A DISCUSSION OF THE PRODUCTION AND DELIVERY OF A GRADUATE COURSE IN MATHEMATICS EDUCATION DELIVERED USING E-MAIL, LISTSERV AND WORLD WIDE WEB FACILITIES.

DEREK MAXWELL HOWSE

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A Discussion of the Production and Delivery of a Graduate Course in Mathematics Education Delivered Using E-mail, Listserv and World Wide Web Facilities.

by

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ABSTRACT

Developers of distance education course materials recognize the possibilities that exist within the framework of emerging computer and communications technologies and how they might be applied to future distance education courses. This project monitored the development of an existing graduate level education course into a distance education course integrating the technologies of the World Wide Web and asynchronous computer conferencing through the use of a listserv. An analysis of the course was conducted and based on four separate evaluation tools: a set of three online questionnaires, a reflective journal kept by the author, an interview with the instructor of the course, and an analysis of both the students' and instructor's postings to the listserv.

The results of this project indicated that the students found the course to be satisfactory and that the technologies used were adequate for the transmission of course content and viewpoints in spite of some initial technical difficulties. Problems occurred with student visualization of some of the posed problems and subsequent solutions since descriptions were solely text based. Students also had difficulty in sending attachments with e-mails. It was noted that, despite the students' feeling that access to the instructor was adequate and that the response time to all messages was prompt, there still existed a feeling of isolation. Students missed the face-to-face interactions and sense of collegiality that occurs in the traditional classroom setting.

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LIST OF ABBREVIATIONS USED

CADE - Canadian Association of Distance Education

CD-ROM - Compact Disk Read Only Memory

GIF - Graphics Interchange Format

JPEG - Joint Photographic Experts Group

WWW - World Wide Web

CHAPTER 1

OVERVIEW OF PROJECT REPORT

Project Background and Rationale

Memorial University of Newfoundland, Newfoundland and Labrador's only university, has in recent years had to deal with funding cutbacks and increased operating costs. A number of different strategies were implemented by the university administration to try and cope with this fiscal challenge including: the offering of early retirement packages to faculty and staff, increasing student tuition fees, and the implementation of a new hiring scheme. The number of courses able to be offered by the individual schools decreased as a result of the drop in available teaching faculty.

During this period one of the two mathematics education faculty members within the School of Education retired. Complicating matters further, the remaining faculty member was scheduled to be out of the province and eventually, out of the country during the Winter semester of 1997. In an effort to continue to provide at least one course offering to graduate students in mathematics education during the Winter semester of 1997, the faculty member investigated the possibility of providing a graduate course through distance education. The scheduled course, *Teaching and Learning to Solve Mathematics Problems,* had been taught the previous year by the same faculty member and the author was a member of that class. The faculty member decided to offer the

course in a distance format, making modifications to the delivery but not to the course content.

Recent widespread and inexpensive access to the Internet for both faculty and students of many post secondary institutions had provided a new means for interacting with students over distance (Brooks, 1997; Besser, 1996; Hansen, 1996). However, as Besser (1996) cautioned, not all curricular subjects and pedagogical styles are appropriate for these new media. He proposed that each new learning situation be analyzed to determine the type of implementation that will provide the student with the most rewarding learning experience. While it is impossible to pre-determine a student's experience in a new educational setting, it was felt by the course instructor that a learner-centered environment and a combination of traditional print media, listserv, e-mail and the World Wide Web (WWW) might prove to be effective.

This project report provides an overview of the efforts taken by the faculty member and the author through the stages of development, implementation and evaluation. By investigating the process followed future courses developed along similar lines might benefit from this experience.

Definitions

This project paper used terminology specific to some of the emerging media and, as such, may not be part of each reader's vocabulary. The following are definitions that may make the reading of this paper a clearer exercise. The definitions were taken from

the Internet Literacy Consultants glossary of Internet terms (1997) that were available at

http://www.matisse.net/files/glossary.html

Browser A Client program (software) that is used to look at various kinds of Internet resources.

E-mail (Electronic Mail) -- Messages, usually text, sent from one person to another via computer. E-mail can also be sent automatically to a large number of addresses (Mailing List).

Home Page (or Homepage)
Several meanings. Originally, the web page that a browser is set to use when it starts up. The more common meaning refers to the main web page for a business, organization, person or simply the main page out of a collection of web pages, e.g. "Check out so-and-so's new Home Page." Another sloppier use of the term refers to practically any web page as a "homepage," e.g. "That web site has 65 homepages and none of them are interesting."

HTTP (HyperText Transport Protocol) -- The protocol for moving hypertext files across the Internet. Requires a HTTP client program on one end, and an HTTP server program on the other end. HTTP is the most important protocol used in the World Wide Web (WWW).

Internet (Upper case I) The vast collection of inter-connected networks that all use the TCP/IP protocols and that evolved from the ARPANET of the late 60's and early 70's.

Listserv The most common kind of maillist.

Maillist (or Mailing List) A (usually automated) system that allows people to send e-mail to one address, whereupon their message is copied and sent to all of the other subscribers to the maillist. In this way, people who have many different kinds of e-mail access can participate in discussions together.

Mosaic The first WWW browser that was available for the Macintosh, Windows, and UNIX all with the same interface. Mosaic really started the popularity of the Web. The source-code to Mosaic has been licensed by several companies and there are several other pieces of software as good or better than Mosaic, most notably, Netscape.

Netscape A WWW Browser and the name of a company. The Netscape (tm) browser was originally based on the Mosaic program developed at the National Center for Supercomputing Applications (NCSA).

Network Two or more computers connected together so that they can share resources. Two or more networks connected together comprise an internet.

Posting A single message entered into a network communications system. E.g. A single message posted to a newsgroup or message board.

Server A computer, or a software package, that provides a specific kind of service to client software running on other computers. The term can refer to a particular piece of software, such as a WWW server, or to the machine on which the software is running, e.g. Our mail server is down today, that's why e-mail isn't getting out. A single server machine could have several different server software packages running on it, thus providing many different servers to clients on the network.

URL (Uniform Resource Locator) -- The standard way to give the address of any resource on the Internet that is part of the World Wide Web (WWW). A URL looks like this:

http://www.matisse.net/seminars.html

WWW (World Wide Web) -- Two meanings - First, loosely used: the whole constellation of resources that can be accessed using Gopher, FTP, HTTP, telnet, USENET, WAIS and some other tools. Second, the universe of hypertext servers (HTTP servers) which are the servers that allow text, graphics, sound files, etc. to be mixed together.

Project Activities

This project reported on the application of a listserv and a WWW site to a graduate class in mathematics education offered using distance delivery. This included, in consultation with the course instructor, the following activities:

- designing and developing a WWW site appropriate for the course,
- providing technical help with problems as they came up during the course,

- monitoring the listserv activity of all participants,
- designing and implementing online questionnaires for the gathering of student feedback on the course,
- describing and analyzing the course and its development, and
- writing this report.

Designing a WWW site required an informal review of the course as it had existed when taught in a face to face manner. Initially questions were discussed from the point of view of a distance education course:

- Would the new format prevent the inclusion of any aspect of the course?
- How might the new format change the manner in which the course is approached by the instructor?
- How would the course evaluation be affected by the change in methodology?

In the end, the instructor decided that the course objectives need not be changed simply because of the change in teaching mode. However, the course evaluation was modified slightly to provide more emphasis on the discussion contributions of each student. Also, in order to achieve a sense of practical application, students were required to develop a problem solving unit for one of the mathematics classes they were currently teaching, implement the unit, and then report on the success of the unit.

All potential participants were mailed a description (see Appendix A) of the course, the format to be used, and what hardware and skills they should have in order to be able to fully participate in this course. The list of potential students was obtained from

the School of Graduate Studies and was assumed to include all interested registrants for the course.

Four data sets were collected during the project and are described as follows:

I. Three questionnaires (see Appendix B), one at the beginning, one in the middle and one at the end of the term, were posted on the WWW in order to record student impressions of the course. The three questionnaires were adapted from two questionnaires developed and used by Dr. Michael Collins of Memorial University of Newfoundland to gather student impressions on an undergraduate course in Biology that was offered using e-mail and the WWW.

II. A record of all listserv interactions was kept and analyzed for number, frequency and size of postings per student and faculty member. Permission to use the data contained within both the questionnaires and the listserv was obtained from each student with the condition that each student remain anonymous (see Appendix C). In order to preserve student anonymity names were omitted from the body of this paper. In the questionnaire data set (see Appendix D) student names were replaced with letters of the alphabet.

III. The instructor's views of the course format and its effectiveness was also recorded. The faculty member was asked to provide a personal view of the various components of the course after the completion of the course. These included topics similar to those contained within the questionnaires filled out by the students.

IV. The author kept a personal journal during the design and delivery phases of the course to provide another data set. This journal highlighted the activities involved in modifying the course from an on-site to a distance delivery format. It also included comments and observations of the course.

The data sets were designed to help provide some insight into the following questions:

- What overall impression did the students have of the course as delivered?
- What were the students' opinions of the delivery format in general?
- Would the students prefer to see other graduate level courses follow the same or similar model?
- What are the students' recommendations for future distance delivery courses offered in this format?
- What was the instructor's impression of the development and presentation of the course?
- What was the instructor's opinion of the delivery format in general?
- What are the recommendations of the instructor for any future courses that may be offered following a similar model?
- What are some general principles that may be derived from the course as delivered that might make future development and implementation of courses following a similar model more effective?

The above questions were reviewed by the instructor of the course and were judged to be appropriate for both the project and to produce data that could be further used for course improvement.

CHAPTER 2

EFFECTIVE DISTANCE EDUCATION AND THE ROLE OF TECHNOLOGY

Introduction

The evolution of distance education from the original print-based correspondence courseware to the multimedia model may be at least partially attributed to developments in the electronics, communications and computing industries. This past decade has seen developments in the areas of digital and video compression, an increase in personal computer use, as well as the widespread use of the WWW and the Internet. According to Bailey (1994) and Hansen (1996), these developments provided new areas of investigation for the distance educator and developer of distance education materials. Effectively applying these technologies requires re-visiting basic educational pedagogies, including the concepts of learning, motivation, and learning environment theories and issues.

Learning

Piaget (1954) has suggested that learning is not a smooth and continuous process but rather occurs sporadically in response to new information. When a person is confronted with new information this information is either assimilated into an existing mental structure or the structure shifts to form a new accommodating structure. Until the information is incorporated into the cognitive structure the person exists in a mental state

of flux. As the process of incorporation proceeds through either assimilation or accommodation the state of disequilibrium shifts towards equilibrium.

According to the Piagetian view of cognitive development, it is necessary for the learner to be mentally active in his or her environment in order to acquire new knowledge and to ascribe meaning to this new knowledge. The mind must organize the perceived reality and act upon it. Accordingly, the learner is not an empty vessel to be filled with facts and figures but must actively participate and integrate the environmental stimuli provided. How the knowledge has been presented or used and what existing mental structures are currently in place will influence the learner's mental conception of the knowledge.

Wittrock and Alesandrini (1990) proposed that the synthesis of new knowledge is directly dependent on the ability of the student to generate relationships between parts of the knowledge base. These connections may be internal, between various parts of the new knowledge, or external, between parts of the new knowledge and existing knowledge.

Wittrock's (1989) investigations have suggested that this ability to generate connections between topics appears to be a characteristic separating good and poor learners. A number of other studies (Seifert, 1994; Bean, Searles, Singer and Cowen, 1990; Wittrock and Alesandrini, 1990; Peters and Levin, 1986; Malone and Dekkers, 1984) have suggested that a lack of learning strategies may also be a significant characteristic of students with learning difficulties. Learning strategies that may be used

to help cultivate the generation of internal and external connections include: summarizing the material; making analogies to topics already cognitively digested; creating a concept map to visually and physically represent the connections within and without the topic; using mnemonic strategies.

The cognitive theories of Piaget are echoed in the instructional theories of Bruner (1960). Bruner subscribed to Piaget's learning theory that learning is an active process in which learners construct new ideas based on current knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structures provide meaning and organization to experiences and allow the individual to explore beyond the scope of the given information.

Accordingly, Bruner (1966) suggested that instructors should approach teaching from a discovery point of view. Learners should be encouraged to try and develop their own principles. An active dialogue should be maintained between the student and the instructor to check the student's level of understanding, to correct any misconceptions that may occur, and to continue to present the student with new learning activities (Eaton, Anderson and Smith, 1984). Curriculum should be organized such that new learning activities reinforce concepts already discussed and discovered.

Bruner (1966) suggested that course developers and teachers should be aware of the following four points when designing instructional activities:

- students' predisposition towards learning.

- the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner.
- the most effective sequences in which to present material.
- the nature and pacing of rewards and punishments.

For the developer of distance education materials, investigating these four points may influence how the course is presented, what types of media might be most effective, and even whether or not a course will be easily and effectively presented in a distance education format.

Ausubel (1963) suggested that learning may be enhanced through an active environment which emphasizes the use of questioning techniques before, during and after the instructional activity. This is echoed in the work of Seifert (1994) who suggested that a student's understanding and recall of information is enhanced through the use of questioning. The questioning goes beyond the simple recitation of facts but rather seeks to have the student reach a higher level of thinking by asking "Why...?" or "How...?". Such questions help to build new information networks and connections. They aid the processes of assimilation and accommodation thereby helping the student learn the material.

For the distance educator these theories suggest a need for the active participation of the student. They also suggest the need for a continued emphasis on interactions between students and interactions between the students and teacher. The developer of distance education courses should determine whether such interactions may be

accommodated through various conferencing systems and which of the systems is most appropriate for a particular course.

Jonassen (1991) has suggested that knowledge is constructed and that there is no such thing as an objective store of knowledge that can be transmitted exactly from teacher to learner. "We all conceive of the external reality somewhat differently, based on our unique set of experiences with the world and our beliefs about them" (Jonassen, 1991, p. 6). He suggested that construction of the internal linkages and structures required to assimilate new knowledge are influenced by the unique set of previous knowledge, personal motivations, aptitudes, experiences, and metacognitive strategies that have been developed by the learner. Such learning theories suggest that ideal learning environments are those which emphasize self-directed learning, problem solving sessions, interactions between the students, and interactions between the students and the instructor. Recent developments in the fields of computers and communications have opened the door to a higher quality in distance education by providing mechanisms whereby such learning environments may be established (Bailey, 1994).

The task for designers of distance education materials is a formidable one. They must find ways to engage students in authentic tasks, to assist students in developing flexible knowledge bases that promote use of information, and encourage diversity of thought. They must build learning communities that link students to others students and promote meaningful learning rather than credentialing.

Student Motivation

Manning (1990) has suggested that personal motivation is an important element in the learning process. This is particularly true for the distance education student who must contend with a sense of both physical and intellectual isolation. This isolation may lessen the student's desire to put forth the effort and discipline required to successfully complete a distance education course. Reiber (1992) has suggested that designers of distance education courses should try to help the student by providing a meaningful context base which supports intrinsically motivating and self-regulated learning.

Attribution Theory

Weiner (1984) attempted to link personal attributes to motivation in learning. He suggested that every attribute begins with a certain action on the part of the student. The outcome of this action, either success or failure, may lead to some general emotional reaction based on three characteristics: locus of control, constancy, and the ability to control the action.

Locus of control refers to whether or not success or failure is dependent on factors which are internal or external to the student. Internal factors include perceived ability and personality whereas external factors would include the degree of difficulty of the task. If the locus is internal and success occurs, then it might be expected that a positive attribute would occur since success would be attributed to some personal characteristic. Failure under the same locus may produce a negative attribute. For example, if a student submits

an assignment late because of poor time management on their part then this failure may be attributed to a fault in their character. If the submission is late due to technical difficulties then a negative attitude may be produced towards technology but a positive reinforcement of personal preparedness may occur.

The second factor proposed by Weiner (1984) is that of constancy. Different perceptions of success and failure occur depending on whether the factors involved are changeable or set. Borkowski, Carr, Rellinger and Pressley (1990) suggested a strong connection between attribution and self-esteem. Failure as a result of a lack of effort - something which is variable -may not affect future successes. However, failure due to a lack of perceived ability may lead to a belief in future failure and a lowering of self-esteem.

Finally, Weiner (1984) describes the ability to control the action as the third factor in his attribution theory. Amount of effort and time spent are examples of this type of controllable factor. How the student may react to such factors is not easy to predict. For example, a student that expends a greater than average amount of time to reach an answer to a typical problem may experience either a rise in self-esteem, since the problem was solved, or a lowering of self-esteem, since it took a longer time.

Self-efficacy Theory

Schunk's (1985) self-efficacy theory referred to a student's perceived ability to successfully complete an activity based on the outcomes of similar past performances and

how these past performances have affected the belief in ones ability to successfully complete a task. Locus of control and stable/unstable factors are also cited as influencing this perception. In order to succeed at a task, students must believe they are able to complete it in order to be motivated to the point of investing effort and risking failure.

The link between effort and success is important in self-efficacy theory. While success at a particular problem may increase a student's sense of self-efficacy in this area, the magnitude of the increase may be tempered if a seemingly undue amount of effort is invested in the problem. In fact, laboring for prolonged periods may negatively affect the sense of self-efficacy. With this connection between perceived ability and effort in mind, Schunk (1985) pointed out several areas that a teacher should be aware of in the learning environment. These have to do with appropriate and effective methods of information presentation, the teaching of learning strategies, feedback on evaluation, goal setting and the influences of peer perceptions.

Both Schunk (1995) and Ames (1992) argued that teachers must be careful in setting appropriate goals and rewards such that a healthy blend of effort leading to a high rate of success is included in the learning environment. Setting goals too high may lead to discouragement while setting the goals too low may lead to success without effort. Student rewards should be reflective of both the amount of effort invested and the goals attained. Rewarding on the basis of solely one or the other is detrimental to self-efficacy.

Ames (1992) also pointed out the importance of allowing students control over decisions. A sense of autonomy, a positive self-perception and an internal locus of

control are important factors in the development of a mastery student. Giving students control in the learning environment may lead to the support of these ideas. Ames stated that these decisions should be allowed only if they are positively influencing a student's decision making process. If the decisions made are an effort to avoid failure or minimize effort, then such decisions should not be supported.

Collaborative and cooperative learning strategies are proposed by both Ames (1992) and Schunk (1985) as alternatives to the risk-taking ventures of individual assignments. In this manner learners would work together to accomplish shared goals, leaning on and learning from the expertise of other students within the learning environment. These small group efforts may have both social and instructional benefits. Recent developments in computer and communications technology allow for the use of group work in distance education courses despite the physical separation of students and instructor. Students are able to share files both asynchronously through e-mail or speak directly with one another through audio conferencing, or chat facilities.

Transforming the Distance Education Learning Environment

Beyond the central ideas of learning theory and motivational theory, another variable that affects the quality of a student's learning is environment. Oliver and Reeves (1996) have suggested that the effectiveness of any learning environment is dependent on the provision of activities which stimulate the learners' cognitive and metacognitive activity at a high level. It was suggested that such activities are most effective when they

present the learner with personally meaningful and relevant content. The learner should also have an opportunity for reflection during this process, a chance to process the presented or experienced situation and come to a personal understanding of the information.

The generative learning process is maximized by creating learning environments in which the student is able to control the exposure to new educational stimuli and have time to process it. Oliver and Reeves (1996) have suggested that active learning environments engaging the students in personally relevant content are particularly effective. Jonassen (1991) and Oliver and Reeves (1996) have also suggested that self-directed exploration, problem solving and knowledge manipulation are characteristics of learning environments which are conducive to the construction of knowledge.

Emerging Technologies in Distance Education

Within the past few years advances in communications and computer technology have included: asynchronous computer conferencing, audio-conferencing, audio-graphics, audio-tapes, cable television, computer disks and CD-ROM, desk-top video-conferencing, interactive laser disks, one-way satellite communication, two-way satellite communication, synchronous computer conferencing, videotape, voice mail and e-mail, Internet and WWW (Thach and Murphy, 1995). Each of these provides the user with a potential global community of learners. With so many technologies evolving and available for the teacher to choose from there is often a tendency for the technology to

drive the development of distance education courseware as opposed to the pedagogical justification for its use (Ely, 1996). Comeaux (1995) has suggested that some present uses of technology, particularly two-way video and audio, in the distance education environment may be obtrusive and psychologically unnerving to the student. According to Comeaux, the learning environment should be designed to transcend geographical as well as psychological barriers.

Ely (1996) has stated that the most successful distance education programs are those which respond to real needs; they offer an alternative to learning that would otherwise be denied or be prohibitive in terms of cost and time. Ely suggested that the following questions be asked before deciding whether to develop a distance education course:

- What is the purpose of the course?
- For whom is the course to be created?
- Why is the distance education format being considered?
- Will distance education improve the quality and enhance the benefits to learners?
- What will the development cost?

When deciding on the type of technologies to incorporate in the distance education course, Ely (1996) also suggested that developers look at the reasons for the inclusion of each of the proposed technologies using the following questions as potential guidelines:

- Does the technology make sense from an educational standpoint?
- Will the technology really advance student learning and scholarship?
- Does the technology make sense financially?
- Will all students and faculty have access to the technology and understand how to use the technology?

Ely (1996) has suggested that each of these questions have a positive answer for the technology to be included in the proposed learning environment.

The necessity that the design of the distance learning environment be driven by educational demands and not technological concerns was echoed by Armstrong (1996). Building on constructivist and active learning principles, Armstrong argued that these learning environments must emphasize the maximization of student interactivity with other students and between students and teachers. Active learning strategies should be sought out and implemented by the teacher. Yakimovicz and Murphy (1995) have suggested that the constructivist approach is a valid and appropriate learning format when teaching adults since they bring to the course backgrounds rich in a variety of experiences.

The role of the teacher in such a learning environment might shift to that of facilitator rather than the transmitter of information. With such technologies as the Internet providing students with potential access to experts in many different fields, the teacher should no longer be viewed as the sole authority on the subject. Ely (1996) has suggested that teachers remain subject experts but should also be technology experts,

teaching experts, and industry experts.

Thach and Murphy (1995) have suggested that the top ten competencies of the distance education professional should be:

- proficiencies in interpersonal communication,
- planning skills,
- collaboration and teamwork skills,
- language of instruction,
- writing skills,
- organizational skills,
- feedback skills,
- knowledge of the distance education field,
- basic technology knowledge, and
- technology access knowledge.

This set of skills has particular implications for the level and type of professional development that might be pursued by the proposed instructors.

Effectiveness of Technology Use in Distance Education

According to Armstrong (1996), there are a number of elements that lead to the development of a successful Internet course:

- institutional support for providing resources and teacher release time,
- development by a project team containing the requisite skills,

- teachers or pedagogies acting as the driving force and not the technologies,
- strategic approach in deciding which courses to offer via distance,
- an emphasis on good design to maintain student interest,
- maximize information retrieval and not information dissemination,
- the focus is on a model of course delivery and not on a specific course,
- immediate, sympathetic, good quality technical support is provided,
- professional development and time release is given for teachers, and
- teachers exhibit continual improvement, responsiveness and innovation in their teaching approaches to best fit the type of student and the particular subject.

Armstrong (1996) has suggested that the Internet represents a revolution in communication. Since teaching may be described as an exercise in communication, then the Internet may also represent a revolution in teaching. Students should be able to absorb information from the exchange of ideas and questions over listservs. New interactions and social protocols have been developed including the use of "smileys" to show humor in a media where body cues are not evident (Mende, 1996).

In comparing the use of the Internet in the delivery of a distance education course with a more traditional format, Armstrong (1996) found that the Internet has the capability of providing immediate contact with the instructor and other students thereby maximizing student involvement in class activities. Group projects are possible even though group members themselves may be thousands of miles apart. The sense of

isolation is greatly diminished. Studying collaborations on the Internet, Yakimovicz and Murphy (1995) found that students' personal experiences served to enrich the learning situation and helped to foster the construction of personal knowledge. Watabe, Hamalainen and Whinston (1995) found that group work on the Internet is motivating. The group atmosphere is often a secure environment in which students try their best so as to not let down the rest of the group. However, they are also empowered by the help given by the other group members. Berge and Collins (1995) found that graduate student discussions on the listserv were most often employed for either information sharing or for decision making purposes. The outcome of these exchanges is an increased personal understanding of the material and the construction of a shared meaning.

Watabe, Hamalainen, and Whinston (1995) have suggested that there are limitations primarily due to the constricting nature of text based communication. Misunderstandings may occur and the time and effort required to input enough information to try and avoid these misunderstandings is significant. McHenry and Bozik (1995) have suggested that there are some problems unique to the distance education format and which need to be considered in the development phase. These include:

- difficulties in meeting deadlines,
- material distribution, and
- technological etiquette.

In order to help the student understand the role of the student in the discussion list, Friedman, Hafeze, Keating, Mullen, Patrick, Plotkin and Strenski (1995) gave a number

which may include appropriate functionality and ease of use. Educational demands should drive the design of the course and not technological concerns. Active learning strategies are suggested by Yakimovicz and Murphy as being appropriate models for a distance education environment. Armstrong suggested that the use of technology should maximize the interactivity of the course.

The effectiveness of a particular implementation of a technology depends on how responsive and able the instructor is in adapting teaching styles and incorporating new technologies in new teaching environments. The effectiveness may also be influenced by the students who should be made aware of their own responsibilities when working with new technologies in a distance education environment. It is possible to enrich the distance learning environment through the use of group projects and presentations. Such projects may help to increase the personal understanding of the material as well as help to construct a shared meaning.

CHAPTER 3

AN OVERVIEW OF THE RESEARCH MODEL

As previously stated, the intent of this project was to provide some insight into the following questions:

- What overall impression did the students have of the course as delivered?
- What were the students' opinions of the delivery format in general?
- Would the students prefer to see other graduate level courses follow the same or similar model?
- What are the students' recommendations for future distance delivery courses offered in this format?
- What was the instructor's impression of the development and presentation of the course?
- What was the instructor's opinion of the delivery format in general?
- What are the recommendations of the instructor for any future courses that may be offered following a similar model?
- What are some general principles that may be derived from the course as delivered that might make future development and implementation of courses following a similar model more effective?

In order to address these questions four distinct items were evaluated:

I the presenting of three questionnaires to the students, one at the start of the

term, the second in the middle and the final at the end of the term.

II an analysis of the electronic correspondences that occurred during the semester, including general mailings to the entire class via the listserv, mailings to the instructor as private memos, and mailings to the technical advisor.

III the instructor was asked to provide feedback on his own experiences with the course.

IV as part of the reflective component of the Masters project, a journal was kept by the author during the entire process.

Questionnaires

The questionnaires identified in Appendix B were originally developed for a distance education undergraduate course in Biology developed at Memorial University of Newfoundland by Dr. Michael Collins. The Biology course used both e-mail and the WWW to present the courseware. Dr. Collins agreed to the modification of the questionnaires for use in this project.

Some of the modifications were a result of the different modes of presentation between the two courses. The undergraduate biology course used the WWW extensively for the presentation of course content including both text and images where appropriate. As such, the original questionnaire included questions concerning the time required to download the WWW pages, the effectiveness of the images used, and the amount of

detail contained in the images. Since the graduate course used the WWW site primarily for disseminating text-based information other than course content, no illustrations were necessary. Hence the associated questions were removed.

The first questionnaire was designed to give feedback on the students' personal and educational background, their level of experience in using the implemented technologies, and their experience with prior distance education courses. It also focused on the type and availability of computer they were using for the course, whether they had prior knowledge as to the nature of the course and also how they learned about the course.

The second questionnaire was broken into four sub-parts and focused on the students' impressions of the course to date, technical problems, web design and course components. Along with having the students give a degree of satisfaction rating to the course, they were also asked whether they would recommend the course to a friend and also whether they would consider taking another course of a similar format. The three questions along with the request for a description of the positive and negative aspects of the course help to clarify the experience of the student. The second section of this questionnaire concerned itself with the nature of technical problems encountered, how long the problem persisted, who helped the student in finding a solution to the problem, and what computer skills the student felt were essential in this course format.

Web design questions were concerned with the ease of use and organization of the web site. A comment section was also provided to allow students the opportunity to expand on any point that may have been missed.

Questions in the course component section dealt with student impressions concerning the appropriateness of the readings, the volume of reading required and suggestions for improvement. This particular aspect deals more with the course content as opposed to how the course was presented. Questions concerning the listserv and e-mail dealt with types of mailings, their quantity and frequency.

The third questionnaire varied only slightly from the second. This was used primarily to determine whether or not the students' impressions of the course had changed throughout the semester. An added aspect was a question on the evaluation scheme used. In setting up the course there was some deliberation as to what measuring instruments might be used to evaluate the students. This question provided an opportunity for the student to provide feedback on this topic.

In keeping with the online format of the course, all three of the questionnaires were posted as forms on the WWW. Students were given the address of each form only at the appropriate time of the term. Students were strongly encouraged to complete these forms but were also aware that their completion was a voluntary act on their part. The forms were completed and submitted online directly to the author.

In agreeing to participate in this project, students were assured of their anonymity. Accordingly, student names were changed to letters of the alphabet with consistent letters used throughout this report.

Listserv and E-Mail Evaluation

A combination of listserv and e-mail were used by both the students and the instructor to discuss the course materials. Students were asked to submit comments on course readings and instructor prompts while at the same time providing personal insights into the course material. Assignments were submitted as attached files to the instructor.

An analysis of the amount of e-mail traffic was carried out in an effort to determine:

- an appropriate class sizes for such courses,
- the amount of time required by the instructor and students to create, submit, read and respond to weekly correspondences, and
- whether a listserv provides an effective means for discussing course content.

Messages were sorted by week to determine the level of activity and by author to determine the personal amount of e-mail activity. Size of the e-mail message was used as an indicator of the amount of time spent by the student in this activity both in composing and writing messages and in reading messages. The size of the message was measured in terms of the number of words contained therein (not including quotes from previous messages). Each message was copied into a wordprocessor which provided an accurate count of the words per message. A tally was kept per student.

Determining the amount of time required of the student, both to read and compose messages, was a more subjective exercise since the typing speed and reading speeds per student was not known.

Instructor's Comments

A reflective account of the course was obtained from the instructor using an interview process. This provided insights into the instructor's opinion of the course development process, the way in which the course proceeded, and what changes might be incorporated into the course if it is offered again through the distance mode.

Reflective Journal

The reflective journal provided an account of the process by which the course evolved from a traditional, face-to-face mode to an online distance education course. It included personal comments, insights, and suggestions for future developers of such courseware.

CHAPTER 4

RESULTS OF THE FOUR DATA SETS

This chapter provides an overview of the results of the data gathered from the questionnaires, the listserv and e-mail communications of the students, the instructor's comments and the reflective journal. It reports on observations obtained from the eight students who initially registered for this course. One student dropped the course after four weeks. The reason given by the student was that of not being able to devote enough time to other courses.

Questionnaire Results

Of the seven remaining students, six responded to the first two questionnaire forms and four responded to the final questionnaire form. E-mail messages were sent reminding, requesting and encouraging students to complete the forms.

Initial (Profile) Questionnaire

The first questionnaire was used to obtain information regarding:

- student background,
- technical proficiencies brought to the course, and
- whether or not students knew about the course format and were satisfied with the format.

Student Background

Of the six students that answered the questionnaire, five were well established in their course work towards their Masters of Education degree program having completed between 8 and 16 credits. All five students were enrolled in the area of Teaching and Learning, a sub-specialty of the Masters of Education degree at Memorial University of Newfoundland. The sixth student was not registered in any Masters Program and had completed only one other course credit at the graduate level.

All five of the more experienced students learned about the format and course offering from the instructor of the course having been members of an on-site class taught the previous term by the same instructor. The sixth student found out about the course from the Faculty of Education and was not informed of the format of the course nor of the requirements in terms of available computer technology and degree of technical awareness until after having registered for the course.

Four of the students had prior experience with at least one distance education course. Their experiences included courses which had used a variety of communication media including print-based materials, video-tape, audio-tape, e-mail, teleconferencing, listservs and computer conferencing.

Three students decided to take this course because of the distance format of the course. The fact that they would not have to make a difficult and sometimes impossible commute to class was given as a reason for their participation. One of these students stated time convenience as a positive aspect of the course format.

Two of the remaining three students not influenced by the format of the course stated they were enjoying the format as presented. They would have taken the course regardless of the format.

Technical Issues

At the time of this project, most teachers in the Newfoundland and Labrador region had access to a computer within the school. Most schools were connected to the Internet via the backbone set up by STEM~Net. Also, for the teachers enrolled in the Masters program and located at the main St. John's campus, each was issued a computer account and had access to computer labs. Each of the labs was networked to the Internet allowing the user access to e-mail accounts and WWW sites.

Access to computers with the appropriate connections did not appear to be a problem for the respondents. Five of the six students had computers at home and the sixth had access to computers both at the workplace and at the university. The computers had a minimum configuration of an IBM compatible 486 computer.

Technical expertise varied greatly from student to student. Students were asked to indicate their personal level of proficiency in file management, word processing, graphics packages, spreadsheets, e-mail, WWW use, and computer conferencing. An opportunity for the student to add other particular areas of computer literacy was provided. Results indicated that each of the students had at least a little knowledge in each of the listed categories. Lesser knowledge was in graphics packages and spreadsheets. Two students

claimed to have no skills in the use of spreadsheets and one of these two also claimed to have no skills in the use of graphics applications. For the purposes of the course, these latter skills were not a requirement and were never formally used. Three of the respondents listed themselves as being proficient in the use of e-mail while two described themselves as being semi-proficient in its use. The remaining student reported having little skill in the area. Most of the students used their computers for educational purposes and primarily for word processing.

The ability to attach files to e-mail messages was considered by the course designers to be an uncommon skill. An area on the course web site was created, outlining, with the aid of diagrams, the full procedure in anticipation of student problems in this area. Despite these instructions, a number of technical questions were presented concerning the method of attaching files to e-mail messages during the first three weeks of the course. Students also sought help from friends and family on this task. Two of the students experienced difficulties in submitting their assignments with one student having eventually to use a friend's machine. The other student used the postal system and mailed an assignment to the instructor.

Five of the six respondents used the STEM~Net service as their Internet service provider. Connection time was limited to ten hours per month so the user had to be careful in its use. The sixth student decided to access the course through a commercial Internet provider so that the ten hour time constraint would not be a worry during the duration of the course. Unfortunately the provider's access proved to be unreliable and

the technical service was slow. As the student stated:

> "Many times I could not connect. It [the trouble] was not on my side but with [the Internet provider]. When called, they would tell me that they would check on it later or the next day. One time it went on for a week." (C, final questionnaire)

Midterm Questionnaire

The second questionnaire was designed to evaluate the student impressions of the course at the midway point, approximately seven weeks into the course. It was thought by the author that after seven weeks students would have settled into the routine of the course, and that technical bugs would have been worked out of the system.

Overall Impressions

Five of the six respondents reported that they were satisfied and one reported to be very satisfied with the format of the course. All repondents would recommend this course to a friend and also consider taking another course using a similar format. These results would appear to indicate a high degree of success in the format of the course for providing an enriching and satisfying environment.

Students were asked to comment on what they considered to be the positive and negative aspects of the course to date. Time convenience and the lack of travel were quoted by a number of students as positive aspects. One student commented on how supportive the instructor and other students were concerning technical problems and

course content questions. The student stated further that this support helped negate feelings of isolation normally found in other distance education courses. One student commented that the requirement for all students to participate in the general class discussions in a formal, written manner was a positive outcome of the distance format.

One student stated that the feeling of isolation was less than that of other distance education courses previously taken by the student. The same student still felt, however, a desire for face-to-face conversations. This sentiment was echoed by two other students.

Visualization of the comments and problems posed appeared to cause problems for a number of students. Statements such as "difficult to communicate as visualization is a problem" (D, midterm questionnaire) and "difficult to explain thoughts" (G, midterm questionnaire) would seem indicate that other means of communication might provide a better medium.

While some of the students commented on the lack of isolation, one of the students commented on feeling left out. As a number of the students had attended an on-site course together during the previous semester with the same instructor, an opportunity to converse with one another, associate personalities with names and get a "feel" for the instructor had been achieved. However a particular student that had not been a member of the previous course conveyed feeling more isolated from the others. No specific indication was given within any of the e-mail messages suggesting a conscious isolation of this student by the other students.

Technical Difficulties

Students were asked to comment on technical problems encountered. The questionnaire was divided into the first week of class and the course to date. Two of the six respondents reported having technical problems during the first week of the course. Both students reported the same problem, that of not being able to connect to the web site, and both were fixed by the student with help from the author. Old versions of web browsers were replaced with new versions of the software.

Five of the six students indicated having technical difficulties at other points during the term. Three students reported trouble connecting to the Internet due to Internet provider difficulties and three students reported trouble sending attached files with e-mail documents. Five students were unable to read a document sent by the other student because of software version incompatibilities. One of the students encountered a computer virus. These problems were overcome with the help of friends and family, work mates, Memorial University of Newfoundland faculty and staff, and an Internet service provider.

Three of the students thought that they were experiencing some, if not all of these problems due to a lack of experience with the technology utilized in the course. They suggested that experience in at least e-mail and a knowledge of the Internet would be important skills to have for this type of course. Other suggested areas were in word processing and an ability to use a graphics package. As suggested by one student: "Know enough not to panic. Enough to get yourself out of trouble." (E, midterm questionnaire)

Web Design

Students also provided a critique of the design of the web site. One student found the page length too long. The student also felt that not enough guidance was given on the page showing the student what to do next. In general, however, the students found the site to be well organized, easy to read, easy to determine where you were inside the web site, had an understandable organization, contained sufficient information for the course, was easy to navigate through, quickly downloaded, and looked neat.

Course Components

Students were asked to comment on a number of different aspects of the course including:

- the course structure,
- their own use of e-mail,
- the instructor's use of e-mail, and
- the WWW links included in the web site.

In general the students indicated that the timetable feature used in the course was easy to understand and follow. All students, except one, found the required readings to be appropriate and aided in their understanding of the course content. All students found the readings to be interesting and only one student found the amount of reading to be extensive. One student felt that further readings providing a different perspective on the subject should be added.

In addition to using the listserv, students sent e-mail to the instructor as well as e-mail to each other on an individual basis. Individual messages, however, were not sent as often as messages on the listserv. Only three students indicated that they e-mailed the instructor concerning help on course content: one student indicated three times; two others e-mailed once. Two of this group of three students also indicated having e-mailed other students for help on course content: one four times; the other twice. One other student also e-mailed students concerning content once. Five students contacted the instructor for help on technical matters. One student contacted him three times, another twice and the other three students once each. Only one student contacted another student for technical help. This occurred once. Four of the five students had reason to e-mail the instructor for administrative reasons and two found it necessary to e-mail other students for the same reason.

The use of e-mails for purely personal reasons was low. Three of the six students sent personal mail to the instructor: one four times, another twice and the last once. Student interactions were rare with only three of the six recording that they used e-mail for personal purposes: one four times, another three times and the final student only once.

All of the students felt that they had adequate access to the instructor. Weekly discussion prompts were provided by the instructor and e-mailed questions were answered quickly. Only one student felt that the instructor should have had a greater level of course related activity on the listserv.

The students considered a reply to an e-mail to be prompt if it occurred within at

most 48 hours of their original posting. Four of the six students felt that 24 hours would be sufficient lag time between question and answer. Considering that the students check their e-mail at least once a day and sometimes twice a day, this means that the students check their e-mail, send a question and expect to have a response the next time they log in.

When asked to comment on the benefit of the listserv, students replied that it replaced the physical classroom, linked the individual student to the other participants and decreased the feeling of isolation. Discussions occurred as they would in a class with individual students sharing their ideas and concepts with the class as a whole. One student felt overwhelmed by the amount of e-mail that had to be read.

While the amount of e-mail may have been viewed as substantial, students were still selective about the choice of topic when e-mailing a response. The questionnaire responses indicated that availability of time was a limiting factor in the amount of e-mail generated by the students. Other professional and social responsibilities were reported as having a higher priority level than the course work. When students had time to compose a response they were selective as to what they wrote depending on what had already been said on the topic and whether they had anything further to add. Other factors reported as having influenced the student's desire to compose a message were whether they were interested in the particular thread of conversation, and whether they had other assignments in the course which needed their attention.

A number of WWW links were included in the web site as an aid in finding other

resources on the course topic. In general the students found these external links to be helpful, appropriate and interesting. They commented that a greater number of links would be desirable. Most students explored beyond the given pages. Despite a note on this web page asking students to help in the expansion of the page by providing the web address of any new and useful links that they may come across, none were received.

Final Questionnaire Results

The final questionnaire had only four respondents. There were some technical difficulties at the end of the term which prevented the students from answering the questionnaire on-line for about a week, prior to which only three students had submitted the questionnaire. The difficulties were repaired and all students were e-mailed advising them that the form was again working properly. Despite this advisory, only one more student responded.

Overall Impression

All four respondents indicated being either satisfied or very satisfied with the course overall. All respondents would recommend the course to a friend and would take another course if offered in the same or similar format. Convenience in terms of time, the ability to "attend" class when time permitted, and convenience of location were indicated as being positive aspects of the course format. One of the respondents also indicated that the writing aspect of the course required the student to be more aware of what others had

been writing in terms of examples and directions. This, in turn, required the student to be organized, sequential and coherent in thinking and deliberate in word choice (G, final questionnaire). Another student indicated that the need to use a computer for the course forced the student to become more adept in the use of the computer (E, final questionnaire).

All students indicated that, while they enjoyed the course and format of the course, they still missed the face-to-face interaction that occurs within the on-site classroom. One student indicated that because of this physical separation between the students then "Topics, concerns are not talked about spontaneously through the computer" (E, final questionnaire). Another student was concerned about the quantity and quality of e-mail being sent, stating that the length of the messages was not warranted by the low quality of what was being said (G, final questionnaire). Yet another student felt that more time was spent dealing with the requirements necessary to access and share course content than if she had actually been in class (D, final questionnaire).

Technical Problems

Two of the four respondents had technical difficulties since the midterm questionnaire. One student reported continuing problems with the commercial Internet service provider. The other student had difficulty sending the final assignment as an attachment on e-mail. The problem was solved with the help of a friend.

Course Components

None of the students indicated that they had contacted the instructor for help on either the course content or for technical help. However, two of the four contacted the instructor for administrative and personal reasons.

Two of the students contacted other students about the course content but no one contacted another student to ask for technical help. One student used e-mail to speak with another student concerning an administrative concern and one other student used it to chat to other students.

Students indicated that course workload and lack of computer access, due to both connection problems and student location problems, such as being out of town or out of the country, restricted the amount of time that they could spend in contributing to the listserv. One student felt that contributions would have been greater had the prompts given by the instructor, and the responses of the other students, been more stimulating.

Course Evaluation

Students indicated that they were satisfied with the course evaluation format as presented. No alternate forms of evaluation were suggested by any of the students.

Listserv and E-Mail Correspondence

Students had the opportunity to write to the class in general using the listserv established for this course. Data provided in Table 1 shows that the number of postings

varied considerably from week to week. The students were under no obligation to post a certain number of responses per week but part of the final mark was based on the contributions of the student to the listserv.

Throughout the semester the instructor posted weekly prompts to the listserv in an effort to help stimulate and guide discussion activity. There were two weeks when these prompts were not posted. One week technical difficulties prevented the posting and during another week the instructor was out of the country and unable to connect to the listserv. Listserv contributions on the part of the students dropped during these two weeks.

Table 1 - Number of Correspondences for the Term

Student / Week	A	B	C	D	E	F	G	H	Student Total	Instructor	Total	Instructor's percentage of total
1	1	1	1	1	1	1	1	0	7	3	10	30%
2	1	0	4	2	0	0	5	9	21	4	25	16%
3	6	1	5	7	9	18	8	16	70	6	76	8%
4	6	0	2	8	4	7	4	6	37	19	56	34%
5	1	0	1	1	1	4	2	2	12	2	14	14%
6	4	0	0	4	2	4	3	3	20	2	22	9%
7	2	0	4	0	2	6	4	0	18	3	21	14%
8	3	0	0	1	0	2	2	2	10	4	14	29%
9	1	0	0	1	0	2	2	1	7	0	7	0%
10	0	0	2	3	0	0	3	2	10	8	18	44%
11	4	0	3	3	0	0	4	6	20	1	21	5%
12	2	0	3	10	8	13	0	8	44	0	44	0%
13	2	0	3	4	2	0	0	3	14	9	23	39%
Average	3	0	2	3	2	4	3	4	22	5	27	17%

During the term, a total of 351 messages were sent to the listserv - an average of twenty seven e-mail messages per week. Twenty two of these messages were, on average, from students while five came from the instructor.

Instructor's Comments

The instructor's views on teaching strategies employed and concerns about the structure of this course form an integral part of this report. An opportunity was provided for the instructor to share his observations, concerns and suggestions for future distance education course development in this format.

Course Development

This report focuses not only on the course delivery and student reactions but also on the process and development of the course into a distance delivery format. The instructor provided some thoughts on this topic.

> Development was largely a matter of modifying assignments so that they could be done independently. I chose to make this course my first distance course because it was already close to being in a suitable form. My main concerns were around making the course accessible (which determined that we would use a listserv instead of WebForum or some other resource hog), and useful (which determined that the new assignment would involve something immediately applicable). The distance format also offered something the local course didn't have: the opportunity to relate the course immediately to school practice, and to reflect on that in the course. Because at least some students in a local course are likely to be away

> from their schools that assignment might not work so well for a local course, and an alternative would have to be offered (the Technology course I offered the previous term included an assignment which could be school based or not, depending on access).

Technical Issues

The course structure concerning the manner in which technologies were implemented was affected by the instructor's own knowledge of how to use these features. The following is a description of the level of computer and technical literacy that the instructor brought to the course.

> I am quite proficient in using computers. I have been programming since I was a child, and I use computers extensively in my work.
>
> In terms of the skills relevant to the course, prior to the course I was comfortable with using Word Perfect and Word on Windows, DOS and MacOS systems; using PINE and Eudora and Netscape for email; using FTP software under UNIX, MacOS and Windows; creating Web pages using HTML editors and text editors (although creating frames is still beyond me); converting files from format to format, and doing basic file management things on UNIX, MacOS, Windows and DOS systems. In order to deliver the course I had to become more proficient in managing a listserv list.

The instructor also experienced technical difficulties during the term the course was offered. For a period of a week the instructor was absent due to repairs being carried out on his computer. The following is the instructor's description of the technical

difficulties encountered and their implications for the course.

> Perhaps the most serious implication of using the Internet in teaching is that we become dependent on the technology to offer the course. When my computer was being repaired I dropped out of sight. Because of my teaching style this wasn't too serious, but it did mean I wasn't there to monitor the discussion. A student also had trouble and wasn't attending for a while.
>
> In a couple of ways though, maybe this isn't a big deal. In live courses we have technical problems. And the penalty for missing class in the e-mail version of 6634 was not nearly what it was for the live version.
>
> While I was in Montreal I was sitting in on a master's course being taught by Tommy Dreyfus at Concordia on using technology (much like 6639). One evening the lights went out. In this case that ended the course for the evening. Even in a course not using a computer lab the lack of lights could easily have ended the class. I have also had classes canceled due to fire alarms. Similarly I have had students not be able to come to class because of technology failures: their cars don't start, their alarm clocks don't go off. etc.
>
> When I taught 6634 live, the main part of the course was the classroom interactions. We solved problems together and discussed issues. When a student missed a day they missed 8% of the course. In the e-mail 6634 students could be off line (or even in Spain) for a week or two and be able to, when they came back, read over the discussions for the weeks they missed. While the class suffered (from the lack of input from that student) the student didn't. If the class were large enough to continue without one voice, the use of technology, even if it failed sometimes, would be an improvement.

Visualization

One of the students questioned the choice of course as a distance education course because of the great demands that the challenge of problem solving places on the interpretation and visualization skills of the learner. During the course, e-mail transactions record how students dealt with trying to compose their own perceptions and problem solving strategies into messages to share with others. Misunderstandings occurred because of the communication gap. One of the students reported having trouble in understanding and communicating ideas when using the primarily text-based medium of the listserv. The instructor of the course recognized these problems and suggested a couple of alternate methods of presentation.

> I am very good at visualizing. Many of the problems which are my favorites are number theoretical in structure but geometric in presentation (like Pins and threads, and Multifacets). This was a problem. It could be solved however, by recasting the problems into web pages with more examples and possibly even dynamic images (as I later did for Pins and threads.) This puts a technical load on the instructor however to prepare GIFs (animated or not) and Web pages. Once done, however, this would not be a big deal. Such pages could be a good resource for other courses and students in schools as well. In a way Thinking Mathematically [text for the course] was a problematic choice, as John Mason is very good at visualizing too. In fact he is the only person I can talk to about these things without having to draw pictures.
>
> When the course was taught live I could sketch things, and use manipulatives. We never set up the Palace site. I'm not sure the course needs it but some sort of interactive whiteboard, at least for one-on-one work, would be good. I think one of the Internet phone packages offers this as

> shareware. If I could have set up a voice and whiteboard interaction with individuals much of the students' frustration would have been lessened.

Timing

A number of assumptions and decisions had to be made concerning the presentation and setup of the course. Recent advances in technology allow for an implementation of both synchronous and asynchronous communication technologies to be implemented. It was decided to keep the communication process as simple as possible and to use a listserv as the basic setup.

> We went asynchronous, which has advantages but also disadvantages. Students might check on Wednesday and find nothing new to react to, and then be overwhelmed on Thursday as everyone responded at once. We might solve this by having a set time, or a set schedule for checking e-mail in the week. There are access problems but these can be worked out.

The instructor also recognized some inherent problems with the asynchronous mode of communication. These had to do primarily with the clear presentation and transmission of ideas.

> There is something which is lost in asynchronous exchanges, and in text based exchanges. It is difficult to decide what I might do in future, because of the necessity of balancing the possibilities of the technology with the demands it places on the students. Ideally we would have an integrated email/Web/whiteboard/audio/visual/chat package that everyone would be able to use easily on whatever computers and Internet connections they have. That's dreaming. Certainly some sort of whiteboard would

> be good, even if it was limited to one-on-one work with students. Also having video might be feasible, if only for one way communications from instructor to students.
>
> I think the discussion aspect survived fairly well. The problem solving aspect suffered, but because this is a course ABOUT problem solving, not IN problem solving that didn't hurt the course objectives. The main interference from the listserv was on occasions when a rapid exchange of questions and answers was needed, usually around solving a problem. For that a real time context is needed.
>
> I am planning very soon to experiment with using the Palace which allows for real time chatting, some visual interactions (through expression changes and moving in an image), a shared space which can be manipulated and a whiteboard. The equipment demands are about the same as for Netscape, so I am hoping it is something that is generally available. If this experimenting goes well then I would plan to make weekly chats a part of the course, with a corresponding decrease in the amount of e-mail traffic that would be expected. E-mail could then serve as a conduit for more finished pieces (reactions from students, etc.). Another change I'd like to make would be having the instructor's weekly prompts be web based, with diagrams and animations included. The work to create these at first would be considerable, but thereafter they would act as a resource for the larger community as well as students in the course.

Teaching Style

Despite the change in teaching environment, the instructor decided to attempt the use of a teaching style similar to that which was used in regular on-site classroom teaching.

> I tried to use my usual style of sitting back as long as discussions are progressing well. This had problems

> however. Students couldn't tell I was listening to them, and I had trouble judging when a discussion was having trouble. Requiring more regular input from all students might help, as would a more involved teaching style.

Specifically, the instructor suggested that this problem may have been related to inexperience in the distance education design and delivery of courseware.

> I have not [taught], nor have I taken a [distance education] course, and so I was learning a great deal as we went along. My delivery of the course was largely based on e-mail exchanges I have with colleagues in which we discuss issues, work on problems, and collaborate on writing in a way which is loosely like the face to face exchanges we have at conferences.
>
> Reflecting on the course I suspect one factor I ignored completely was the fact that usually I begin an exchange with my colleagues in person and then we continue by email. I have had some exchanges with people I have never met, but they tend to be impersonal, and difficult to sustain. The students in the course who knew each other and me were more comfortable I suspect than those for whom I was an unpredictable source of problem-filled emails. Students in local courses can discuss the instructor's expectations and style with more experienced students after class. As far as I know the students who hadn't taken courses with me didn't contact the more experienced students for advice.

The instructor also compared the perceived effectiveness of the course as offered in the distance mode to that offered using a conventional classroom model.

> I would say it decreased a bit. As I was doing something new, I was learning as we went along. I could certainly do things better now. When I taught the course locally, I had taught similar courses and taken similar courses many times. On-line I had to relearn some basic principles of

teaching as my previous intuitions didn't work.

> Overall effectiveness is probably too broad to be determined. The course might not have been offered on-site due to enrollment, and some student wouldn't have taken it, so one comparison would be that it was more effective than nothing. In terms of what the students learned about problem solving in mathematics education I'd say it was on par with the local course. They learned differently and different things, but as much and as well. The marks were similar, but I don't think that means anything. I suspect the students had to work harder to achieve that learning however, due to both the medium being difficult, and my own inexperience with distance teaching. One way in which the two courses did differ was the camaraderie which developed when students were together in one room, and meeting for coffee afterwards. Achieving the same social atmosphere may not be possible at all for a distance course, but real time interactions might go a long way towards helping.

Assignments

The course went through a period of inactivity on the listserv. In an effort to restart the discussions the instructor decided to ask the students to summarize the discussions to date.

> I got a lot of positive feedback on the week 8 assignments (which may have revitalized the course). It gave the students a clear task (rather than the open discussion format) and helped to collect some of the ideas floating around. One scenario would be to have students prepare reports to the class more often and these would feed further discussions.

Project Experiences: a Critical, Reflective Journal

The following journal contains details of the course development and implementation. It is an informal, personal reflection of the events and activities that occurred during the time of the project.

Initial Planning of the Project: April 1996

I suspect that I am relatively typical in my approach to the Masters of Education degree. I entered the program without a clear plan as to what I might attempt as either a thesis or project topic. However, as each course in the program played out I found that I was increasingly focusing on emerging technologies and the impact that these technologies may have on the teaching of mathematics.

I have just recently been seconded from my normal teaching role (Mathematics, Computer Applications and Physics) to work with the Instructional Development and Student Services at the Fisheries and Marine Institute of Memorial University of Newfoundland. My new role (which will officially start in September, 1996) will be to act as the Instructional Designer of a project which will take the existing Chemistry 1100 course from the first year provincial college curriculum and develop it into a distance education course. The emphasis is to utilize emerging technologies (CD-ROM, World Wide Web, Internet, conferencing technologies) to enhance the course overcoming the traditional, student-isolating format of distance education courses.

It was my initial intention that this project itself be treated as my Masters project.

However, upon meeting with my supervisor, he rightly pointed out that while the technology aspect fitted closely with my own background, the specific subject matter - chemistry - was not appropriate considering that my Masters is in the Learning and Teaching of Mathematics.

With one door having been closed, another was then opened. I was told by my supervisor that he was planning on offering one of the graduate courses in mathematics education (Education 6634 - Teaching and Learning Mathematics using Problem Solving) via distance during the Winter semester of 1997 and suggested that I help develop this course into a distance education course.

A number of meetings are planned during which time the course outline, course evaluation, implementation strategies, and roles and responsibilities will be discussed. I am looking forward to this experience. I am hoping that this project and the chemistry project will complement one another such that, in the end, both courses will be of a very high quality.

CADE Conference: May 1996

This past week I had the privilege of traveling to Moncton, New Brunswick for the annual meeting of the Canadian Association for Distance Education (CADE). I was amazed at the number of international institutions that were represented and also at the breadth and depth to which many distance education courses are being offered.

An overview of the offered workshops and presentations would be enough to

convince most people that the distance education of today is very different from the classic view of distance education as a simple correspondence course. Workshops were offered in many new technologies with presenters giving first hand accounts of how effective these technologies proved to be and what they would do to improve their implementation.

As at other conferences, there were a number of presentations running concurrently so it was important to pick and choose wisely which presentation to attend. For the most part I found myself attending those presentations which dealt more with the technical and practical side of organizing a distance education course. I also tried to focus on the subject areas of science and mathematics, hoping that the experiences of others would do much to help me clarify my own role and responsibilities in the upcoming months.

Several of the presentations at the conference dealt with the use of the World Wide Web as a medium for the presentation of course material. I found myself being more than a bit skeptical when several presenters showed off their own course materials as they were being presented on the web. My skepticism was based on the fact that what the presenters had done was nothing more than "publish" their course notes on the web. They had missed the power of the web to access other related sites, use hypertext to present material in a non-linear format allowing for the student to synthesize their own relational links, and to present material in a format that might be two-way, dynamic and interactive as opposed to one-way, static and stagnant. I hope that when it s my turn to

design web sites for various courses, that I keep these particular thoughts in mind.

What I saw in more than a few instances were people who saw the emerging technology as being the pedagogical solution. Unfortunately, the change in medium did not change the presentation of the message. What was initially stagnant remained stagnant.

6634 Course Development: May 1996

I have had a couple of meetings now with my supervisor dealing with the course content and how the presentation of the content might be altered due to the change in course format. Having completed the course in the Fall semester, I found myself wondering how it would be possible to include many of the concrete illustrations and examples that were so much a part of the learning process of the course at that time. It quickly became apparent that a method of student interaction would be required. It was decided that a listserv would be useful for providing students with an opportunity to interact and discuss the weeks' topics.

While a listserv provides for asynchronous discussions, it does not have the same "flavor" as a true synchronous discussion. For this aspect a piece of software called The Palace was suggested.

A web site was also discussed, not so much for providing course content, but rather for the providing of relevant dates, answers to possible technical questions, links to relevant external sites, and providing a short biography of each of the students. The

biography is intended to provide a greater sense of class membership. Discussions would not be occurring with a nonentity but rather with someone with interests and experiences common to other members of the class.

In thinking about the initial design of the web site I try to recall some of the things that have impressed me by certain web sites and what I have disliked about others. I will try to learn from other people's mistakes.

Peer Evaluation of the Web Site: October, 1996

During this Fall semester I am taking the final course of my Masters program. It is a course in the application of technology in the teaching and learning of mathematics. It is focusing on a number of emerging technologies including the world wide web. One of our assignments includes the finding and evaluation of various web sites related to mathematics.

I decided that my classmates would be a good group of students to give feedback on the web site that I have designed for the project course. I have used frames in my design and am nervous about their effectiveness. Personally, I think that frames help in the organization of the page, allowing the user to have constant access to the table of contents and able to switch between topics with little difficulty. I have been warned that there are some technical issues that may crop up unexpectedly, for example, incorrect programming may cause the "back key" on the web browser to jump to an unexpected site. I have tried to anticipate these problems and hope that I have designed the page so

that such problems will not occur.

The result of this informal survey is general approval. They think that the site is well designed, easy to use and even think the frames are a good idea. Hopefully the students in the project course will feel the same.

Pre-course Logistics: November, 1996

The time for the first offering of this course is quickly drawing near and I am starting to become somewhat anxious about the whole affair. Questions such as: "Will anybody register for this course?" arise. It is also a time to start sending off letters to possible registrants explaining the course, the format, and what computer skills and computer accessibility might be required for a student to take this course.

These questions make me think about the polarizing of society into the technologically rich and poor. I am wondering if perhaps we are increasing the difference between these two groups through the promotion of this course in this format. Are we excluding any possible registrants from their taking of this course by such technological requirements? Since all graduate students have access to e-mail and the world wide web through STEM~Net then this is not the case for this course. However it may certainly be an issue for other courses in this and other institutions.

I have been given copies of the required reading materials for the course which I am to copy and send out to any student that is later in registering and who won't have an opportunity to receive the material from the course instructor. The fact that the instructor

will himself be removed from the site will be an added complication since all these logistical arrangements must be made prior to his departure.

It has been agreed that I will act as a technical support person should any problems of that nature arise. Hopefully there will be a small number of a rather banal nature.

Week 1

I have had several e-mails from students asking for copies of the course readings. In each case I have had to ask for the mailing address of the student. Some are located in St. John's while others are in central Newfoundland and also in Labrador. I am pleased with the response and location of the students. It would appear to me that the course is making a significant impact already since it is obvious that at least one of the students would not be able to do the course if it was offered in the conventional format. Other students would have a dangerous weekly commute.

It would appear that some of the students are unable to connect to the World Wide Web site. I am checking this out now since there is information contained therein which would be useful for the students to follow. This is a strange thing since it appears that they are able to connect to other sites on the web.

I am updating the biography page of the web site with the short introductions that the students are providing as their first mail to the listserv. This provides them with the opportunity to make sure that their e-mail is working correctly and some experience in its

use. It also quickly introduces the students to one another. I wish there was a way to have some sort of visual identity with each student. Perhaps a small mug-shot of each student would not be a bad idea. These could be quickly scanned into a computer, saved in either GIF or JPEG format, and added to the biography web page.

Week 2

More students have e-mailed me to say that they are unable to connect to the 6634 site. I have checked with other technically minded people and it would appear that these students don't have the latest version of their web browser. Perhaps this should have been stated explicitly in the letter to the students. Apparently the older versions of the various browsers are unable to support the frames that have been built into this site.

My solution has been to point out to the student what the problem is, that they should update their browser software, and give them some brief instructions as to how to find the latest version of the software and how to install it on their machine. So far I have heard back from a few of the students who state that when they have done this and tried to connect, they see the site without difficulty. No other technical complaints so far.

There has been a complaint from the students that received their course readings from myself, that they are missing a couple of pages. I have checked the original copies given to me by the instructor and notice that these too are missing the same pages - hence the problem. I mention this since I think it illustrates the need for careful planning. In this case the particular pages were of no apparent consequence and so the students will do

without them.

I have set up the first of the three questionnaires. The first one deals primarily with an assessment of the student's background in terms of education and computer experience, some logistical questions and also a quick summary of why they took this course. The form is an interactive web page form that I have modified, with permission, from a form used by Dr. Michael Collins in his Biology course offered over the web. While the level of student in the two courses may be quite different (undergraduate versus graduate) the type of questions that need to be asked remain the same, at least for an initial investigation into the effectiveness of this type of medium. It might be an idea to compare results with the Biology course once this project is complete.

Week 3

The course instructor has solved the frames problem in a way that should have been obvious to me from the start. My solution involved changing the student's configuration to suit the present technology. Now that I reflect on this approach I am rather sheepish about my input in this area. The solution given by the instructor was to build a new front page for the web site that does not include frames but offers the opportunity to use frames if one's browser is able. Such a solution provides a greater flexibility to the student. It removes the student one step further from the technology.

I have always been an advocate of using technology where appropriate. However, it should not hinder instruction but rather be transparent to the user and help in the

transmission of the material. I must admit that I did not meet these criteria in either my initial production of the web site or the provision of an appropriate solution.

My solution required that the student take the onus of meeting the demands of the technology. They must now deal with a whole new skill set. They must be capable of changing the configuration of their computer or find someone that can do it for them. This is not the point of this course and such a requirement only added a greater level of stress to the students.

The instructor's solution required that the technology adjust to the student. This is a much more student-friendly scenario and one which I shall endeavor to follow in the future.

Week 4

All of the technical queries seem to be answered. The e-mails to myself have dropped off to nothing and no further complaints seem to have arisen. From the number of submissions to the listserv it would appear that most of the students are fully immersing themselves into the course and seem to have little difficulty in accessing any of the information given either online or as part of the course materials.

I am finding it interesting to note how the discussions online have been going. Having done the same course during the previous year on site, I realize that the bulk of the learning within this course goes on during the discussion of the assigned course problems. The discussions helped each of the students in my particular class evaluate

how problem solving actually works for each of us and, in so doing, helped illuminate how the process of problem solving might be integrated within the mathematics curriculum both as a method to enhance the understanding of other course materials and also as a topic unto itself.

The advantage of a discussion on site is that in trying to describe the concepts and processes followed in the attainment of a particular solution, one is able to draw upon more than simple words for the conversation. Facial expressions, vocal tones, concrete objects and diagrams may be used to help illustrate a point quickly and accurately. The online discussions are perhaps a double-edged sword in this regard. The students must try and describe accurately to each of the other students their own mental process. This requires a very carefully worded electronic transmission to avoid confusion and misunderstandings. While this may be difficult to avoid, I believe it may actually enhance the reflective aspect of the course. Just a thought.

Week 5

I have finally received the last of the letters of consent from each of the students in the course to use the questionnaire results and their comments in this project report. It has taken quite a bit longer than I anticipated. I suspect that the students simply placed the letter on a table and left it there until they got sick of looking at it. Looking back now I wonder if perhaps a more efficient means to collect their approval might have been to have the letter online with the student submitting their approval in this manner.

The advantage of an online form would be the instantaneous receipt of the answer (at least instantaneous from the time of submission). Perhaps a point for other courses to consider. Another advantage is the amount of time required to submit the form. A traditional 'snail-mail' postage would require the student to fill out the form and then physically post the letter. In the online version the letter is sent from the computer so the inconvenience of finding a post box does not exist.

Perhaps a small point but I think it illustrates the busy lives of those people involved in this course. Lives have become so cluttered with other family, job and social responsibilities that a new addition - no matter how trivial - becomes difficult to fit in. Response time would depend upon the individuals personal set of priorities. If this particular set of students is similar to myself, then these extra school responsibilities take a backseat to other commitments and remain low on the priority totem pole.

Week 6

I am in the process of looking at the overview questionnaire of the students involved in this class. I know most of the students and so something of their own background. I am able to put a face to almost all of their names. I find it interesting how a face, with associated personality, helps make conversation and the understanding of a viewpoint so much easier. I anticipate that this will be one of the comments at the end of the course - the lack of a physical identity to place with the e-mail caricature that will have been developed in the mind's eye.

I happened to hear on one of the Canadian Broadcasting Corporation radio broadcasts recently a description of the Masters of Business Education program from one of the universities in Ontario (Queens University I believe). The entire program is delivered via distance. One of the more advanced technologies was the three-way video link with each student being able to see the instructor and other students. This would certainly take care of the lack of a visual contact between class members. The comments made by the students involved in the program were all very positive. Students were "attending" class from as far away as Whitehorse. One of the major drawbacks was the incredibly high cost of the course for the student.

While such technologies may allow for the lowering of physical barriers, the sheer cost of the course - high due to the need for cost recovery on the technologies in place - would present an economic barrier which may not be as easy for some students to overcome. Yet another example of the polarizing of society along the haves and have-nots.

Week 7

The discussion seems to be waning somewhat these past two weeks. In fact one of the students even commented as to whether or not anyone was still out there. Perhaps this is somewhat symptomatic of a class whose lives continue on in spite of the fact that they are taking this course. Work, family and personal commitments sometimes take priority over school. This might be one of the reasons for the slump. The instructor also

did not post topics for discussion for this particular week. For a graduate class this should not be a major reason to stop learning from one another. However, I am sure there was some slowing of the conversational threads because of this.

Perhaps this illustrates the necessity of an instructor in the running of a distance education course. I am reminded of the reason that so many administrators are looking so longingly at distance education as a means of increasing students numbers while decreasing costs. I am not a proponent of such a theory. Apart from the cost of course development, the need to keep student teacher ratios at a minimum is a pedagogical imperative. Hoping to effectively educate thousands of students using a single instructor may be an economic salvation, but may also be a pedagogical disaster.

Week 8

This week's discussion continued a thread of paralleling musical ability and that of mathematical ability. The fact that such an offshoot of a discussion should occur is a reassuring feature of this discussion group in my opinion. The building of these cross-generative relationships is indicative of the type of thinking that is possible to generate even in a distance format. Particularly within a graduate level class it must be expected that the level of discussion would rise above the trivial and obvious. While such a discussion may very well rise on its own, the instructor may provide the catalyst to get it moving in a somewhat directed focus.

Week 9

Very few contributions to the discussion this week. In fact I was wondering if there may not be some technical problems which might be at the root of this problem. I have not received any calls of distress so perhaps it is simply a slow week on the mental end of things. Well, I find that this week is also a slow week for myself. Not much in the way of things to note or discuss. My only comment would be that there is very little in the way of content for this week's discussion. This is in stark contrast to the comments made concerning last week's discussion. Then again, even in a face to face class not all classes are outstanding. There are high points and low points. Perhaps this is simply a low point in the term for the students. I wonder if there has been a study done on when these various highs and lows occur? Are they usually at the beginning, end or middle of the term? How would this class compare to any other classes utilizing the same types of technology?

Week 10

The term is winding down and I find that I really have not much more to add in terms of critical or reflective observations. Perhaps now might be a good time to try and summarize this experience for myself.

I must admit that I began this exercise with a feeling of trepidation. Technically, I knew that the setting up of the Web site would not pose a large problem. As it turned out however, while the technical side went fine (at least for the site) the design aspect was

somewhat lacking. I fell into the technology trap of building on the latest innovation without ensuring that earlier technologies would also be accommodated. This is a fact that I hope I never forget.

My solution to the problems the students were having with the website was to modify the student's computer configuration instead of modifying the site. Once again this, I feel, was inadequate for the student. It required a knowledge base that was not necessarily in place and that should not have been required. The optimal solution would be to modify the site so that the student would not have to modify the configuration of their computer at all. The best technology to use might be the technology that is invisible to the user.

I have promptly answered any technical questions that were presented to me. This I did in an effort to keep the students from feeling isolated and bereft of any help. Whether or not I was successful would be the students' decision.

My observations of the online discussions that took place indicate that a relatively high level of thinking was taking place throughout the term. The mode of discussion required that the student ruminate on the concepts presented in order to clearly and succinctly present any personal views. They were forced to describe in detail their own mental processes in solving problems - an exercise that may help them understand the problem solving process to a greater degree.

Overall I think that the course went reasonably well - perhaps in spite of any effort on my part. I am reminded of a saying that the good students in a class will learn despite

the best efforts of the teacher. Perhaps a negative view of the teaching establishment, but a saying nonetheless.

I hope that this exercise will be of benefit to any future distance course developments.

CHAPTER 5

DISCUSSION OF QUESTIONNAIRE AND LISTSERV RESULTS

Discussion of Questionnaire Results

Student Profile

Questionnaire responses indicated that students ranged in age from 25 to 40. Only one of the students was not officially registered in a masters of education program. From this data it may be assumed that the students are at the beginning or middle of their professional careers.

There was only one male participant in the class of seven students. It is an interesting observation that, in a field in which women have characteristically been fewer in number, significantly more women were enrolled in this class than men.

The need for a greater amount of communication between faculty and administration may be indicated by the answers given by students as to whether or not they realized the course would be offered in this format. While a description of the course indicating the format was sent to all possible graduate students, one student registered without realizing either the format or the technical expertise required by the course. This was due to the fact that the student was not a registered graduate student and so the student's name was not on the mailing list.

Four of the seven students had taken a course the previous semester from the same instructor and had found out about the course and new format from him. This

familiarization may have been one of the factors in the breakdown of communication. It was mistakenly assumed that the appropriate information had been transmitted to everybody by word of mouth since the graduate community here at Memorial University of Newfoundland is a relatively small community, or by the sending out of the initial letter of introduction to prospective students (see appendix A).

Distance Education Background

Four of the six questionnaire respondents had done at least one distance education course prior to this one. Students' prior experiences and successes with the difficulties associated with the use of technology and its use in a distance education format may have softened the impact of this particular format for these students. Three of these four students reported having used e-mail in other distance education courses.

Students had differing attitudes towards the course format. Those students expressing enthusiasm for the format also had greater difficulties in commuting throughout the Newfoundland Winter. Others found the format beneficial due to work and personal commitments. The time and location convenience appealed to most because of these factors. Those students expressing ambivalence towards the format stated that they would have taken the course whether it was offered via distance or in the traditional format. The need for appropriate course credits and a lack of other appropriate course selections would appear to cause these students to feel they must take whatever course is offered in their field, no matter what the course format happened to be.

At the beginning of the term it was questioned whether any potential students had been discouraged from taking this course because of the format. In checking with the Registrar's office it was found that all graduate students that required this particular course had registered for it. It would appear that the change in format was not great enough to discourage students from taking the course.

Student Skill Set

Students indicated a range of computer experience, from expertise in all listed areas to a little experience with e-mail and word processing. Students having limited computer skills may have experienced a sense of nervousness since this course uses the computer as its primary vehicle of communication. However, since the choice of course format was external to the student, success in the course for these less experienced students may have instilled a positive attribute towards this type of course. Those students with more experience with computers may have been more self-assured having fewer concerns about the format of the course.

In the second questionnaire, students were asked to indicate what they felt would be the most important computer skills to have before taking a course in this format. Proficiency in the use of e-mail including how to attach files, knowledge of web browsers and word processing were all indicated as areas in which a prior knowledge would be an asset. These were also the areas that students indicated as having some technical difficulties during the term. Technical difficulties with e-mailing assignments, old

browsers, and incompatible word processor files all occurred in the first half of the course.

For the instructor, technical issues such as the format of submitted assignments might have been an issue if the word processing package used was not one of the more common packages. Compatibility between the instructor's and students' computer and operating system are technical issues that should be addressed before the start of the course. If conversion packages need to be installed then the instructor's skill set should also include proficiency in the use of these packages.

Connectivity Questions

Connectivity questions are important for the user of Internet services. While most students used the STEM~Net service provided to teachers in Newfoundland and Labrador, there is some question as to whether this service will be available for much longer. In future students may be required to purchase their own connections through Internet service providers. One of the students decided to use a private Internet service provider instead of the STEM~Net service. Reasons stated for the change in Internet providers included the limited number of hours allowed on STEM~Net. The student felt that the allocated time would not be sufficient. Unfortunately the student experienced a number of interruptions in service and did not find satisfaction in the technical help provided by the company. Such interruptions in service can prove to be frustrating for the student. While they may not miss out on the entire listserv conversation since the

messages continue to reside in their mailbox, they are forced to wade through a backlog of messages and try to follow the thread of the conversation once they become re-connected.

Student Satisfaction

The questionnaires were spread out over the term to give an indication of any change in student perception, enjoyment, or degree of satisfaction of the course. Both the second and third questionnaires asked the student whether they were satisfied with the course and whether or not they would take another course in the same format or recommend the course to a friend. In the second questionnaire five of the six respondents stated that they were either satisfied or very satisfied with the course, would recommend the course to a friend and would consider taking another course given in the same format. The sixth student gave a satisfied response concerning the course and would consider taking another in the future but failed to give any response to the recommendation to a friend question. The four respondents to the third questionnaire all stated that they were either satisfied or very satisfied with the course and would both recommend the course to a friend and consider taking another course given in the same format.

Web Design

The second questionnaire results also indicated that the students were very satisfied with the design of the web pages; despite the fact that the initial design

containing the frames format was not compatible with some of their browsers. Only one person indicated that the pages themselves were too long and that the navigation through the pages was not obvious. The fact that the frames aspect of the web design caused so much confusion and needless panic for students that were already in an unfamiliar situation is enough to make their use in the future questionable for the author. The frustration caused by this circumstance may have caused students to doubt their own abilities, particularly since the problem persisted for over a week before being resolved. Having little or no prior knowledge base upon which to build, the students were forced to wait in this state until a solution was found. During this time concern about their future success in this course and a negative perception on the use of technology within the area of distance education may have developed.

Visual Contact

The second questionnaire gives the first indication that face-to-face contact was missed by the students in this course despite the technologies in place. It had been hoped that the use of the listserv and e-mail would be sufficient to overcome this desire. However, students indicated that they were missing visual contact. In particular students desired a face-to-face talk with the instructor concerning the assignment content. Such comments would seem to indicate that the ability to communicate at any time and receive a personal reply to the comment using e-mail is still not an optimum mode of communication for some students.

Another student wondered if there was as much one-on-one communication in this mode as there might have been in a face-to-face classroom setting. The comment itself would seem to indicate that this particular student was finding that this was indeed the case and that this aspect of the classroom setting is valued as an important part of the collegial experience. Despite the ability of the students to interact on a more personal level through the use of e-mail, this medium was rarely used for this purpose.

Visualization Problems

Visualization of the presented exercises was a problem for most students. Trying to indicate how various solutions were achieved proved to be difficult for some. As mentioned previously, however, the exercise of trying to put into words what had originally been fleeting thoughts, might have been one of the benefits of this course format. The instructor's comments show that the instructor recognized this difficulty and has made some suggestions as to how this might be overcome in any subsequent offerings of this course.

The visualization problem led one student to question the rationale for choosing this course for delivery in this format. This highlights the need for a considered selection process in deciding which courses are to be offered in a distance format and also in the choice of instructional methodologies and technologies.

Course Components

Students generally gave a positive reaction to the various course components. The course readings had one person indicate that they were of no help in understanding the course content , another felt that the readings were too long while a third felt that more readings from a different standpoint would be helpful. Despite the group's small size various student perspectives are represented: those that want more work; those that want less, desiring only the minimum amount of work to pass the course; and the majority that do what is required, deriving what they can from the course. A range of motivations would appear to be expressed in these student types: those that are motivated to become mastery students, those for whom the amount of work did not fill their appetite for the subject, versus the performance oriented students motivated by the mark at the end of the term.

The use of e-mail to communicate on an individual basis was not used as much as the author had originally anticipated. The trend indicated that if a student used this mode of communication, then they did so extensively. If they were not so inclined, then they did so reservedly. This is much the same as in a regular classroom setting in which there are those students that tend to hang around at the end of the class to chat and ask questions of each other and the instructor, while there are others that leave, for numerous reasons, as soon as the class is over. The mimicking of this particular on site group dynamic was an interesting side effect of this technology.

Despite the earlier indication of a desire for face-to-face communication, all

students indicated that the level of interaction with and their access to the instructor was sufficient. Perhaps this is an indication that, at least at the graduate level, face-to-face communication, while desirable, is not a necessary component of a distance education course. The instructor appeared to have met the needs of the students despite the physical distance separating them. It would appear that prompt replies to e-mail messages help to minimize the degree of isolation that surrounds the student in a distance education class. The degree of promptness is an individual factor that varied from 12 hours to two days depending on the person. When dealing with an asynchronous form of communication, it would appear that the best rule to follow would be to reply to e-mail messages at the first opportunity. If time is required to formulate an answer, to check facts, find sources, then a quick note to the concerned party indicating that their question is being considered might help to reduce the sense of isolation. This may also have the dual effect of allaying their fears that their message was not received, and also of imbuing a sense of personal academic worth to the student. Most students checked and sent off their e-mail at least once a day, some twice a day. Questionnaire results would seem to indicate that most students expect to receive a reply to their queries by the time of their next login.

Generally a discussion oriented course, students were asked to perform four basic tasks in trying to understand the role of problem solving in mathematics education. The instructor had the students first solve problems, a process that was to continue throughout the remainder of the course. Next, the students were asked to reflect on the process they followed in solving these problems. Thirdly, having revisited what the

problem solving process consists of, students were asked to create and implement a problem solving unit. Finally, the unit was to be examined in terms of how effective it was in the classroom. Each of these four exercises involves the student in an active learning situation. The first two assignments find the student involved in active doing, then active reflection on a personal level. The second two assignments mimic the first but on a more general and personally relevant scale.

The second set of assignments placed the student in a contextually relevant situation. Students were not discussing theories without application but rather were applying theories and reflecting on their effectiveness in their own teaching practices. This personalizing of the course materials appeared to have made the course more intrinsically motivating.

Course Evaluation

One of the aspects of the course that was of a particular concern to the developers was the course evaluation. When the course was presented in a classroom setting the course evaluation included a presentation to the class. This aspect of the course evaluation was found to be difficult to incorporate into the new distance format. Eventually it was decided that three assignments and listserv contributions would be used as the evaluation tools for the course. Questionnaire responses indicate that the students were satisfied with this format, offering no alternate form of evaluation.

A collaborative effort was made possible by the instructor in the students'

summarizing of listserv discussions. Students were encouraged to work together on this short assignment. The collaborative format was found to be an effective method and echoes the results of Yakimovicz and Murphy (1995), Watabe, Hamalainen and Whinston (1995), and Berge and Collins (1995).

The level of student contribution to the listserv varied considerably throughout the term. Students gave time as the basic reason for their amount of contribution. Time was required to read prompts and other student postings, as well as construct and type a reply. Adding this amount to the regular priorities of work and family can be demanding. As such, students found themselves replying to what interested them and only then if what they were going to say had not already been stated by another student. The emphasis on quality versus quantity was not a bad thing. Verbose e-mailings tended to fall flat as they lacked the natural tonal, facial and body inflection found in an animated face-to-face conversation.

Listserv Discussion

E-mail Correspondence

During the Winter semester, part time graduate students that are also teaching in the regular school system must divide their time between their own course work and the added pressure of giving and marking school exams during the last part of January. Full time students will, by the same time period, be faced with assignments for their various courses. These two factors may account for the dramatic drop in postings between weeks

three and five. Week eleven marked the start of the Easter break during which more time may have been set aside for contributions to the listserv. It was also near the end of term. Since part of the final grade was to be based on listserv contributions, part of the renewed activity may have been due to this fact.

The value of 17% as an average share of the listserv time is a reflection of the teaching style employed by the instructor which is described in his own reflections of the course as being student-centered. Armstrong (1996) suggested that the facilitator approach may provide the most effective teaching mode for the distance education instructor.

Teaching Format

The instructor suggested that the "sit-back-and-let-the-discussion-happen" approach may not be as effective in this type of environment. The students have no immediate feedback in the form of a nod, eye contact or other body language to let them know that their input has been acknowledged and is appreciated. As suggested by the instructor, a more moderated approach may induce a more consistent number of contributions.

Size of Contribution

Apart from the number of contributions, both the size of contribution and the quality of contribution are important characteristics. The size of the contribution might

be seen as an indicator of the amount of time required by the student to compose, type, and send the mailing. It may also be an indication of the amount of time required to read the weekly assortment of mailings on the listserv. The time factor has important implications for the number of students that may be accommodated per class. This course had seven students participating through the semester. Even with this small number the amount of e-mail traffic was considerable. The quality of correspondence gives an indication of how effective the course format is in meeting its stated objectives. It also indicated the level of thinking exercised by the student. With a chance for reflection, students had the opportunity to incorporate their ideas into other knowledge base structures.

Table 2 - On Line Time Investment Required

		A	B	C	D	E	F	G	H	Instructor
1	Size of messages with quotes (number of words)	5394	649	5015	4742	4889	6809	3910	13286	15519
2	Number of words less quotes	5056	649	3993	3983	4445	6093	3910	10565	14493
3	Time, in minutes, to compose and type (20 words per minute)	253	32	200	199	222	305	196	528	725
4	Time, in minutes, to read all received messages less quotes (300 words per minute)	160	N/A	164	164	162	157	164	142	129
5	Number of Messages	33	2	28	45	29	57	38	58	61
6	Average length of message	153	325	143	89	153	107	103	182	238
7	Total Online Time Investment in Minutes (Time to read + Time to write)	413	N/A	364	363	385	462	360	670	854
8	Hours spent dialoging on the listserv	6.9	N/A	6.1	6.1	6.4	7.7	6.0	11.2	14.2

Table 2 provides data describing the e-mail activity of each student. E-mail allowed a student to quote what another student had written if he or she wished to make a comment on the message. This promoted continuity of the discussion within the asynchronous setting. Since a previous message had most likely been read, then the amount of time required to glance at the quoted portion of the message and recall its meaning was assumed to be negligible. For this reason the quotations have been left out of the time calculations within the table.

The first row of the table gives the total number of words within each of the student's and the instructor's messages for the term. The value includes only messages sent to the listserv. Individual e-mail messages to other students or to the instructor are not included. The second row indicates the total number of words in the messages sent per student and instructor minus the amount of quotations included in the message.

From this information it is possible to extrapolate the amount of time the students and instructor spent in using the listserv during the term. The amount of time is dependent upon a person's reading and typing speed. Exact values for these variables are unknown for both the students and the instructor. However, by assuming two values it is possible to get an indication of the amount of time spent in using the listserv during the term. The values assumed were a typing speed of 20 words per minute and a reading speed of 300 words per minute. Since student B dropped the course then time spent by this student on the listserv were not calculated. The 2 messages sent by this student were included in the overall calculations.

Values in the third row were calculated by taking the number of words sent by the student, less quotes, and dividing this value by the assumed value of 20 words per minute. The assumed value was chosen deliberately low to allow for time composing the messages. However, the value may have been significantly higher had the student spent time composing responses and messages before going online.

Values in the fourth row were calculated for each student and the instructor by finding the sum of the number of words, less quotes, for all but the individual in question. The individual student was left out of this equation. It was assumed that since the student composed these messages then he or she would not then read them once they were posted. This sum was then divided by the assumed reading speed of 300 words per minute. For example, when finding the value for student A, all values from row two were added except the value for student A. The resultant was then divided by the assumed value of 300 words per minute.

Rows seven and eight, the total online time for the listserv, was calculated by adding the values from rows three and four then dividing by 60 to get a value in hours. The calculated values, based on assumed values of a typing speed of 20 words per minute and a reading speed of 300 words per minute, gave a range of values from a low of 6.0 to a high of 11.2 hours for the students with the instructor investing 14.2 hours.

A significant value in this table is the average length of the e-mail message. Most of the students fell within the 100 - 200 word range per message. This corresponds to the size of a paragraph. Scanning through the semester's messages reveals that this is indeed

the case. Most students treated each e-mail as a single comment on a particular topic.

Message length is also an indication of the time and effort that the student put forth in the composition of e-mail messages. Students were reacting to previous lines of thought and generating new threads of conversation. The content of the messages gave evidence of the involvement of higher order thinking skills. Student interactions became activities of constructing shared meaning of the material echoing the results of Berge & Collins (1995).

Student Time Investment

This particular distance education course was a two credit course. This means that, in an on-site setting, students meet for a total of two hours per week for the full thirteen week term for a total of twenty six hours. As may be seen in Table 2, the time required of this student in reading and composing messages on the listserv ranged from a low of 6.0 hours to a high of 11.2 hours. This includes the time required to compose and send material as well as read other students' contributions. The necessity of on-line participation forced each student to be active in this learning environment. Looking at the time required to type and compose messages, the equivalent of discussing and making a class presentation, it may be seen that students contributed over thirty seven hours of work in a course which on site would have taken place in a twenty six hour timespan.

Students developed the direction and pace of the class discussions based initially on the prompts presented by the instructor, but took more of a lead role as the term

progressed. The instructor's contributions to the listserv were greater in number and longer in composition when compared to the students' compositions. However, the instructor did not overshadow the discussion setting, choosing instead to provide initial discussion prompts to guide the students and to summarize the students' discussions at the end of each week. Students were encouraged to pursue alternate lines of discussion, e.g. on the relationship between music and mathematics, and the role of assumptions. Students were allowed to develop the focus and direction of the specific topics while the instructor guided them in the direction of the overall course topic.

Class Size

Class size is a determining factor in the amount of time that might be required to keep up with the listserv correspondence. This class had seven students that completed the course plus the instructor. Correspondingly, the amount of e-mail was not exhausting, although one student mentioned that keeping up with even this amount of material was a difficult task. Extrapolating the amount of time that might be required for managing larger class sizes, it may be readily seen that, even with moderately sized classes of 20 to 30 students, the time may triple or even quadruple. Administrators seeking an economic windfall through the packing of distance education classes with hundreds, even thousands, of students should be aware of this incredible workload on both the faculty member and the students. It would be impossible for either the student or the instructor to keep abreast of the amount of e-mail generated by such numbers.

Summary

In general it would appear that the students enjoyed participating in this course and found the format to be an effective means of presenting and discussing the course materials. Some students expressed having difficulty in visualizing some of the presented problems and solutions. Students also had difficulty in describing their solutions to the rest of the class in a purely textual fashion. The instructor recognized these difficulties and has suggested that future offerings of this course in this format also include the use of an electronic whiteboard or some other graphically intense medium.

The curriculum resources provided by the instructor were viewed positively by the students. They rated the web based materials as well-designed and user-friendly. This was only qualified by an indication of initial problems encountered due to the use of frames and the older versions of the web browsers used by some students. The course readings were described as sufficient and appropriate for the course matter. The amount of required reading was not overly burdensome for the students.

The amount of listserv and e-mail traffic generated by the students and instructor was heavy, but reported as manageable for most of the students. One student stated that it was difficult to keep up with the amount. It follows that keeping abreast of the various discussions and addressing the topical issues may prove to be problematic for both the instructor and students involved in larger classes. The amount of time invested in this course format proved to be comparable to, if not greater than, the amount of time a student would invest in a face-to-face classroom setting.

CHAPTER 6

RECOMMENDATIONS AND CONCLUSION

Recommendations

This project has provided an opportunity to reflect upon and monitor various aspects of the implementation of a distance education course. The course delivery was based on the use of a listserv, e-mail facilities as well as print materials mailed to the students. The choice of these media was influenced by the stated course objectives, the desired teaching strategy, and the technology available to the student and instructor. All involved reported having enjoyed the course and felt that it had met the stated objectives.

It would be convenient to pull a prescriptive list of procedures from this project which other instructors and course designers might follow in the hope of achieving similar success. This, however, would be neither practical nor pedagogically sound. The rate of technological change and the variables associated with a specific combination of students, instructor, course content and delivery model make the provision of such a list an impracticality. However, there are a number of general questions which have been generated from this project which might be considered when setting up a course for distance delivery when using this technology set.

- Who will be teaching this course and would a change in instructor require a change in the course setup or choice of computer technology?
- Who will be offering technical assistance to the students while they are registered for this course?
- Who will pay for the technical assistance?
- What technology will be utilized in the implementation of the course?
- What, if any, changes to the course presentation and evaluation must be made in order to implement the course in a workable distance format?
- Why was this particular course chosen for distance delivery?
- What might be the characteristics of a typical student enrolled in the course?
- How many students will be enrolled in the course?
- How will students be informed of the course format and of any technical requirements before the start of the course?
- Where will students be able to access any online materials?
- When will students meet in the virtual classroom for synchronous discussion of course content?
- When will the student set aside a specific time to concentrate on the course content and activities?
- What means of courseware evaluation may be implemented?

Choice of instructor may influence course setup and choice of media.

Each instructor has their own unique style affecting the manner in which a course is presented. This affects the type of technology chosen. Topic discussions and group problem solving activities provided personal insights into the problem solving process and how it might be incorporated into the mathematics classroom. Consequently it was decided that any technology chosen for distance delivery of this course should provide the capability to continue with this particular methodology.

It is not clear whether all course instructors can be equally proficient in the use of emerging media. For the developer of distance courseware the level of instructor computer proficiency is an important factor since it may pre-determine what media are implemented and subsequently affect how the course is structured.

Technical assistance must be made available for students.

The need for technical assistance was made apparent in the delivery of web courses as technical difficulties in both hardware and software may arise. Students should not have to deal with these problems in isolation. It was found in this instance that students can rely on the technical expertise of the course instructor. However, this may not always be the case since the technical ability of each instructor will vary considerably. Although friends, relatives and work mates were also sources of technical advice, an apparent and dedicated technical service system was viewed as a refinement.

Specifically, public relation skills, communication skills, patience and technical expertise in hardware and software may need to be reviewed as characteristic components of such a service.

Responsibility for payment for technical assistance must be pre-determined.

Putting a help service in place may incur extra course delivery costs. These costs may become significant if an institution decides to offer a number of courses via distance. A number of options may be considered to pay for these costs.

- A flat fee may be incorporated into the course fee. All students would contribute in this manner to the provision of technical assistance.
- A user-pay number might be established. In this way only those students that use the system become responsible for the continuation of the service.
- The institution may consider establishing a toll free phone line providing access to the system.
- A separate newsgroup or listserv may be established for handling technical questions.

Choices must be made in terms of specific media to be used for course delivery.

Primary concern generally lies with the course content, course objectives and the various teaching strategies that will be employed by the instructor in meeting these

objectives. Such course specific properties tend to be the impetus in deciding which technologies will be implemented. In this course the instructor decided upon a discussion based learning environment. This led to the decision to use a listserv as the delivery vehicle while other aspects of the course, for example course outline and timeline, would be placed on WWW pages. It should not be perceived that the structure of the course must remain static. As the course develops and the instructor reflects on the positive and negative aspects of the course delivery, other media may be recognized as being more appropriate. For example, in this course the instructor suggested that in the next delivery of the course the use of an interactive white board, as well as the use of graphics or animations might prove to be useful in helping students visualize specific problems.

The technological capabilities of the instructor must also be taken into account. In this course the instructor was literate in many different areas of computer use. Implementing the listserv and WWW site was not a concern. The instructor was not required to learn a new skill set prior to the start of the course.

Student ability to use or quickly learn how to use the associated technology and the student's access to the technology must also be considered. Certain assumptions must be made in this area. Within this particular course students were made aware of the computer skills that would be required for participation in this course through the use of a letter sent out to prospective students before the start of the semester. It might be worth investigating whether the course format discriminates against those students that do not

have the technical background to participate in this course.

Assumptions were made concerning student access to hardware. There is not much point in having distance education through online technology if the student is unable to access the resources through a lack of hardware. In this course the student was made aware of this requirement through the pre-course letter.

Computer software used in the course must be available to the student. The student must be able to access any new pieces of software and have the technical expertise to install new programs or have access to an outside technical resource to help them through this process. This was made evident in this course during the first weeks when two of the students were having difficulty in accessing the WWW site. It became apparent that the students did not have the correct version of the WWW browser and would have to update their versions. Technical help was provided by the author and by colleagues and friends of the two students.

As much as possible, the technology employed should remain in the background, enhancing the amount of student-teacher and student-student interactions. The technology should not be an impediment to the learning process. Within this course the original course format of student-centred, discussion based classes suggested the implementation of a listserv. The use of a WWW site provided the instructor with an opportunity to update weekly problems and suggest alternative web sites for more information on the topic of problem solving.

Changes to the course presentation and evaluation may be necessary in order to implement the course in a workable distance format

While no change in course objectives should occur when converting to a distance mode, it may be necessary to alter the traditional presentation of the course material as well as the evaluation format used. One of the reasons why this particular course was chosen to be implemented using a distance format was because of the particular mode of presentation that was used when it was taught in a face to face manner. The main part of the course was the interaction occurring in the classroom. It was felt that this interaction may be continued through the use of the listserv. There were difficulties in application. These difficulties were primarily due to misunderstandings of assigned problems which sometimes required a visual interpretation. The instructor recognized these difficulties and suggested the use of more graphics on the web site or the use of an interactive whiteboard. There was also a problem with the listserv when immediate reactions were required in a discussion. Again, the instructor proposed the use of a synchronous chat facility and hoped that this will do much to facilitate the discussions and help eliminate some of the misunderstandings in future offerings of the course.

Specific courses must be chosen for distance delivery.

Students may express a desire for this mode of delivery due to personal time schedules, family responsibilities, transportation difficulties or geographic location. This

particular course was offered through distance due to the particular set of circumstances for that term: the only mathematics education instructor in the university would be away for the semester. This meant that either a distance course would be offered or else no course in mathematics education would be available for this particular semester. A benefit to some of the students was realized through the negating of a long and dangerous Winter commute. The cancelling of this commute also meant the realization of some cost savings in terms of gas and servicing of the vehicle used. For other students the presentation of the course in this format meant that they would have the opportunity to continue with their academic studies during an otherwise empty semester. As expressed by the instructor, this particular course was chosen since it appeared to be relatively easy to convert to the distance education format.

A student profile must be assumed before the start of the course.

Student characteristics such as age, culture, education, experience with distance learning and with various instructional methods and media may influence the manner in which courseware is presented. This set of characteristics needs to be assumed by the course developers. For established courses, or for new courses which are a part of a larger educational program, determining the characteristics of the student audience may not be a large problem. For example, this course was part of a Masters in Education program. Students enrolling in the course would have at least an undergraduate degree

completed and have some prior work experience in the area of teaching.

For those courses which are not well established and are not part of a larger program, making assumptions about the potential student population may not be as easy. It may be necessary to assume a student profile based on the characteristics of the course itself. At the end of the course it may be necessary to alter this 'typical' student profile and subsequently make appropriate adjustments to the course delivery model.

An approximate number of students that will enroll in the course should be determined.

As illustrated in this course the time commitment involved in a course that follows this format is dependant on the number of students enrolled. For even moderately sized classes the amount of time required to read and respond to discussion topics, by both instructor and student, may become prohibitive. Hence, this format is particularly suited to the small, seminar setting found in most graduate course offerings. For undergraduate courses in which typical class sizes may range in the hundreds, this would not appear to be a workable format.

Students must be informed of the format and any technical requirements before the start of the course.

The initial contact made between the instructor and the student is perhaps the most important and may be implemented through a simple letter of introduction, phone call, audio conference, video conference, or personal interview. During this meeting the tone of the course and the need for the student to take responsibility for their own education may be set. It is also during this initial contact that the student may be informed about the format of the course and also of any technical requirements.

Students must have access to online materials.

Students having access to the required media was one of the stipulations for students taking this course. It was assumed that the student had either a personal computer at home with an e-mail account or had access to a computer through either school, library facilities or at work. This is a major assumption for distance course developers considering using these media. It determines how and where information may be presented and how student interactions may be encouraged. The assumption places a non-academic prerequisite on the course.

Virtual classroom times must be set for synchronous discussion of course content.

One of the advantages of using an asynchronous discussion facility like the listserv is that a specific course time during the week is not necessary. However, there are certain times, as mentioned by the instructor of this course, when immediate feedback would be advantageous in order to become fully involved in the discussion. During such times the use of a synchronous form of communication would be required. This means that specific times would need to be set to ensure that all students know when such interactions are occurring and are able to participate. If students are spread over a number of different time zones, as may be the case in distance education courses, then setting a convenient time for all students may not be as easy as would initially appear.

Students must set aside a specific time to concentrate on the course content and activities.

Students in this course stated that one of the advantages they found with doing this course in this format was the lack of specific times during which they were required to attend class. The difficulty with this open concept is the need for students to prioritize their time. Specific time periods during which they are able to focus their thoughts on the course content must be determined. For the adult student at home facing the regular demands of family life, education often takes a lower place on the list of priorities.

Conclusion

The process of developing and presenting a graduate course in mathematics education in a distance format using a combination of listserv, e-mail, web resources and print media has resulted in valuable insights in how both to develop and teach using these media. Perhaps the most striking impression of this exercise was the need to plan all aspects of the course in detail before the start of the course. The predetermined role of the instructor and the student affected what media were chosen for use and how they were applied. The planning stage included the need to make certain assumptions concerning the students' skill-set, the computer equipment available to the student, and the type of access the students would have to online materials. The danger in making such assumptions may be great as the possibility exists of precluding a student from taking a course due to technical as opposed to intellectual limitations.

The need to create an effective learning environment is as critical in the distance format as it is in the face-to-face classroom. The role of the instructor as facilitator becomes particularly important in an environment where the student must rely primarily on their own efforts for ideas and information. The instructor should try to design the environment in such a way that each student feels included and valued.

For the distance education student emerging technologies provide a means to move intellectually, if not physically, closer to their fellow students and instructor. While

technology may not yet be able to entirely remove the sense of isolation that exists in such a learning environment, it may help to create a sense of community that would otherwise be non-existent. Discussions within this community need not be limited to specific times and places but may be picked up and dropped according to the desire and personal constraints of the student. The time lapse allows for more considered replies and a greater depth of understanding and intuition to dominate the discussion.

The distance education student may need to take more personal responsibility in order to quickly become comfortable and competent with the realities of learning at a distance. This may mean generating coping strategies to deal with personal motivation problems and the sense of isolation prevalent within the distance learning community. Students not adept at independent learning may need to develop more effective learning skills.

Developers of materials and learning environments should be cognizant of the characteristics of the student, keeping in mind cultural differences, educational levels, and physical limitations. They should keep in mind that, while implementing a number of different technologies may provide a more exciting learning environment, each technology should be examined according to its strengths and weaknesses within a particular delivery approach. Technologies should not be used simply because they are available.

Technical help is critical to the overall success of the course. This help should be

available before the start of the course to deal with last minute bugs and during the course to deal with the inevitable emergencies that arise. The technical help should be available at off hours since distance students may work during the evenings and weekends.

While the task of preparing or adapting a course for delivery over distance may be difficult and involve a number of uncertainties, the end result can be a course which is every bit as effective as a course delivered in a face-to-face manner.

BIBLIOGRAPHY

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261-271.

Armstrong, L. (1996). *Report on the Teaching and Learning on the Internet Projects.* (ERIC Document Reproduction Services No. ED 396 720).

Ausubel, D. P. (1963). *The psychology of meaningful verbal learning.* New York: Grune and Stratton.

Bailey, E.K. (1994). Teaching Via the Internet. *Communication Education, 43*(2), 184-193.

Bean, T., Searles, D., Singer, H., & Cowen, S. (1990). Learning concepts from biology text through pictorial analogies and an analogical study guide. *Journal of Educational Research, 83*(4), 233-237.

Berge, Z. & Collins, M. (1995). Computer -Mediated Scholarly Discussion Groups. *Computers and Education, 24*(3), 183-189.

Besser, H. (1996). Impact of Distance Independent Education. *Journal of the American Society for Information Science, 47*(11), 880-883.

Borkowski, J., Carr, M., Rellinger, E., & Pressley, M. (1990). Self-regulated cognition: Interdependence of metacognition, attributions, and self-esteem. In B.F. Jones & L. Idol, *Dimensions of thinking and cognitive instruction.* Hillsdale: NJ.

Brooks, J.M. (1997). Beyond Teaching and Learning Paradigms - Trekking into the Virtual University. *Teaching Sociology, 25*(1), 1-14.

Bruner, J. (1960). *The Process of Education.* Cambridge, MA: Harvard University Press.

Bruner, J. (1966). *Toward a Theory of Instruction.* Cambridge, MA: Harvard University Press.

Carpenter, E.H. (1995). Multimedia - The Distance Classroom - Hardware, Software, and Administration Considerations. *Social Science Computer Review, 13*(4), 434-452.

Comeaux, P. (1995). The Impact of an Interactive Distance Learning Network on Classroom Communication. *Communication Education, 44*, 353-361.

Donald, D. (1996). *Distance Education: By Design or Default?*. (ERIC Document Reproduction Services No. ED 396 715).

Eaton, J., Anderson, C. & Smith, E. (1984). Students' misconceptions interfere with science learning: Case studies of fifth-grade students. *The Elementary School Journal, 84*(4), 365-379.

Ely, D. P., (1996). *Distance Education: By Design or Default?* (ERIC Document Reproduction Services No. ED 396 715).

Friedman, E., Hafeze, L., Keating, K., Mullen, M., Patrick, M., Plotkin, D. & Strenski, E. (1995). An Electronic Discussion List in an Undergraduate Writing Course. *Computers and Education, 24*(3), 191-201.

Jonassen, D.H. (1991). Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm?. *Journal of Educational Research, 39*(3), 5-14.

Hansen, N.E. (1996). Teaching Graduate Psychology Seminars Using Electronic Mail - Creative Distance Education. *Teaching of Psychology, 23*(4), 252-256.

Malone, J. & Dekkers, J. (1984). The concept map as an aid to instruction in science and mathematics. *School Science and Mathematics, 84*(3), 220-231.

Manning, B. (1990). Cognitive self-instruction for an off-task fourth grader during independent academic tasks: A case study. *Contemporary Educational Psychology, 15*(1), 36-46.

McHenry, L. & Bozik, M. (1995). Communicating at a Distance: A study of interaction in a distance education classroom. *Communication - Education, 44*(4), 362-371.

Mende, R. (1996). *Building Global Learning Communities Through the Internet.* (ERIC Document Reproduction Services No. ED 397 928).

Newlands, D. & McLean, A. (1996). The Potential of Live Teacher Supported Distance Learning: a case-study of the use of audio conferencing at the University of Aberdeen. *Studies in Higher Education, 21*(3), 285-298.

Nolen, S. (1988). Reasons for studying: Motivational orientations and study strategies, *Cognition and Instruction, 5*(4), 269-287.

Oliver, R. & Reeves, T. (1996). Dimensions of Effective Learning with Telematics for Distance Education. *Educational Technology Research and Development, 44*(4), 45-56.

Peters, E. & Levin, J. (1986). Effects of a mnemonic imagery strategy on good and poor readers' prose recall. *Reading Research Quarterly, 21*(2), 179-192.

Piaget, J. (1954). *The construction of reality in the child.* New York: Basic Books.

Reiber, L. (1992). Computer-based microworlds: A bridge between constructivism and direct instruction. *Educational Technology Research and Development, 40*(1), 93-106.

Schunk, D. (1985). Self-efficacy and classroom learning. *Psychology in the Schools, 22*(2), 208-223.

Seifert, T.L. (1994). Enhancing memory for main ideas using elaborative interrogation. *Contemporary Educational Psychology. 19*(3), 360-366.

Thach, E. & Murphy, K. (1995). Competencies for Distance Education Professionals. *Educational Technology Research and Development, 43*(1), 57-79.

Watabe, K., Hamalainen, M. & Whinston, A. (1995). An Internet Based Collaborative Distance Learning System: CODILESS. *Computers and Education, 24*(3), 141-155.

Weiner, B. (1984). Principles for a theory of student motivation and their application within an attributional framework. In Ames, C. & Ames, R. (eds.), *Research on Motivation in Education, vol. 1.* Toronto: Academic Press.

Wittrock, M. (1989). Generative processes of comprehension. *Educational Psychologist, 24*(4), 345-376.

Wittrock, M. & Alesandrini, K. (1990). Generation of summaries and analogies on analytic and holistic abilities. *American Educational Research Journal, 27*(3), 489-502.

Yakimovicz, A. & Murphy, K., (1995). Constructivism and Collaboration on the Internet: Case Study of a Graduate Class Experience. *Computers & Education, 24*(3), 203-209.

APPENDIX A

Course description sent to all potential graduate students.

Teaching and Learning to Solve Mathematics Problems
Graduate Education Course 6634

To all potential students of Graduate Education Course 6634:

In this coming term (Winter '97), **Teaching and Learning to Solve Mathematics Problems** will be offered for the first time via distance learning. The course will be covering the same objectives as it did in the previously offered on-campus course and will remain a 2 credit course.

Graduate students wishing to take part in this course should be aware that part of the course will require familiarity with e-mail and connections to the Internet. Also, in an effort to evaluate and improve future offerings of graduate courses online, there will be three evaluations of the course: one at the beginning, one midway and the final at the end of the term. The outline for the course as well as timeline and descriptions for the assignments are available at the following Web site:

http://www.ucs.mun.ca/~mathed/6634/problem.htm

The course instructor will be **Dr. David Reid** (dareid@morgan.ucs.mun.ca) with assistance provided by **Derek Howse** (dmhowse@gill.ifmt.nf.ca).

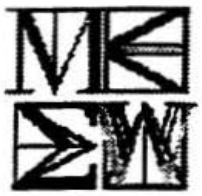
Derek will be evaluating the delivery of the course as a part of his work on a Master's project. If you have any objection to your contributions to the course being used by Derek, please let us know. You may also be asked to sign formal letter of consent if the Faculty Ethics Committee deems this necessary.

Students who are considering taking the course should contact us as soon as possible in order to ensure that course materials are available by the start of the term. Should you have any concerns or questions regarding the nature and delivery of this course please feel free to contact either David or Derek via e-mail.

APPENDIX B

Copy of online questionnaires.

Education 6634
Using Problem Solving in the Teaching and Learning of Mathematics



Course Evaluation

Part 1: Student Profile

Education 6634 is one of the first Education Graduate Courses to be offered in a distance format using online technologies. In order to assist us in the evaluation and future delivery of this and other online courses, we would appreciate it if you would take the time to fill out the following form. This part of the evaluation focuses on your background, your experience with distance education and computer technology. There will be two other evaluations - one during the term and one at the end of the term. The evaluation at mid-term will be used to determine how the course is going up to that point, using the responses to provide some guidance on how to improve the remainder of the course. The final evaluation will be more summative. It would be greatly appreciated if you would take the time to complete each of these evaluations as your input will be invaluable in determining the success of this course and the nature and format of future distance online courses.

Part 1: Student Profile

1. Name: [ ]
2. City/town: [ ]
3. Age:
   - ○ under 25
   - ○ 25-30
   - ○ 31-40
   - ○ 41-50
   - ○ over 50

4. What Masters program are you working on? (If you're not currently working on a program, please enter "none".)

5. How many credits towards your Masters program have you accumulated to Jan. 1, 1997? ☐

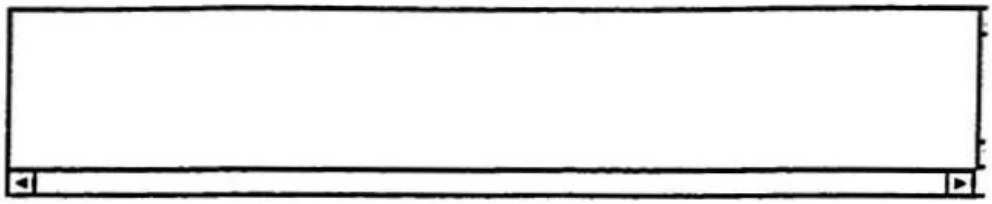
6. Not including this course, how many distance education courses have you taken. (If none, please enter "0" and go to Question 8.) ☐

7. Indicate which of the following distance learning media you have used in *previous* distance education courses. (Check as many items as apply.)
   - ☐ printed manuals, textbooks or readings
   - ☐ teleconferencing
   - ☐ videotape
   - ☐ satellite TV broadcast
   - ☐ audiotape
   - ☐ e-mail
   - ☐ listserve
   - ☐ computer conferencing
   - ☐ Web site

8. At the time of registering for Education 6634:
   - were you aware that you were registering for a distance/online course?
     - ○ Yes
     - ○ No
   - were you aware of the recommended system requirements for successful participation in and completion of this course?
     - ○ Yes
     - ○ No

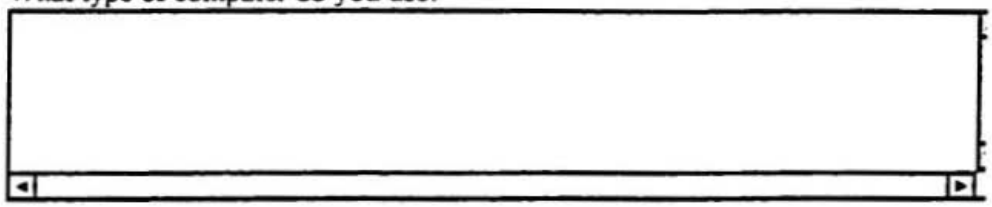
9. How did you first learn about this course offering?

10. Was your decision to take this course influenced by its being offered as an online distance education course ? Please explain.



11. On whose computer do you most frequently access the course site?
    - O my own computer at home
    - O family/household computer
    - O friend or relative outside home
    - O educational institution
    - O business
    - O other (please specify) [ ]

12. What type of computer do you use?



13. Please indicate your level of experience with each of the following (0 indicates no experience; 3 indicates enough experience to be proficient in that application):

	3	2	1	0
file management	O	O	O	O
word processing	O	O	O	O
graphics packages	O	O	O	O
spreadsheets	O	O	O	O
e-mail	O	O	O	O
World Wide Web navigation	O	O	O	O
computer conferencing	O	O	O	O
other application (please specify) [ ]	O	O	O	

14. What computer program do you use most often? [ ]

15. What Web browser (including version number) are you currently using? (e.g., Netscape 1.1, Netscape 2.0.1, Mosaic 2.1.1)

16. What is the main purpose of your computer usage?
    - O personal
    - O educational
    - O business

17. Who provides your internet service?
    - O Memorial University
    - O StemNet
    - O Commercial Provider
    - O other (please specify)

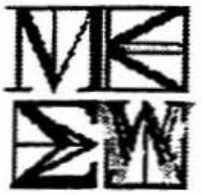
Comments:

Submit Reset

Education 6634: Using Problem Solving in the Teaching and Learning of Mathematics
This form has been used and modified with permission by Derek Howse from the original by Dr. Michael Collins.

Last updated: Dec. 4, 1996
http://www.ucs.mun.ca/~mathed/6634/Profile.html

Education 6634
Using Problem Solving in the Teaching and Learning of Mathematics



Course Evaluation

Part 2: The Course to Date

Education 6634 is one of the first Education Graduate Courses to be offered in a distance format using online technologies. In order to assist us in the evaluation and future delivery of this and other online courses, we would appreciate it if you would take the time to fill out the following form. This part of the evaluation focuses on your experiences with the course format to date. There will be one more evaluation at the end of the term. It would be greatly appreciated if you would take the time to complete each of these evaluations as your input will be invaluable in determining the success of this course and the nature and format of future distance online courses.

If you haven't filled out Part 1: Student profile please do so now.

Overall Impression

1. Name: [ ]

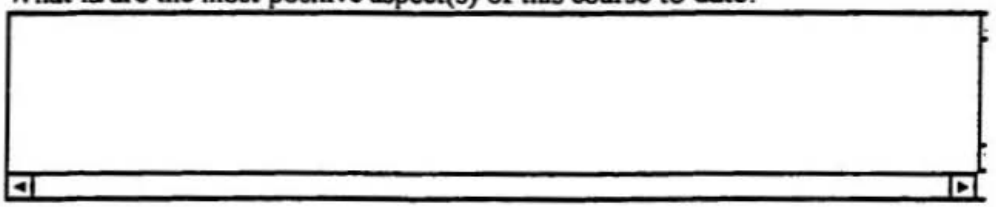
2. Indicate the degree to which you are satisfied or dissatisfied with your overall experience with this course to date.
   - ○ Very satisfied
   - ○ Satisfied
   - ○ Somewhat dissatisfied
   - ○ Dissatisfied

3. Based on your experiences to date, would you recommend this course to a friend?

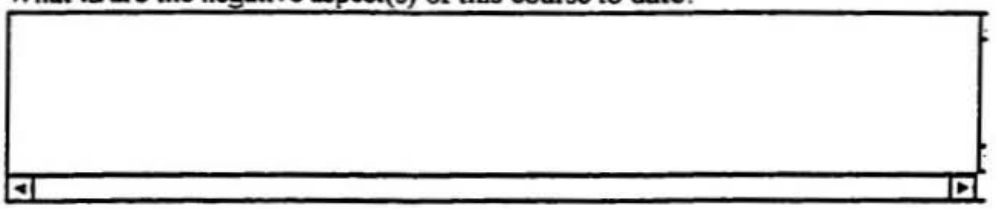
O Yes, O No

4. Based on your experiences to date, would you consider taking another Web-based distance course?
   O Yes, O No

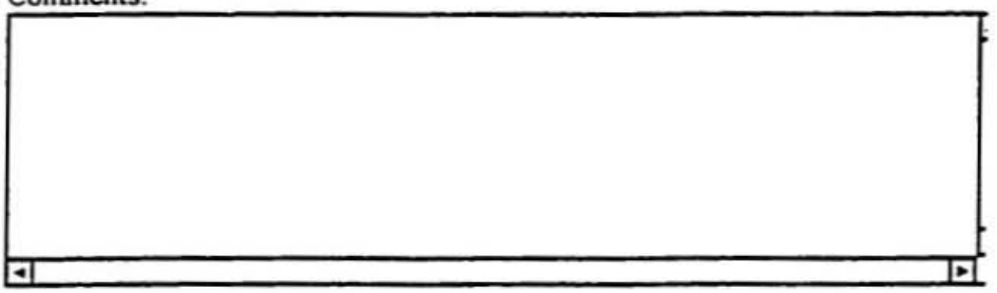
5. What is/are the most positive aspect(s) of this course to date?



6. What is/are the negative aspect(s) of this course to date?



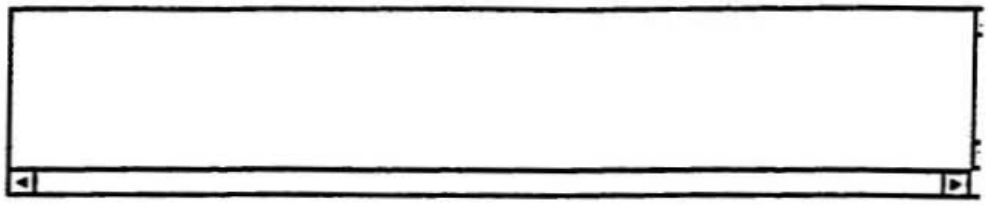
7. Comments:



Technical Problems

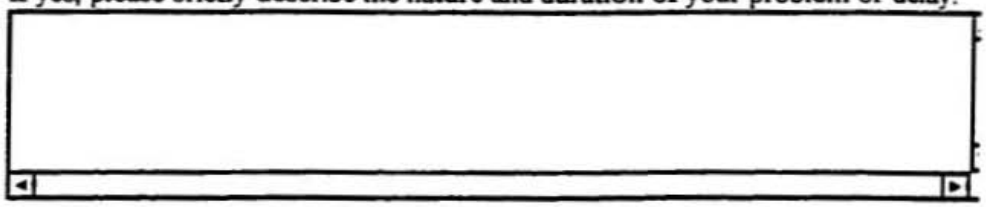
1. Did you experience any technical problems or delays accessing this course during the first week of classes?
   O Yes, O No

   If yes, please briefly describe the nature and duration of your problem or delay.



2. Have you experienced any technical problems at any other time during the course to date?
   ○ Yes, ○ No

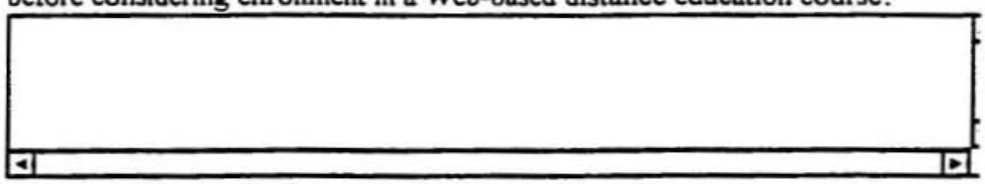
   If yes, please briefly describe the nature and duration of your problem or delay.



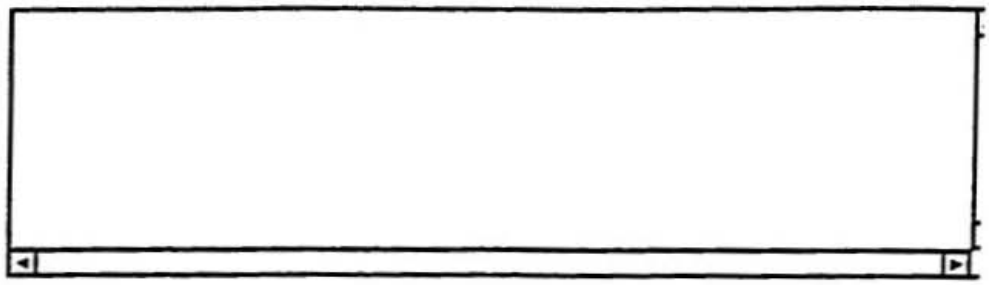
3. Who/what was the main source of advice or help in solving your technical problems?
   ○ user/technical manuals or help files
   ○ friend or relative
   ○ MUN faculty/staff
   ○ commercial computer dealer or service provider
   ○ other (please specify) [ ]

4. Did you experience difficulty due to a lack of experience with, or knowledge of, either the hardware or software required to access the course material?
   ○ Yes, ○ No

5. What computer and other skills do you feel are important for a student to have before considering enrollment in a Web-based distance education course?



6. Comments:



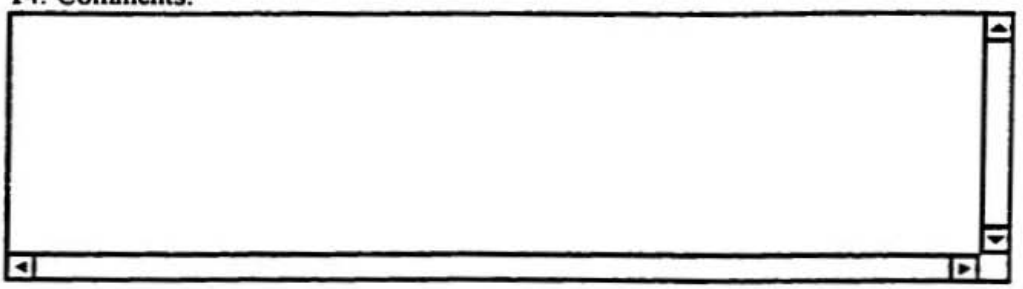
Web Design

Please indicate the degree to which you agree or disagree with the following statements about the design of this course site and the pages. (**Note:** The term "site" refers to the complete set of pages; "page" refers to an individual document or file that is loaded and scrolled through from the top to the bottom.)

5 = Strongly Agree, 1= Strongly Disagree

	5	4	3	2	1
1. The site is well organized.	O	O	O	O	O
2. The pages are easy to read.	O	O	O	O	O
3. It is easy to identify what page I am on in relation to the whole site.	O	O	O	O	O
4. It is easy to understand the organization of information on the pages.	O	O	O	O	O
5. The site contains all the information I need relating to my participation in this course.	O	O	O	O	O
6. The pages contain too much information.	O	O	O	O	O
7. The site is easy to navigate.	O	O	O	O	O
8. The pages are not too long.	O	O	O	O	O
9. With respect to the web-site, I often do not know what to do or where to go next.	O	O	O	O	O
10. I can immediately identify the content of each page.	O	O	O	O	O
11. It is easy to find information I am looking for.	O	O	O	O	O
12. The pages take a long time to transfer.	O	O	O	O	O
13. The pages look neat.	O	O	O	O	O

14. Comments:



Course Components

1. Is the timetable easy to follow and understand?
   ○ Yes, ○ No

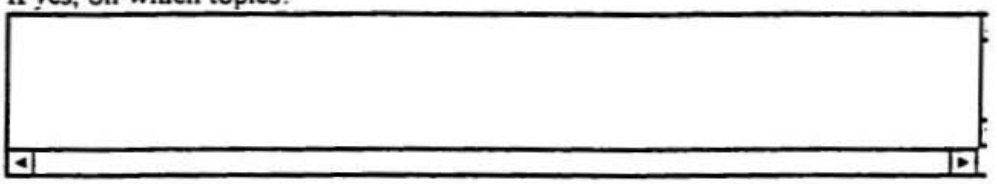
2. Do the required readings aid in your understanding of the course material?
   ○ Yes, ○ No

3. Are the required readings interesting?
   ○ Yes, ○ No

4. Do the required readings add too much to the course load?
   ○ Yes, ○ No

5. Would you like to see more readings on additional topics included in the required readings?
   ○ Yes, ○ No

   If yes, on which topics?



6. Indicate the approximate number of times you contacted the professor to date via e-mail (apart from the class listserv) for each of the following reasons.
   ☐ to get help in understanding the course content
   ☐ to get technical help
   ☐ for administrative reasons

☐ just to chat

7. Indicate the approximate number of times you contacted other students to date via e-mail (apart from the class listserv) for each of the following reasons.
   ☐ to get help in understanding the course content
   ☐ to get technical help
   ☐ for administrative reasons
   ☐ just to chat

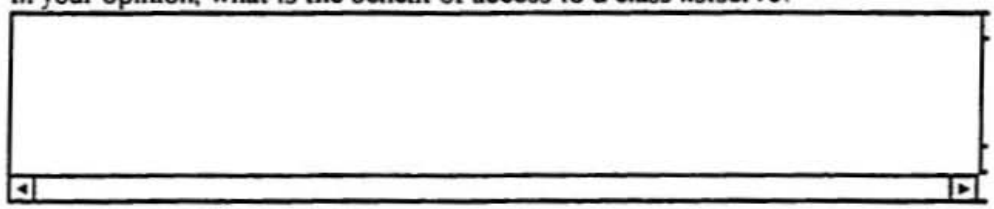
8. Do you feel that you have adequate access to the professor?
   ○ Yes, ○ No

9. Are you satisfied with the response time to your questions/inquiries?
   ○ Yes, ○ No

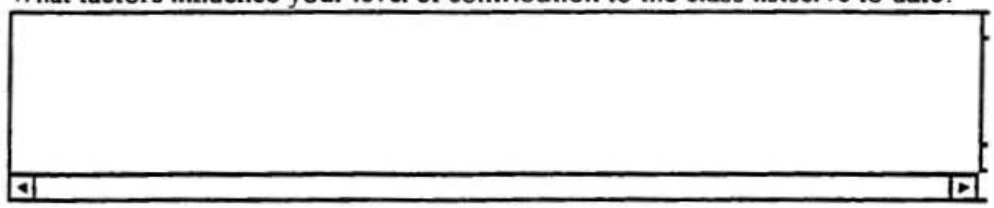
10. In your opinion, what is the maximum amount of time a Web course student should have to wait for a response to a question/inquiry?
    ☐

11. Is the professor's level of activity on the listserve sufficient for your needs?
    ○ Yes, ○ No

12. In your opinion, what is the benefit of access to a class listserve?



13. What factors influence your level of contribution to the class listserve to date?



14. Approximately how many times a week do you check your e-mail for messages relating to the course? ☐

15. Do the links to external sites help you understand the course material?
    ○ Yes, ○ No

16. Are the links appropriate to your level of understanding?
O Yes, O No

17. Would you say that most of the links are interesting?
O Yes, O No

18. Would you like to see more links to related material included in the course?
O Yes, O No

19. Did you explore the external link site beyond the referenced page?
O Yes, O No

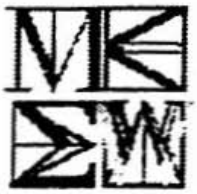
20. Comments:

Submit Reset

Education 6634: Using Problem Solving in the Teaching and Learning of Mathematics
This form has been used and modified with permission by Derek Howse from the original by Dr. Michael Collins.

Last updated: Mar 2, 1997
http://www.ucs.mun.ca/~mathed/6634/midterm.html

Education 6634
Using Problem Solving in the Teaching and Learning of Mathematics



Course Evaluation

Part 3: Final Course Evaluation

This is the final time you will be asked for information concerning your impressions of this course. We trust that the experience thus far has not been too painful.

Thank you for filling out these forms. They will go a long way in improving the delivery and format of future online courses.

If you haven't filled out Part 1: Student profile please do so now

---

Overall Impression

1. Name: [ ]

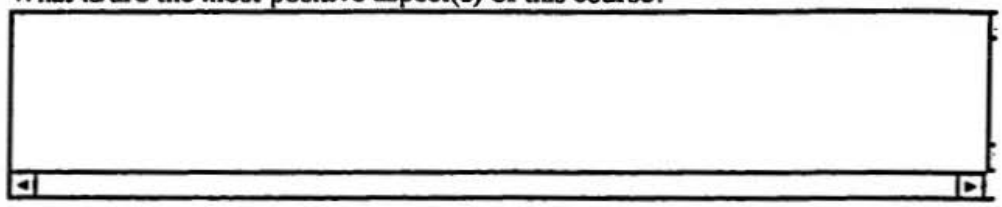
2. Indicate the degree to which you are satisfied or dissatisfied with your overall experience with this course.
   - ○ Very satisfied
   - ○ Satisfied
   - ○ Somewhat dissatisfied
   - ○ Dissatisfied

3. Based on your experiences, would you recommend this course to a friend?
   ○ Yes, ○ No

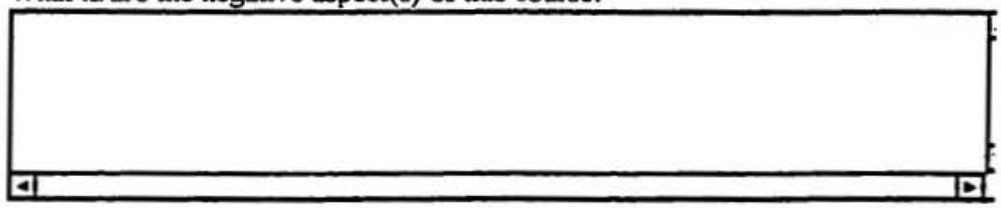
4. Based on your experiences, would you consider taking another Web-based distance course?

○Yes, ○No

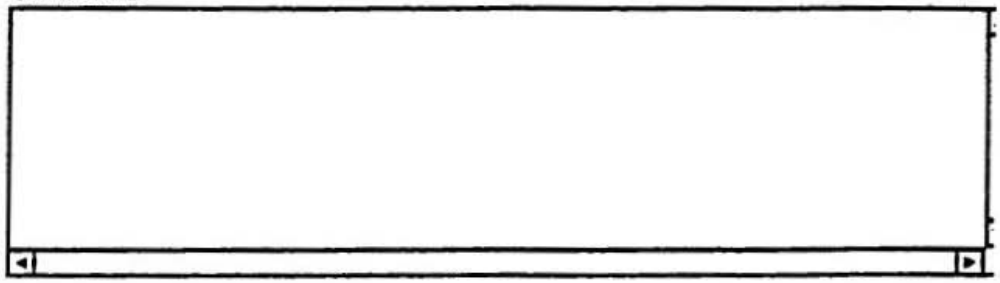
5. What is/are the most positive aspect(s) of this course?



6. What is/are the negative aspect(s) of this course?



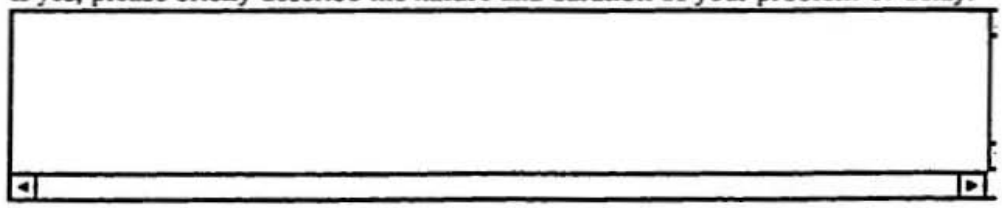
7. Comments:



Technical Problems

1. Since midterm, have you experienced any technical problems?
   ○Yes, ○No

   If yes, please briefly describe the nature and duration of your problem or delay.



2. Who/what was the main source of advice or help in solving your technical

problems?

- ○ user/technical manuals or help files
- ○ friend or relative
- ○ MUN faculty/staff
- ○ commercial computer dealer or service provider
- ○ other (please specify) [ ]

3. Comments:

[ ]

Course Components

1. Indicate the approximate number of times you contacted the professor since midterm via e-mail (apart from the class listserv) for each of the following reasons:
   - [ ] to get help in understanding the course content
   - [ ] to get technical help
   - [ ] for administrative reasons
   - [ ] just to chat

2. Indicate the approximate number of times you contacted other students since midterm via e-mail (apart from the class listserv) for each of the following reasons:
   - [ ] to get help in understanding the course content
   - [ ] to get technical help
   - [ ] for administrative reasons
   - [ ] just to chat

3. Do you feel that you have adequate access to the professor?
   ○ Yes, ○ No

4. Are you satisfied with the response time to your questions/inquiries?

O Yes, O No

5. In your opinion, what is the maximum amount of time a Web course student should have to wait for a response to a question/inquiry?

6. Is the professor's level of activity on the listserve sufficient for your needs?
O Yes, O No

7. What factors influence your level of contribution to the class listserve since midterm?

8. The following is the evaluation scheme by which you will receive your final mark:

Introspective Account	15%
Design Teaching Unit	35%
Implement Teaching Unit	35%
Online Participation	15%

Do you have any suggestions for alternate methods of evaluation?

9. Comments:

Are you willing to participate further in this evaluation by being interviewed by telephone? Please indicate your consent to be contacted by telephone by providing your telephone number (with area code) and a convenient time of day to be contacted.

Telephone:

The best time of day to contact me at the above number is:

Submit Reset

APPENDIX C

Copy of letter of permission sent to each registered student.

Dear Graduate Student,

I am a graduate student in the Faculty of Education at Memorial University. During the 1997 Winter semester I will be conducting an evaluation of the online presentation of the course 6634 - Teaching and learning to solve mathematics problems. This project will involve three student questionnaires and a qualitative analysis of online discussions for the purpose of evaluating and improving the presentation of graduate course materials in an online, distance format. I am writing to request your permission to conduct this project and to invite you to ask any questions you might have.

No change of course content will occur as a result of this project.

All information obtained will remain confidential with each student's anonymity preserved and will be destroyed at the conclusion of the research. This project has received the approval of the Faculty of Education's Ethics Review Committee. The results of this project will be made available to you upon request. Your participation is entirely voluntary and you have the right to request freedom from, or a cancellation of the project at any time.

Please indicate your permission for this project by signing and returning the form below (a stamped, addressed envelope is enclosed for this purpose). If there are any restrictions you would like to impose please indicate them in the space provided. Should you have any questions regarding this project please contact me at 579-6328. If at any time you wish to speak to a resource person not associated with this project, pease contact Dr. Patricia Canning, Associate Dean, Research and Development, 737-8587.

Yours Sincerely,

Derek Howse

I agree to participate in the project conducted by Derek Howse of the course 6634 - Teaching and learning to solve mathematics problems subject to the restrictions I have listed below. I understand that my participation is completely voluntary, and that at any time I may withdraw this permission. I understand that all information collected during this project will remain confidential and at no time will individuals be identified.

Date: Signature:

Name (Please print):

I impose the following restrictions on my participation in this project:

APPENDIX D

Copy of student data in tabular format.

Profile Questionnaire - Personal Data

Name	City	Age	Master's Program	Number of Credits	Number of Distance Ed Courses	Learning Media Used	Aware Registering for Distance	Aware of Requirements	How First Learned of Course	Decision to take influenced by format
A	St. John's	31-40	none	1	1	printed material, e-mail, listserv	No	No	Faculty of Ed	No - not aware until after registered
C	Carbonear	31-40	MED - Teaching and Learning	9	0		Yes	Yes	From Instructor	Yes - Difficult commute
D	Cupids	25-30	MED - Teaching and Learning	8	2	printed material, teleconferencing	Yes	Yes	Instructor	Would have registered either way but find this format convenient
E	Paradise	25-30	Teaching and Learning (Math)	16	0		Yes	Yes	Instructor	No - Enjoying format and would like to see others offered in this format
F	Shoal Harbour	25-30	Teaching and Learning (Math)	8	2	printed material, videotape, audiotape, e-mail, computer conferenceing	Yes	No	Previous course (6639)	Definitely - impossible commute
G	St. John's	25-30	Teaching and Learning (Math)	8	2	printed material, videotape, audiotape, e-mail, listserv, computer conferencing	Yes	Yes	Instructor and students	Yes - Work and school commitments make own time structure convenient

Profile Questionnaire - Computer Experience

Name	Whose computer	Computer Type	File Management	Word Processing	Graphics Packages	Spreadsheets	E-Mail	WWW	Conferencing	Other
A	Family	Acer Pentium 150	Semiproficient	Semiproficient	Semiproficient	Little	Semiproficient	Proficient	Semiproficient	
C	Own	Shaw Pentium	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Networks
D	Own	486 Compaq Presario	Proficient	Proficient	None	None	Proficient	Proficient	Proficient	
E	Own	Pentium 133	Little	Semiproficient	Little	None	Semiproficient	Semiproficient	Semiproficient	
F	Own	486/dx	Semiproficient	Semiproficient	Little	Little	Little	Little	Little	
G	educational	pentium and 486	none	Proficient	Semiproficient	Little	Semiproficient	Semiproficient	Little	

Profile Questionnaire - Computer Experience (cont)

Name	Programs used often	Web Browser	Main purpose of computer usage	Internet Provider	Comments
A	Wordperfect	Netscape Gold	Educational	Stemnet	
C	e-mail, WWW	Netscape 2.0.1	Educational	Commercial	
D	Wordperfect	Netscape	Educational	Stemnet	
E	MS Word	Netscape 2.0.1	Educational	Stemnet	
F	Wordperfect	Netscape 1.1	Educational	Stemnet	
G	Wordperfect	Netscape 3.0	Educational	Stemnet	

Midterm Questionnaire - Overall Impressions to Date

Name	Degree of Satisfaction	Recommend?	Take another?	Postive aspects?	Negative aspects?	Comments
A	Satisfied		Yes	Time and location convenience, students required to respond in a formal way; all students required to participate.	Not met others face to face - others have. Feel left out. Not met instructor and not sure of what is expected or how he thinks. Technical issues are frustrating.	
C	Satisfied	Yes	Yes	No commute, Work at own convenience	Asynchronous discussion. Missing visual contact. Desire face to face talk with prof concerning assignment content.	Grateful that course is being offered
D	Satisfied	Yes	Yes	Time convenience	Difficult to communicate as visualization is a problem	Enjoy the concept but not certain this is a good course for the format.
E	Satisfied	Yes	Yes	Enjoy comfort of home, No drive, Respond at own convenience	Wonder if not as much one on one discussion is occuring	Enjoying course. Feel more courses will be offered this way in future.
F	Very Satisfie	Yes	Yes	Lack of travel	Trouble sending unit. Fax line?	Asset to students at a distance
G	Satisfied	Yes	Yes	Support from prof and other students concering technical problems and course content. Rarely feel isolated as in other distance classes.	Miss face to face contact. Difficult to explain thoughts.	

Midterm Questionnaire - Technical Problems

Name	First week technical problems?	Comment	Technical problems at other time?	Comment	Source of help	Difficulty due to lack of experience	Important computer/other skills	Comments
A	Yes	Couldn't access Internet on Stement. Needed new version of Netscape.	Yes	Unable to connect. Sending attachment using wordperfect 7 - unable to be read by other students.	friend/relative	Yes	Word processing, graphics, computer conferencing	
C	No		Yes	Virus on computer. Trouble with internet provider (switched to commercial)	dealer/provider	No	Familiarity with Internet, e-mail, attaching files, WWW	
D	No		Yes	Unable to send attached file from own computer	MUN faculty/staff	No	Knowledge of Internet, e-mail	
E	Yes	Unable to connect to homepage. Downloaded different browser.	No			Yes	Overall knowledge of computers and e-mail. Know enough not to panic. Enough to get yourself out of trouble.	
F	No		Yes	Trouble accessing Stemnet (Stemnet's fault)	Other - work mates	Yes	Netscape, eudora light, stemnet, word processor	
G	No		Yes	Trouble submitting assignments. Received help from a friend	Friend/relative	No	Web, e-mail, patience with technology	

Midterm Questionnaire - Web Design

Name	Well Organized	Easy to Read	Easy to identify location	Understandable organization	Contains sufficient information	Contins too much information	Easy to Navigate	Pages not too long	Don't know what to do or where to go	Immediately identify the content	Easy to find information	Pages take long to transfer	Look neat
A	5	5	5	5	3	5	5	1	5	5	5	5	5
C	5	5	5	5	5		5	5		5	5	1	5
D	5	5	4	5	4	1	5	5	1	5	5	2	5
E	4	4	4	4	4	2	4	4	2	4	4	2	4
F	4	4	4	4	4	2	4	4	2	4	4	2	4
G	4	4	4	4	3	2	4	4	1	3	4	2	4

Midterm Questionnaire - Timetable and Readings

Name	Timetable easy to follow and understand	Required readings aid in understanding	Required readings interesting	Required readings too much	Want more readings	On what topics?
A	Yes	Yes	Yes	No	No	
C	Yes	No	Yes	No	No	
D	Yes	Yes	Yes	No	No	
E	Yes	Yes	Yes	No	No	
F	Yes	Yes	Yes	No	Yes	From a different perspective- other than rubric writing
G	Yes	Yes	Yes	Yes	No	

Midterm Questionnaire - E-Mail Activity

Name	Number of times e-mailed prof for help on content	for technical help	for administrative reasons	to chat	Number of times e-mailed students for help on content	for technical help	for administrative reasons	to chat
A	1	1	1	0	0	0	1	0
C	3	1	1	0	4	0	0	4
D	0	3	5	5	0	0	3	3
E	0	0	2	0	1	0	0	0
F	0	1	1	0	0	0	0	1
G	1	2	0	0	2	1	0	0

Midterm Questionnaire - E-Mail Activity (cont.)

Name	Adequate access to prof?	Satisfied with response time to questions?	Maximum time should wait	Prof's listserv activity sufficient?	What is the benefit of listserv?	Factors affecting contributions	Number of times e-mail is checked per week
A	Yes	Yes	1 day	No		Assignment requirments	14
C	Yes	Yes	2 days	Yes	Class access. Creates feeling of "classroom"	Time- doing other courses	14
D	Yes	Yes	24 hours	Yes	Takes place of class, discussions happen, contact is maintained.	Interest in prompts, Time, other assignments for the course take priority	7
E	Yes	Yes	1 day	Yes	Able to mail to whole class	Time, Professional workload, Interst in discussion, Personal opinions on what is said	7
F	Yes	Yes	1 day	Yes			7
G	Yes	Yes	2 days	Yes	Don't feel isolated, sometimes overwhelmed with amount of e-mail	time, topic. Only mail when have something important to say - quality over quantity	5

Midterm Questionnaire - Web Hypertext Links

Name	External links helpful?	Links appropriate?	Links interesting?	More links wanted?	Explored beyond given links?	Comments
A	Yes	Yes	Yes	Yes	Yes	
C	Yes	Yes	Yes	Yes	Yes	
D	Yes	Yes	Yes	Yes	No	
E	Yes	Yes	Yes	Yes	Yes	Derek Howse's site
F	No	Yes	Yes	Yes	Yes	School personnel site
G					Yes	Only looked at one other

Final Questionnaire - Overall Impression

Name	Degree of satisfaction	Recommend to a Friend?	Take another?	Most postive aspect?	Negative aspects	Comments
C	Very Satisfied	Yes	Yes	Not restricted by time or location.	Problems with internet provider was a major headache.	
D	Satisfied	Yes	Yes	Convenient for those not living onsite. Broadens accessibility.	No face to face interaction with other students/prof.	Enjoyed the course (but not as much as being in class)- convenient not being in class. Time consuming contributing to the listserv. Felt as if spending more time than if physically in class.
E	Satisfied	Yes	Yes	Convenience. Time Saving. Learning how to use my computer	No technical problems	Enjoyable course and format. Liked convenience of not having to leave home but missed the face to face interaction. Topics, concerns are not talked about spontaneously through the computer
G	Very satisfied	Yes	Yes	Online discussion - able to read at own leisure - sometimes more convenient than attending class. Writing aspect requires more awareness of what is being written interms of directions and examples. Forced to be organized, sequential and coherent in thinking and choice of words.	Online discussion. Sometimes felt that face to face discussion was only way to fully explain ideas. So much e-mail! Amount was overwhelming. Felt people were writing long messages but not saying much.	

Final Questionnaire - Technical Problems

Name	Since midterm - problems?	Comments	Source of advice	Comments
C	Yes	Many times could not connect. Problems with internet provider. Service was slow - at one point it went on for a week.	dealer/provider	
D	No			
E	No		friend/relative	
G	Yes	Trouble sending last assignment. Used friend's account to send the assignment.	Friend/relative	

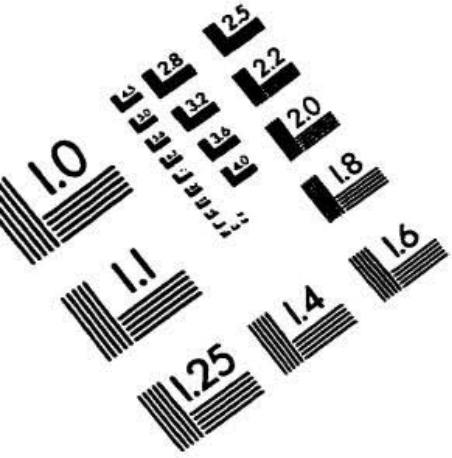
Final Questionnaire - E-Mail Activity

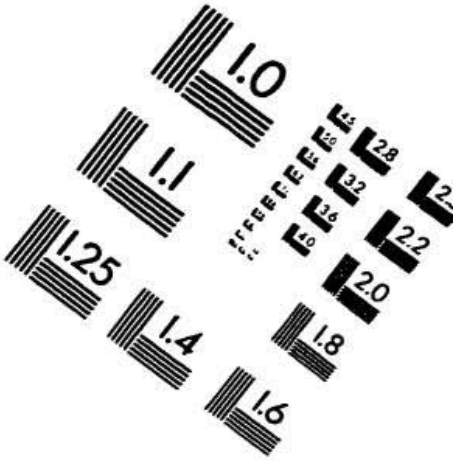
Name	Contacted prof for help on content	for technical help	administrative reasons	chat	Contacted students for help on content	for technical help	administrative reasons	chat
C	0	0	1	2	0	0	0	10
D	0	0	2	2	3	0	2	0
E	0	0	0	0	1	0	0	0
G	0	0	0	0	0	0	0	0

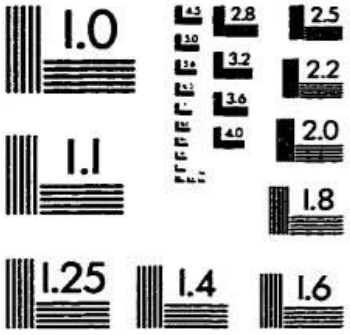
Final Questionnaire - E-Mail Activity (cont.) and Evaluation

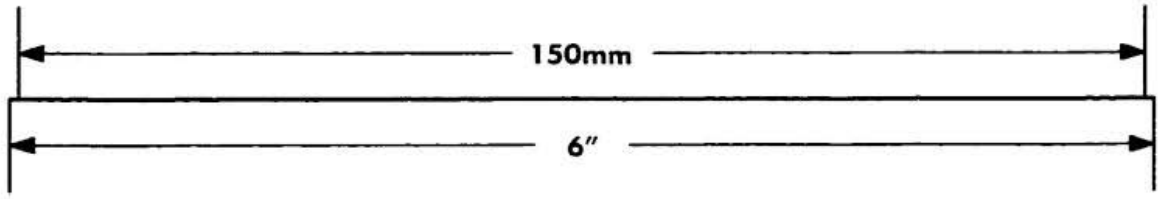
Name	Adequate access?	Satisfied with response time?	Maximum time to wait	Prof's level of activity sufficient?	Factors affecting contribution level since midterm	Alternate evaluation	Comments
C	Yes	Yes	2 days	Yes	Two factors. Heavy courseload and not near computer as often as desired. Also had trouble logging on.	Satisfied with course evaluation.	
D	Yes	Yes	24 Hours	Yes	Time. Interest in prompts and comments.	Satisfied with course evaluation.	A good course.
E	Yes	Yes	12 hours	Yes	Time. Out of the country during Easter. Out of town on weekends.		
G	Yes	Yes	Couple of days	Yes	Time! Very involved at work (musical, grad/prom). When finally logged on the number of e-mail messages was overwhelming. People sending lots of quantity but little quality. Regret not having more time but am a full time student and half time teacher.		

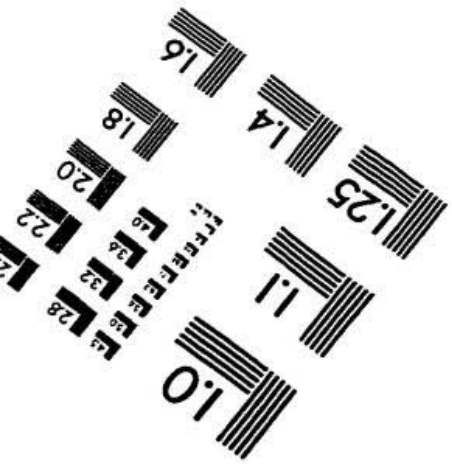
IMAGE EVALUATION
TEST TARGET (QA–3)

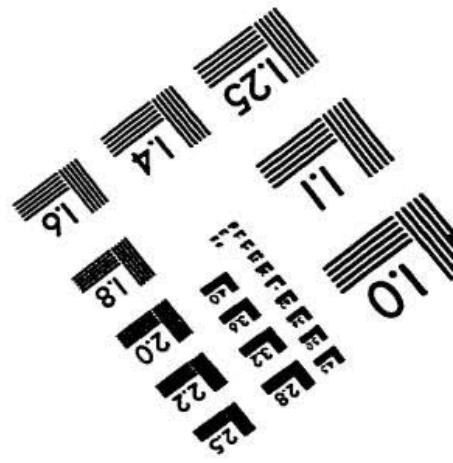












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