

3. Where did you graduate from high school?
   □ Iowa
   □ Minnesota
   □ Wisconsin
   □ Illinois
   □ Other state (please specify)___________.
   □ Other country (please specify)___________.

4. What was the approximate size of your high school graduating class?
   □ Less than 50
   □ 50 to 100
   □ 101 to 150
   □ 151 to 200
   □ 201 to 250
   □ 251 to 300
   □ 301 to 350
   □ 351 to 400
   □ 401 to 450
   □ Greater than 450

5. Did you or your family own a computer before coming to Waldorf?
   □ Yes
   □ No

6. What impact did providing a laptop computer and Internet access have on your decision to attend Waldorf College?
   □ Was the major reason I chose Waldorf
   □ Was one of several reasons I chose Waldorf
   □ Had no impact on my decision

Academic Computing Department
Part II
Experience Before Waldorf College

Please indicate your level of experience with each of the following before you came to Waldorf College by circling the appropriate response:

1. Computers
2. Word Processing
3. Spreadsheets
4. Databases
5. E-mail
6. World Wide Web

1 = No experience
2 = Very little experience
3 = Some experience
4 = A lot of experience
5 = Extensive experience

Part III
Technology Use At Waldorf College

(check only one response for each question)

1. I use my laptop computer:
   - never
   - monthly
   - weekly
   - bi-weekly
   - once a day
   - several times a day

2. I use e-mail:
   - never
   - monthly
   - weekly
   - bi-weekly
   - once a day
   - several times a day

3. I use the World Wide Web:
   - never
   - monthly
   - weekly
   - bi-weekly
   - once a day
   - several times a day

4. I use my laptop computer the most for: (check only one)
   - course work
   - entertainment
   - personal work
   - I do not use my laptop computer

5. I use the WWW (netscape search) the most for: (check only one)
   - course work
   - entertainment
   - personal work
   - I do not use the WWW

6. I use e-mail to communicate the most with: (check only one)
   - faculty or staff at Waldorf
   - friends on the Waldorf campus
   - friends off campus
   - family
   - I do not use e-mail

Academic Computing Department
7. This year computer use has been required for:
   - none of my classes
   - at least one class
   - several of my classes
   - all of my classes

8. This year e-mail has been required for:
   - none of my classes
   - at least one class
   - several of my classes
   - all of my classes

9. This year World Wide Web (Netscape) based resources have been required for:
   - none of my classes
   - at least one class
   - several of my classes
   - all of my classes

10. This year having laptop computer access has been important for learning in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

11. This year being able to search the World Wide Web has been important for learning in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

12. This year the use of e-mail has been important for learning in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

13. This year computers have been effectively used by the professor for instruction in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

14. This year computers have been used effectively by the professor for homework assignments in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

15. This year computers and e-mail have been used effectively by the professor for communication in:
    - none of my classes
    - at least one class
    - several of my classes
    - all of my classes

16. Check all the computer applications below that you use:
    - data base
    - computer entertainment
    - course specific software
    - desktop publishing
    - E-mail
    - multimedia
    - presentation
    - programming
    - Web search
    - word processing
    - Other (please list) __________________________
    - I do not use computer applications

17. Please circle the one application in question 16 above that you use the most.
Part III Continued
Technology Use

Please rate the following statements by circling the appropriate response:

18. Having computer resources available is changing the way in which I learn.
19. Having Internet and WWW access is changing the way in which I learn.
20. Having computer resources available improves the types of projects and papers that I prepare for course work.
21. Having Internet and WWW access improves the types of projects and papers that I prepare for course work.
22. I would like to learn more about word processing.
23. I would like to learn more about spreadsheets.
24. I would like to learn more about data bases.
25. I would like to learn more about presentation software.
26. I would like to learn more about WWW applications.
27. I would like to learn more about e-mail.
28. I would like to learn more about my computer's operating system.
29. The computer, WWW, and e-mail training given at the beginning of the year was useful.

1 = Strongly Disagree
2 = Disagree
3 = Moderately Disagree
4 = Undecided
5 = Moderately Agree
6 = Agree
7 = Strongly Agree

SD  D MD U MA A SA
### Part IV

**Inventory of Characteristics of Waldorf College**

*Please rate the following statements by circling the appropriate response:*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD D MD U MA A SA</td>
<td></td>
</tr>
<tr>
<td>1. cautious about accepting new ideas.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>2. a leader among other colleges.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>3. suspicious of new ways of thinking.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4. very inventive.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>5. often consulted by other colleges for advice and information.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>6. skeptical of new ideas.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>7. creative in its method of operation.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8. usually one of the last of its kind to change to a new method of operation.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>9. considered one of the leaders of its type.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>10. receptive to new ideas.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>11. challenged by unsolved problems.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>12. follows the belief that “the old way of doing things is the best”.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>13. very original in its operating procedures.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>14. does not respond quickly enough to necessary changes.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>15. reluctant to adopt new ways of doing things until other colleges have used them successfully.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>16. frequently initiates new methods of operation.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>17. slow to change.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>18. rarely involves students in the decision-making process.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>19. maintains good communication with students</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>20. influential with other colleges.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>21. seeks out new ways to do things.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>22. rarely trusts new ideas and ways of functioning.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>23. never satisfactorily explains to students the reasons for procedural changes.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>24. frequently tries out new ideas.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>25. willing and ready to accept outside help when necessary.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>
Part V
Inventory of Characteristics of Students

Please rate the following statements by circling the appropriate response:

1 = Strongly Disagree
2 = Disagree
3 = Moderately Disagree
4 = Undecided
5 = Moderately Agree
6 = Agree
7 = Strongly Agree

SD D MD U MA A SA

1. My peers often ask me for advice or information. 1 2 3 4 5 6 7
2. I enjoy trying out new ideas. 1 2 3 4 5 6 7
3. I seek out new ways to do things. 1 2 3 4 5 6 7
4. I am generally cautious about accepting new ideas. 1 2 3 4 5 6 7
5. I frequently improvise methods for solving a problem 1 2 3 4 5 6 7
when the answer is not apparent.
6. I am suspicious of new inventions and new ways of thinking. 1 2 3 4 5 6 7
7. I rarely trust new ideas until I can see whether the vast 1 2 3 4 5 6 7
majority of people around me accept them.
8. I feel that I am an influential member of my peer group. 1 2 3 4 5 6 7
9. I consider myself to be creative and original in 1 2 3 4 5 6 7
my thinking and behavior.
10. I am aware that I am usually one of the last people 1 2 3 4 5 6 7
in my group to accept something new.
11. I am an inventive kind of person. 1 2 3 4 5 6 7
12. I enjoy taking part in the leadership responsibilities 1 2 3 4 5 6 7
of the groups I belong to.
13. I am reluctant about adopting new ways of doing things 1 2 3 4 5 6 7
until I see them working for people around me.
14. I find it stimulating to be original in my thinking and behavior. 1 2 3 4 5 6 7
15. I tend to feel that the old way of living and doing things is the best. 1 2 3 4 5 6 7
16. I am challenged by ambiguities and unsolved problems. 1 2 3 4 5 6 7
17. I must see other people using new innovations 1 2 3 4 5 6 7
before I will consider them.
18. I am receptive to new ideas. 1 2 3 4 5 6 7
19. I am challenged by unanswered questions. 1 2 3 4 5 6 7
20. I often find myself skeptical of new ideas. 1 2 3 4 5 6 7
# Part VI.
## Computer Opinion Survey

*Please rate the following statements by circling the appropriate response:*

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>SD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Having a computer available improves my productivity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. When I use a computer for some reason, it saves me some time and work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. When I use a computer, I get a better picture of facts and figures.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Having a computer available improves my general satisfaction.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Having to use a computer makes my life less enjoyable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. Having a computer available to me makes things easier for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I feel very negative about computers in general.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Having a computer available to me makes things more fun for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. If I had a computer at my disposal, I would try to get rid of it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. I look forward to a time when computers are more widely used.</td>
<td>1</td>
<td>2</td>
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<td>5</td>
</tr>
<tr>
<td>11. I doubt if I would ever use computers very much.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. I avoid using computers whenever I can.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. I enjoy using computers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. I feel there are too many computers around now.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. Computers are probably going to be an important part of my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. A computer makes learning fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. When I use a computer, I get a lot of satisfaction from it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. When I use a computer, it is probably more trouble than it is worth.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. I am usually comfortable when I have to use computers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. I sometimes get nervous just thinking about computers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21. I will probably never learn to use a computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. Computers are too complicated to be of much use to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. If I had to use a computer all the time, I would probably be very unhappy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>24. I sometimes feel intimidated when I have to use a computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. I sometimes feel that computers are smarter than I am.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. I can think of many ways that I could use a computer.</td>
<td>1</td>
<td>2</td>
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<td>5</td>
</tr>
</tbody>
</table>
APPENDIX B. FOCUS GROUP QUESTIONS
Focus Group Questions

Entering students

1. Introduce yourself and tell:
   • where you are from.
   • the impact the laptop and Internet access had on your decision to attend Waldorf College

2. Explain to me how you used computer and Internet access in high school on an average day.

3. When doing work for your classes in high school, what kinds of things did you do with
   • computers?
   • Internet access?

4. Did having a computer and/or Internet access
   • change the way you approached assignments?
   • change your approach to research?

5. Think how your high school teachers used technology in and out of the classroom to support learning. What have you observed? What do you imply?
   • What were some exemplary uses?
   • What is their level of comfort?

6. What do you think about Waldorf and its decision to give laptop computers and Internet access to students? What suggestions do you have for administration?
Focus Group Questions Continued

Experienced students

1. Introduce yourself and tell:
   • where you are from.
   • the impact the laptop and Internet access had on your decision to attend Waldorf College

2. Explain to me how you use your laptop computer and Internet access on an average day.

3. When doing work for your classes, what kinds of things do you do with your
   • laptop computer?
   • Internet access?

4. Given the fact that you have computer and network access:
   • Does it change the way you approach assignments?
   • Does it change your approach to research?

5. Think how your professors are using technology in and out of the classroom to support learning. What have you observed? What do you imply?
   • What are some exemplary uses?
   • What kinds of things could professors do?
   • What is their level of comfort?

6. What do you think about Waldorf and its decision to give laptop computers and Internet access to students? What suggestions do you have for administrations?
APPENDIX C. HUMAN SUBJECTS APPROVAL
Checklist for Attachments and Time Schedule

The following are attached (please check):

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

13. ☐ Consent form (if applicable)

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

15. ☒ Data-gathering instruments

16. Anticipated dates for contact with subjects:

<table>
<thead>
<tr>
<th>First Contact</th>
<th>Last Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week of 3/31/97</td>
<td>Week of 4/1/98</td>
</tr>
<tr>
<td>Month / Day / Year</td>
<td>Month / Day / Year</td>
</tr>
</tbody>
</table>

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

   3/1/98
   Month / Day / Year

18. Signature of Departmental Executive Officer

   Richard M. Monchi
   3-19-97
   Curriculum Test

   Date
   Department or Administrative Unit

19. Decision of the University Human Subjects Review Committee:

   ☒ Project Approved
   □ Project Not Approved
   □ No Action Required

   Patricia M. Keith
   Name of Committee Chairperson
   3/19/97
   Date
   Signature of Committee Chairperson
REFERENCES


Ely, D. P. (1995, April 14). *Technology is the answer: But what was the question?* Lecture presented for the Capstone College of Education Society, Syracuse University.


