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ASYNCHRONOUS DISTANCE LEARNING TECHNOLOGY: THE INSTRUCTORS' VIEW

by

EARL ALEXANDER EVANS, 1967-

A THESIS

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ABSTRACT

Advances in communications, computer technology and human-computer interfaces have enabled concurrent advances in Web-based education. A number of case studies concerning applications of Web-based education for both distance learning and on-campus programs have been published. Primarily, these studies have focused on individual assessments of the Web-based technologies. In addition, these published studies have generally highlighted the successes while little discussion about failed attempts has been presented in the literature.

In contrast, this thesis provides a broad-based assessment of applied Web technology for higher education. This research was conducted via a survey completed by twenty five university and college faculty from seventeen four-year institutions. The survey instrument was composed of two parts. Part I gathered information about the course characteristics; equipment required, software, course title and credit hours. Part II of the survey included eleven categories of web-based course delivery tools, such as chatrooms and digitized lectures. Course instructors were asked for the frequency of application of the particular tool and their perceptions of importance, efficiency of use, and instructor satisfaction for each tool. The general findings of the study as well as the statistically significant interaction effects between course characteristics are presented. The study found that electronic mail and on-line information sources were the most important course delivery tools used by the survey participants. Highly favorable ratings were given to digitized lectures as well.

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I. INTRODUCTION

A. PURPOSE

"Those who explore an unknown world are travelers without a map; the map is the result of the exploration. The position of their destination is not known to them, and the direct path that leads to it is not yet made" (Hall 1992, 3). With this quote from the Japanese physicist Hideki Yukawa, Stephen S. Hall begins his book, Mapping the Next Millennium. Many university educators today are explorers, applying new advances in technology to course instruction without a clear guide to follow and, by doing so, laying the path by which future educators will teach. The explosion of the Internet, the proliferation of personal computers, and advances in communications technology have all allowed for radical changes in education. In today's environment, a student taking an on-campus course may never set foot in a classroom, distance students may take a course concurrently with on-campus students, and course instructors may find themselves conducting office hours via electronic means. The implications of such changes are wide ranging, for they affect the quality of instruction, the public's access to higher education, and the control consumers will have over their own education (Boschmann 1995).

Among these new developments in higher education has been the introduction of *Asynchronous Learning Networks (ALNs)*. The Journal of Asynchronous Learning Networks (Bourne 1997) describes ALNs as networks which provide the capability for learners to secure education anywhere and at anytime. ALNs have been applied to on-campus courses, distance courses, and combined distance and on-campus courses. Published research on the topic of ALNs has primarily concerned individual case studies of

applications, where the method of application and the subsequent results are described. What is lacking in the published research is an assessment of attitudes and experiences with ALN from faculty of multiple institutions. It is in this area, therefore, that this thesis will focus.

The research focus for this thesis is how are university faculty currently providing an asynchronous distance learning environment, what tools are being applied for this purpose, and how do different course characteristics affect the results? With this question in mind, this study examines the different course delivery tools currently applied in asynchronous learning networks for distance courses and for distance components of on-campus courses. Faculty from seventeen institutions were surveyed for this purpose. These faculty had recently taught or were currently teaching applicable courses at both the graduate and undergraduate levels and in subjects ranging from liberal arts to engineering. The survey captured each faculty member's level of satisfaction and opinion of efficiency for each of the examined tools, as well as the frequency of use and the relative importance of the tool to the instruction of the course. The survey data and an analysis of this data are presented further in this report.

B. IMPORTANCE OF THE TOPIC

Distance education is not new in concept; in fact, distance courses have been offered in the United States since the 1880s. However, distance education has traditionally been relegated to a position of relatively minor importance in education. Distance courses in the past were usually taught through correspondence via traditional mail, a slow process

which involved little to no interaction between the student and the instructor nor among the students. As a result, these courses were often seen as inferior to classroom instruction. Since the 1930s, broadcast media has been employed for distance learning in remote areas, such as northern Canada and the Australian outback (Berge and Collins 1995), but this has been the exception rather than the norm. Elsewhere, the pool of students was too small to make broadcast media a cost effective means of course delivery. However, in the past 20 years, the model for distance education has begun to change. The advent of video technology in the early 1980s greatly advanced the reach and the capabilities of distance education programs. Using the video technology, instructors could now simultaneously broadcast a live lecture for students at remote locations or video tape the lecture to share with distance students. Through this means, distance students could, for the first time, participate in a course simultaneously with in-residence students.

A primary advantage of video technology for distance education programs is that it allowed students to access a course through either synchronous or asynchronous means. In synchronous distance education, the students participate concurrently, as with a live televised broadcast of a course where the distance students participate through a telephone or satellite connection. With asynchronous distance education, however, the students participate at non-concurrent times, as with a video tape. There are advantages and disadvantages to both synchronous and asynchronous video programs. The synchronous video environment can be very active for the distance student, but it forces the student to meet at a given place and at a given time. Essentially, synchronous video courses defeat the boundary of distance but not the boundary of time. The asynchronous

video environment allows the student to access the course at a time of his or her own choosing. As such, it defeats the boundary of both distance and time. However, asynchronous video, usually video tape, tends to be a very passive experience, with little means for active involvement and interaction.

Video programs can be very expensive to conduct. If a program is conducted synchronously through live broadcast, then a broadcast studio must be constructed, satellite uplinks established and teleconferencing centers provided for the distance students attending the course. All of these requirements can be very expensive and susceptible to outside market forces. For example, in 1995 a rapid increase in the cost of satellite access time nearly forced many smaller programs to cancel courses (DeLoughry 1995). Asynchronous programs do not require the elaborate broadcast system, but do require the recording and production of multiple video tapes as well as the inconvenience and time lag of mailing tapes and other educational material to all distance students.

The 1990s have seen the introduction of computer technology and the Internet to distance education. Courses and degree programs are now being offered via the World Wide Web. This has led to a radical change in the nature of asynchronous distance education. Through this technology, the students can become active participants in the course, despite the fact that they are separated by both distance and time. Active participation can be achieved through electronic mail, chat rooms, digitized interactive lectures, coordinated group projects between distance students, and a variety of other technologies and applications of these technologies.

The increased availability and use of technology in distance education has coincided with a dramatic increase in demand for higher education at all levels. Much of this demand is driven by the need for continuing professional education. The modern business and technical professional faces a need for lifelong learning in order to stay current and progress in his or her career. Continuous and rapid changes in technology and business practices have placed a finite life on a professional education, particularly a professional technical education (Berge and Collins 1995). Graduates from undergraduate programs can no longer expect their bachelor degree education to suffice for their entire career. Professions in which the knowledge base was more or less static just twenty years ago have become rapidly changing and dynamic. As an example, library science for many years focused on the traditional library organization of books and periodicals. Today, a librarian must not only serve as a guide to the traditional library resources but must also guide researchers to a growing variety of alternative information sources (Collins 1996). This requires the modern librarian to keep constantly abreast of new technology and changes in information media.

The demand for higher education is also driven by an increase in the number of non-traditional students returning to school for a graduate degree or even a first undergraduate degree. These students have unique needs and time constraints not faced by the typical undergraduate student. In addition, the business travel requirements on many working professionals can provide too many interruptions to their schedules to allow them to attend traditional on-campus courses. The issue of time is what can make distance education programs an attractive option to the working professional. Asynchronous

distance education programs can provide this type of student the flexibility he or she needs to balance multiple demands on their time.

Many working professionals who return as students have specific educational goals in mind, directly related to advancing their career. These students are not seeking a general academic experience, but rather a tailored program which fits well with their current position and aspirations for the future. With this in mind, these students may not be satisfied with locally available education programs. Distance education options can give them the alternative of learning through a specific program that is not readily available locally. In order to avail themselves of this type of program, however, the student must feel that the program provides at least the equivalent educational value as a traditional program. In many cases, not only must the student be convinced of the program's value, but the student's current or potential employer must be as well. This has placed a burden on the educator and the providing institutions to provide evidence that their distance programs are acceptable alternatives.

Corporate and organizational training programs are another area where asynchronous distance education techniques, if proven to be effective, can be applied. Many organizations seek to minimize training costs, particularly related travel expenses. If an effective course can be provided through an asynchronous distance means, then these organizations are likely to seize upon the opportunity. Picard (1996) provides the examples of Ford Motor Company, Xerox, and Hewlett-Packard as corporations that have come to heavily rely on distance education for employee training. Picard predicts exponential growth in this type of distance education application over the next five years.

He describes this as happening through two primary methods, Simultaneous Interactive Distance Learning (SIDL) and individual training. SIDL is a synchronous method where groups of students meet in specially equipped training rooms where they can interact with similar groups and the instructor at different locations. Individual training could be asynchronous and could be accomplished through an individual seated at a personal computer.

In direct address of this credibility issue, the validity of asynchronous distance education programs has been documented through several case studies presented in the published literature. These cases include applications at a variety of university environments, including Mercer University (Leonard 1996), Marywood College (Technology Horizons in Education Journal 1996), and Drexel University (Andriole et al. 1995). These cases also present both successes and failures and include recommended procedures for conducting an asynchronous distance education course. In one article concerning courses taught for on-campus undergraduate students at Vanderbilt University, a model for designing an asynchronous distance learning course is presented (Bourne et al. 1997).

There are many other programs and courses being offered at many more institutions around the country. The experiences at these programs generally have not been well publicized. In addition, many of the cases presented in the literature discuss the results in terms of student achievement reached in the course. However, these discussions frequently fail to discuss the instructor's view of how well the applied technologies functioned as individual course delivery tools. In particular, instructor perceptions of

frequency of use, importance, efficiency and satisfaction with different applications of technology for education have generally not been documented. These factors present gaps in the existing literature concerning asynchronous distance education, for the instructor perceptions are important to capture in order to ensure that the most beneficial technologies are being applied to provide the greatest value to the course. In addition, if the instructors felt that a particular technology or group of technologies was an impediment to course delivery, then this needs to be communicated to future course instructors for these types of distance courses as well.

C. DEFINITION OF TERMS

In discussing the application of technology to higher education in general, and asynchronous distance education in particular, some definitions need to be provided. Bourne et al. define key terms which are used in this report.

> *World Wide Web (WWW)* - A collection of knowledge and information sources provided on the Internet in hypertext transfer protocol (http) format. WWW is typically referred to as the Web.
>
> *Intranet* - A network whose access is restricted within some domain
>
> *Internet* - A world-wide collection of interconnected networks.
> (Bourne et al. 1997, 4)

D. FORMAT OF THE STUDY

The stated research question for this study did not lend itself to a hypothesis testing approach. Instead, an exploratory research methodology was chosen. This study presents a surveyed sample, and analysis of this sample, of faculty from asynchronous graduate and

undergraduate programs at institutions around the nation. The purpose of this survey was to assess the faculty's experiences with several different technologies and technology facilitated methods currently used in Internet based asynchronous distance education. Many of the surveyed faculty conducted asynchronous distance courses, although several faculty were instead involved in the application of asynchronous distance methods as part of in-residence courses. The survey instrument included ten applications of technology for asynchronous education in addition to a category for class meetings in a physical location. Instructors were asked to provide their perceptions of frequency of use, importance to the course, efficiency, and instructor satisfaction for each category. In addition, the survey instrument included general questions designed to obtain an outline of course requirements for both the student and instructor. A total of 25 faculty members from 17 institutions participated in this survey.

The survey of existing literature concerning synchronous and asynchronous distance education is presented in the section labeled *Review of Current Literature*. The next section, *Data Gathering*, includes the data collecting methodology including design of the survey and identification of survey participants. The remainder of the thesis includes *Discussion of Survey Responses* and *Results and Conclusions*. The survey instrument and the collected survey data are presented in the *Appendices*.

II. REVIEW OF CURRENT LITERATURE

A. DISTANCE LEARNING AND ASYNCHRONOUS LEARNING NETWORKS

The need for alternative delivery of courses and degree programs, particularly in engineering and management, has been driven in part by the changing demographics of the students. This has been particularly true for advanced degrees and continuing professional education programs. Many demographic groups of students have grown from fringe minorities into major forces among the student population pool. As Ehrmann states, "today's pool of potential students includes virtually all adults, including many who have different schedules from faculty and from one another, are distant from the appropriate campus, are physically challenged, or have varying preparation and learning styles" (Boschmann 1995, xi). These students all have different needs that cannot be met through traditional, on-campus courses. Asynchronous learning networks (ALNs), which use a variety of current technologies to provide a high quality course for students separated from the instructor by both distance and time, are growing in use and acceptance to meet the needs of these students.

In general, distance education programs have evolved over a period of 100 years to meet the needs of the student unable to attend classes on the traditional campus. The early distance programs reflected the tiny size of this pool of students, but as the pool has grown, so has the depth and quality of the distance programs. Mayadas of the Sloan Foundation states,

> The history of serving these off-campus learners began a century ago. Correspondence style off-campus education first appeared in the late 1800s and remains popular today. Technology delivery has evolved from print and radio to

> broadcast television and computer-aided instruction, and now to CD-ROMs and the World Wide Web. These disparate technologies, along with some others, are the enabling tools for what is now called 'distance education.' They have had large -- even revolutionary -- influence on education. In the process, they have extended educational opportunities to people in places that would otherwise not have been served. (Mayadas 1997, 2)

The use of ALNs is not restricted to distance learning, ALNs have been applied to varying degrees for on-campus course delivery as well. Mayadas (1997, 2) describes the beneficiaries of ALNs when he writes, "While off-campus learners will benefit the most from ALNs, it is likely that important benefits will also be realized on campuses. ALNs bring with them new kinds of functions that may, in turn, allow new outcomes". He continues to state that asynchronous access and communication through existing on-campus computer networking can provide for "better learning" and opens up opportunities for student collaboration, improved access to instructors which may improve student motivation, and the possibility for self-paced study.

B. THE CHALLENGES FACING ALNS IN DISTANCE EDUCATION

Such uses of ALNs open up new methods to address the challenges currently faced in engineering education. Swart et al. (1996, 737) described these challenges as including,

> The need to provide engineering students with 'soft' skills including excellent written, oral and verbal communication, the ability to work in teams, and knowledge of the social, political and economic impacts of technological decision making. At the same time, it is recognized that the technological state-of-art in many fields is changing every two years, while many state legislatures are exerting pressure to reduce the number of credit hours required for degrees at state institutions.

They continue to state that changes in current societal realities including technology, downsizing, and population demographics, are forcing the higher education community to shift focus to a wider mission. This broader mission has caused these institutions to

explore new means of course delivery for both on-campus and distance learning students and through both synchronous and asynchronous means.

The "virtual classroom" is a term commonly used in reference to the delivery of instruction through the use of computer technology. Hiltz defines the virtual classroom as a teaching and learning environment located within a computer-mediated communication system (Hiltz 1994). Such a learning environment can be particularly helpful by allowing the course to simultaneously meet the requirements of on-campus and distance education users. These users can be defined as not just the students, but the instructor and administrative staff as well. Each of these users has independent as well as shared requirements; however these requirements are essentially the same, whether the course is on-campus or at a distance. Lockledge et al. (1996) describe how the use of the World Wide Web (WWW) for a virtual classroom environment can make meeting the needs of these users relatively simple through its simplicity as a delivery system .

The widespread use of computer technology in all fields has helped the virtual classroom to gain acceptance among students, educators and employers as a means for distance education. However, the concept of the virtual classroom has far to go before it is accepted as equal to the traditional education format. The change to a virtual classroom requires a paradigm shift. This new paradigm includes such issues as: "student authenticity far beyond plagiarism, the convergence of professional and personal time produced by 24-hour on-line or video teleconferencing availability, the dependency on a team of connectivity technicians and professionals in order to communicate with students, and a virtual higher education world which is less faculty-centered and where curriculum is

interdisciplinary" (Swart et al. 1996, 738). The issues involved in this paradigm bring about challenges, not the least of which is how to develop a culture which accepts distance learning. Hiltz states that to address these issues and challenges, instructors must recognize that distance education in general, and the virtual classroom in particular, requires a different model than successful traditional instruction. Three basic principles that can help guide successful instruction in a virtual classroom environment are media richness, timely responsiveness, and interaction (Hiltz 1994). These require that the instructor be aware of both the benefits and the shortcomings of a virtual classroom.

C. MODELS FOR DISTANCE EDUCATION AND ALN

In considering a model for the virtual classroom and asynchronous distance education in particular, it is important that distance education first be defined. David C. Leonard defines modern distance education as, "involving 1) the separation of the teacher and the learners in space and often in time, 2) the shift in volitional control from the teacher to the students, and 3) contiguous interactive communication between teachers and students through the use of electronic media" (Leonard 1996, 391). M.G. Moore defined distinctions between highly structured and unstructured educational programs. Using Moore's definitions, traditional distance education is, by necessity, highly structured and rigid with deadlines, course content and materials strictly defined by the instructor, although the student does have a great deal of personal flexibility through controlling the time and place of study (Kearsley and Lynch 1996). With very limited interaction between the student and the instructor, it is very important that the student be given a clear

understanding from the beginning of what the course entails and what is expected. However, the more interaction that can occur between the student and instructor, the more dynamic and less rigid the instructor can make the course.

The Sloan Foundation has sponsored extensive research into applications of technology for education in both distance and on-campus programs. The Sloan Foundation groups traditional distance education into two categories: self study techniques with little or no human interaction, and techniques with limited human interaction (Mayadas 1997). Self study techniques include use of books and videotapes while techniques with limited human interaction include interactive television. These two categories of distance education fail to provide opportunities for formal and, in particular, informal discussion that can be a critical medium for instruction. The Sloan Foundation suggests a third, new category of asynchronous interactivity (Mayadas 1997). This category combines "self study techniques with asynchronous interactivity to create environments in which learners can access remote learning resources asynchronously -- using relatively inexpensive equipment -- to learn at home, at the work place or at any place of their choosing" (Mayadas 1997, 1). Furthermore, under this category, every person involved in the course and on the network, whether an instructor or student, is seen as simultaneously "a user and a resource". Muller lists some current applications which facilitate this category of distance education. These applications include electronic mail; information search and retrieval through servers, FTP, archie server and wide area information servers; internet browsers; special interest groups (listservs and newsgroups); and remote login computer access (Muller 1995).

In general, asynchronous interactivity is enabled by computer networks. Probably the most well known and visible capability enabled by computer networks is electronic mail, which has become a standard and well used method of communication in both corporate and academic circles (Bourne et al. 1997). Mayadas of the Sloan Foundation summarized the computer network enabled ALN analogs to traditional, on-campus learning activities (Table I).

Table I. Typical Learning Related Activities at a Traditional, On-Campus Environment and Comparable ALN Analogs (Mayadas 1997, 5)

TRADITIONAL, ON-CAMPUS	ALN ANALOG
Attendance at lectures	Books (on-line or hard copy), web postings, videotape, groupware (text and image or video-on-demand)
Recitation sessions	Groupware, interaction on web
Interaction with peers	Groupware, web, list serve, electronic mail
Self-study, library	Books and articles (on-line or hard-copy), web instruments
Lab work	Computer simulation, lab kits, remote control of instruments
Interaction with tutors and teaching assistants	Groupware, web, list serve, electronic mail
Interaction with faculty	Groupware, web, list serve, electronic mail
Attendance at seminars and colloquia	Videotape, video-on-demand (over ISDN and groupware or web)
Inquiries: academic and administrative issues	Electronic mail, voice-response systems
Exams	Timed examinations and submission over computer network or proctored exam at remote site

Teaching asynchronously via computer networks is not as simple as merely substituting on-campus course activities with ALN activities. It requires consideration of what the students should learn and how they should learn it, in other words, the learning taxonomies. For engineering courses, Bourne et al. (1997) suggests that learning material can be classified along two commonly known taxonomies, Barrett's taxonomy and Merrill's taxonomy. Barrett's taxonomy divides learning into four categories: literal, inferential, applicative and evaluative. Merrill applies a performance-context matrix which includes actions of remember, use or find (create) and content classified as fact, concept, procedure or principle (Bourne et al. 1997). These taxonomies are important to consider as the instructor selects the course delivery technology for different components of an asynchronous course. Truman (1995) of the University of Central Florida emphasized that distance education requires an increased emphasis on teaching strategy since poor methods are exaggerated in distance education and technology used improperly may interfere with the learning process.

D. GUIDELINES AND CASE STUDIES

Several researchers have proposed guidelines, suggested tools and described methodologies for constructing a course using both synchronous and asynchronous distance education methods. Truman (1995) lists and describes course delivery tools for this type of environment. This list includes, among others, the use of compressed video, audioconferencing, World Wide Web/Internet, computer mediated communications, computer conferencing, E-mail and listservs, asynchronous learning networks, video tapes,

audio tapes, telephone/fax, CD-ROM. Starrett (1996) proposes some general steps towards incorporating the Internet into any course. In addition, Truman (1995) states that instructors must acquire new distance learning teaching skills in order to effectively teach via these methods, including an understanding of the nature of distant education and of the distance student's characteristics.

Bourne et al. (1997) provide a set of recommended steps for building an "on-line" course. These steps apply a client-server model using an instructor interface. The recommended steps include:

1. Analyze needs and desired student outcomes from the course,
2. Design assessments (e.g. types of exercises, labs and written tests),
3. Build table of contents and homepage for the course,
4. Determine strategies and types of components needed to prepare students for the assessments,
5. Create exercises, labs, text materials and graphic for each item in table of contents,
6. Tryout basic skeleton course materials,
7. Add demonstrations, pointers to lab software,
8. Evaluate course with known metrics, and
9. Revise course materials.

(Bourne et al. 1997, 7)

Successful accomplishment of the steps described above requires that instructors develop the teaching skillset referred to by Truman. For instance, an understanding of learner characteristics is critical to successfully completing step 2, the design of instructional assessments.

Other researchers have provided case studies of the application of asynchronous distance education courses and programs offered at their own or other institutions. Leonard (1996) describes Mercer University's master of science program in technical communication management. He cites Sherry's definition of distance learning as

"involving the separation of the teacher and the learners in space and often in time, the shift in volitional control from the teacher to the students and the noncontiguous interactive communication between teachers and students through the use of electronic media" (Leonard 1996, 391). Leonard's core elements for a distance learning graduate program include the instructor, the student, technical support and administration. In this course, the distant learning students access the lectures through video tape delivered to them following completion of each live lecture. The students then access course syllabus, lecture slides, assignments, electronic document posting information, off-line and on-line resource information, and, student, team and topics information through the courses World Wide Web page. Leonard's conclusions from his ongoing experiences with teaching the course include the need for developing a sense of community in a distance course, the necessity of E-mail to the asynchronous communication process, the need for the Web page as the binding element of the course, and the difficulty in accomplishing collaborative work despite the available technology (Leonard 1996).

"Establishing an On-Line Educational Program", published in Technology Horizons in Education Journal (1996), describes issues surrounding a new on-line off-campus degree program in Instructional Technology and Communication Arts established at Marywood College. This study raises several points concerning academic issues, the communications system and the channel to support the on-line program, and the personnel issues. The authors found that the on-line program can provide a comparable educational experience to a traditional class; however academic standards for the on-line courses were still in discussion with the institution's graduate curriculum committee at the time the

article was written. The authors include a discussion about using a university developed and maintained web site versus using an outside provider. They found the outside provider to be beneficial since the university did not have adequate personnel resources to support a web site and the outside provider gave the students and instructors access to information sources they would not have had access to otherwise. Personnel issues raised included considerations of teaching load, compensation for teaching an on-line course versus an on-campus course, and how to administer tests. (Technology Horizons in Education Journal 1996)

Andriole et al. (1995) describe Drexel University's experiences with ALN. The ALN network is accessed by students via Windows-based personal computers or Apple Macintosh computers. Their discussion focuses on the results of a study of five courses offered via ALN, in 1994. The study was ongoing at the time the article was written, however the preliminary conclusions were encouraging. 80% of the surveyed sample of students stated they would take another ALN course, the students generally found the ALN format convenient and a "superb learning environment". In addition, the communications hardware and software used in presenting the course were readily available items and, therefore relatively inexpensive, non-specialty equipment. (Andriole et al. 1995)

These are just a few examples of such case studies that have been published. Others include the article, "Colleges Ease Into Internet Education", which provides an overview of Ohio State University's efforts to establish graduate courses on the Internet in addition to similar efforts at Franklin University and Columbus State College (May 1997).

Gillespie (1997) lists numerous programs in a variety of evolutionary stages which provide on-line courses and programs. Bartz (1996), of the University of Memphis, provides a case study describing the instruction of an on-campus course in software design using Web resources. He concluded that the future for Web based education is promising, primarily due to its advantage as the primary communications media at the present time for Internet users. Sedlack and Cartwright (1997) present the lessons learned from two approaches towards distance education at the University of Wisconsin-Stout. Among their conclusions was the need for faculty incentives to encourage instructors to invest the time and effort required to work with new technologies and modes of delivery in providing modern distance courses.

E. THE NEED FOR THIS STUDY

Although specific programs have been documented, evaluations of technologies and technology facilitated course delivery tools used in ALN specifically from both a student and a faculty perspective, using a survey of multiple institutions, are lacking. Klesius et al. (1997) describe a study comparing a variety of student behaviors in a distance education course versus the same behaviors with students enrolled in a traditional instruction course. The distance learning course included in this study did not use an on-line course delivery format, but rather used video tape for lecture presentation. In general, the study found that learner satisfaction was equal to or better than with the traditional course on most variables. In addition, the study found "the convenience of distance education overshadowed the lack of teacher accessibility".

There is a need to assess the wider perceived effectiveness of each of the various technologies and course delivery tools currently employed in distance education. The previously cited study attempts to do this for a tele-learning format in distance education and used student behaviors to measure effectiveness. What is lacking is a similar study for the tools used in ALN and from a faculty perspective. As Truman noted, the faculty perception of effectiveness is a necessary element of evaluating the technologies used in distance education (Truman 1995).

This thesis gauges the perceived effectiveness of different technologies for ALN applications. This is accomplished through use of a survey instrument and the ALN analogs to on-campus learning related activities provided by Mayadas in Table I. Accordingly, the technologies selected for use in the survey instrument were chosen to include all of the learning related activities listed in Table I. The format of the study, the survey instrument and the findings of the study will be discussed in the upcoming sections.

III. DATA GATHERING

A. THE SURVEY INSTRUMENT

As discussed in the earlier sections, the purpose of this study was to gain an assessment of course delivery tools applied to asynchronous learning networks (ALN) for distance education or distance components of traditional on-campus courses. Specifically, this assessment was achieved by collecting the perceptions of faculty who have taught courses through ALNs. These perceptions were gained through use of a survey instrument completed by each of the participating faculty.

The survey instrument was divided into two sections. Part I was designed to acquire information about the specific course. This information included the course title, credit hours, level (undergraduate or graduate), student computer requirements, instructor computer requirements, the number of students enrolled in the course, and information about the students. Part II of the survey instrument contained specific questions about course delivery tools that may have been used in the course. Each course delivery tool was rated for its: (1) Frequency of use in the course, (2) Importance to the course, (3) Efficiency of use, and (4) Satisfaction of the instructor with this course delivery tool. Rating levels were included in text format, together with a corresponding numeric rating from 1 to 5. In selecting course delivery tools to include in the survey, each traditional learning activity included in Mayadas' table, shown previously in Table I, was matched with at least one course delivery tool. These tools were selected as shown in Table II. The survey in its entirety is included in Appendix A.

Table II. Learning Activities with Corresponding Survey Course Delivery Tools

TRADITIONAL, ON-CAMPUS LEARNING ACTIVITY	COURSE DELIVERY TOOL
Attendance at lectures	Class meetings in a physical location Real time video conferencing Lectures delivered via video tape Lectures delivered via digital means
Recitation sessions	Class meetings in a physical location Real time video conferencing Chatrooms for group interaction
Interaction with peers	Chatrooms for group interaction Collaborative student assignments
Self-study, library	On-line sources of course information
Lab work	On-line laboratory modules and simulations
Interaction with tutors and teaching assistants	Electronic mail for 1 to 1 communication between student and teacher and vice-versa Chatrooms for group interaction
Interaction with faculty	Electronic mail for 1 to 1 communication between student and teacher and vice-versa Electronic mail for communication between the teacher and all students concurrently Chatrooms for group interaction
Attendance at seminars and colloquia	Class meetings in a physical location Real time video conferencing Lectures delivered via video tape Lectures delivered via digital means
Inquiries: academic and administrative issues	Electronic mail for 1 to 1 communication between student and teacher and vice-versa
Exams	On-line evaluations of student knowledge

B. SURVEY PARTICIPANTS

It was desired that the participants in this study be from universities with established traditional on-campus programs, thereby providing a basis for comparison with the asynchronous courses. In addition, the courses taught by the participants should primarily be taught through asynchronous means. Several sources were considered for finding

potential study participants. Many sources, including the Sloan Foundation home page (http://www.sloan.org/education/ALN.new.html) and the Peterson's Guide home page (http://www.petersons.com/dlearn/), list a multitude of organizations providing distance courses on-line. However, many of the courses listed under these programs did not meet the desired criteria, being merely traditional courses with a home page. Therefore, the approach taken for this research was to contact universities directly and locate faculty offering courses which met the study criteria.

The American Universities Web page, maintained by Professor Mike Conlon at the University of Florida, was used as the primary resource for identifying potential participating institutions. This Web page lists the home pages for most universities and colleges in the United States, in excess of 600 institutions. Of these, 83 institutions were identified as having courses of potential interest to this study and subsequently contacted via electronic mail. Of this group, 25 institutions responded positively that faculty might be willing to participate in the survey. A total of 62 surveys were mailed to these 25 institutions, of which 25 completed surveys from 17 institutions were returned. This represented a 40.3% response rate.

Initially, it was hoped that the study participants could be limited to faculty involved in engineering and management graduate programs. However, the pool of potential participants quickly became very limited using this criteria. Accordingly, the pool of potential participants was extended to include faculty who have taught distance courses or distance components of on-campus courses using Asynchronous Learning Networks. These courses were for either graduate or undergraduate students and in a variety of

programs, including liberal arts and science programs. The affect of this varied sample of participants will be discussed in Section V, *Results and Conclusions*.

IV. PRESENTATION OF DATA

A. DISCUSSION OF SURVEY RESPONSES

The survey data is presented in Appendix B. The Part I survey responses are utilized in the upcoming *Data Analysis* section and will be discussed in Section V, *Results and Conclusions*. What follows is a summation of the data collected in Part II of the survey; beginning with the first factor surveyed, *Class Meetings in a Physical Location.*

Some practitioners of asynchronous learning networks consider periodic physical meetings of the class to be vital to building a bond among the class members (Leonard 1996). However, the survey results on this issue (Table III) revealed that 64% of the respondents did not include a physical meeting of the class as part of the course. Of the remaining 36%, or 9 respondents, who did use physical meetings of the class, 16% considered the meeting only somewhat important and 20% considered it important or very important. In addition, 28% were only somewhat satisfied with the results of these meetings.

The next factor included in the survey, was *Real Time Video Conferencing* (Table IV). Of the survey respondents, 88% of the respondents never utilized video conferencing in their course. Accordingly, it would be difficult to draw any conclusions from the survey results about the importance, efficiency, or satisfaction levels with using video conferencing in courses.

Table III. Surveyed Ratings for Class Meetings in a Physical Location

Frequency	**Never**	**1 or 2 Meetings per Course**	**3 or 4 Meetings per Course**	**5 or 6 Meetings per Course**	**Greater than 6 Meetings per Course**
	16 (64.0%)	**4 (16.0%)**	**3 (12.0%)**	**0 (0.0%)**	**2 (8.0%)**
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	16 (64.0%)	**0 (0.0%)**	**4 (16.0%)**	**2 (8.0%)**	**3 (12.0%)**
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	16 (64.0%)	**1 (4.0%)**	**2 (8.0%)**	**4 (16.0%)**	**2 (8.0%)**
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	16 (64.0%)	**0 (0.0%)**	**7 (28.0%)**	**1 (4.0%)**	**1 (4.0%)**

Table IV. Surveyed Ratings for Real Time Video Conferencing

Frequency	**Never**	**1 or 2 Conferences per Course**	**3 or 4 Conferences per Course**	**5 or 6 Conferences per Course**	**Greater than 6 Conferences per Course**
	22 (88.0%)	**1 (4.0%)**	**1 (4.0%)**	**0 (0.0%)**	**1 (4.0%)**
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	22 (88.0%)	**0 (0.0%)**	**0 (0.0%)**	**2 (8.0%)**	**1 (4.0%)**
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	22 (88.0%)	**0 (0.0%)**	**0 (0.0%)**	**2 (8.0%)**	**1 (4.0%)**
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	22 (88.0%)	**0 (0.0%)**	**0 (0.0%)**	**2 (8.0%)**	**1 (4.0%)**

In contrast to video conferencing, every respondent indicated that they had used *Electronic Mail for One-to-One Communication* in their course (Table V). Among these respondents, frequency of use was generally high; 24% indicated they used electronic mail for this purpose at least once per week, 40% used it 2 or 3 times per week, and 28% used it daily. In addition, 72% said it was very important to the conduct of their course and an additional 16% said it was important. Satisfaction with using electronic mail for this purpose was also very high, 92% responded that they were satisfied or very satisfied with this tool. Of note, one respondent indicated that they had used electronic mail for this purpose but provided a "not applicable" response to the questions of efficiency and satisfaction. Given the lack of a similar discrepancy for any of the respondent's other answers, it can be assumed that the respondent understood the nature of the question. The respondent may have felt they couldn't make a judgment concerning efficiency and satisfaction with electronic mail, and marked "not applicable" accordingly.

The frequency of use for *Electronic Mail for Communication Between the Teacher and Students Concurrently* (Table VI), commonly referred to as *broadcast messages*, was somewhat lower than for individual electronic mail. Eighty eight percent of the respondents indicated they had used electronic mail for such a purpose in their course; 16% used it once or twice per month, 24% once per week, 32% 2 or 3 times per week and 16% used it daily. However, despite its lower usage, 72% considered it to be important or very important as an instructional tool for conducting their course. Furthermore, 84% thought it was efficient or very efficient to use and all respondents who had used electronic mail for this purpose responded that they were very satisfied.

Table V. Surveyed Ratings of Electronic Mail for 1 to 1 Communication Between Student and Teacher and Vice-Versa

Frequency	**Never**	**Once or Twice per Month**	**Once per Week**	**2 or 3 Times per Week**	**Daily**
	0 (0.0%)	**2 (8.0%)**	**6 (24.0%)**	**10 (40.0%)**	**7 (28.0%)**
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	0 (0.0%)	**1 (4.0%)**	**2 (8.0%)**	**4 (16.0%)**	**18 (72.0%)**
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	1 (4.0%)	**0 (0.0%)**	**3 (12.0%)**	**9 (36.0%)**	**12 (48.0%)**
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	1 (4.0%)	**0 (0.0%)**	**1 (4.0%)**	**13 (52.0%)**	**10 (40.0%)**

Chat Rooms for Group Interaction (Table VII) received something of a mixed reaction from the survey respondents. Forty eight percent of the respondents did not use chat rooms in their course at all. Only 12% of the respondents indicated that more than 70% of their students were using the course chat rooms and 28% of respondents indicated less than 30% of the students were using the chat rooms. There did not appear to be a consensus on the importance, efficiency or satisfaction levels either. Twenty percent considered the use of chat rooms to be very important, while 20% considered this use to be only somewhat important. Twenty four percent considered its use to be efficient or very efficient, while 24% considered the use of chat rooms to be only somewhat efficient.

Twenty eight percent of respondents were satisfied or very satisfied with the use of chat rooms, while 20% were only somewhat satisfied.

Table VI. Surveyed Ratings of Electronic Mail for Communication Between the Teacher and Students Concurrently (Broadcast Messages)

Frequency	Never	Once or Twice per Month	Once per Week	2 or 3 times per Week	Daily
	3 (12.0%)	4 (16.0%)	6 (24.0%)	8 (32.0%)	4 (16.0%)
Importance	Not Applicable	Low Importance	Somewhat Important	Important	Very Important
	2 (8.0%)	1 (4.0%)	4 (16.0%)	6 (24.0%)	12 (48.0%)
Efficiency	Not Applicable	Inefficient	Somewhat Efficient	Efficient	Very Efficient
	3 (12.0%)	0 (0.0%)	1 (4.0%)	7 (28.0%)	14 (56.0%)
Satisfaction	Not Applicable	Unsatisfied	Somewhat Satisfied	Satisfied	Very Satisfied
	3 (12.0%)	0 (0.0%)	0 (0.0%)	9 (36.0%)	13 (52.0%)

The category of *On-Line Sources of Course Information* referred to the use of course homepages and on-line information links such as libraries, journals and appropriate Web sites. Only 8% of the respondents (Table VIII) indicated they did not use on-line sources of course information in their course. The majority of respondents, 72%, indicated use by greater than 70% of the students. 76% of the respondents indicated these on-line sources were very important to the conduct of the course. In addition, 84%

considered the on-line sources to be efficient or very efficient with an equal percentage stating they were satisfied or very satisfied with the results of using these sources in the course.

Table VII. Surveyed Ratings for Chat Rooms for Group Interaction

Frequency	**Never**	**Frequency of Student Use Unknown**	**Used by less than 30% of all Students**	**Used by 30-70% of Students**	**Used by More than 70% of Students**
	12 (48.0%)	**2 (8.0%)**	**7 (28.0%)**	**1 (4.0%)**	**3 (12.0%)**
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	12 (48.0%)	**2 (8.0%)**	**5 (20.0%)**	**1 (4.0%)**	**5 (20.0%)**
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	12 (48.0%)	**1 (4.0%)**	**6 (24.0%)**	**1 (4.0%)**	**5 (20.0%)**
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	12 (48.%)	**1 (4.0%)**	**5 (20.0%)**	**4 (16.0%)**	**3 (12.0%)**

The study included the use of videotaped and digitized lectures. Eighty four percent of respondents stated they never used videotaped lectures in their course (Table IX). Two of the four respondents who did use the videotaped lectures, did so for more than 70% of the course lectures while the remaining two respondents indicated they had used this lecture format for less than 30% of their course lectures. Of these four, three respondents considered the videotaped format to be important or very important to their course and an

equal number stated they were satisfied or very satisfied with the format. Three of the four stated that the videotaped format was very efficient.

In considering the use of digitized lectures delivered via computer (Table X), 44% of the respondents stated they had never used this lecture format in their course. Of the remaining 14 respondents, 10 reported using digitized lectures for more than 70% of their course lectures. Thirteen of these fourteen respondents, or 52% of the total respondents, indicated that the digitized lectures were very important (44%) or important (8%) to the conduct of their course. An equal number considered the digitized lectures to be very efficient (32%) or efficient (20%) in terms of constructing the course. All fourteen respondents who reported using the digitized lecture format were satisfied (28%) or very satisfied (28%) with its use.

Table VIII. Surveyed Ratings for On-Line Sources of Course Information

Frequency	**Never Used by Students**	**Used but Frequency unknown**	**Used by Less than 30% of Students**	**Used 30-70% of Students**	**Used by More than 70% of Students**
	2 (8.0%)	**1 (4.0%)**	**1 (4.0%)**	**3 (12.0%)**	**18 (72.0%)**
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	2 (8.0%)	**1 (4.0%)**	**1 (4.0%)**	**2 (8.0%)**	**19 (76.0%)**
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	3 (12.0%)	**0 (0.0%)**	**1 (4.0%)**	**6 (24.0%)**	**15 (60.0%)**
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	3 (12.0%)	**1 (4.0%)**	**0 (0.0%)**	**5 (20.0%)**	**16 (64.0%)**

In considering *Collaborative Student Assignments via the Computer and Web*, (Table XI), 24% of the respondents indicated they did not use this assignment format in their course. The remaining 76% of the respondents indicated a fairly well distributed frequency of use; 16% used this format for one assignment, 8% for two assignments, 16% for three assignments and 36% for four or more assignments. Only two respondents indicated that these assignments accounted for more than 50% of the course grade, 16% for 30-50% of the course grade and 36% for 10-30% of the grade. Thirteen of the eighteen respondents who utilized this assignment format, or 52% of all respondents, indicated that they thought the format was efficient (36%) or very efficient (16%). Satisfaction levels were well distributed among somewhat satisfied (24%), satisfied (20%) and very satisfied (24%).

Table IX. Survey Ratings for Lectures Delivered via Video Tape

Frequency	Never	Less than 30% of all Lectures	30-50% of all Lectures	50-70% of all Lectures	More than 70% of all Lectures
	21 (84.0%)	2 (8.0%)	0 (0.0%)	0 (0.0%)	2 (8.0%)
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	20 (80.0%)	2 (8.0%)	0 (0.0%)	1 (4.0%)	2 (8.0%)
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	21 (84.0%)	0 (0.0%)	1 (4.0%)	0 (0.0%)	3 (12.0%)
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	21 (84.0%)	0 (0.0%)	1 (4.0%)	1 (4.0%)	2 (8.0%)

In addition to the collaborative assignments, two additional on-line course instruction tools were considered. The first was the use of *On-Line Evaluations of Student Knowledge* (Table XII). Forty eight percent of the respondents reported never using on-line evaluations in their course, 12% used one evaluation in the course, 28% used two evaluations, and 12% used four or more such evaluations. The relative importance of the on-line evaluations varied considerably among those who reported using these. One respondent did not apply the evaluation towards the course grade, two respondents applied it towards less than 10% of the grade, five respondents applied these evaluations to 10-30% of the grade, two respondents applied these to 30-50% of the grade and two for greater than 50% of the course grade. Of the respondents who indicated that they utilized the on-line evaluation, the efficiency and satisfaction ratings were high; ten of the thirteen indicated that these evaluations were efficient (5) or very efficient (5) and eleven were either satisfied (6) or very satisfied (5) with the results.

The second on-line instructional tool considered was the use of *On-Line Laboratory Modules and Simulations*. Sixty four percent of the respondents indicated they never used this instructional tool in their course, 24% used one or two on-line labs or simulations, and only 12% used 3 or more labs and simulations in their course. Sixty eight percent of the respondents did not use on-line labs or simulations for grading purposes, indicating that one of the respondents did use on-line labs or simulations in their course but for non-grading purposes only. Twenty eight percent of the respondents used the on-line labs and simulations for 30% or less of the course grade and only one respondent, or 4%, used these for 30-50% of the grade. Efficiency ratings were mixed; 12% were somewhat

efficient, 20% efficient and 1% very efficient. Satisfaction ranged from 4% unsatisfied, 4% somewhat satisfied, 20% satisfied and 8% very satisfied.

Table X. Surveyed Ratings for Lectures Delivered via Digital Means

Frequency	Never	Less than 30% of all Lectures	30-50% of all Lectures	50-70% of all Lectures	More than 70% of all Lectures
	11 (44.0%)	2 (8.0%)	1 (4.0%)	1 (4.0%)	10 (40.0%)
Importance	**Not Applicable**	**Low Importance**	**Somewhat Important**	**Important**	**Very Important**
	11 (44.0%)	1 (4.0%)	0 (0.0%)	2 (8.0%)	11 (44.0%)
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	11 (44.0%)	0 (0.0%)	1 (4.0%)	5 (20.0%)	8 (32.0%)
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	11 (44.0%)	0 (0.0%)	0 (0.0%)	7 (28.0%)	7 (28.0%)

Table XI. Survey Data for Collaborative Student Assignments (Group Assignments) Via the Computer and Web

Frequency	Never	One Assignment per Course	Two Assignments per Course	Three Assignments per Course	Four or More Assignments per Course
	6 (24.0%)	4 (16.0%)	2 (8.0%)	4 (16.0%)	9 (36.0%)
Importance	Not Applicable	Less than 10% of Grade	10-30% of Grade	30-50% of Grade	More than 50% of Grade
	6 (24.0%)	4 (16.0%)	9 (36.0%)	4 (16.0%)	2 (8.0%)
Efficiency	Not Applicable	Inefficient	Somewhat Efficient	Efficient	Very Efficient
	7 (28.0%)	1 (4.0%)	4 (16.0%)	9 (36.0%)	4 (16.0%)
Satisfaction	Not Applicable	Unsatisfied	Somewhat Satisfied	Satisfied	Very Satisfied
	7 (28.0%)	1 (4.0%)	6 (24.0%)	5 (20.0%)	6 (24.0%)

Table XII. Survey Ratings for On-Line Evaluations of Student Knowledge

Frequency	Never	One Evaluation per Course	Two Evaluations per Course	Three Evaluations per Course	Four or More Evaluations per Course
	12 (48.0%)	3 (12.0%)	7 (28.0%)	0 (0.0%)	3 (12.0%)
Importance	Not Applicable	Less than 10% of Grade	10-30% of Grade	30-50% of Grade	More than 50% of Grade
	13 (52.0%)	2 (8.0%)	5 (20.0%)	3 (12.0%)	2 (8.0%)
Efficiency	Not Applicable	Inefficient	Somewhat Efficient	Efficient	Very Efficient
	13 (52.0%)	0 (0.0%)	2 (8.0%)	5 (20.0%)	5 (20.0%)
Satisfaction	Not Applicable	Unsatisfied	Somewhat Satisfied	Satisfied	Very Satisfied
	13 (52.0%)	0 (0.0%)	1 (4.0%)	6 (24.0%)	5 (20.0%)

Table XIII. Survey Ratings for On-Line Laboratory Modules and Simulations

Frequency	Never Used	One Lab/Sim per Course	Two Labs/Sims per Course	Three Labs/Sims per Course	Four or More Labs/Sims per Course
	16 (64.0%)	3 (12.0%)	3 (12.0%)	2 (8.0%)	1 (4.0%)
Importance	**Not Applicable**	**Less than 10% of Grade**	**10-30% of Grade**	**30-50% of Grade**	**More than 50% of Grade**
	17 (68.0%)	3 (12.0%)	4 (16.0%)	1 (4.0%)	0 (0.0%)
Efficiency	**Not Applicable**	**Inefficient**	**Somewhat Efficient**	**Efficient**	**Very Efficient**
	16 (64.0%)	0 (0.0%)	3 (12.0%)	5 (20.0%)	1 (4.0%)
Satisfaction	**Not Applicable**	**Unsatisfied**	**Somewhat Satisfied**	**Satisfied**	**Very Satisfied**
	16 (64.0%)	1 (4.0%)	1 (4.0%)	5 (20.0%)	2 (8.0%)

B. DATA ANALYSIS

The numeric counterparts to the text responses of the survey Part II were utilized in analyzing the data. The lowest rating for each category corresponded to 1 and the highest rating to 5. This allowed for comparative statistical analysis of the data. Of specific interest were the potential interaction effects between the course characteristics found in Part I of the survey and the ratings given in Part II.

Comparison of the data revealed three areas of potential interest, which prompted further investigation. The first was the interaction effects between graduate and undergraduate courses; specifically the ratings for chat rooms, digitized lectures, electronic "broadcast" messages, electronic mail, and group assignments. The second was the interaction effects between student computer modem speeds (14.4 kbps and 28.8 kbps); specifically involving the ratings for electronic "broadcast" messages, electronic mail, group assignments, and on-line information sources. The third involved two categories of courses, defined as Category 1 and Category 2 courses. Category 1 courses were defined as those assumed to be numerically intensive, reliant on mathematical symbols and formulae. Category 2 courses were defined as language intensive courses, primarily using the written word to communicate course material. The courses were categorized as shown in Appendix B.

The means for each rating category were plotted graphically for comparison. In addition, as a general test for differences in means, an analysis of variance (ANOVA) was conducted for each of the effects. These graphs and ANOVA analyses are shown in their entirety in Appendix D.

The ANOVA for the graduate and undergraduate courses revealed there was no statistical difference between the mean ratings for any of the rating categories examined. Likewise, the ANOVA for the student computer modem speeds failed to demonstrate any statistical difference between the mean ratings. However, the ANOVA for the Category 1 and Category 2 courses did reveal some statistical differences, specifically in the two rating categories of *On-line Evaluations* and *On-line Experiments and Simulations*. Within the *On-Line Experiments and Simulations* category, a further examination of the data revealed that while the ANOVA gave an indication of a difference in means, few instructors in Category 2 had applied the course delivery tool. Therefore, it was determined that the data was insufficient to support any conclusion. The relatively low application of on-line experiments and simulations is not surprising, as the language intensive courses would not normally be expected to require use of experiments and simulations.

Within the category of *On-line Evaluations*, a low probability of a difference in means was found by the ANOVA in the frequency and importance ratings. However, differences in means were indicated for the Efficiency and Satisfaction with the use of On-Line Evaluations. Accordingly, a subsequent T-Test analysis (assuming unequal variances) was conducted for each of these two ratings. The results of the T-Tests are shown in Table XIV.

The results in Table XIV demonstrate a 2.6% probability, in both cases, of being wrong in rejecting the null hypothesis of equal means. This indicates that the respondents

who taught Category 2 courses thought the use of *On-Line Evaluations* were less efficient and less satisfying than did the respondents who taught Category 1 courses.

Table XIV. T-Test Comparison for Category 1 and Category 2 Courses: Use of On-Line Evaluations

Factor	Category 1 Courses: Mean Rating	Category 2 Courses: Mean Rating	T	PR>|T| alpha=0.5	Result
Efficiency	2.27	1.3	-2.38	0.026	Reject Null Hypothesis
Satisfaction	2.53	1.3	-2.37	0.026	Reject Null Hypothesis

V. RESULTS AND CONCLUSIONS

The stated purpose of this study was to answer the question, "how are university faculty currently providing an asynchronous distance learning environment, what tools are being applied for this purpose and how do different course characteristics affect the results?" This purpose has been accomplished through the summation and discussion of the survey responses and through the data analysis, where interaction effects were considered. The summation of the survey responses and the data analysis in Section IV provide an overview of how university faculty currently involved in asynchronous distance education are conducting their courses. Table XV gives the percentage of survey respondents who indicated they had used each of the subject course delivery tools at least once in their course, ranking the tools from most popular to least popular. Based on this table and the discussion in Section IV, several conclusions can be made.

One initial conclusion is that physical meetings of the class body are not a necessary component to the successful execution of an asynchronous distance course. In the data of the Part II survey responses, it was revealed that 64% of the respondents never assembled their students for any physical meetings. Of the 36% who did use such meetings, the overall satisfaction level was rated at somewhat satisfied by all but two of these respondents. In addition, 88% of the respondents did not use real time video conferencing as a course delivery tool and only 16% used video taped lectures. This data leads to the conclusion that courses can be conducted successfully through non-video, computer supported asynchronous means.

The survey respondents relied heavily upon electronic mail in conducting their courses. Every respondent used it for one-to-one communication between the instructor and students, and 92% used it at least once per week to communicate with each student. Likewise, while the frequency was not quite as high, electronic mail for communication between the instructor and all students concurrently was used by 88% of the respondents and 80% used it at least once per week. In addition to electronic mail, on-line sources of course information were used by 92% of the respondents, 72% of whom reported more than 70% of the course students use these resources. In both cases, electronic mail and on-line information sources; the importance, efficiency and satisfaction ratings were all high. This supports the conclusion that these tools are important to a successful asynchronous course.

Collaborative student assignments via the computer and the web were used by 76% of the respondents, although the relative importance of these assignments in terms of percentage of course grade varied considerably. Only 4% of the respondents indicated that these assignments were inefficient and they were unsatisfied with using collaborative assignments in this fashion, the remainder of the respondents who used the collaborative assignments indicated this assignment method was at least somewhat efficient in use and they were somewhat satisfied. Chat rooms were not as frequently used in the courses as were the collaborative assignments, however the subsequent ratings for chat rooms were equally inconclusive. Therefore, the conclusion can be made that this data is inconclusive when considering whether collaborative assignments via the computer and web and chatrooms are advisable or necessary components of an asynchronous course.

Table XV. Most Popular Course Delivery Tools

Course Delivery Tool	Percentage of Respondents (25) Using Tool in Course
1. Electronic mail for one-to-one communication between instructor and students	100%
2. On-line sources of course information	92%
3. Electronic mail for communication between instructor and all students concurrently	88%
4. Collaborative student assignments via computer and the web	76%
5. Lectures delivered via digital means	56%
6. Chat rooms for group interaction	52%
7. On-line evaluations of student knowledge	52%
8. Class meetings in a physical location	36%
9. On-line laboratory modules and simulations	36%
10. Lectures delivered via video tape	16%
11. Real time video conferencing	12%

Digitized lectures were used by only 56% of the respondents. However, most of the respondents who had used digitized lectures rated them high for importance, efficiency, and satisfaction. Likewise, on-line evaluations were used by 52% of the respondents but received high ratings for efficiency and satisfaction, and varied ratings for relative importance to the course grade. This data supports the conclusion that digitized lectures

and on-line evaluations can be successfully included in an asynchronous course and are not overly taxing on the instructor's time.

As discussed in the *Data Analysis* section of Section IV, the Part I data collected in the survey was used to seek potential interactions between the course characteristics and the ratings given in Part II. Of these interactions, only one proved to be of statistical interest. The language intensive (Category 2) course instructors had a lower mean efficiency and satisfaction rating for on-line evaluations than did the numerically intensive course instructors. This was probably due to two reasons. First, the level of familiarity with the computer technology may have been higher among the Category 1 course instructors and students than with their Category 2 course counterparts. Second, the course material in the Category 1 courses would likely lend itself to being tested in an on-line format.

One limitation of this study involved the wide variation of courses among a relatively small sample of participants. As was seen in particular in the discussion of collaborative assignments and chatrooms as well as the discussion of interaction effects between course categories, the data was inconclusive in some areas. The variation of the courses contributed to this problem. Due to the difficulty in obtaining survey participants, this limitation was largely unavoidable. However, there was a benefit to the course variation, in that opinions were received that ordinarily would not be included in such a study.

As discussed in the *Data Gathering* section, the survey response rate was 40.3% or 25 of 62 potential participants. Of the 83 institutions identified in the population, survey

responses were received from faculty at 17 institutions, or approximately 20% of the total population. The population size, in terms of the number of institutions, was well defined through use of the university listing and the research criteria. What is unknown, however, is the number of asynchronous distance courses offered by these institutions at the time of the survey. This presents a possible weakness in this study, in that the size of the sample in terms of the percentage of total available asysnchronous distance courses is unknown. Therefore, this study could be improved if the total course population could be determined, a difficult prospect as this number is continually changing. However, such a determination may also facilitate a larger study participation rate as a greater number of faculty would be identified.

In general, this study can benefit those interested in research activities and applications of asynchronous education. Primarily, this study provides a practical and current assessment, from the instructors' perspective, of course delivery tools used in asynchronous education. The associated research findings can be helpful to educators contemplating applying asynchronous techniques to their courses. Secondly, this research has identified the most commonly used asynchronous course delivery tools, based on the sample data. Accordingly, researchers who are investigating the educational effectiveness of such tools can use the research findings to identify which tools to focus their efforts on.

Potential further research efforts could include an analysis of failures in application of ALN to distance education. This thesis encompassed a wide range of faculty and sought to find common characteristics of successful courses. The opposite would be interesting, to find out what courses were less than satisfactory in outcome and what

factors may have led to these unsatisfactory outcomes. In addition, a larger survey population would help to clarify some of the inconclusive areas of this study, such as the use of chatrooms and on-line experiments and simulations. The discussion of the use of chat rooms is an example of this. This thesis included 25 responses. A much larger participation rate might be achievable if outside funding support could be obtained from such organizations as the Sloan Foundation, who have supported similar previous research efforts.

APPENDIX A

SURVEY INSTRUMENT

Methods in Asynchronous Distance Learning Survey

Administered by: Earl A. Evans
Department of Engineering Management
University of Missouri - Rolla

I. Course Questions

Please answer the following questions regarding the most recent distance education course you have taught in your distance education program. If you do not feel you can answer a given question or if the question does not apply, please indicate as such. If necessary, feel free to use the comments section at the back of this survey for additional information or comments.

1. Your Name _____

2. Title of Course _____

   2a. Course credit hours _____

   2b. What is the course level?

   Graduate _____ Undergraduate _____ Other (Explain) _____

3. Is a computer required for the student enrolled in the course? YES _____ NO _____
   If YES, continue question 3.
   If NO, skip remainder of question 3 and proceed to question 4.

3a. What type of computer is required? (Please check all that apply)

IBM/IBM Compatible ____ Apple/Macintosh _____ Other (Explain) _____

3b. If an IBM/IBM Compatible is required, what is the minimum size processor needed?

386 ____ 486DX ____ 486DX2 ____ Pentium ____ Other (Explain) _____

3c. What size hard drive is required for the student's computer? _____

3d. How much RAM is required for the student's computer? _____

3e. Is a CD-ROM required for the student's computer? YES _____ NO _____

3f. What is the minimum modem speed required for the student's computer?

9.8 kbps ___ 14.4 kbps ___ 28.8 kbps ___ 36.6 kbps ___ Other (Explain) _____

3g. What software is required for the student's computer (i.e. Windows 95, Lotus Notes, etc.)?

_____

_____

3h. Are students required to have Internet access? YES _____ NO _____

If YES, do the students have to subscribe to a commercial Internet access provider (i.e. America Online, CompuServe, etc.)? YES _____ NO _____

4. Is a computer required for the course instructor? YES _____ NO _____
If YES, continue question 4.
If NO, skip remainder of question 4 and proceed to question 5.

4a. What type of computer is required? (Please check all that apply)

IBM/IBM Compatible _____ Apple/Macintosh _____ Other (Explain) _____

4b. If an IBM/IBM Compatible is required, what is the minimum size processor needed?

386 _____ 486DX _____ 486DX2 _____ Pentium _____ Other (Explain) _____

4c. What size hard drive is required for the instructor's computer? _____

4d. How much RAM is required for the instructor's computer? _____

4e. Is a CD-ROM required for the instructor's computer? YES _____ NO _____

4f. What is the minimum modem speed required for the instructor's computer?

9.8 kbps ____ 14.4 kbps ____ 28.8 kbps ____ 36.6 kbps ____ Other (Explain) _____

4g. What software is required for the instructor's computer (i.e. Windows 95, Lotus Notes, etc.)?

_____

_____

4h. Other Requirements (i.e. File Server, Campus Resources, etc.)

_____

_____

5. Are your distance learning students required to purchase a textbook? YES _____ NO _____

6. What is the maximum class section size (number of students) desired for your distance learning course?

Less than 20 _____ 20 to 29 _____ 30 to 40 _____ 40 Plus _____ Not Known ____ No Policy _____

7. If the same course is also taught in traditional format to on-campus students, what is the maximum desired class section size (number of students)?

Less than 20 _____ 20 to 29 _____ 30 to 40 _____ 40 Plus _____ Not Known _____ No Policy _____

8. If there is typically more than one instructor for your distance learning course, what is the maximum desired student to faculty ratio? _____

9. Are the majority of students in your course part time students? YES ____ NO _____ Don't Know _____

If YES, do the majority of students work full time? YES ____ NO _____ Don't Know _____

II. Rated Questions

Please rate the following course delivery tools for the frequency of use, importance, efficiency and satisfaction in the most recent distance education course(s) you have taught in your program.

When considering frequency, please select the choice which most closely matches your experience. In considering importance, consider how much of the course material is delivered or discussed through the given course delivery tool. For efficiency, consider the amount of time you must invest versus the return in student learning you perceive. For satisfaction, consider how satisfied you are with the results you have experienced regarding the given course delivery tool.

1. Class meetings in a physical location

Frequency	Never [1]	1 or 2 Meetings per Course [2]	3 or 4 Meetings per Course [3]	5 or 6 Meetings per Course [4]	Greater than 6 Meetings per Course [5]
Importance	Not Applicable [1]	Low Importance [2]	Somewhat Important [3]	Important [4]	Very Important [5]
Efficiency	Not Applicable [1]	Inefficient [2]	Somewhat Efficient [3]	Efficient [4]	Very Efficient [5]
Satisfaction	Not Applicable [1]	Unsatisfied [2]	Somewhat Satisfied [3]	Satisfied [4]	Very Satisfied [5]

2. Real time video conferencing

Frequency	Never [1]	1 or 2 Conferences per Course [2]	3 or 4 Conferences per Course [3]	5 or 6 Conferences per Course [4]	Greater than 6 Conferences per Course [5]
Importance	Not Applicable [1]	Low Importance [2]	Somewhat Important [3]	Important [4]	Very Important [5]
Efficiency	Not Applicable [1]	Inefficient [2]	Somewhat Efficient [3]	Efficient [4]	Very Efficient [5]
Satisfaction	Not Applicable [1]	Unsatisfied [2]	Somewhat Satisfied [3]	Satisfied [4]	Very Satisfied [5]

3. Electronic mail for 1 to 1 communication between student and teacher and vice-versa

Frequency (with average student)	Never 1	Once or twice per month 2	Once per week 3	2 or 3 times per week 4	Daily 5
Importance	Not Applicable 1	Low Importance 2	Somewhat Important 3	Important 4	Very Important 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

4. Electronic mail for communication between the teacher and all students concurrently (i.e. broadcasts)

Frequency	Never 1	Once or twice per month 2	Once per week 3	2 or 3 times per week 4	Daily 5
Importance	Not Applicable 1	Low Importance 2	Somewhat Important 3	Important 4	Very Important 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

5. Chat rooms for group interaction

Frequency	Never Used [1]	Used by students but frequency is unknown [2]	Used by less than 30% of students [3]	Used by 30-70% of students [4]	Used by greater than 70% of students [5]
Importance	Not Applicable [1]	Low Importance [2]	Somewhat Important [3]	Important [4]	Very Important [5]
Efficiency	Not Applicable [1]	Inefficient [2]	Somewhat Efficient [3]	Efficient [4]	Very Efficient [5]
Satisfaction	Not Applicable [1]	Unsatisfied [2]	Somewhat Satisfied [3]	Satisfied [4]	Very Satisfied [5]

6. On-line sources of course information (i.e. library, course homepage, hypertext links)

Frequency	Never Used by Students [1]	Used by students but frequency is unknown [2]	Used by less than 30% of students [3]	Used by 30-70% of students [4]	Used by greater than 70% of students [5]
Importance	Not Applicable [1]	Low Importance [2]	Somewhat Important [3]	Important [4]	Very Important [5]
Efficiency	Not Applicable [1]	Inefficient [2]	Somewhat Efficient [3]	Efficient [4]	Very Efficient [5]
Satisfaction	Not Applicable [1]	Unsatisfied [2]	Somewhat Satisfied [3]	Satisfied [4]	Very Satisfied [5]

7. Lectures delivered via video tape

Frequency	Never 1	Less than 30% of all Lectures 2	30-50% of all Lectures 3	50 – 70% of all Lectures 4	More than 70% of all Lectures 5
Importance	Not Applicable 1	Low Importance 2	Somewhat Important 3	Important 4	Very Important 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

8. Lectures delivered via digital means (i.e. via computer and web)

Frequency	Never 1	Less than 30% of all Lectures 2	30 – 50% of all Lectures 3	50 – 70% of all Lectures 4	More than 70% of all Lectures 5
Importance	Not Applicable 1	Low Importance 2	Somewhat Important 3	Important 4	Very Important 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

9. Collaborative student assignments (group assignments) via computer and web

Frequency	Never 1	One Assignment per Course 2	Two Assignments per Course 3	Three Assignments per Course 4	Four or More Assignments per Course 5
Importance	Not Applicable 1	Accounts for Less than 10% of Course Grade 2	Accounts for 10 – 30% of Course Grade 3	Accounts for 30 – 50% of Course Grade 4	Accounts for More than 50% of Course Grade 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

10. On-line evaluations of student knowledge, e.g. on-line tests and quizzes

Frequency	Never 1	One Evaluation per Course 2	Two Evaluations per Course 3	Three Evaluations per Course 4	Four or More Evaluations per Course 5
Importance	Not Applicable 1	Accounts for Less than 10% of Course Grade 2	Accounts for 10 – 30% of Course Grade 3	Accounts for 30 – 50% of Course Grade 4	Accounts for More than 50% of Course Grade 5
Efficiency	Not Applicable 1	Inefficient 2	Somewhat Efficient 3	Efficient 4	Very Efficient 5
Satisfaction	Not Applicable 1	Unsatisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5

11. On-line laboratory modules and simulations

Frequency	Never Used [1]	One LAB/SIM per Course [2]	Two LAB/SIMs per Course [3]	Three LAB/SIMs per Course [4]	Four or More LAB/SIMs per Course [5]
Importance	Not Applicable [1]	Accounts for Less than 10% of Course Grade [2]	Accounts for 10 – 30% of Course Grade [3]	Accounts for 30 – 50% of Course Grade [4]	Accounts for More than 50% of Course Grade [5]
Efficiency	Not Applicable [1]	Inefficient [2]	Somewhat Efficient [3]	Efficient [4]	Very Efficient [5]
Satisfaction	Not Applicable [1]	Unsatisfied [2]	Somewhat Satisfied [3]	Satisfied [4]	Very Satisfied [5]

APPENDIX B

SURVEY PARTICIPANTS

Survey Participant Information

ID	*Category*	*Course Title*	*Course Credit Hours*	*Course Level*
1	1	Health Care Information Systems	3	Graduate
2	2	Freshman Writing 2	3	Undergraduate
3	2	Literature and Ideas	3	Undergraduate
4	1	Pharmacology	3	Undergraduate
5	1	Transmission Systems	4	Graduate
6	2	Comparative Government	3	Undergraduate
7	1	Statistics for Business and Economics II	3	Undergraduate
8	1	Principles of International Economics	4	Undergraduate
9	2	Introduction to Urbanism and Planning	3	Undergraduate
10	1	Qualitative Analysis Methods	3	Graduate
11	1	Advanced Environmental Science	4	Undergraduate
12	1	Information Security	4	Graduate
13	1	Database Management	4	Graduate
14	1	Systems Analysis	4	Graduate
15	1	Object Oriented Design and Programming	4	Graduate
16	1	Software Project Planning	4	Graduate
17	1	Technology Used in Schools	2	Undergraduate
18	1	Introduction to Systems Analysis	3	Undergraduate
19	2	NCTM Standards	3	Graduate
20	2	Middle School Education	3	Graduate & Undergraduate
21	2	Tests and Measurements	3	Graduate & Undergraduate
22	2	Theories of Personality	3	Undergraduate
23	1	Quantitative Methods for Management	2	Graduate
24	1	Energy Conversion	3	Undergraduate
25	2	Introduction to Music	3	Undergraduate

APPENDIX C

SURVEY DATA

Part I Survey Data: Student Computer Requirements

ID	*Student Comp Req'd*	*Type*	*Processor Req'd*	*Hard Drive*	*RAM*	*CD-ROM Req'd*	*Modem Req'd*
1	Yes	Any that can Access the Internet	386	None	8 MEG	No	No minimum required
2	Yes	IBM or Macintosh	386/Mac II	50 Meg Free Space	8 Meg	No	14.4 kbps
3	Yes	IBM or Macintosh	386/Mac II	50 Meg Free Space	8 Meg	No	14.4 kbps
4	Yes	IBM/IBM Compatible	386	Min 40 MB	Min 4 Meg	No	14.4 kbps
5	Yes	IBM or Macintosh	486DX	None	16 MEG	No	28.8 kbps
6	Yes	IBM or Macintosh	386	20 MEG	16 MEG	No	9.8 kbps
7	Yes	IBM or Macintosh	486DX2	540 MB	8 MEG	No	14.4 kbps
8	Yes	IBM or Macintosh	486 DX2	Does not matter	32 MB	No	28.8 kbps
9	No	N/A	N/A	N/A	N/A	N/A	N/A
10	Yes	Anything that can run DOS	8088	80 MB	640 KB	No	9.8 kbps
11	No	N/A	N/A	N/A	N/A	N/A	N/A
12	Yes	IBM/IBM Compatible	Pentium	100 MB Free Space	16 MB	No	128 kbps (ISDN)
13	Yes	IBM/IBM Compatible	Pentium	100 MB Free Space	16 MB	No	128 kbps (ISDN)
14	Yes	IBM/IBM Compatible	Pentium	100 MB Free Space	16 MB	No	128 kbps (ISDN)
15	Yes	Any that supports OO language	N/A	N/A	N/A	N/A	N/A
16	Yes	IBM/Macintosh	486DX	80 MB	16 MB	No	28.8 kbps
17	Yes	IBM/Macintosh	486DX	10 MB	16 MB	No	28.8 kbps

ID	*Student Comp Req'd*	*Type*	*Processor Req'd*	*Hard Drive*	*RAM*	*CD-ROM Req'd*	*Modem Req'd*
18	Yes	IBM/IBM Compatible	486DX2	500 MB	16 MB	No	14.4 kbps
19	Yes	Internet Capable	486DX2	t word processor and	N/A	No	28.8 kbps
20	Yes	Apple/Macintosh	N/A	500 MB	16 MB	No	28.8 kbps
21	No	N/A	N/A	N/A	N/A	N/A	N/A
22	Yes	IBM/IBM Compatible	486DX	N/A	8 MB	No	14.4 kbps
23	Yes	IBM/IBM Compatible	Pentium	700 MB	16 MB	Yes	28.8 kbps
24	Yes	IBM/IBM Compatible	486DX	1 GB	16 MB	Yes	14.4 kbps
25	Yes	IBM/IBM Compatible	386	Not Sure	Not Sure	No	14.4 kbps

Part I Survey Data: Student Computer Requirements Continued

ID	*Student Software Req'd*	*Commercial Internet Access Provider Req'd*
1	Any Net Browser	No
2	Windows 3.1/MAC Os	No
3	Windows 3.1/MAC OS	No
4	Netscape, Wordprocessing, Chat Software(i.e. MIRC)	Yes
5	Windows 95, First Class provided by RIT	Yes
6	Netscape and First Class	No
7	Windows 3.1 and Netscape 2.02	No
8	Windows 95	No
9	Sim City	No
10	Windows 3.1, Macintosh system 6.0:7, 1st Reader (BBS Client)	Yes
11	Must have Web access, can do this through University	No
12	Windows 95, Netscape 3.0 or MS Internet Explorer 3.0	No
13	Windows 95, Netscape 3.0 or Microsoft Internet Explorer 3.0	No
14	Windows 95, Netscape 3.0 or Microsoft Internet Explorer 3.0	No
15	Any OO language	No
16	First Class (provided) and Web Browser	Yes
17	Netscape or Equivalent, E-Mail	No

ID	Student Software Req'd	Commercial Internet Access Provider Req'd
18	Windows 95, Netscape 2.2	No
19	Any Word processor and Netscape or equivalent	Yes
20	Internet Browser w/email and html capability	Yes
21	N/A	No
22	Windows, Netscape	Yes
23	Windows 95, MS Office, Netscape	No
24	Any Operating System, An Internet Browser	No
25	email program, word processing program able to read text files	Yes

Part I Survey Data: Instructor Computer Requirements

ID	*Instructor Comp Req'd*	*Type Req'd*	*Processor Req'd*	*Hard Drive*	*RAM Req'd*	*CD-ROM*	*Min Modem Speed*
1	Yes	IBM/IBM Compatible	Pentium	100 MEG Minimum	8 MEG	No	N/A
2	Yes	IBM/Macintosh	386	50 MEG Free Space	8 MEG	No	14.4 kbps
3	Yes	IBM/Macintosh	386	50 MEG Free Space	8 MEG	No	14.4 kbps
4	Yes	IBM/IBM Compatible	Pentium	Min 200 MB	8 MEG	No	.6 kbps (multiple student acce
5	Yes	IBM/Macintosh	486DX	None	16 MEG	No	28.8 kbps
6	Yes	IBM/Macintosh	386	20 MEG	16 MEG	No	9.8 kbps
7	Yes	IBM/Macintosh	486DX2	16 MB	16 MB	No	28.8 kbps
8	Yes	IBM/Macintosh	486DX2	2 GB	32 MB	No	28.8 kbps
9	Yes	IBM/Macintosh	Pentium	N/A	32 MB	No	36.6 kbps
10	Yes	IBM/Macintosh	8088	80 MB	640 KB	No	9.8 kbps
11	Yes	Any	N/A	1 GB	32 MB	No	28.8 kbps
12	Yes	IBM/IBM Compatible	Pentium	200 MB Free space	16 MB	Yes	128 kbps (ISDN)
13	Yes	IBM/IBM Compatible	Pentium	200 MB Free space	16 MB	Yes	128 kbps (ISDN)
14	Yes	IBM/IBM Compatible	Pentium	200 MB Free Space	16 MB	Yes	128 kbps (ISDN)
15	Yes	Anything that connects to Internet	N/A	N/A	N/A	No	N/A
16	Yes	IBM/Macintosh	486DX	80 MB	16 MB	No	28.8 kbps

ID	*Instructor Comp Req'd*	*Type Req'd*	*Processor Req'd*	*Hard Drive*	*RAM Req'd*	*CD-ROM*	*Min Modem Speed*
17	Yes	IBM/Macintosh	N/A	600 MB	16 MB	No	Ethernet Connection
18	Yes	IBM/IBM Compatible	Pentium	500 MB	16 MB	Yes	28.8 kbps
19	Yes	Any Internet capable machine	N/A	N/A	N/A	No	28.8 kbps
20	Yes	Apple/Macintosh	N/A	1 GB	48 MB	Yes	6.6 kbps or ethernet connectio
21	No	N/A	N/A	N/A	N/A	No	N/A
22	Yes	IBM/IBM Compatible	Pentium	400 MB	8 MB	No	Network Link
23	Yes	IBM/IBM Compatible	Pentium	700 MB	16 MB	Yes	28.8 kbps
24	Yes	IBM/IBM Compatible	486DX2	4 GB	32 MB	Yes	28.8 kbps
25	Yes	IBM/IBM Compatible	486DX	Not Sure	Not Sure	No	14.4 kbps

Part I Survey Data: Instructor Computer Requirements Continued

ID	*Software Required of Instructor Computer*	*Other Computer Resources*	*Textbook Req'd*	*Maximum Class Section Size*	*Maximum Traditional Class Section Size*	*Desired Student to Faculty Ratio*	*Majority of Students Part-Time*	*Do The Majority of Students Work Full-Time*
1	Netscape/pkg allowing files to be posted on WEB	Programs supporting password protection on the web	Yes	20 - 29	No Policy	N/A	Yes	Yes
2	N/A	N/A	Yes	20 - 29	20 - 29	N/A	Yes	Yes
3	N/A	N/A	Yes	20 - 29	30 - 40	N/A	Yes	Yes
4	Windows, MIRC	Technician to assist in campus server maintenance	Yes	20 - 29	30 - 40	20 to 1 faculty	No	No
5	Windows 95, First Class	First Class Server at RIT	Yes	20 - 29	N/A	N/A	Yes	Yes

ID	*Software Required of Instructor Computer*	*Other Computer Resources*	*Textbook Req'd*	*Maximum Class Section Size*	*Maximum Traditional Class Section Size*	*Desired Student to Faculty Ratio*	*Majority of Students Part-Time*	*Do The Majority of Students Work Full-Time*
6	Netscape and First Class	UNIX Server	Yes	20 - 29	20 - 29	30 to 1 faculty	No	No
7	Windows 95 preferred, Netscape 2.02	Web CT	No	20 - 29	20 - 29	N/A	Yes	Yes
8	Windows 95	File Server	No	20 - 29	40 plus	Does not Apply	Don't Know	Don't Know
9	Windows 3.1 or 95, Sim City, MS Word, Word Perfect	File Server, Technical Help	Yes	< 20	30 - 40	N/A	No	No
10	Same as student	N/A	Yes	< 20	< 20	N/A	Yes	Yes

ID	*Software Required of Instructor Computer*	*Other Computer Resources*	*Textbook Req'd*	*Maximum Class Section Size*	*Maximum Traditional Class Section Size*	*Desired Student to Faculty Ratio*	*Majority of Students Part-Time*	*Do The Majority of Students Work Full-Time*
11	Web Page making software	Web Server or capability to download to web server	No	<20	N/A	N/A	No	No
12	Windows 95, Lotus Notes Client 4.5, Lotus Learning Space	None	No	20 - 29	20 - 29	20:1	Yes	Yes
13	Windows 95, Lotus Notes Client 4.5, Lotus Learning Space 2.0	None	No	20-29	20-29	20:1	Yes	Yes
14	Windows 95, Lotus Notes Client 4.5, Lotus Learning Space 2.0	None	No	20-29	20-29	20:1	Yes	Yes
15	N/A	N/A	Yes	30-40	30-40	1 instructor	Yes	Yes

ID	*Software Required of Instructor Computer*	*Other Computer Resources*	*Textbook Req'd*	*Maximum Class Section Size*	*Maximum Traditional Class Section Size*	*Desired Student to Faculty Ratio*	*Majority of Students Part-Time*	*Do The Majority of Students Work Full-Time*
16	First Class and Web Browser	None	No	30-40	30-40	N/A	Yes	Yes
17	Netscape, Clavis Home Page	Web Server	Yes	No Policy	30-40	N/A	No	No
18	Windows 95, Netscape 2.2	N/A	Yes	20-29	20-29	N/A	No	No
19	Word Processor and Netscape	N/A	Yes	20-29	20-29	N/A	Yes	Yes
20	Internet Browser w/email and html editing	Campus LAN/WAN	Yes	< 20	20-29	40:1	Yes	Yes

ID	*Software Required of Instructor Computer*	*Other Computer Resources*	*Textbook Req'd*	*Maximum Class Section Size*	*Maximum Traditional Class Section Size*	*Desired Student to Faculty Ratio*	*Majority of Students Part-Time*	*Do The Majority of Students Work Full-Time*
21	N/A	N/A	Yes	> 40	20-29	25:1	No	No
22	Windows, Netscape	Network Link	Yes	> 40	< 20	N/A	No	No
23	Windows 95, MS Office, Netscape	N/A	Yes	< 20	20-29	N/A	No	Yes
24	Admin Server such as Fast Track, A/V servers, Discussion forum server, multi media programs and development, MS Office	Connectivity and DNS Administration	Yes	< 20	20-29	20:1	Yes	Don't Know
25	Admin Server such as FastTrack, A/V Servers, Discussion Forum Server, Multimedia, MSOffice, Windows95, Netscape	LAN with servers connected to internet	Yes	20-29	20-29	N/A	Don't Know	Don't Know

Part II Survey Data
Rating Information: Class Meetings in a Physical Location

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	Never	N/A	N/A	N/A
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	Never	N/A	N/A	N/A
5	Never	N/A	N/A	N/A
6	Never	N/A	N/A	N/A
7	Never	N/A	N/A	N/A
8	1 or 2 meetings per course	Somewhat Important	Somewhat Efficient	Satisfied
9	Never	N/A	N/A	N/A
10	Never	N/A	N/A	N/A
11	> 6 meetings per course	Very Important	Very Efficient	Very Satisfied
12	Never	N/A	N/A	N/A
13	Never	N/A	N/A	N/A
14	Never	N/A	N/A	N/A
15	1 or 2 Meetings per course	Important	Inefficient	Somewhat Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	3 or 4 Meetings per course	Very Important	Very Efficient	Satisfied
18	3 or 4 Meetings per course	Important	Efficient	Satisfied
19	Never	N/A	N/A	N/A
20	Never	N/A	N/A	N/A
21	1 or 2 Meetings per course	Somewhat important	Somewhat Efficient	Satisfied
22	1 or 2 Meetings per course	Somewhat Important	Efficient	Satisfied
23	> 6 Meetings per course	Very Important	Efficient	Satisfied
24	3 or 4 Meetings per course	Somewhat Important	Efficient	Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: Real Time Video Conferencing

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	Never	N/A	N/A	N/A
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	Never	N/A	N/A	N/A
5	Never	N/A	N/A	N/A
6	Never	N/A	N/A	N/A
7	Never	N/A	N/A	N/A
8	Never	Important	N/A	N/A
9	Never	N/A	N/A	N/A
10	Never	N/A	N/A	N/A
11	Never	N/A	N/A	N/A
12	Never	N/A	N/A	N/A
13	Never	N/A	N/A	N/A
14	Never	N/A	N/A	N/A
15	Never	N/A	N/A	N/A

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	Never	N/A	N/A	N/A
18	Never	N/A	N/A	N/A
19	Never	N/A	N/A	N/A
20	1 or 2 conferences per course	Important	Efficient	Satisfied
21	> 6 conferences per course	Very Important	Very Efficient	Very Satisfied
22	Never	N/A	N/A	N/A
23	Never	N/A	N/A	N/A
24	3 or 4 conferences per course	Important	Efficient	Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: Electronic Mail for 1 to 1 Communication

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	2 to 3 times/week	Very Important	Efficient	Satisfied
2	2 or 3 times/week	Very Important	Very Efficient	Very Satisfied
3	2 or 3 times/week	Very Important	Very Efficient	Very Satisfied
4	Daily	Very Important	Very Efficient	Very Satisfied
5	2 or 3 times/week	Important	Efficient	Satisfied
6	Daily	Very Important	Efficient	Satisfied
7	2 or 3 times/week	Very Important	Very Efficient	Very Satisfied
8	Daily	Very Important	Very Efficient	Very Satisfied
9	Once per week	Very Important	No Answer	No Answer
10	Daily	Very Important	Very Efficient	Very Satisfied
11	1 per week	Low Importance	Somewhat Efficient	Somewhat Satisfied
12	1 per week	Somewhat Important	Efficient	Satisfied
13	1 per week	Somewhat Important	Efficient	Satisfied
14	1 per week	Important	Efficient	Satisfied
15	Daily	Very Important	Very Efficient	Very Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	2 or 3 times per week	Very Important	Very Efficient	Satisfied
17	1 or 2 times per month	Very Important	Efficient	Satisfied
18	2 or 3 times per week	Important	Efficient	Satisfied
19	1 per week	Very Important	Very Efficient	Satisfied
20	2 or 3 times per week	Very Important	Very Efficient	Very Satisfied
21	Daily	Very Important	Very Efficient	Very Satisfied
22	2 or 3 times per week	Very Important	Efficient	Satisfied
23	1 or 2 times per month	Important	Somewhat Efficient	Satisfied
24	Daily	Very Important	Very Efficient	Very Satisfied
25	2 or 3 times per week	Very Important	Somewhat Efficient	Satisfied

Part II Survey Data
Rating Information: Electronic Mail for Broadcast Messages

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	1 or 2 times/month	Very important	very efficient	very satisfied
2	Daily	Very Important	Very Efficient	Very Satisfied
3	Daily	Very Important	Very Efficient	Very Satisfied
4	1 per week	Very Important	Very Efficient	Very Satisfied
5	Never	N/A	N/A	N/A
6	2 or 3 times/week	Important	Efficient	Satisfied
7	2 or 3 times/week	Very Important	Very Efficient	Very Satisfied
8	2 or 3 times/week	Important	Very Efficient	Very Satisfied
9	Once per week	Very Important	No Answer	No Answer
10	Daily	Important	Very Efficient	Very Satisfied
11	Never	N/A	N/A	N/A
12	1 or 2 times/month	Somewhat Important	Somewhat Efficient	Satisfied
13	1 per week	Somewhat Important	Efficient	Satisfied
14	1 or 2 times/month	Somewhat Important	Efficient	Satisfied
15	Daily	Very Important	Very Efficient	Very Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	2 or 3 times per week	Very Important	Very Efficient	Very Satisfied
17	2 or 3 times per week	Very Important	Efficient	Satisfied
18	1 per week	Somewhat Important	Efficient	Satisfied
19	2 or 3 times per week	Important	Very Efficient	Satisfied
20	1 or 2 times/month	Important	Very Efficient	Very Satisfied
21	1 per week	Important	Very Efficient	Very Satisfied
22	1 or 2 times/month	Low Importance	Efficient	Satisfied
23	1 per week	Very Important	Very Efficient	Very Satisfied
24	2 or 3 times per week	Very Important	Very Efficient	Very Satisfied
25	2 or 3 times per week	Very Important	Efficient	Satisfied

Part II Survey Data
Rating Information: Chat Rooms for Group Interaction

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	> 70% of Students	Very Important	Very Efficient	Satisfied
2	<30% of Students	Somewhat Important	Somewhat Efficient	Satisfied
3	<30% of Students	Somewhat Important	Somewhat Efficient	Satisfied
4	>70% of Students	Very Important	Very Efficient	Very Satisfied
5	Never	N/A	N/A	N/A
6	<30% of Students	Important	Somewhat Efficient	Somewhat Satisfied
7	<30% of Students	Somewhat Important	Efficient	Satisfied
8	<30% of Students	Somewhat Important	Somewhat Efficient	Somewhat Satisfied
9	Never	N/A	N/A	N/A
10	Never	N/A	N/A	N/A
11	Never	N/A	N/A	N/A
12	Never	N/A	N/A	N/A
13	Used but Frequency Unknown	Low Importance	Somewhat Efficient	Somewhat Satisfied
14	Never	N/A	N/A	N/A
15	Used but Frequency Unknown	Low Importance	Inefficient	Somewhat Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	Never	N/A	N/A	N/A
18	Never	N/A	N/A	N/A
19	> 70% of Students	Very Important	Very Efficient	Very Satisfied
20	30-70% of students	Very Important	Very Efficient	Very Satisfied
21	Never	N/A	N/A	N/A
22	< 30% of students	Somewhat Important	Somewhat Efficient	Unsatisfied
23	Never	N/A	N/A	N/A
24	30-70% of students	Very Important	Very Efficient	Somewhat Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: On-Line Course Information

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	>70% of students	Very important	Very efficient	Very Satisfied
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	>70% of Students	Very Important	Very Efficient	Very Satisfied
5	30-70% of Students	Somewhat Important	Efficient	Satisfied
6	30-70% of Students	Very Important	Efficient	Satisfied
7	>70% of Students	Very Important	Very Efficient	Very Satisfied
8	>70% of Students	Very Important	Very Efficient	Very Satisfied
9	>70% of Students	Very Important	No Answer	No Answer
10	>70% of Students	Very Important	Very Efficient	Satisfied
11	>70% of Students	Very Important	Very Efficient	Very Satisfied
12	>70% of Students	Very Important	Efficient	Very Satisfied
13	>70% of Students	Very Important	Efficient	Very Satisfied
14	>70% of Students	Very Important	Very Efficient	Very Satisfied
15	>70% of Students	Very Important	Very Efficient	Very Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	>70% of Students	Very Important	Very Efficient	Very Satisfied
17	>70% of Students	Very Important	Very Efficient	Very Satisfied
18	>70 of Students	Important	Efficient	Satisfied
19	Used, frequency unknown	Low Importance	Somewhat Efficient	Unsatisfied
20	30-70% of Students	Very Important	Very Efficient	Very Satisfied
21	< 30% of Students	Important	Efficient	Satisfied
22	> 70% of Students	Very Important	Very Efficient	Very Satisfied
23	> 70% of Students	Very Important	Very Efficient	Very Satisfied
24	> 70% of Students	Very Important	Very Efficient	Very Satisfied
25	> 70% of Students	Very Important	Very Efficient	Very Satisfied

Part II Survey Data
Rating Information: Lectures via Video Tape

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	Never	N/A	N/A	N/A
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	Never	N/A	N/A	N/A
5	>70% of Lectures	Very Important	Very Efficient	Satisfied
6	Never	N/A	N/A	N/A
7	Never	N/A	N/A	N/A
8	Never	Low Importance	N/A	N/A
9	Never	N/A	N/A	N/A
10	Never	N/A	N/A	N/A
11	Never	N/A	N/A	N/A
12	Never	N/A	N/A	N/A
13	Never	N/A	N/A	N/A
14	Never	N/A	N/A	N/A
15	Never	N/A	N/A	N/A

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	Never	N/A	N/A	N/A
18	Never	N/A	N/A	N/A
19	Never	N/A	N/A	N/A
20	< 30% of all lectures	Very Important	Very Efficient	Very Satisfied
21	Never	N/A	N/A	N/A
22	< 30% of all lectures	Low Importance	Somewhat Efficient	Somewhat Satisfied
23	Never	N/A	N/A	N/A
24	> 70% of all lectures	Important	Very Efficient	Very Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: Lectures via Digital Means

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	> 70% of all lectures	Very Important	Very Efficient	Very Satisfied
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	Never	N/A	N/A	N/A
5	Never	N/A	N/A	N/A
6	>70% of all lectures	Very Important	Very Efficient	Very Satisfied
7	>70% of all lectures	Very Important	Very Efficient	Satisfied
8	>70% of all lectures	Very important	Very Efficient	Very Satisfied
9	Never	N/A	N/A	N/A
10	<30% of all lectures	Important	Somewhat Efficient	Satisfied
11	<30% of all lectures	Low Importance	Efficient	Satisfied
12	>70% of all lectures	Very Important	Very Efficient	Satisfied
13	>70% of all lectures	Very Important	Efficient	Very Satisfied
14	>70% of all lectures	Very Important	Very Efficient	Very Satisified
15	Never	N/A	N/A	N/A

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	Never	N/A	N/A	N/A
18	30-50% of all lectures	Important	Efficient	Satisfied
19	> 70% of all lectures	Very Important	Efficient	Satisfied
20	50-70% of all lectures	Very Important	Very Efficient	Very Satisfied
21	Never	N/A	N/A	N/A
22	Never	N/A	N/A	N/A
23	Never	N/A	N/A	N/A
24	> 70% of all lectures	Very Important	Very Efficient	Very Satisfied
25	> 70% of all lectures	Very Important	Efficient	Satisfied

Part II Survey Data
Rating Information: Group Assignments Via Computer Web

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	Never	N/A	N/A	N/A
2	4 or more assignments per course	<10% of Grade	Somewhat Efficient	Somewhat Satisfied
3	Never	N/A	N/A	N/A
4	4 or more assignments per course	30-50% of Grade	Very Efficient	Very Satisfied
5	1 assignment per course	<10% of course grade	Efficient	Somewhat Satisfied
6	3 per course	10-30% of course grade	Efficient	Satisfied
7	Never	N/A	N/A	N/A
8	1 assignment per course	<10% of course grade	Somewhat Efficient	Somewhat Satisfied
9	2 per course	10-30% of course grade	No Answer	No Answer
10	3 per course	10-30% of course grade	Very Efficient	Very Satisfied
11	4 or more assignement per course	10-30% of course grade	Efficient	Satisfied
12	3 per course	>50% of course grade	Very Efficient	Very Satisfied
13	4 or more per course	30-50% of course grade	Efficient	Satisfied
14	4 or more per course	>50% of course grade	Efficient	Very Satisfied
15	1 per course	<10% of course grade	Inefficient	Somewhat Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	2 per course	10-30% of course grade	Efficient	Somewhat Satisfied
17	Never	N/A	N/A	N/A
18	4 or more per course	10-30% of course grade	Efficient	Satisfied
19	4 or more per course	10-30% of course grade	Efficient	Very Satisfied
20	4 or more per course	10-30% of course grade	Efficient	Satisfied
21	Never	N/A	N/A	N/A
22	3 per course	10-30% of course grade	Somewhat Efficient	Unsatisfied
23	1 assignment per course	30-50% of course grade	Somewhat Efficient	Somewhat Satisfied
24	4 or more assignments per course	30-50% of course grade	Very Efficient	Very Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: On-Line Evaluations

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	2 per course	10-30% of Grade	Somewhat Efficient	Somewhat Satisfied
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	4 or more per course	10-30% of Grade	Very Efficient	Very Satisfied
5	Never	N/A	N/A	N/A
6	Never	N/A	N/A	N/A
7	4 or more per course	<10% of course grade	Very Efficient	Very Satisfied
8	1 per course	<10% of course grade	Efficient	Satisfied
9	2 per course	>50% of course grade	No Answer	No Answer
10	2 per course	30-50% of course grade	Very Efficient	Very Satisfied
11	Never	N/A	N/A	N/A
12	1 per course	10-30% of course grade	Somewhat Efficient	Satisfied
13	2 per course	10-30% of course grade	Efficient	Satisfied
14	1 per course	N/A	Efficient	Satisfied
15	2 per course	30-50% of course grade	Efficient	Satisfied

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	Never	N/A	N/A	N/A
17	Never	N/A	N/A	N/A
18	2 per course	30-50% of course grade	Efficient	Satisfied
19	Never	N/A	N/A	N/A
20	4 or more per course	> 50% of course grade	Very Efficient	Very Satisfied
21	Never	N/A	N/A	N/A
22	Never	N/A	N/A	N/A
23	Never	N/A	N/A	N/A
24	2 per course	10-30% course grade	Very Efficient	Very Satisfied
25	Never	N/A	N/A	N/A

Part II Survey Data
Rating Information: On-Line Laboratory Modules Simulations

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
1	Never	N/A	N/A	N/A
2	Never	N/A	N/A	N/A
3	Never	N/A	N/A	N/A
4	Never	N/A	N/A	N/A
5	Never	N/A	N/A	N/A
6	Never	N/A	N/A	N/A
7	Never	N/A	N/A	N/A
8	Never	N/A	N/A	N/A
9	Never	N/A	N/A	N/A
10	Never	N/A	N/A	N/A
11	Never	N/A	N/A	N/A
12	1 per course	<10% of course grade	Somewhat Efficient	Satisfied
13	2 per course	10-30% of course grade	Efficient	Very Satisfied
14	3 per course	10-30% of course grade	Efficient	Satisfied
15	Never Used	N/A	N/A	N/A

ID	*Frequency*	*Importance*	*Efficiency*	*Satisfaction*
16	1 per course	<10% of course grade	Somewhat Efficient	Somewhat Satisfied
17	1 per course	<10% of course grade	Somewhat Efficient	Unsatisfied
18	2 per course	10-30% of grade	Efficient	Satisfied
19	Never	N/A	N/A	N/a
20	Never	N/A	N/A	N/A
21	Never	N/A	N/A	N/A
22	4 or more per course	N/A	Efficient	Satisfied
23	2 per course	30-50% of course grade	Efficient	Satisfied
24	3 per course	10-30% of course grade	Very Efficient	Very Satisfied
25	Never	N/A	N/A	N/A

APPENDIX D

MEAN RATINGS AND ANOVA FOR SELECTED DATA

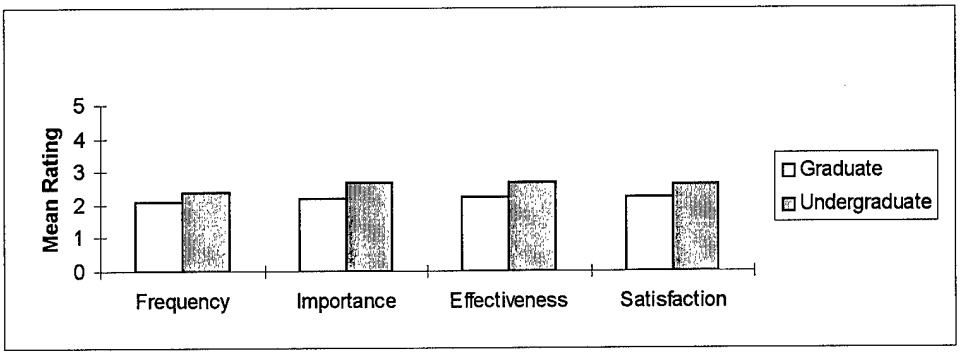

Figure 1. Graduate vs. Undergraduate Courses: Chat Room Mean Ratings

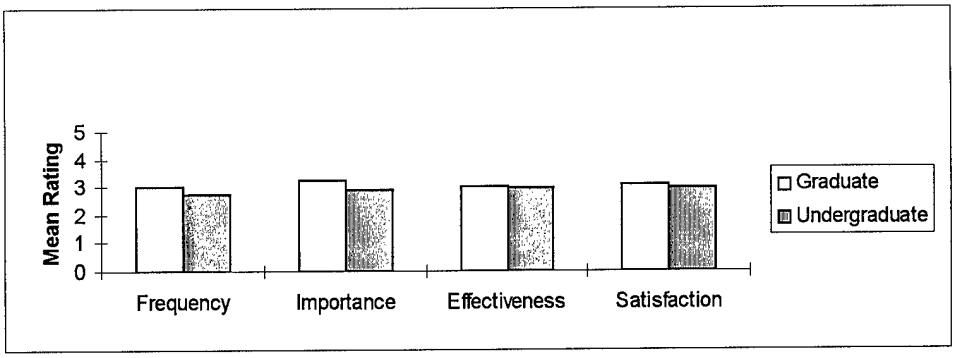

Figure 2. Graduate vs. Undergraduate Courses: Digitized Lecture Mean Ratings

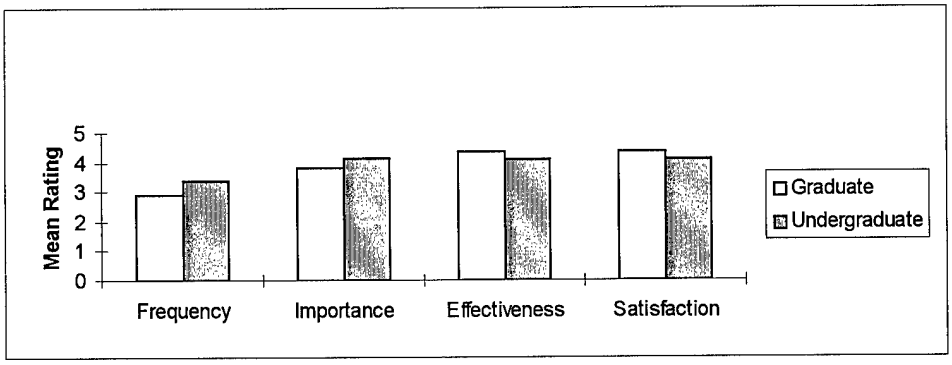

Figure 3. Graduate vs. Undergraduate Courses: Electronic Mail Mean Ratings

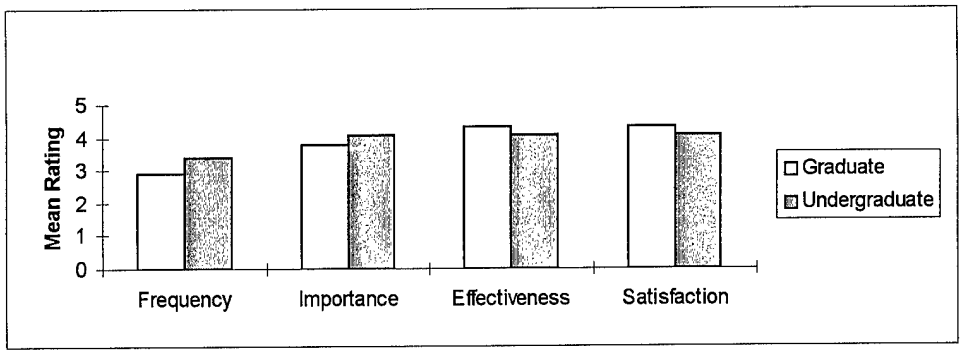

Figure 4. Graduate vs. Undergraduate Courses: Electronic Bulletin Mean Ratings

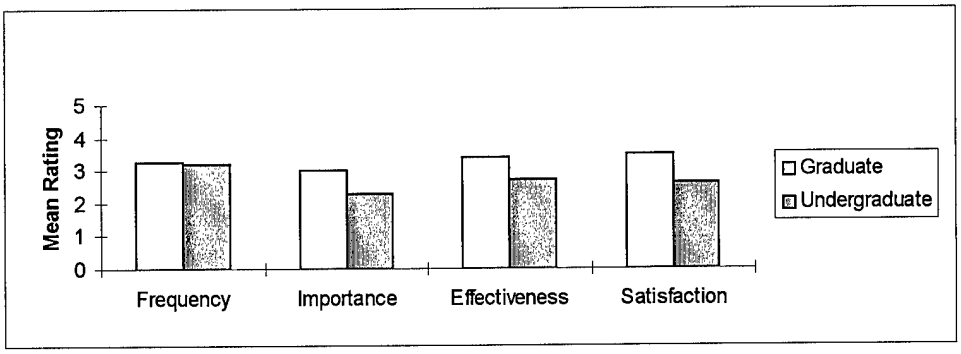

Figure 5. Graduate vs. Undergraduate Courses: Group Assignment Mean Ratings

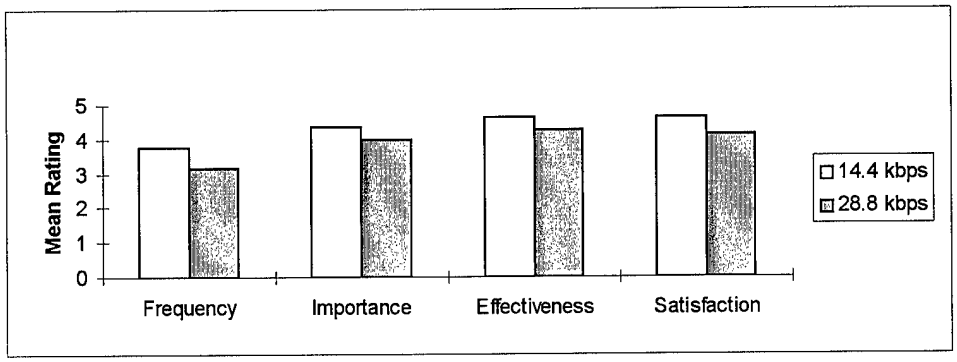

Figure 6. Student Modem Speed: Electronic Broadcast Mean Ratings

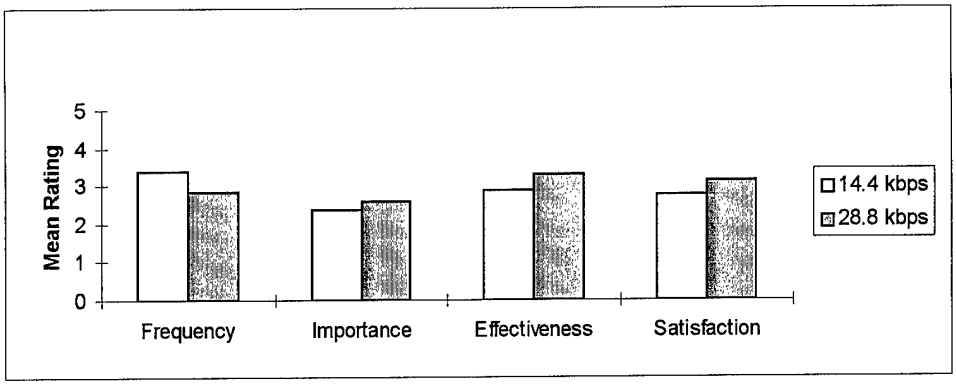

Figure 7. Student Modem Speed: Electronic Mail Mean Ratings

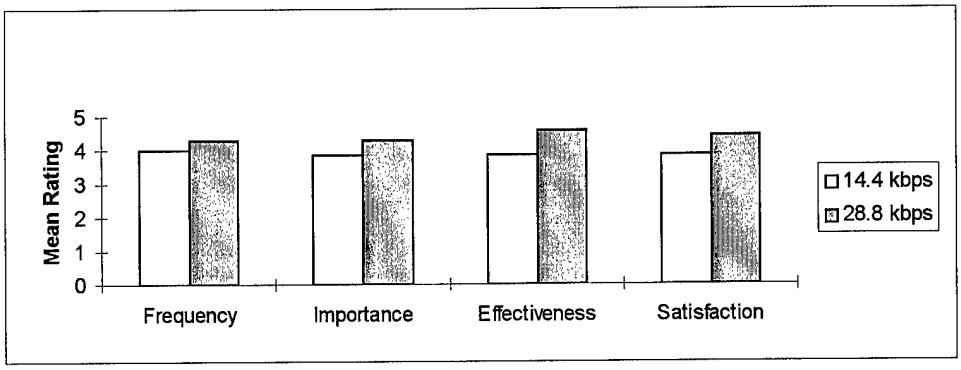

Figure 8. Student Modem Speed: On-Line Information Sources Mean Ratings

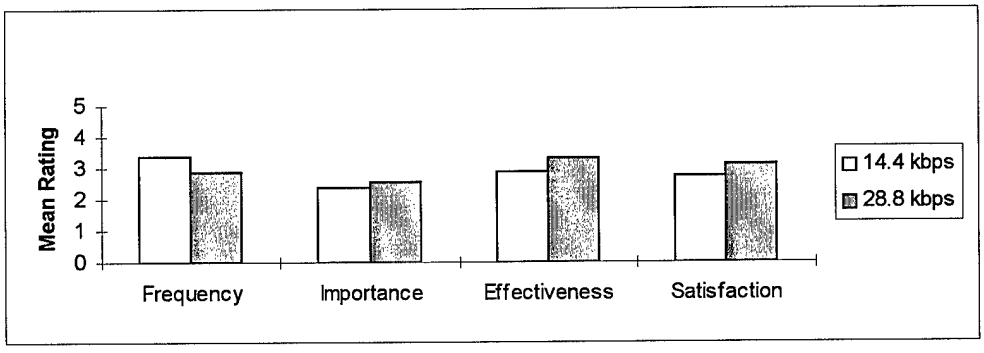

Figure 9. Student Modem Speed: Group Assignments Mean Ratings

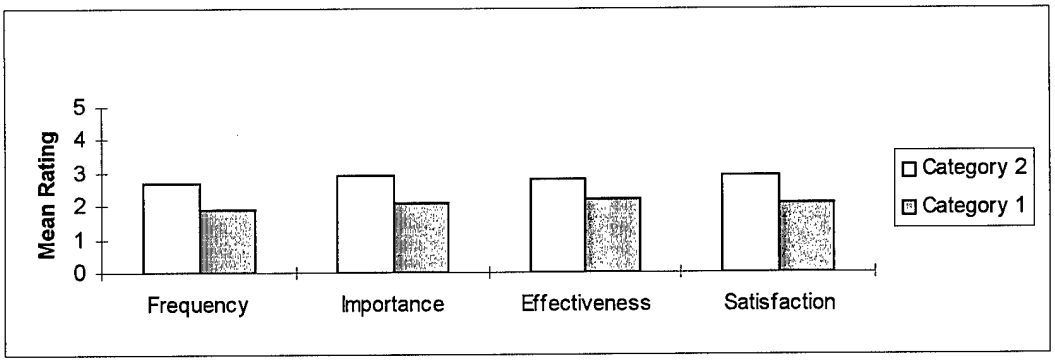

Figure 10. Category 1 vs Category 2 Courses
Chatroom Mean Ratings

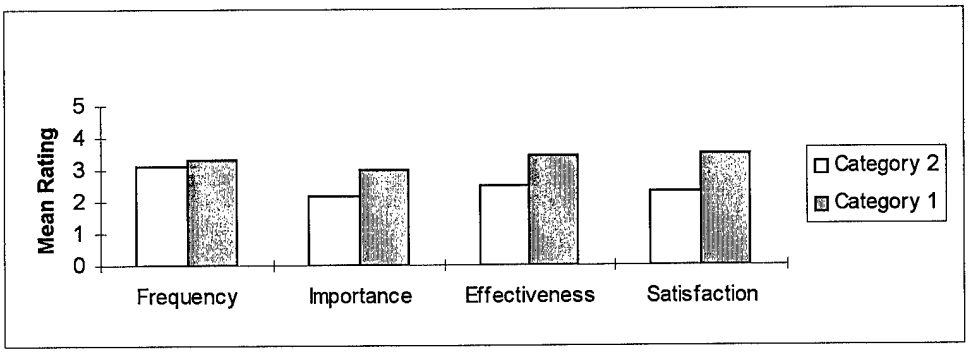

Figure 11. Category 1 vs Category 2 Courses
Group Assignment Mean Ratings

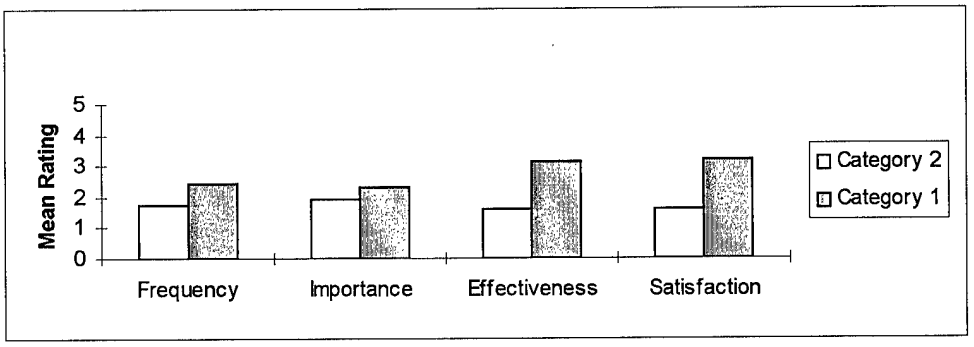

Figure 12: Category 1 vs Category 2 Courses On-Line Evaluation Mean Ratings

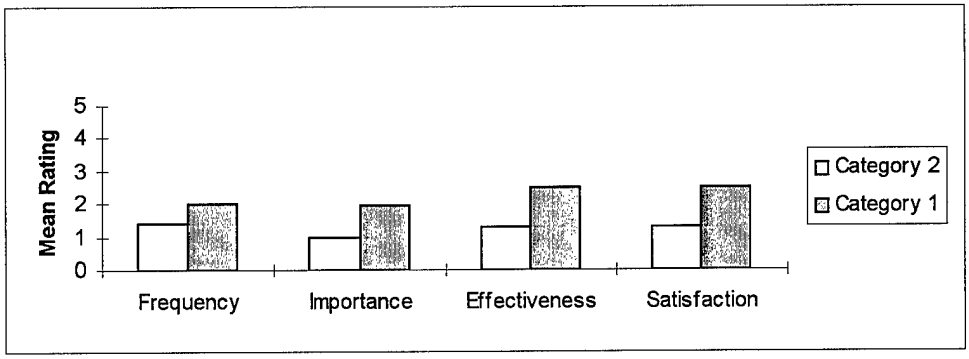

Figure 13. Category 1 vs Category 2 Courses
On-Line Laboratory Modules and Simulations Mean Ratings

Table XVI. ANOVA: Language Intensive vs Numerically Intensive Courses

Analysis of Variance on Chatroom Ratings - Language Intensive vs Numerically Intensive Courses				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	3.257	1.801	0.193
Importance	1	4.167	1.657	0.212
Efficiency	1	2.160	0.828	0.372
Satisfaction	1	4.167	1.849	0.187
Analysis of Variance on Group Assignment Ratings - Language Intensive vs Numerically Intensive Courses				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.327	0.113	0.739
Importance	1	3.840	2.629	0.119
Efficiency	1	5.607	2.674	0.116
Satisfaction	1	6.827	2.797	0.108
Analysis of Variance on On-Line Evaluation Ratings - Language Intensive vs Numerically Intensive Courses				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	3.527	1.939	0.177
Importance	1	1.127	0.560	0.462
Efficiency	1	14.107	5.222	0.032
Satisfaction	1	15.360	5.625	0.026
Analysis of Variance on On-Line Experiments and Simulation Ratings - Language Intensive vs Numerically Intensive Courses				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	2.160	1.533	0.228
Importance	1	5.227	8.050	0.009
Efficiency	1	8.167	4.715	0.040
Satisfaction	1	9.127	4.580	0.043

Table XVII. ANOVA: Student Computer Modem Speeds (14.4 kbps & 28.8 kbps)

Electronic "Broadcasts" Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	1.376	1.094	0.315
Importance	1	0.525	0.312	0.586
Effectiveness	1	0.43	0.365	0.556
Satisfaction	1	0.868	0.766	0.397
Electronic Mail Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	2.519	3.554	0.082
Importance	1	0.096	0.544	0.474
Effectiveness	1	0.019	0.032	0.861
Satisfaction	1	0.43	1.69	0.216
On-Line Information Source Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.305	0.126	0.73
Importance	1	0.63	0.253	0.62
Effectiveness	1	1.81	0.885	0.394
Satisfaction	1	1.144	0.486	0.498
Group Assignment Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	1.001	0.305	0.59
Importance	1	0.144	0.106	0.75
Effectiveness	1	0.63	0.289	0.60
Satisfaction	1	0.576	0.247	0.63

Table XVIII. ANOVA: Undergraduate vs. Graduate Courses

Chat Room Ratings - Undergraduate versus Graduate Courses				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.669	0.318	0.578
Importance	1	1.667	0.604	0.444
Effectiveness	1	1.157	0.416	0.525
Satisfaction	1	0.817	0.320	0.577
Digital Lectures Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.474	0.130	0.721
Importance	1	0.980	0.250	0.621
Effectiveness	1	0.100	0.008	0.928
Satisfaction	1	0.150	0.040	0.840
Electronic "Bulletin" Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	1.557	1.011	0.324
Importance	1	0.600	0.401	0.532
Effectiveness	1	0.474	0.239	0.629
Satisfaction	1	0.474	0.249	0.249
Electronic Mail Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.669	0.789	0.383
Importance	1	0.669	1.054	0.314
Effectiveness	1	0.535	0.437	0.515
Satisfaction	1	0.119	0.109	0.744
Group Assignment Ratings				
Source	df	Sum of Squares	F-Value	PR>F (alpha=0.05)
Frequency	1	0.017	0.006	0.941
Importance	1	2.963	1.984	0.171
Effectiveness	1	3.113	1.393	0.249
Satisfaction	1	5.400	2.157	0.154

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VITA

Earl Alexander Evans was born on June 10, 1967 in Bellevue, Washington. After spending the early part of his childhood in Bellevue, his family moved to Mt. Arlington, New Jersey; where he completed his primary and secondary education. Following graduation from high school, he received an Air Force Reserve Officer Training Corps academic scholarship and enrolled at Stevens Institute of Technology in Hoboken, New Jersey. In May 1989 he received a Bachelor of Engineering degree in Mechanical Engineering.

Following graduation, Mr. Evans was commissioned as a second lieutenant in the United States Air Force. He was first assigned to Cannon Air Force Base, New Mexico as a civil engineering officer. In this capacity, he served in positions including mechanical design and maintenance supervision positions. In January 1993, Mr. Evans was transferred to McClellan Air Force Base, California; where he again served in a variety of roles including project management and as the chief of a readiness and training division.

Mr. Evans returned to graduate studies in June 1996 when he was accepted to the Air Force Institute of Technology Civilian Institution Program. He attended the University of Missouri-Rolla and will receive a Master's of Science degree in Engineering Management in December 1997. Following graduation, Mr. Evans will be transferred to the Air Force Institute of Technology Civil Engineer and Services School in Dayton, Ohio where he will serve as an instructor. Mr. Evans currently holds the rank of Captain in the U.S. Air Force and is a registered professional engineer (mechanical) in the state of California.