The e-Volving Practitioner:

A Heuristic Formative Evaluation of an Online Course
Based on an Action Research Methodology

Patrick L. Devey

A Thesis

In

The Department

Of

Education

Presented in Partial Fulfillment of the Requirements
For the Degree of Master of Arts at
Concordia University
Montreal, Québec, Canada

August 2002

Abstract

The e-Volving Practitioner: A Heuristic Formative Evaluation of an Online Course based on an Action Research Methodology

By Patrick L. Devey

Teachers using traditional classroom methodologies have had the option to consult with vast amounts of literature and research, not to mention the diverse and extensive knowledge of their colleagues, when in need of inspiration for their courses. On the other hand, due to the fact that online instruction is still in its infancy, instructors who delve into e-Learning do not have the same luxury. The nominal amount of research in that field usually ends with recommendations and possible remedies to encountered problems, as opposed to practical solutions or "cures" to the identified issues.

This thesis will make use of those limited studies, and combine that knowledge to the experience of practitioners in the field, as well as with the feedback from the participants in the e-Learning environment, in order to devise a set of successful practices for an undergraduate statistics course offered entirely online. In other words, this research aims to successfully implement practical procedures into a Web-based course in order to make it the best possible experience for everyone involved. In accomplishing these goals, this work could then serve as a resource for other practitioners in the field by providing them not just with recommendations for Web-based courses, but also with concrete, proven, and successful interventions in this particular environment.

Acknowledgements

To my mother and father for warning me to stay out of education (they are both high school teachers),

To my two brothers for reminding me not to take things too seriously.

To my sister for bringing me a slice of pizza and a glass of stale Sprite while I wrote this.

To my girlfriend for putting up with my long, intimate moments...with a computer screen.

To my pals at Club 7310 for proving that sometimes an intelligent man must be drunk in order to spend some time with his fools.

To my colleagues at Concordia University for providing me with both a target on which to vent my frustrations, as well as with an eager boot to send me back on my way.

To my teachers and classmates in Educational Technology for humouring me in and out of class.

And to the thousands of students who have allowed me to warp their minds over the past six years and counting...they were voluntary, although sometimes unknowing researchers for this thesis, and it was by living vicariously through them that I could better understand the issues that surrounded online instruction. Your sweat and tears are paving the way for better education for all... (It really wasn't that bad!).

Table of Contents

List of Figures

List of Tables

Chapter One: Introduction and Literature Review

Introduction

Evolution is a process that occurs over time in response to external factors that are sometimes beyond one's control. In some instances, it can also be seen as a necessary adaptation to conform to the external environment in order to survive. For example, in the business world, production companies must be able to make rapid changes to their products in order to satisfy consumer demands. Failure to do so would spell a quick end to their revenue, an "Adapt or Die" scenario. This scenario is no different in the field of education. At Concordia University, in Montreal, Québec, Canada, new courses are constantly being developed and modified by faculty in order to better reflect the changes that are happening in the workplace. In fact, this phenomenon is echoed in one of Concordia's mottos: "Real education for the real world".

The emergence of computer technologies, fuelled by the unfathomable impact that the Internet and the World Wide Web has had on society as a whole, could not be ignored in academic circles. Universities around the globe began offering courses on how to use word processors, create Web pages, and write programs. More recently, a trend has begun where instead of offering courses about how to use the technology, the technology itself became the medium used to offer courses. In particular, courses that made use of the Internet as its primary delivery system have relied heavily on the latest computer technologies. Unfortunately, instructors who delve into this form of teaching are often

left to fend for themselves due to a lack of information, especially practical knowledge, in the subject matter.

Teachers who employ the classic classroom delivery method have always had plenty of research, best-practice scenarios, and the experience of their colleagues to consult with and fall back on when in need of inspiration for their course. On the other hand, due to the fact that online instruction is still in its infancy, instructors going the e-Learning route do not have the same luxury. Not only is there a nominal amount of studies in the field, but also for the most part, that research ends with recommendations and possible remedies to encountered problems, as opposed to practical solutions and cures to the identified enigmas. In the meantime, these practitioners must rely on their own experience, as well as on the limited experience of others in their field if they hope to find the best ways to help their courses evolve, and in doing so, provide students with an electronic alternative for acquiring the "real education" they need to face the "real world".

This thesis examines the ongoing evolutionary journey for Concordia University's first course offered using an online delivery method. INTE 296 – Discover Statistics, is an introductory statistics course offered entirely over the Internet to undergraduate students in the faculty of Arts and Science and Concordia University. This means that there are no lectures, and all materials (book, assignments, tables), are available through the course's Website. Although many students take this course as an elective, the majority of the participants are required to complete the class as part of their program's requirements.

The course aims at mastering the elementary analytical concepts of the subject matter and is designed for students with basic mathematical skills, but not for mathematicians.

Six years ago, I was among the 20 volunteers who stepped out of an Exercise Science statistics lecture, and into a brand new computer laboratory to undertake what I though would be a very interesting course in a unique environment. Now, I am the course's instructor, or at or at least the closest thing to an instructor this course has. Regardless of my exact role, the point here is that in that time span, I went from being an "Internet-illiterate" student to a practitioner in the e-Learning field. Needless to say, the transition was far from smooth.

Aside from the obvious theoretical deficiencies, which I would like to think that educational technology fulfilled, my practical skills needed some enhancing. Among other things, I had to teach myself HTML programming, image editing, some JavaScript, as well as perfect my e-mail, word processing, spreadsheet, and database skills. Since there were no other courses on which to model mine at the University, I had to rely on research, feedback from the students in the course, as well as on my own personal experiences, both as a student, as well as an instructor.

I knew what I liked and disliked about the course as a learner, and now I was empowered to do something about it to benefit the future students, as well as the course and delivery method's image. I also had the opportunity to see the online class from the eyes of a teacher, something that would have to be "looked into" as I pondered my course of action. But where should I start? What should I change? What should I add? What should

I remove? I concluded that the only way to tackle a project of this magnitude was to concentrate on one element at a time and try to develop it as I went along. Since I did not have any other models to consult, I investigated the research in the field, hoping to find some answers to my questions.

The end result of my review was a list of untested recommendations that tended to be general and vague. In other words, they did not necessarily apply to my particular situation when considering the type of students enrolled in the course, as well as the resources I had to work with. That being said, these resources did provide me with some useful ideas and information with regards to my field, but none dealt exclusively with the creation, implementation, and continuing re-evaluation of a successful course that is offered completely online. It was then that I realized that maybe there is no "all-encompassing" formula for a successful online course because what may work in one course at a particular institution, may fail miserably at another.

The conclusion I came to was that the only way to accomplish this feat was to use the ideas generated via the research, combine this theoretical knowledge with the feedback I was getting from the course's stakeholders, and come up with a customized practical solution for an identified problem. Following this implementation, I could then modify, or "fine-tune" the procedure, based on the results of constant evaluations by the instructor, other professors, advisors, technicians, content experts, and especially the learners themselves. In other words, to take full advantage of the flexibility and responsiveness that Web technologies offer us and use it to tailor the course to the immediate needs of its users.

Thesis Statement

This thesis examines the development, as well as the continuing refinement, of an undergraduate course that is offered completely via the World Wide Web. The goals of this thesis are threefold. First of all, this research aims to uncover, through an extensive literature review, the elements and attributes that make up a good online course. Secondly, to couple this information with the feedback garnered from the stakeholders of the course (instructors, students, educational technologists) to establish a concrete set of recommendations that are immediately applicable to INTE 296. And lastly, to implement these recommendations into the course and through constant monitoring, make any necessary adjustments or modifications to the intervention in order to succeed at solving an identified problem. In other words, to successfully implement my own best practice procedures in hopes of making this unique course the best possible experience for everyone involved in it. Not only will these deeds be examined, but the course of action that led to the implementation of these practices will also be explored in a detailed sequence.

In accomplishing these goals, this work could then serve as a resource for other practitioners in the field by providing them not just with recommendations for Web-based courses, but with proven and successful interventions in this particular environment. In addition, this project may also aid them to generate new ideas to use in their unique, yet similar situations.

Thesis Structure

This thesis has been broken into three phases that correspond to the three steps that have been taken in the "life" of the online course in question. In section one, I will explain the history behind the development of this online course, as well as provide a short history about my involvement in INTE 296, both as a student, as well as an instructor. This section will include the reasons why this particular subject matter was chosen, how the delivery method was selected, as well as the steps behind the development of the first version of the course Web site. The second section of the thesis will focus on the evaluation of the course during the first year of its operation. This will include an extensive literature review that was conducted in the fields that were found to be important, in one way or another, to Web-based instruction. The methodology of the thesis, including the data collection methods, as well as an explanation of action research will follow. The results of the evaluations will be presented, and problems with the course will be identified. This phase of the thesis will end with a concrete list of recommendations that are immediately applicable to the course. Section three will be a detailed description of the course of action that was taken to remedy the problems with the course based on the recommendations made in the previous section. Using a methodology that is based on action research, the individual intervention cycles will be meticulously analyzed in order to explain the interventions that were made in hopes of countering a given problem. The end result of this section will bring us to the current status of the course (at the time of the completion of the thesis), as well as a list of practices that were found to be successful.

Research Objectives

Choosing a topic for my thesis was not as complicated as I had originally feared. In fact, it was quite easy to do since it combined my personal interests in online learning and Internet technologies with my job of running a computer-based learning centre, as well as teaching an online course to undergraduate students. I chose to focus my thesis on the continual refinement of the online course I teach in hopes of using my newly acquired knowledge in the field of Educational Technology to improve the overall success of the lesson for all the involved parties. For the past five years I have had the unique opportunity to learn about computers and their uses in computer-assisted instruction in a high-tech facility that includes such multimedia technologies as streaming video lectures, videoconferencing classes, as well as simplified Website generation templates for automatic and simple course site creation. Now with my two years of studying in the field of Educational Technology, I believe that I have gathered enough theoretical knowledge to apply it to the course and improve it tremendously. That is, this project will use the theory and skills that I learned during my studies to critically evaluate the course, and then implement the recommendations using my practical skills.

Furthermore, this project will make modifications to the course from several angles. First of all, since I am the course facilitator, I will be looking at the situation from the eyes of a teacher and online course practitioner so as to try to find ways to improve the online experience from that point of view. This means that the thesis will deal with topics such as communication strategies, feedback methods, as well as motivational techniques. Secondly, since I am also responsible for the design and maintenance of the Web site, I

will also be acting in the best interests of the educational technologist. This means that I will have to be conscious of the layout of the Website, the types of multimedia technologies used in the site, as well as the readability and flow of the course materials. Lastly, but most importantly, since I was at one point a student of the same course, and since it is the learners who are the most important element in any educational situation, this thesis will explore this online course from the perspective of the typical student enrolled in the course.

This being said, the main reason for undertaking this topic, as well as for adopting this methodology, is to produce change. I want to create the best online course possible for as many people as I can while making use of the knowledge I have, the skills I have, as well as the resources that are at my disposal. The end result will be a product of years of work that mirrored my personal evolution from a relative newcomer to a seasoned practitioner in the field of online education. This thesis can also serve as a guide for other practitioners and educational technologists who are undertaking, or are involved in, similar situations.

Limitations of the Study

This project was not completed without encountering a few bumps in the road. First of all, when dealing with computer-based learning, we put ourselves at the mercy of technology. In other words, as the reader makes their way through these lines of text, new technologies are or have emerged that may offer a more efficient alternative to the techniques and practices presented within this thesis. However obsolete the technology

may be at the time, I'm sure that the ideas generated in this document can provide some insight into successful online practices with the means at one's disposal at any given time.

Technology, as well as its implementation into the curriculum is not without its price, especially when dealing with the latest market products. In other words, the budget I had to work with dictated in many ways the technology to which I had access. Fortunately, despite the recent cutbacks to the education system, as well as the fact that I was working in a publicly funded institution, I was lucky enough to have access to a wide-variety of sophisticated equipment as the administrator of a newly constructed learning centre. However, despite my providential situation, there was still nonetheless a financial boundary, and therefore, a limitation to the technology I could use.

Since the maintenance of the Website, as well as the use of all of the multimedia technologies was my responsibility, I was limited in own technical and programming abilities. That being said, I did take the time and made the effort to learn how to use several programs in order to be fully independent in my multiple roles with the course. Eventually, as the popularity of online courses grew within my educational institution, more personnel were hired to help out, especially in the specialized fields (programming, video editing, etc...). Although I had access to these individuals when I ran into troubleshooting problems, their primary role was to aid teachers who lacked the technical skills needed to manage their own online applications, and so I usually found my own way. But since my undergraduate degree was in Exercise Science, there is no doubt that some of these problems could have been rectified had I completed a degree in Computer

Science or Digital Imaging. The bottom line is, online learning encompasses so many different theories and practices that it is quite unlikely that one individual would have the time to master all of them, especially if they are the ones responsible for teaching the course as well!

Research Questions

Based on the results of the research, as well on the evaluations, what are the professed problems with INTE 296? What are some of the common problems that the students in this course are having? What elements, from the teacher's point of view, need to be altered in order to improve their experience with the delivery of the instructional material? Which methods of communication seem to work best, and in which situations? What enhancements and modifications can be made to the course in order to solve these problems? What other recommendations can be made with regards to the adoption of multimedia technologies, communication strategies, and feedback mechanisms when dealing with this online course?

How are these recommendations to be implemented? What impact, if any, did these interventions have? Can this new technique be improved in any way? What variables contributed to the techniques used within this course delivery system? Which techniques were successful within this course and why?

Background Information

My Involvement in the Course

The course INTE 296 – Discover Statistics, was first offered in the winter session of 1996 to students registered in the department of Exercise Science's statistics course at Concordia University in Montreal, Quebec, Canada. I was among the twenty volunteer recruits who followed a tall, white-haired man out of the classroom, and into a computer lab to undertake a unique version of the statistics. Little did I know about the impact that this decision would have on my academic and professional career.

In order to "lure" us from our classroom seats, we were told that this new course would not require attendance to any more lectures and that all of the work could be done from the lab, or from the comfort of our own homes. Although I have always been proficient with computers (word processing and spreadsheets), I had never been on the Internet before, nor had I ever experienced "e-mail". I learned a lot about computers that semester, mainly because of the exposure to a brand-new computer laboratory that gave me instant access to a high-speed Internet connection. However, on the flip side, this course did not teach me much about statistics. Instead, I relied on my prior knowledge from a statistics course I completed in CEGEP (Québec's junior college) the previous year, as well as on numerous reference books. In other words, the online resource proved to be quite useless, and support for the course materials was non-existent.

Although there was a professor assigned to the course, he was not easily accessible to answer questions about the course material. Furthermore, when he was tracked down, he did not seem to be too familiar with what was posted on the Website. It was later that I found out that the subject matter experts who supplied the content for the online book were not involved in the course anymore. Therefore, there was no subject matter expert who was immediately available to help the students with the course! Secondly, the assignments that we submitted were never corrected. We would simply receive a "Pass" for submitting them, but would get no other form of feedback. Third, the course Website itself was basically an online textbook with links to a mathematical glossary, statistical tables that we would need during the course, and a page with links to other "interesting sites" such as Dave Letterman's Top 10 Lists, Sony, and a "Guide to Getting Started in HTML". There were no links to sites that could serve as a practical statistical tool, nor any obvious aids for students needing immediate help with certain topics. All in all, it was for these reasons, among others, that pressed me to do something I had never done before in my academic career: confront the professor about their course. I must confess that at first, the teacher seemed taken aback that a student who scored so well in the class was complaining, but I was equally taken aback when he offered me a job.

The Evolution of INTE 296

I was hired to serve as a tutor for students taking the course INTE 296 (then called INTE 298s) in the fall 1997 session and spent the summer of 1997 preparing the course by editing and "beautifying" the online textbook. To do so, I had to learn some basic HTML programming since the HTML editors we were using at the time were all text-based. I also had to teach myself how to use image-editing software to produce customized graphics that would accompany the "e-book". As the semesters passed, I became increasingly proficient with the software, as well as more knowledgeable in the subject matter. After taking several other statistics courses, both at the undergraduate, and graduate levels (graduate diploma in Sports Administration), and arming myself with my favourite statistics textbooks, I undertook the task of redoing the entire INTE 296 site in the summer of 2000.

In this version of the Website, I wanted to integrate more features to aid the students, and at the same time, cut down on the useless links that had contributed to making the site a cluttered and confusing mess. This meant that not only did I have to restructure the way that the information was presented on the site, but I also had to do it in such a way that users would be able to find the information they required with the shortest critical path possible. I relied on the feedback of students, as well as my own personal experience in the course, to identify issues and problems with the Web site. I then used my limited, but improving computer skills to solve the predicament.

In the fall of 2001, the course underwent another major facelift, as its new Website was unveiled (Figure 1). The only changes that were made were of an aesthetic nature and the structure and content remained untouched. Of course, the Website is always undergoing minor adjustments as topics are clarified, graphics are changed, and extra examples are added, but all in all, the Web site remained static. Please see Appendix E for a sample of the "facelifts" that the course Web site has undergone since its inception in 1996.

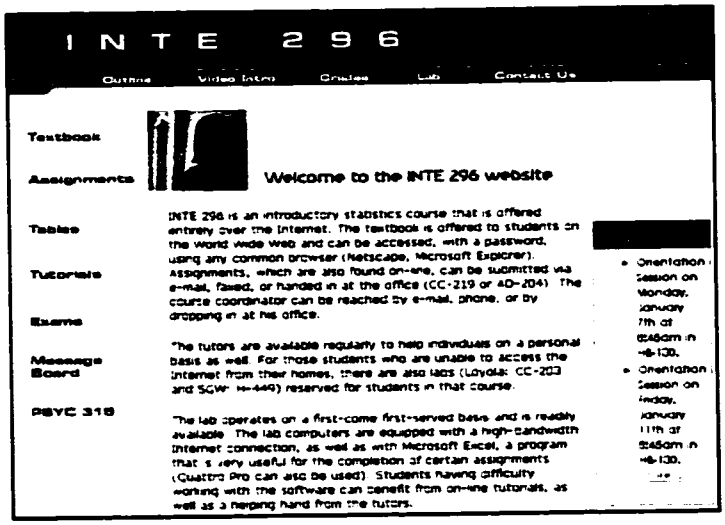


Figure 1 – Screenshot of INTE 296 Home Page, circa 2001

Chapter Two: Literature Review

Introduction

The purpose of my literature review was to give me an opportunity to explore and evaluate past studies about Web-based courses in hopes of finding best practice techniques that I could employ to improve my course. I started the process by scouring the university library, as well as the Internet, for Web-based instruction studies. Although I was able to discover several case studies and articles dealing with the various issues related to online learning, I did not find a concrete list of proven solutions to the identified problems. There were plenty of suggestions and recommendations, but they seemed very generalized, repetitive, and not necessarily applicable to my situation. Furthermore, most of the literature concluded with these suggestions, without trying them out in a practical situation to see if they actually worked. That being said, I still ended up using the literature as a rich base to generate ideas and provide me with techniques that I may not have thought about employing in my course, and it gave me a chance to discover potential deficiencies that had to be addressed with this type of methodology.

Since I could not find exactly what I wanted, I took a step back and decided to research the individual components that make up Web-based instruction so that I could construct my own set of solutions that I could implement directly into my online course. I began by investigating subjects like distance education and Web usability issues, and quickly found myself reading about computer-mediated communication, the uses of multimedia in learning, instructional technology techniques, as well as some instructional theory and

design issues. My conclusions were further reinforced by Khan (1997) who described Web-based instruction as being an amalgamation of the following components:

- Content development (learning theories, instructional design)
- Multimedia components (text, graphics, audio, video, compression tools)
- Internet tools (communication, remote access, navigation, search engines)
- Computer storage devices
- Authoring programs
- Connection and Service providers

It seemed as though the more I read, the more resources I had to check out, and the more my list of topics and references grew. This exercise not only enlightened me in the subject matter, but it also helped me realize just how many fields can contribute, in one way or another, to a successful online course.

The Evolution of Distance Learning and the WWW

Distance education is by no means a new concept. Ever since humans have developed the written word, pupils have been able to learn things from their mentors without having to be in the same geographical location. In fact, the first such event is believed to have occurred in 360 B.C. with Plato's publication of Socrates' Dialogues. Since then, new media technologies coupled with better delivery techniques (like mail services), have catalyzed the proliferation of learning to remote areas of the world and to individuals who would not normally have the opportunity to attend a "traditional" educational institution. Terms like correspondence study, home study, and independent study became increasingly popular in academic circles.

Keegan (1996) characterizes true distance education as instruction where the learner is physically separated from both the teacher, as well as from the learning group, at least quasi-permanently during the learning process (as opposed to traditional teaching). Furthermore, the instruction must be under the influence of an educational institution so that course materials are validated, as well as to provide students with the necessary support services (as opposed to private or home study). In addition, it is an environment in which face-to-face communication of conventional instruction has been replaced by a mode of interpersonal contact that enables two-way communication mediated by some form of technology. This technology can also be used to carry the course content (as opposed to other uses of technology in education). Therefore, distance education, be it distance learning or distance teaching, is a method that encompasses all of these

characteristics, and whose goal of is to provide instruction to a student, or to a group of students, anywhere, at any time.

In the 1920s, motion pictures were heralded as the instructional medium of the future, whereas the invention of the radio gave educational institutions another tool to deliver their lessons. In fact, in 1923, over ten percent of all of the radio stations in the United States were owned and operated by academic institutions to broadcast educational programs. Unfortunately, none of these media proved to be too popular at that time, and the trend dwindled. The 1950s introduced the world to the television, a medium that is still used today to transmit educational programming to the public. This invention helped push the popularity of distance education to new levels, especially with the escalating costs of attending school, (University of Houston, online). The invention of the audiocassette by Philips in 1962, as well as the introduction of the Beta format by Sony and the subsequent development of VHS standards, saw audio and videocassettes become popular mediums for the delivery of lessons at a distance. The reasons that these technologies flourished, even though there were better ones available (for instance, the videodisc) was because of the fact that these formats had become a standard in society, and that the new technology was easier to use (Crossman, 1987).

The development of ARPANET in the late 1960s set the framework for the mega-network known today as the Internet. Although the Internet physically connected computers together, the variety of platforms (Unix, Windows, Macintosh) made it very difficult to communicate with each other. Therefore, there was a need for a standard protocol that would enable a user on one machine to exchange information with a

colleague on another machine halfway across the world. The development of hypertext mark-up language (HTML) by scientists at a Swiss nuclear research facility solved that problem. All documents that were created using HTML language could be accessed on another machine, regardless of the computer platform they were using. The next significant development was created at The University of Illinois in 1993 as they launched their alpha version of the first public Web browser in 1993, "called Mosaic for X". Now computer users from around the globe could access the World Wide Web (Alessi & Trollip, 2001). So, in hindsight, the evolution of the Internet has seen it go from a military communications protocol (1960s), to a text-based searchable database used by universities (1980s), to the multimedia edutainment resource accessible to everyone today.

The adoption of the Internet continues to be the biggest and fastest technological innovation of our time, as proven by the fact that it only took seven years for 25% of the Canadian population to make use of the medium. Sales of personal computers have swollen on a global scale. Not only has the student-computer ratio increased dramatically in all educational institutions, but numbers at home, as well as at work have also amplified significantly. It was estimated that 60% of Canadian households were equipped with at least one computer in 1999 (Deloitte and Touche, 2000). Furthermore, the International Data Corporation (IDC) estimates that worldwide Internet users will grow to about 502 million in 2003. This will prove to be an astounding increase from the estimated 87 million users in 1997, or even the 103 million in 2000 (IDC, 2001).

What this all means is that the adoption of the Internet, and the subsequent popularity

surge of the World Wide Web, are the catalysts that distance education has been looking for. Its enormous potential, popularity, and widespread use make the Internet a very lucrative medium for the propagation of e-Learning in educational institutions worldwide.

According to the University of Maryland (online), distance education courses today fall into three models. The first is a distributed classroom (model A) where a centralized location serves as a hub for the "live" distribution of the lesson to other locations. In this situation, the instructor controls the pace of the lessons, and the class members are required to be at a particular site at the time of the lesson. This method is typically used in a synchronous (same-time) environment where the teacher instructs both an onsite, as well as a distant site via teleconferencing or videoconferencing technologies. In this scenario, students have the choice to enrol at a location that is nearer to their homes or work, and enjoy an environment that is much like the traditional one.

In another method, called independent learning (model B), the students are equipped with the tools they need to learn the material (physically and/or virtually), and are given access to a faculty member to answer their questions and perform the evaluations. This is a typical asynchronous (not at the same time) class where communication between the teacher and the students, as well as amongst the students, is done via the phone, fax, or some form of computer-mediated communication. Here, the locus of control rests on the shoulders of the students, as they review the course content at their own pace, from anywhere, at any time. Students who succeed in these types of courses must be highly motivated, have good communication skills, and have the time-management skills

necessary to plan their lessons. The content for this course tends to remain static over a number of semesters so faculty find themselves acting more like individual tutors since they are released from the burdens of lesson planning.

In the third situation (model C), the open learning and class environment uses a combination of synchronous and asynchronous technologies to allow students to participate in periodic class-wide discussions. Although the pace of the instruction is user controlled, there are learning pre-requisites that exist if one is to fully benefit from the group meetings. Therefore, there are still scheduled classes in this structure, but at a much-reduced frequency than in a traditional setting. These class meetings are synchronous in nature, and can be achieved via teleconferencing, videoconferencing, or by using chat rooms. Much like in model B, the teacher serves more as a facilitator or tutor for students since the course material is pretty much static and there is no need to prepare regular lessons.

Synopsis: I started with this brief history lesson because I wanted a better understanding of the medium that delivers the statistics course to my students. According to the literature, the evolution of the Internet and its adoption by society has been nothing short of a technological revolution. Much like the radio and the television, the Internet seems to have firmly integrated itself into our everyday lives. Will this medium also catalyze an educational revolution? Only time will tell. However, in the limited amount of time that the Internet has been around, there is no denying the fact that it has already begun transforming the way that traditional and distance courses are taught. Although the research in this field is in its infancy, especially when dealing with e-Learning, studies

have identified issues and concerns about distance education that will have to be addressed. In addition, according to the models presented by the University of Maryland (online), INTE 296 seems to fall into the Independent Learning model (B) with students having control over the pace and place of instruction, the asynchronous communication, and the teacher acting more like a tutor throughout the semester.

Issues in Distance Education

There has been a rapidly growing clientele that has thrived in a distance education milieu and their needs differ from the "traditional" pupils (Palloff & Pratt, 2001). These students tend to be older, are part of the workforce, are returning to school, and typically live further away from the educational institution than a traditional student (Keegan, 1996). A major challenge of distance education remains the customization of the content and the architecture to fit the needs of learners who come from different cultural backgrounds, are from diverse age-groups, have various interests, as well as assorted educational levels (Willis & Dickson, 1997). This "non traditional" clientele has been at the forefront of increasing demands for flexible learning, which has resulted in new and innovative approaches to education. In fact it is to satisfy the demand of these individuals that open learning was developed, a method of instruction that included flexible courses that were designed to meet an individual's specific learning requirements (Maxwell, 1995).

Another major concern in distance education involves communication. Through the innovative use of technology, distance education must find ways to substitute for the absence of the spoken word, nonverbal cues, interactions with fellow students, feedback from the teacher, and delayed reinforcement (Keegan, 1996). The emergence of numerous technologies has given rise to innovative procedures that have the ability to replicate traditional learning environments across barriers of time and space. This has given rise to new an instructional concept called distributed learning (Dede, 1996). Distributed learning is a combination of technology-mediated, as well as traditional teaching events that are merged into a unique course outline. Communication is a mixture

of synchronous (traditional lecture, chat rooms), asynchronous (e-mail, office hours, homework), as well as limited synchronous interaction (group work, collaborative presentations) (Welsh, 1999). That being said, the effectiveness of said technologies has yet to be thoroughly researched due to their recent evolution. In the meantime, the predominant types of research will be case studies and formative evaluations (Dede, 1996).

In one research project, the University of Maryland (online) identified planning issues that were common to all types of distance education models. These concerns were logistical, student/faculty support, the evaluation of the course, as well as the lab experiences.

Logistical support issues in distance education keyed on the fact that an individual enrolled in a distance course should not be at a disadvantage to those students who have access to the campus facilities. This means that the distance students should have access to the course instructor through a variety of communication channels (e-mail, telephone, courier service, fax), as well as a proctored examination service.

So as not to increase the student's cost in taking a distance course, especially if they are taking it from out-of-town, it is suggested that the faculty incur the long-distance charges (University of Maryland, online). In order to help the distance students plan their learning schedule, it would also be a good idea to have faculty adhere to special office hours where they would be available to communicate with the students through a chosen medium of communication. In addition, it is up to the institution to find creative ways for students to have access to the non-academic services normally available to on-campus

students, as well as to make sure that the pupils have all of the tools necessary to accomplish the learning goals of the course. This might include access to electronic databases of research articles through the school library, or accounts to access electronic journal sites that are often for paying members-only (AFT, 2000).

A major stumbling block for distance education programs involves the participation of faculty members. Training services are needed to help the teachers familiarize themselves with the technology, as well as to provide continual and timely support throughout the ordeal. They must also have access to technical experts to help them integrate multimedia into their site should they want it. It is suggested that offering the teachers an added incentive to participate may help them justify the extra effort they are putting into the distance course. However, it is worth noting that teachers who voluntarily adopt this delivery method into their curriculum are the ones who usually experience greater satisfaction from it (Palloff & Pratt, 2001).

The evaluation of distance courses cannot be done in the same way that traditional courses are assessed. In this case, both the instructor, as well as the strategies used in the course must be scrutinized. The students enrolled in the course should also evaluate the administrative and technical support they had during the session, and the teachers should reflect upon their training and support (Palloff & Pratt, 2001).

In the case where classes have an important laboratory component, several methods can be used in order to recreate the same on-campus environment at a distance. One such possibility is the use of videoconferencing technology to offer a "live" demonstration to students. This demo could also be videotaped and either sent to the students, or offered

via streaming technology online for asynchronous use. Digital simulations, "home lab kits", as well as intensive onsite lab experiences can also be used as a substitute (Palloff & Pratt, 2001).

Henri and Kaye (1985) argue that the real challenge in distance education is the creation of an environment suitable for instruction in the learner's own milieu such that a teaching-learning relationship can be established.

In order for the distance learning industry to flourish, the roles of both the teacher and the student must be modified. Faculty must be willing to give up some of their control to the student, and the student must be willing to accept their new responsibilities as constructors of their own knowledge (Palloff & Pratt, 2001).

Synopsis: Distance learning, as a paradigm, has its inherent issues. However, the recent evolution of technologies, especially in the computer industry, has given designers added tools to use to correct the problems. This portion of the literature review gave me a generic overview of the concerns with distance education without focusing on the specifics of Web-based instruction. I also included some suggestions made by the researchers to overcome these problems, although these can be applied to any form of distance education. In the next section, I turn to online education and the specific issues that have been recognized in e-Learning methodologies.

E-learning and online learning

"What can be done in a Web-based classroom is limited only to the imagination of the educator and the available resources" (McCormack & Jones, 1998).

The World Wide Web, through the use of free Web browsers, has given educators and students an exciting new tool for distance teaching and learning. The user-friendly environment, along with the ability to integrate graphics, sound, text, and video onto a page using a fairly simple authoring tool, has given rise to a popular, and increasingly widespread medium to offer and seek instruction. Web-based instruction (also known as online learning) is a "hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported" (Khan, 1997). Graves (2000) describes an e-learning environment as one in which the instruction is supported, in one way or another, by Internet technologies. The terms online learning, e-learning, and Web-based instruction will be used synonymously throughout this thesis.

Web-based instruction (WBI) is made up of several components, which in turn offer numerous features that make the environment so inviting to learners (Banathy, 1992). For example, a student can employ e-mail (component) to ask their professor a question so as to take advantage of the asynchronous communication (feature) technology that the WWW supports. For certain researchers, the Web is a methodology for instruction and training (Khan, 1997), whereas others would argue that it is more of an integrating

medium for course delivery, or a "methodology for developing a learning environment" (Alessi & Trollip, 2001).

One of the major advantages of using the World Wide Web is the fact that the information is delivered on a platform-independent system (McCormack & Jones, 1998). In fact, as was mentioned in a previous section, this was one of the main reasons why it was created in the first place. Instruction via this medium means that users are not bound by time, or space, and have permanent access to a variety of dynamic resources (Relan & Gillani, 1997).

There are still several pressing issues with Web-based instruction that will have to be addressed by anyone wishing to partake in, or create a course, delivered using this methodology. One must realize that the use of computers is not yet a widespread phenomenon. There is no doubt that the use of computers is growing at an exponential rate, but there still are "technology novices" out there who have yet make use of the machines for a variety of reasons (Boston, 1992). Access to a computer and the Internet can be restricted due to geographical, economic, as well as for personal reasons. These students tend to need extra help to in order to get assimilated into the learning community, and without the extra help, it is very easy for them to fall behind right from the start of the course (McCormack & Jones, 1998). This has a profound psychological effect on the pupils in question, and it is not uncommon that they develop sentiments of intimidation and fear because of it (Boston, 1992). Training is needed for these students, and teachers should try to closely monitor their progress in the initial stages of the course (McCormack & Jones, 1998). Palloff and Pratt (2001) suggest that instructors should

offer an orientation session for their students where they can learn the basics of Internet browsing techniques, how to save and print material, how to use e-mail and message boards, as well as how to be successful in this type of instructional environment.

For many students, this will be their first experience in a course that is delivered at a distance, let alone entirely online. They must be made aware of the fact that not only is the type of learning methodology used different then what they are used to, but that the formation of a learning community, made up of the class members, needs to be established from the get-go to ease the transition (Palloff & Pratt, 2001). This community must be fostered through electronic interactions since this is the medium that they will be using throughout the course (Bernard & de Rubalcava, 2000). It should be made to clear to first-time distance education students before undertaking the course what kind of time commitments to expect, common difficulties encountered in the course due to its methodology, as well as the computer skills required (AFT, 2000). Boston (1992) recommends that students should possess at least simple text editing skills so that they can function in that type of environment. Furthermore, teachers should be quite proficient typists since, have the self-discipline to provide feedback by e-mail, and participate in the online discussions on a regular basis (Boston, 1992).

E-learning empowers the student in the dictation of the lesson's pace, as well as when they want to receive the instruction. Their teacher is no longer the traditional "sage on the stage" and has instead turned into more of a "guide on the side". This entails added responsibility on the student's part that they must be ready to undertake (Palloff & Pratt, 2001). The employment of multimedia and hypermedia in the online environment are

interactive tools that help make the instruction process learner-controlled (Dede, 1996). Examples of elements that are controlled by the user in online learning environments consist of (Alessi & Trollip, 2001):

- Forward progress, pace, and the termination of the lesson.
- Playing, pausing, rewinding, and advancing audio, video, and animations.
- Searching, accessing internal help, and admittance to the Web for external help.
- Reviewing and bookmarking Web pages.
- Font type, size, and colour.
- Printing, copying, and saving.

According to the American Federation of Teachers (AFT), Web-based courses have much potential, as well as its own limitations. If a teacher is to make use of the Internet to offer instruction, then they should make use of the strengths of the medium, and not turn the course into a poor imitation of its traditional face-to-face version (AFT, 2000). The use of the Web simply to offer an electronic book, or an electronic format of a print-based course, falls well short of the Internet's capabilities and potential (Hill, 1997).

Studies of e-Learning courses identified some common problems, most of which were voiced directly to the researchers by the participants themselves. These issues included the feelings of isolation by the student (Hill, 1997), procrastination due to bad time management and lack of motivation, the lack of two/three-way communication, as well as self-regulation problems related to the newfound autonomy in the course (Bernard & de Rubalcava, 2000). Working in an environment with a whole host of hyperlinks and

multimedia, coupled with the course content itself, had led to feelings of inundation because of information overload (Hill, 1997) and a lack of cohesiveness with the material (Wang-Chavez et al., 2001). This phenomenon has also been identified by Marchionini (1988), who found that "dissonance is often associated with hyperlinked environments". Instructors found themselves spending an increased amount of time trying to facilitate online communication, and were sometimes overwhelmed themselves with the amount of e-mails awaiting their attention, especially if they had been away for a few days (Gale, 2000). Shotsberger (1997) also acknowledged a lack of technical training and support, as well as a deficiency of resources, as common concerns for online learners and teachers alike.

In the study by (Wang-Chavez et al., 2001), it was revealed that students enjoyed the flexibility and convenience of online courses, but that technical problems and a lack of social or face-to-face interaction made the experience frustrating at times. However, technology was also acknowledged as a time-saver for both teachers and students since the time commuting had been eliminated (if working from home), finding the location of articles and books in the library was more convenient (if the services are available online), and teachers were not burdened with printed student assignments (if submitted by e-mail) (Chickering and Ehrmann, 1996).

Relan and Gillani (1997) insist that Web-based instruction is a synthesis of "cognitively-oriented instructional strategies implemented within a constructivist and collaborative learning environment" that makes use of the features of the World Wide Web. On the other hand, some researchers believe that e-learning methods will simply act as an

accessory to complement traditional classroom instruction, and that the "old school" methods will never be replaced (Davis, 2001).

There have been suggestions that face-to-face tutorials would help alleviate the feelings of isolation (Thomas & Carswell, 2000), as would the encouragement of interactions by facilitating cooperative and independent work (Davie & Wells, 1991). However, face-to-face tutorials are not always possible when students do not share the same schedules, or live near the academic institution. The use of technology-mediated communication, such as audio or videoconferencing, chat rooms, e-mail, and voice mail can help make the student feel like they are part of the learning community (Keegan, 1996). Other suggested techniques to enhance communication and reduce isolation barriers include the use of emoticons to simulate nonverbal cues, providing prompt feedback, the promotion of collaboration activities among the students, and built-in interactive activities.

Synopsis: This portion of the literature review helped me ascertain the current problems associated with this mode of instruction. However, the authors also had suggestions for ways to counter these inconveniences. Still, many of these issues were redundant, and it is clear that more research into online learning is needed, not only from the student's perspective, but from the viewpoint of the facilitator as well. These studies will have to focus on best practice techniques in traditional classroom, and how those same techniques can be recreated and exploited in a Web-based environment.

Instructional Technology and Online Learning

"Experts believe that the use of the Web will likely have the greatest impact on learning than any other innovation in instructional technology in the past thirty years" (Alessi & Trollip, 2001).

Instructional technology revolves around three main areas of research (Newby et al., 1996):

- Instructional design: the process whereby learning principles are implemented and integrated into instructional activities and content.
- Instructional media: the different mediums that can be used to deliver instructional materials to learners.
- Instructional computing: using computers to design, develop, deliver, and evaluate instruction.

Multimedia refers to a system whereby various media, such as video, audio, graphics, and text, are incorporated into a single computer-controlled delivery method (Newby et al., 1996). When these objects are linked together in a hypertext environment, as is the case in the World Wide Web, then multimedia takes on an added level of user-controlled interaction and is known as hypermedia. The Web is therefore a global collection of millions of hypermedia files (Alessi and Trollip, 2001).

Picciano (2001) mentions that although a designer has chosen one particular medium as the primary source for content delivery, other types of media may be more appropriate in

certain situations. He goes on to mention that educators need not "take a purist attitude" and stubbornly decide that all instruction must be offered through their preferred medium. The fact is that each form of media has its strengths and weaknesses. For instance, Hedberg et al. (1997) pointed out that using the World Wide Web to deliver course content is better than doing the same on a CD-ROM because the subject matter can be easily updated, less equipment is required for its production, and there is less of a need for high-level graphics. However, on the flip side, common Web-authoring tools are quite limited in their creative capabilities, and English is currently the dominant language of the Web, which in turn makes non-Anglo HTML programming a concern (Hedberg et al., 1997). The American Federation of Teachers (2000) agree that each medium has its strengths and weaknesses and that consequently, it can deliver "different kinds of dramatic experiences". The AFT justified their point by comparing the disparity between one's experiences at a live theatre show to those of a spectator watching a static video camera capturing the same performance.

Picciano (2001) also claims that depending on the technology used, students who have access to computer technology may have an advantage over those who do not. By using a class Web site, for example, instructors can offer their students their PowerPoint slides before the lesson is offered so that they can better prepare themselves (or not have to take notes during the lecture), review images that were offered in class, or interact with digital simulations of a phenomenon they are studying at the time. Welsh (1999) suggests that an instructional designer would do well to "learn from the experience of others charged with developing integrated mixed media projects".

Multimedia technologies can be used to create an interactive environment which, according to Barker (1994), "is a necessary and fundamental mechanism for knowledge acquisition and the development of both cognitive and physical skills". Sims (1997) stresses that interactivity is essential to encourage discovery learning and effective instructional practice. Although multimedia is not interactive per se, it can easily be used by developers to create an application that is. The Web, although not initially designed to be an interactive environment, can support high levels of interactivity. This includes traditional interactions such as questioning and answering, problem solving, simulations, and games (Alessi and Trollip, 2001). With the help of newer authoring technologies, such as Macromedia Shockwave and JavaScript, the Web can also support dragging and dropping, typing, temporary data storage, and user-controlled animations. The communication capabilities of the Web not only support interactions between the computer and the learner, but also between groups of learners. Researchers agree that although interactivity on the Web is impoverished at this time, newer technologies are helping to make the manipulation of objects and networks easier for designers to implement into the Web site (Buckingham, 1996).

Chickering and Ehrmann (1996) claim that students need opportunities to showcase their strengths by learning in ways that they find to be the most effective. This could mean the use of a detailed diagram coupled with some well-written text, a structured schedule, as well as an open-ended agenda, thus giving the learner a choice for their instruction. Some experts believe that multimedia is an ideal vessel to stimulate learners through their

preferred learning style. By offering instruction in various formats (text, video, audio, animation), a learner would be able to relate to at least one of the objects and use it to accomplish the learning objectives. In other words, the more a teacher knows about a student's particular learning style, the better they can tailor their lesson to fit that style, and consequently, make it easier for that student to learn (Brooks, 2001). Even if there is not much research to support these claims, Brooks mentions that such propositions have "face validity" since they seem "reasonable, rational, and appropriate just for what it is without the need for further justification or research". In other words, these claims make "horse sense", and "horse sense is very good...especially when you are a horse" (Brooks, 2001). Dede (1996) agrees with this thought process since the lack of research in the field puts a constraint on the extent to which past evaluative studies can be generalized. He describes the use of inferences without conclusive evidence of their viability as being ideas presented "in the realm of informed surmise". It is through the use of multimedia (full-motion video, graphics, integrated audio) and hypermedia (learner-controlled data retrieval system) that users are able to view the course materials using their preferred learning style (visual, auditory, symbolic).

Another reason for using multimedia is to introduce a degree of realism into the instruction, thus enabling the learner to better understand the message being transmitted. Realism is a concept that "reflects the relative concreteness and abstraction of a medium". The more realistic the instruction, the easier it is for the learner to make the proper associations and to transfer this information to new situations (Smith & Dillon, 1999). Bandwidth, which refers to the amount of information that can be transferred between two terminals on a computer network, is a limiting factor that must be taken in

consideration when designing applications to accompany instructional events. For instance, full-motion video requires much more bandwidth than static graphics and text. The higher the bandwidth, the easier it is to deliver sophisticated simulations and models of real experiences (Smith & Dillon, 1999). According to Dede (1991), increasing the bandwidth will also increase the potential for interaction via communication channels, further influencing distance education courses. Buckingham (1996) cautions that since simple text and graphics are what made the Web so popular today, designers should be aware that simplicity is the key for hypermedia usage, especially if bandwidth is an issue.

Not everybody agrees with the benefits of multimedia and hypermedia in instruction. For instance, some researchers believe that media is but a vehicle that delivers instruction and does not influence a student's learning. In other words, the type of media used is of no importance since it is the content that determines scholastic success. Saying otherwise would be like admitting that the truck used to deliver our groceries also causes changes in our nutrition (Clark, 1983). Reeves and Reeves (1987) add that the World Wide Web is but a vehicle for the mix of media and information resources, its true effectiveness and worth will be determined in its ability to deliver "pedagogical dimensions" to learners around the globe.

According to Dede (1996), the "generic model of pedagogy underlying these types of multimedia and hypermedia systems is analogical, case-based learning-by-doing". It is through this process that students are able to make a connection between what they are learning, and how this knowledge can be applied in a real-life situation. By staying up-to-date on the latest trends and developments in instructional technology, and by assessing

emerging technologies in terms of making instruction more effective, efficient, and convenient, instructional designers will continue to play a key role in the evolution of distance learning techniques (Welsh, 1999).

Synopsis: Although there is some dissention amongst researchers with regards to the importance of media in instruction, there is consensus about the role of technology in education: it is not the technology that is critical to the success of a course, but rather the pedagogy. This portion of the literature review served as an overview of the influence of media in instruction, as well as its role in helping to make Web environments interactive. The next step was to investigate how these techniques could be used within a Web site in order to optimize the instructional experience.

Web Site Usability and Design

"A well-constructed course is one that is logical in its design, easy to navigate, and inviting to the user" (Palloff & Pratt, 2001).

The whole premise of Web site usability is to find out "whether those who are trying to use the site can achieve a specified goal or accomplish what they are trying to do". It goes beyond graphic design (colour scheme, background, fonts) and takes into consideration the layout of the content, the navigation system of the site, and how effective the searching feature is (Donnelly, 2001). Nielsen (1990) describes a "usable" Web site as one that allows for easy comprehension of the content, whose navigation is easily remembered, has few errors, is efficient, and is pleasant to use.

During a Web site's design phase, it is important to conduct a thorough user analysis that will collect as much information as possible about the "typical user". This process must unearth the target audience's social and economic factors, their skill levels (such as their familiarity with the Web), their language (vocabulary level and keywords used), and the environment they are working in (hardware and software being used) (Donnelly, 2001). Rathbun (1999) describes a "user-centred" design as one in which the designer concentrates on the interests, needs, and capabilities of potential users. Buckingham (1996), on the other hand, marvels at the paradox that the Web is such a vast and accessible hypertext system that no designer can be certain of the end-user's specifications.

One of the main problems with the design of Websites today is that the focus is increasingly put on the aesthetic quality of the pages, and not on the overall usability of the site. In other words, designers are hoping that users will judge the book by its cover, and not its content or use (Donnelly, 2001). The author goes on to list six design features that are critical for common Web tasks: waiting, browsing, hunting, reading, navigation, and searching/printing.

Web page designers must be conscious of the period of time that users must wait for the site content to be downloaded and displayed. Donnelly (2001) suggests finding ways to display the "value content" first, followed by the "fluff", and to offer text links before the loading of graphics. Graphics should also be carefully used, and animated ones should be avoided if possible. Jones and Farquhar (1987) suggest that the important information should be found at the top of the Web page so that the users do not have to scroll down to find it. They explain that a large static graphic at the top of the page not only wastes space, but also slows down the downloading process. This problem is especially obvious when users vary widely. Their connection speeds will differ, as will the type of computer they are using. Therefore slow-speed users become an issue for designers when they are adding multimedia features to the site (Alessi and Trollip, 2001). Slow loading pages are a common complaint for users and designers will have to accommodate the "lowest denominators" so that the delivery of materials is done at an acceptable speed for everyone.

A second issue involves a user's browsing tendencies, such as the fact that they perceive familiar words first, and naturally tend to notice subject headings (Donnelly, 2001). Users

tend to focus on keywords or phrases that match the task at hand, their current or ongoing interests, or "hot" words that are natural attention grabbers (Krug 2000). Nielsen (1997) suggests being consistent with keywords, using headings that are meaningful, as opposed to "clever", and when appropriate, to use bulleted lists to present "scannable" data. Writing should be concise (to get information quickly), and the language used should be objective (neutral). The combination of these three characteristics will yield the highest usability scores on any Website (Nielsen, 1997). He added that keywords should be highlighted, either as hyperlinks, or by varying the typeface and/or colour. Furthermore, text should be organized in a way such that each paragraph represents a single idea, otherwise, users will skip them as they seek out the information they want (Nielsen, 1997). Jones and Farquhar (1997) believe that information can be properly structured through consistent placement and common style usage for section titles. Alessi and Trollip (2001) suggest the use of familiar icons as "semantic cues" for the users. They describe the cues as a quick way that users use to determine the nature of the hyperlink. For instance, the use of a loudspeaker icon beside a link would suggest that a sound would be played if activated.

The concept of hunting was described as a user's predisposition to scan a page for keywords, or to use the site's search capabilities in order to find information rather than reading everything that is displayed (Krug, 2000; Donnelly, 2001). It is suggested that by providing an advanced search feature that would include synonym support, and by avoiding the use of specialized terminology, a user's burden would be lessened in finding the information they seek (Donnelly, 2001). The physical appearance of the onscreen text, as well as the user's ability to decipher the facts being presented, is another

"reading" issue that must be addressed once the user finds the information they want. In order to make the onscreen reading experience easier, Donnelly (2001) suggests keeping the vertical scrolling to a minimum, eliminating any horizontal scrolling if possible, and to concentrate on the writing style. Krug (2000) points out that if a document is longer than a few paragraphs, users are more likely to print it out and read it on paper because it's easier and faster to do so. It is for these reasons that Krug suggests designing pages for scanning, and not for reading. This includes making important words prominent, making sure that logically-related themes are also linked visually, and that "nesting" strategies, like the use of tabs, can be used to show relationships among the content while giving the designer the opportunity to "physically" divide the site (Krug, 2000). Nielsen (1999) acknowledges the fact that a Web page is fundamentally a scrolling experience. Companies like Logitech and Microsoft have also recognized this tendency as is demonstrated in the production of mice equipped with a scroll button.

As far as navigation goes, the site structure should be designed to map the tasks of the user while avoiding deep hierarchies, or "link density". Although some Web designers will argue that more links are better since it gives the user access to all relevant resources, others will caution that too many links will encourage browsing, and not focus a user's attention on the important information. Also, where some designers believe that links should be clear and evident, others will dispute that the more obvious a link is, the more distracting it would be for a user. Therefore, a compromise must be made to maintain readability while sustaining a user's flexibility of getting additional information (Alessi and Trollip, 2001). To avoid confusion within the Website, familiar link properties and labels should be used. For instance, hypertext links should be coloured in royal blue and

underlined, active links in dark red, and visited links in purple (Jones & Farquhar, 1997). Lee and Lehman (1993) suggest that browsers should be equipped with a button or feature that would allow users to hide hyperlinked and "hot word" indicators. This would eliminate the confusion from the source and enable learners to concentrate on what they are reading without being distracted. Relying on the alteration of the mouse pointer is not an effective strategy for hyperlink identification since it forces the user to move the cursor all over the page in order to find them (Alessi and Trollip, 2001). Furthermore, the external links, the links that take the user outside of the Website, should be maintained on a regular basis in order to avoid "dead links" which are always a source of frustration for a user (Donnelly, 2001). Welsh (1999) also adds that there is an increased importance on the continual maintenance of the Website as a whole after the course has been launched. In fact, he goes on the mention that it is the course designs that allow for easy maintenance and content revision that will survive longer than those that do not (Welsh, 1999).

Lastly, a designer should be conscious of a user's need to be able to return to a page to access previously-viewed materials. Instead of relying on a "physical" sense of where the information is found (like driving directions), users must remember conceptual hierarchies and attempt to retrace their steps (Krug, 2000). To ease this task, Web surfers should be provided with an easy way to search, bookmark, or at least printout the information (Donnelly, 2001). Alessi and Trollip (2001) suggest the use of menus, indexes, tables of contents, maps, and timelines as methods to help learners find their way back to information they had previously accessed.

Donnelly (2001) also brings up a phenomenon that is slowing down the transfer of content to a Web page, thus affecting the speed at which it is updated. An "HTML development bottleneck" occurs when a writer's content must go through the graphic designer and the HTML developer before it is finally uploaded to the server. This is a usability issue for the teacher who is writing content for their Website, especially if they are not proficient in HTML programming, as well as for the learner who is waiting for new information and feedback. The solution is to break up the bottleneck by creating a two-lane highway that only merges at the server. This is accomplished by having the graphic designers create ready-made templates that the HTML developers encode and upload, while the content writers simply publish their content directly into the template of their choice.

Hypermedia has a distinct advantage in that it makes use of the "random access capabilities of computers to overcome the strictly sequential medium of print on paper". It is an enabling environment rather than a directive one since it is the learner who controls their own navigation. However, in this environment, especially for new users, it is not uncommon to feel "lost in hyperspace" due to the amount of information and choices that are available. Web page designers should consider building in some sort of navigation guide for the users, especially in electronic books where users have no indication of the "size" of the document, nor how many pages they have read or have left to read (Marchionini, 1988). Marchionini described the dilemma as being akin to handing over the television remote control to a child (Marchionini, 1988). Jones and Farquhar (1997) refer to this same phenomenon as "info vertigo". Alessi and Trollip (2001) bring up the point that hyperlinked Web environments have a natural tendency to open up

multiple windows. This also contributes to navigation confusion and desktop clutter since users are forced to close unwanted windows instead of simply clicking on "Back".

To alleviate the problem, Gillani and Relan (1997) preach simplicity and consistency in the page design so as not to distract a learner's attention with superfluous elements. Using techniques like chunking, overviews, advanced organizers, maps, and a fixed display format, may also aid with the predicament. Alessi and Trollip (2001) suggest including a site map, using frames, offering printed directions, and under no circumstance, underestimate the problem of disorientation. With regards to the multiple windows, the authors suggest minimizing the amount used and making it clear to users that a particular link will open a new window. Krug (2000) suggests the use of "breadcrumbs" to visually display the path the user is on. This technique is used to give users a sense of where they are in the scheme of things without having to use the site map. He compares the feature to a "you are here" map commonly found in shopping malls or other large buildings. Krug also mentions the fact that Web surfers must always be able to count on the home page link, the "North Star" of a Web page. This is considered the "start over" or "escape" button that users who are lost in the site can activate to start anew.

Krug (2000) also identifies other tendencies that Web users have when they are browsing. One of particular interest was the fact that users do not always make the optimal selection when choosing a particular hyperlink. Instead, they identify the first reasonable option and select it. Krug describes this action as "satisficing" (a cross between satisfying and sufficing). Also, users don't take the time to read instructions and would much rather

"forge ahead and muddle through" the site. These are user characteristics that designers may want to keep in mind when putting together a Web site. This phenomenon, along with Web page scanning, is an example of a typical Web user's impatience (Nielsen, 1999).

All in all, usability testing is a simple and inexpensive tool to use that is beneficial to both the users, as well as the designers of the Web site. Krug (2000) compares the procedure to having friends in from out of town and acting as a tour guide for them. It is during those tours that "you see things about your home town that you usually don't notice because you're so used to them". It is at that point that one realizes that what may seem obvious for one individual, may not be so for others.

As far as the specific Web design issues are concerned, common characteristics that designers must address during the design process include (Konrad et al., 2001):

- The use of white space to help break up the content into manageable chunks, thus creating a favourable and relaxed visual environment for the users.
- Placing objects within the text in such a way that patterns are created, thus making it easier for the user to make relationships between the graphics and the content.
- The use of the same icons, colours, and text styles throughout the Web site so that users do not have to rediscover their meaning.
- Designing a site in such a way that all users, regardless of their screen resolutions, can access and view the information. This means that the content should at least fit within a 640 by 480 pixel screen resolution layout.

- Hot Spots refer to the areas on the computer screen that users will focus on the most. Tests show that individuals look at the top left corner of a screen first, and then move to the right. Important information should be included in these quadrants. This, of course, applies to individuals from cultures that read from left to right.
- The overuse of colours can distract the readers. The number of colours used on a Web page should be monitored and limited. This also applies to "busy" backgrounds.

Buckingham (1996) concludes that in Web site design, quality sites speak for themselves and when found, they should serve as a guide for other designers.

Synopsis: Web site usability is a topic that must be investigated since an unusable or useless site defeats the purpose of providing online instruction in the first place. This portion of the literature review highlighted the importance in the design of a Web page, the common problems that users have with site navigation and hyperlinks, and ways in which to counter those predicaments. After exploring issues related to the physical design of the Web site, the next main issue deals with the communication techniques that the Internet can support in an online course.

Computer Mediated Communication

Communication is an essential part of the learning experience. Be it with the teacher, fellow students, or an expert in the field, a learner must be able to express their thoughts and seek the counsel of fellow academics as they attempt to make sense of their surroundings. The communications and entertainment industries, coupled with the global marketplace, are the driving force behind the rapid evolution of computing and communications (Dede, 1996). However, with the increase of telecommunication options for the students, this has also increased their confusion over which to use and when.

Interaction in a Web-based environment, although different from the traditional face-to-face communication, offers some unique opportunities. First of all, communication via the Internet can be accomplished synchronously (at the same time), as well as asynchronously (at different times) between two individuals using various Internet tools. For example, chat rooms, multi-user dungeons (MUDs), and desktop videoconferencing features support real-time communication, whereas e-mail is a popular asynchronous mode of contact (McCormack & Jones, 1998). In order to maximize the amount of electronic interaction, the AFT suggests incorporating both synchronous, as well as asynchronous modes of communication within the course (AFT, 2000). Since all of these techniques are mediated through a computer interface, via the Internet, they are dubbed computer mediated communication (CMC) techniques. CMC is a means for geographically scattered pupils to communicate with each other. It encourages group interaction since all of the participants are given equal opportunities to express their thoughts (Romiszowski & de Haas, 1989). This is especially beneficial for shy students

who would not normally ask questions or participate in debates during traditional classes. Also, this mode of communication is ideal for the "non-traditional" students who work or have family responsibilities. This advantage also applies to inter-student communication where the increased opportunities for meaningful exchanges can help learners form study groups, pool their resources to complete problems, and perform other collaborative learning tasks (Chickering and Ehrmann, 1996).

According to Paulsen (1995), computer-mediated communication is composed of four elements: information retrieval, electronic mail, bulletin boards, and computer conferencing. One-alone techniques are used when a student employs the computer for information retrieval purposes without the need to communicate with the teacher or a fellow student. One-to-one techniques typically occur via e-mail between the teacher and the student, and include learning contracts, correspondence study, and mentorship and apprenticeship. Interestingly, students have expressed a preference for using e-mail to communicate with the professor since replies were more "immediate" than with the telephone (Thomas & Carswell, 2000). Furthermore, they appreciated the fact that they could send a question via e-mail to their professor and receive a personal reply (Kearsley, Lynch, & Wizer, 1995). In the one-to-many scenario, an individual will serve as a subject matter expert in a lecture, or skit. A simple way to accomplish this with CMC technology is via a bulletin board system. The use of debates, role-playing, simulations, games, brainstorming activities, and discussion groups are examples of many-to-many communication scenarios that can be recreated using computer conferencing systems such as chat rooms (Paulsen, 1995). Communication among several people can also be

easily achieved via message boards, newsgroups, mail list servers (listservs), chat rooms, and through audio/videoconferencing technologies (Alessi & Trollip, 2001).

Sherry and Wilson (1997) have described a phenomenon where students and teachers alike are transformed into learners through a two-way, dynamic communication system. According to the authors, transformative communication is occurring when a student teaches an instructor something about the technology or the content of the course, students are notifying the instructor about other available learning resources, students collaboratively guide much of their own learning, and the instructors find themselves saving student work for future reference.

In order to familiarize themselves and become comfortable with the communication protocol, students should interact with their professor and classmates early in the course. Despite initial efforts to maximize participation in the CMC environment, teachers may notice that their strategies do not seem to be completely effective. Thomas and Carswell (2000) caution that this may be due to the presence of "lurkers", who are individuals who read the messages and follow the conversations, but who do not post messages of their own. Kimball (1995) proposes some tips for facilitators to help keep the students motivated to use many-to-many conferencing systems. These recommendations include adding new material on a regular basis in order to keep the discussions fresh and thought provoking and providing feedback via personal e-mail to the students who post good messages.

According to Bates (1997), the benefit of computer-mediated communication technologies in distance education is no longer an issue. Instead, researchers are now

concentrating on how to make more efficient use of it. Teachers must play an active role in keeping their pupils on track by providing the necessary support and motivation they need to succeed (Smith & Dillon, 1999).

Synopsis: Computer-mediated communication is an integral part of Web-based instruction since it is the primary means of communication that a student has at their disposal. Whether it is with the computer itself, with the course instructor, with fellow students, or with other knowledgeable sources, CMC serves as a means to establish a learning community. The purpose of this section of the literature review was to investigate the uses of CMC in distance education courses, as well as to determine what were the drawbacks of such a system. Now that all the tools were identified and explored, it was time to move on to the instructions for assembling a Web-based course.

Constructivism and Technology

"Learning is not a spectator sport" (Chickering and Ehrmann, 1996).

Technology enables distance education students to participate in a much more diversified and socially rich environment, meaning that their instruction is supported through interactions with others. For example, telecommunication technologies such as electronic mail and message boards, provide learners with a tool to mediate group-based cooperative learning activities, and in doing so, promote active rather than passive learning (Tam, 2000). These values are very much like the ones integrated in the philosophy of open and distance learning. The student autonomy in these institutions reflects the constructivist views by encouraging learners to be "active, collaborative, and responsible" (Maxwell, 1995). This point was also mentioned by Romiszowski and de Haas (1989) who claimed that "distance education provides the unique context in which to infuse constructivist principles". They went on to explain that in situations where the learner is physically separated from the source of instruction, and where technology serves as a medium for communication, there is a greater need to instil constructivist environments where students are encouraged to work together, and where the teacher goes from the "purveyor of knowledge to facilitator of personal meaning making" (Romiszowski & de Haas, 1989). Therefore, constructivism provides us with guiding principles to help Web designers and instructors create surroundings that foster learner-centred, collaborative, reflective, and experiential meaning making. Oliver (1999) believes that the critical design components of online courses are found in the content, the learning activities, and the learner supports, all offered in a constructivist

environment. However, Rowntree (1995) cautions that not every learner may be ready for this type of collaborative, constructivist environment that is encouraged through computer-conferencing.

Constructivists believe that knowledge and truth do not exist outside the human mind, but are rather constructed by the learners from their own experiences and interactions. Therefore, in contrast to objectivists, learners "are not seen as empty vessels waiting to be filled, but rather active organisms seeking meaning" (Driscoll, 2000). Constructivist instruction involves a learner's application of their knowledge to solve problems through interactions with their environment (Newby et al., 1996). The goal of constructivist instruction is for students to see the lesson as being relevant and interesting, and by providing them with an opportunity to see its implications in real-life situations (Tam, 2000).

In the constructivist environment, the responsibility for the generation of knowledge shifts from the traditional teacher-centred philosophy to a learner-centred one (Maxwell, 1995). In addition, the teacher takes on the role of a facilitator. The facilitator's task is to "help students become active participants in their learning and make meaningful connections between prior knowledge, new knowledge, and the processes involved in learning" (Copley, 1992). Rowntree (1995) agrees that in an online environment, the teacher becomes more of a facilitator with the following roles:

- Deal with the organizational details of setting up an online course to ensure that students have the proper hardware and software to participate.

- Plan the structure and content of the course, including the establishment of learning objectives.
- Act as a host that congregates the learners for a face-to-face meeting at the beginning of the course.
- Assume the responsibility of being the instructor to certify that students understand the course concepts and content.

Chickering and Ehrmann (1996) claim that learning is not a "spectator sport". They firmly believe that sitting and listening to a teacher's sermon will not enlighten students, nor will the memorization of terms followed by the subsequent "spitting out" of answers. Instead, they must discus, reflect upon, associate, and apply the knowledge to their daily lives. In other words, they must interact with the information and become active in the construction of their own learning. The interactivity of a medium allows students to receive better feedback, and consequently, increase their motivation levels and make them better individual learners (Dede, 1991). Many online courses limit the interactivity to learner-content, and do not make use of the vast potential for learning outcomes that other forms of CMC can provide (Jasinski & Thiagarajan, 2000). However, other researchers insist that the ultimate levels in interactivity lie not with the user's manipulation of data, but rather in the knowledge-creating process itself (Hedberg et al., 1997).

It is through motivational and metacognitive skills that a user can self-regulate themselves to make the most out of a constructivist learning environment (Hedberg et al.,

1997). "In getting started, students may need help in assessing their existing knowledge and competence" (Chickering & Ehrmann, 1996). This must be followed by regular opportunities for students to test their understanding of the knowledge and receive feedback. Not only can technology be used to send and receive feedback via communication channels, but teachers can also make creative use of it to aid students in their own self-assessment. For example, video technologies can be made to aid an athlete or an actor critique their own performance (Chickering & Ehrmann, 1996).

It is common to encounter literature on collaborative learning that is based on the theoretical and philosophical foundations of constructivism, such as Vygotsky's theory of social constructivism (Bernard & de Rubalcava, 2000). By simply using hyperlinks in a document, users are not only able to control the information they receive, but they also benefit from a basic level of interactivity. This "freedom of choice" is key when operating within a constructivist environment (Hedberg et al., 1997). The instructional designer can integrate external links into the Web page that will allow the user to explore relative content outside of the Web site with the click of the mouse. Other types of interactivity can include automatically graded quizzes, advanced search engines, and dynamic simulations that are based on a learner's input (Starr, 1997). The students themselves, with the aid of a bulletin or message board system, can provide feedback to their fellow classmates. This is a good way for the teacher to gauge any deficiencies in the course and address them immediately, either by changing the online content, or by posting a FAQ page with answers to popular questions (Oliver, 1999). Rowntree (1995) insists that students are able to learn just as much from one another as they are from the course facilitator through collaborative learning.

Just because a constructivist approach has been adopted, it does not mean that the course instructor can assume a "hands-off" approach. Although it is up to the student to construct their own meaning when deciphering the course content, it is up to the institution to monitor the students's progress and verify the quality of the instruction (Westera, 1999).

Synopsis: This portion of the literature review focused on the instructional theory that best suited the online learning environment I wanted to create. Due to its emphasis on individual knowledge construction via problem solving, collaboration through CMC technologies, computer-based tools, and open-ended environments, constructivism was determined as being the learning theory of choice among many researchers for use in such environments. However, implementing constructivist activities into online curricula entails several adjustments to the design and structure of the Web site. The suggestions made by the authors were noted and integrated into recommendations using the tools at my disposal.

Chapter Three: Methodology and Results

Phase One – Course Development

In the first part of the methodology behind this thesis, the course development phase, an examination of the steps undertaken in the creation of the first version of the online statistics course is made. Since I was not directly involved in this phase, I had to rely on the testimony and knowledge of personnel who were implicated in the project in hopes of getting as much information as possible. This meant that the data collection was going to be achieved through some sort of inquiry process where the informants would help me understand the problem that they faced. According to Cresswell (1994), the only realities available to the researcher are the ones created by the individuals who were directly involved in the experience.

To accomplish this, I employed two qualitative research strategies. First, I conducted in-depth interviews with both the course instructor (at the time), as well as with the project leader, who was responsible for overseeing the development of the original course. In-depth interviews are typically informal, much like normal conversations, and do not make use of predetermined response categories (Marshall & Rossman, 1995). I made use of interviews because they can used in a variety of contexts and situations and are quite compatible with other research techniques. One of the main strengths with interviewing is the fact that they are done in-person so that clarifications can be made on the spot, and misunderstandings are purged at the source (White, 2000). Marshall and Rossman (1995)

add that interviews are a useful way of quickly getting large amounts of data. On the flip side, interviews can be quite lengthy, and there is an inherent issue with the reliability of the information recorded since the researcher has limited options for validating objective facts (White, 2000). One way of counteracting this is to interview several individuals and compare the results, or by combining interviewing with another methodology to triangulate the data (Marshall and Rossman, 1995).

In preparation for the interview, I put together a list of topics that I wanted to investigate. In particular, I wanted to find out the rationale for picking an undergraduate statistics course as the subject for Concordia's first online course, as well as the reasons why it was decided to offer it online. I also would like to investigate the procedure that was followed in putting the course together, as well as identify the source of the course content.

The second qualitative method used was the document review in which a researcher supplements the interview data with an analysis of documents produced in the course development process. It is an unobtrusive way of collecting data and of verifying facts (Marshall and Rossman, 1995).

For the document review, I surveyed a collection of course outlines that had been gathered prior to the development of the content for the online course. I also had access to the Website itself, where the final product was found. I was able to carefully analyse these documents prior to the interview (in order to help me generate questions), as well as afterwards, to help me understand the information I had collected.

Phase Two – Course Evaluation

In phase two, the course was evaluated from different angles using diverse techniques. Researchers who believe in qualitative research methods argue that every situation is unique and therefore, the research must take place in actual, everyday settings since it cannot be recreated in a laboratory (White, 2000). The evaluation of such an environment is "inherently a social, political, and value-oriented activity", and therefore, is incompatible with the traditional scientific approach (Guba & Lincoln, 1989). In qualitative studies, researchers interact with the individuals they are studying in such a way as to eliminate as much "distance" between them as possible (Cresswell, 1994). Methodologies that are grounded in inquiry techniques, such as through interviews and questionnaires, are constructivist in nature since it is assumed that realities are not "out there", but are instead constructed by individuals as they react with their surroundings. In other words, it is the researcher's job to find out what meanings the individuals have constructed as opposed to relying solely on the results of their own observations. This is much different than the traditional scientific method where the emphasis in on the researcher acting as an unobtrusive observer so as not to influence the natural phenomenon being studied (Guba & Lincoln, 1989).

According to Guba and Lincoln (1989), in constructivist inquiries, researchers must not enter a study as a "knower", as they would in traditional, or positivistic research, but rather as learners. Therefore, one must use their senses, their observations, as well as their

interactions with the subjects of the study in order to collect the information they need. Tacit knowledge is welcome, as are vicarious experiences, since the basic mechanism for learning in humans is experience.

Data collection procedures

For this phase of the study, I wanted to look at the course through the eyes of all the stakeholders, that is: from the students' perspective, from the teacher's, as well as from an educational technologist's.

Students

- In-depth interviews/Focus groups

Although this technique was used over a five-year period to collect information about the course, they were rarely pre-planned. Students would regularly drop by my office for clarifications, to ask questions, or to drop-off/pick-up assignments. This was usually done in-between classes, so they were "killing off" time by coming to see me. I took those opportunities to ask them how things were going in the course, if they were having difficulties, and how they were enjoying this type of methodology thus far. If they were responsive and wanted to talk, then I would follow up with more questions, sometimes regarding the course content, sometimes about the usability of the Web site, and sometimes about the use of CMC technologies. Although the interviews were informal

and unstructured, the students understood that this information would be used to improve the course, and it gave me a chance to gauge the audience, as well as to explore unanticipated issues.

On some occasions, groups of students would show up at my office at the same time. Since I allowed for assignments to be worked on in groups, these were usually individuals from the same gang who would drop by to visit. I would normally ask the group the same question with regards to their current feelings about the course, await one of the members to respond, and this would usually open the floodgates since everyone seemed to have an opinion. I would simply let them talk, giving them the floor to carry the discussions wherever they wanted it to go. I paid special attention to disagreements within the group and would usually ask more pointed questions when I saw a member shake their head or crease their eyebrows. These were the most interesting and fulfilling sessions I had in the data collection process. The only problem with them was that they were unpredictable, could be quite chaotic when everyone wanted to talk at the same time, sometimes veered off topic, and were unscheduled. That being said, since I was able to interact with the students on a regular basis, I did not feel a need to schedule formal interview or focus group sessions.

On the other hand, this procedure incurred a slight responder's bias since the individuals I was interviewing were all on campus students, mostly from the same program of study (since their classes were right next to my office). These students tended to hand in their assignments in person, and come to see me personally when they needed help. To get the

"real" distance education students, I had to rely on the phone calls from these individuals to have the same opportunity to ask similar questions. For those interviews, I tried to concentrate a little more on communication issues since I figured that usability and evaluation concerns would be the similar to the students who came by the office. I would ask these "distance" students about the quality and quantity of feedback, their methods for dealing with problems they had with the material, as well as their technical difficulties. These sessions provided me with a new perspective about the course methodology since these individuals differed from the on-campus crowd since they tended to be older, had jobs, had families, and were typically part-time students at the university.

- Cognitive walkthrough (thinking aloud)

A cognitive walkthrough is a usability test executed by a system's user in which the goal is to record the user's thought process as they perform a pre-determined task. The student performing the test was asked to "think out loud" and explain why they were doing what they were doing. Although the student had made an appointment to meet with me, the test itself was unscheduled. The appointment had already been arranged to help them with technical difficulties with the course, including site navigation. What would happen is that in some situations where I could not understand their dilemma, I would have them sit at a computer and explain to me what they were trying to do, how they were doing it, and why they were doing it this way. Sometimes I had to interrupt them to ask why they selected a certain link, or what was going through their minds as they scanned a given

page, but often times I would be able to sit back, listen to them, and observe their actions as they used the Web site. When they would get lost, or seemed too frustrated to continue, I would intervene and guide them to their destination with pointed questions. Once they had succeeded with their task, I would ask the student to perform another task, just to make sure that I fully had understood their mental model for the navigation of this Web site, as well as to ensure their competence with the system. This type of session proved to be a little lengthier than interviews, but ultimately benefited the student who would leave the office a little more confident about their computer abilities. These meetings also tended to be the most frustrating for me as I fought the urge to grab the mouse and show the baffled student where to find the information. But what was obvious for me was not as evident for them, and I wanted to know why.

- Questionnaires

Since the course was first introduced, there have been a few studies conducted by third parties interested in the attitudes and feelings of the students enrolled in online courses. I consented to those studies on condition that (1) the students volunteer their participation and (2) the data collected be made available to me for my own research should I choose to analyse it. In one of those studies, data were collected with regards to the demographics of the student (age, gender, language, and student status), their attitudes towards online learning before doing the course, as well as on their preferred learning style. I requested the raw data from the group conducting the research, conducted my own analysis of the results, and compared my conclusion with theirs. This proved to be a

great opportunity to have unbiased researchers study my course. In addition, the individuals performing the study were in contact with me throughout the ordeal, made a copy of the questionnaire available to me, and awaited my approval and comments prior to distributing it to my students. Therefore, I felt that using their data would give my study an added tool to help me better understand the learners. Please see Appendix A for the third-party survey completed by INTE 296 students.

- Observation

For any qualitative researcher, observation is a primary and essential tool since it is used to "discover complex interactions in natural social settings". It can also be used in conjunction with other techniques in order to note nonverbal cues. Educational studies commonly use classroom observation as a data collection method (Marshall & Rossman, 1994). Observation involves the identification and subsequent focusing on the characteristics that are the most relevant to the problem being investigated. This technique also provides some depth to the prolonged engagement method and increases a study's internal validity (Guba & Lincoln, 1989).

In my case, due to the limited face-to-face contact, observation came into play during the interview sessions, the focus groups, as well as during the cognitive walkthroughs. During these meetings, I would observe nonverbal cues that students would sometimes demonstrate and come up with follow-up or more specific questions based on the reaction I saw.

Sometimes I would have the opportunity to see students working in the computer lab, and would casually observe their behaviours, or the work they were doing. In this case, I tried to be discreet so as not to distract them with my presence. At the same time, I was there to help them so the observation would never last that long. However, in the short amount of time that I was able to observe them in their "natural setting", I was able to note their navigation habits, their computer skills, as well as how they went through the statistics lessons and completed the assignments.

- Course Evaluation

At the end of each semester, students are encouraged to complete the online course evaluation. Although this is an optional endeavour, several students go through the motions at their own leisure. The problem with this, however, is that only the students who feel very strongly for or against the course will likely be the ones filling in the form. In addition, the questions asked in the evaluation had the standard "Agree", "Disagree" answers to be filled in, and did not help me too much with regards to generating ideas, or identifying problematic areas. So in order to get some additional anonymous feedback from the students, I added two open-ended questions at the end of the evaluation and focused my data collection on the answers to those particular questions. The questions were: "Name three things you would improve about this course" and "Name three things you liked about this course". Please see Appendix B for the INTE 296 course evaluation.

- Participation

The other factor that I had going for me was the fact that I myself was a student in the course when it was first offered. Therefore, I was able to objectively provide an evaluation of the same factors from the eyes of a student. There was no way that I was going to be able to find the original evaluation that I had sent in, but I do remember the difficulties that I had with the course and the experiences that I underwent during that winter semester, therefore I could sympathize with the pupils on most occasions. In fact, it was because of those experiences that I got involved in the administration of this course in the first place! As Mauldin (1996) stated, "Knowledge of the observations is essential. Relying solely on interviews or written questionnaires does not allow for observations of important factors". Guba and Lincoln (1989) insist that prolonged engagement is a popular technique to ensure study credibility. In order to counter misinformation, distortion of the facts, and build the necessary trust to uncover as much information as possible, it is suggested that "substantial involvement at the site of inquiry" be made.

Educational Technologists / Experts

- Review of the Literature

The literature review was an important aspect of this project since it served to uncover as much information as possible that could help me augment the quality of the online course by being aware of the current issues with e-Learning. Be it through the physical design of

the site, the use of computer-mediated communication technologies, or the creation of constructivist exercises, the plethora of articles, Websites, and books that I perused served as a virtual think-tank of ideas, techniques, and practices that could be implemented into INTE 296. Although some of the suggestions made had been tried out in the field of practice, most were simply left as recommendations, leaving it up to me to try it out if I dared.

- Participation

Throughout the time I have been involved with the course, I have not only acted as the teacher, but I have been a learner as well. My computing skills increased dramatically while I was employed as the course facilitator, as did my knowledge of the Web-based instruction field. I became much more aware of what had been done, what could be done, and what was beyond my expertise when it came to technology. However, through some sort of osmosis process, I was increasingly able to find technical solutions for problems that students were having with the design of the site, as well as with the course content. I began to experience success with certain techniques, and failure with others. Despite the fact that I was missing the theoretical skills of an educational technologist (I had not yet enrolled in the program), I had developed some very practical ones, and was using them to the best of my abilities. The only limit I had, other than budgetary constraints, was my skill level, and that was still evolving, and under my direct control. The information I could provide then, at this point of the evaluation process, would be what could be done

with the site based on my abilities, as well as what had worked in the past, and what had not.

Teachers/Professionals

- In-Depth Interviews

As the only teacher for this course, as well as the researcher, I found it a little difficult to interview myself, especially since my technique is casual and unstructured. Luckily, I was able to turn to several other sources for this information.

First of all, I am blessed with the services of an individual who has helped me with the course for several years as the content expert (since I am not a statistician by nature). He was more than willing to chat about the deficiencies about the course, as well as offer his suggestions, sometimes insisting upon prompt action! Again, our discussions were informal and unstructured, but this process enabled me to look at the course from a new point of view from an individual who was also on the "front lines".

Secondly, for CMC and other delivery method issues, I was able to consult with a colleague of mine who also teaches an online course. This was the same individual who acted as project leader for the construction of the first version of INTE 296, so while I was getting my history lesson about how the course came to be, I took the opportunity to

discus issues about online instruction and get his take on it. This was especially beneficial since both our classes were entrenched in the same "culture" within the university.

A new and exciting opportunity presented itself during the course of my involvement with INTE 296 in that we "rented it" to another university after having made some content modifications. At the other institution, a professor was assigned to facilitate the course while I stayed on board as a technical advisor. This was the teacher's first experience with an online course and it was quite interesting to relive my initial struggles through them. In addition, an internal study of the course was carried out by that university and a third party was brought in to conduct, among other things, a structured interview with the teacher. Thankfully, the transcript of the interview was provided to me and I was able to analyse the answers they gave. In addition, I then took the structured questions that were posed to the professor and answered them myself, thus conducting my own interview! All professionals involved in the research were asked to fill out a consent form so that their expertise and experience could be used in this project (Appendix C).

In order to ensure the validity and accuracy of the information collected from these individuals, the interviewer would repeat what the participant said and allow them to confirm their statements and refine them if necessary. This technique also proved to be efficient in eliciting further discussions from the participant as it gave them a chance to reflect upon their comments and think about other details they wanted to share. Guba and

Lincoln (1989) referred to these practices as peer debriefing and member checks, two techniques that added to the credibility of a study.

- Vignettes

As an added method of collecting information from teachers and colleagues, Miles (1990) suggests the use of vignettes, a "mini-movie" of a practitioner at work. The procedure involves the professional describing, in detail, a recent episode including explanations of how they approached it. In other words, it is a short story that recounts the thought process that one went through in order to solve, or attempt to solve, a given problem. This method tends to be straightforward and stirs up the feelings and thoughts of a practitioner that accompanied their action. Of course, on the down side, vignettes can be biased such that the researcher may not be given the entire story. In these situations, the respondent seems much more insightful and noble than they really were!

The use of vignettes, I must admit, was integrated by accident when one of my colleagues began recounting how they dealt with a particular situation during one of the interviews that I conducted. I thought that the episode was quite interesting and, more importantly, relevant to my situation. Therefore, I made note of it, not quite knowing how valid such information would be. But, just in case it was acceptable, I wanted to ensure the reliability of the vignette. To do so, I would recount the scenario back to the interviewee to allow them to make clarifications and additions. I would also ask questions with regards to the circumstances surrounding the scenario, or about the individual(s)

involved. Either way, this method left me with an added idea or two that I could try out with my own course. Thankfully, from the literature research I conducted on qualitative study design, I found several examples of vignettes being used as viable data sources.

- Formative Evaluation and Self-Assessment

According to Guba & Lincoln (1985), "formative evaluation is the collection of empirical data during the developmental stage for revision and improvement of instructional products". The ultimate goal of such an endeavour is to improve the quality of the product while it is still being developed so that it will fulfil its intentions at the time of its release. However, since best practices are still evolving with Web-based instruction, as well as the fact that the methodology allows for easy modifications to the site at any time, formative evaluation techniques can be used during a Web site's implementation stage (Wang-Chavez et al., 2001).

According to the authors, there are three main reasons why they chose to use a formative evaluation to assess Web-based instruction in their study. The first is the fact that no validated model exists for Web courses so the designers are forced to perform continuous improvements to the site. Second, even with the best planning, unforeseen problems can occur during the site's implementation that will need to be rectified. And third, timely interventions may be needed in cases where the instructor is not familiar with the course delivery system. With the rapid changes occurring in distance education, the instructors found that formative evaluations served as a beneficial tool for making improvements to

the course in a timely manner. Through this type of intervention, teachers have a way to improve their course, and at the same time, reduce emerging problems that are a result of changes in distance education (Wang-Chavez et al., 2001). A formative evaluation also gives the researcher a way of monitoring their own evolution in their construction of meaning, a process that Lincoln and Guba refer to as "progressive subjectivity".

In the case of this thesis, nobody can perform the formative evaluation of this course other than myself. As a participant in the course, I have been immersed in the online learning environment and have been able to observe and experience first hand, what the participants in the course go through. As an instructor, I must listen to the feedback I have been getting from my students, from my colleagues, from educational technologists, as well as from my own experiences, and use this information to find ways to improve the course. "The degree to which a course is deliverable by instructors and accessible by learners will have to be the focus of ongoing formative evaluation" (Welsh, 1999). However, with the continual changes in distance education, this procedure will be an ongoing one.

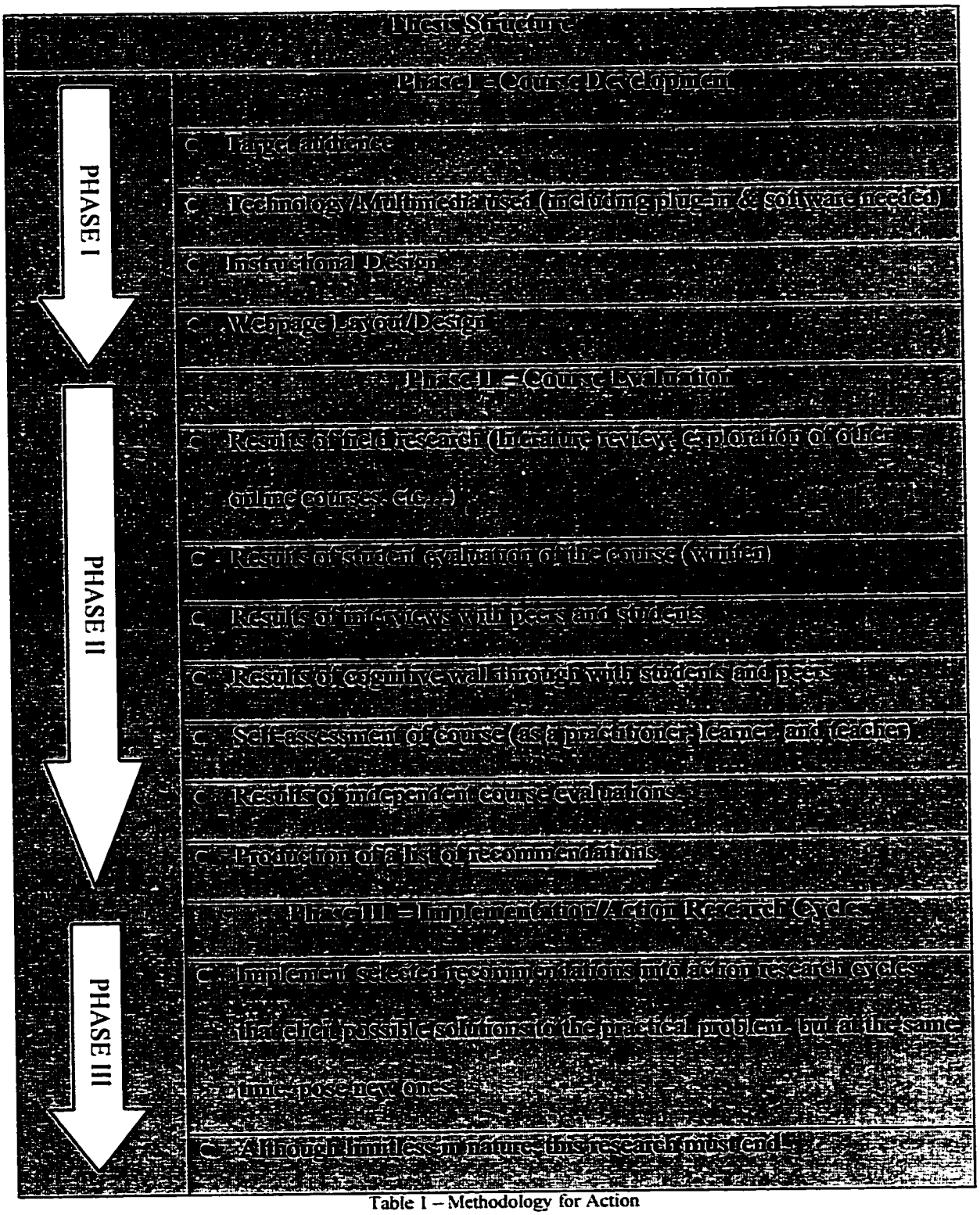


Table 1 – Methodology for Action

Recommendations

Design practitioners do the research first in order to fully understand their surroundings, and then they transform these understandings into recommendations for action. The research serves as the bases, the boundaries, and the references, but the design is not as precise. From the pool of knowledge and experience, the designer must use their best judgement to develop an informed intervention (Frascara, 2000).

Based on the results of the evaluations from the perspective of students, teachers, and other professionals in the field, as well as from the information gathered in the literature review, phase two of the methodology for this thesis will end with a list of recommendations to be implemented in the course. The list will be carefully concocted to reflect realistic changes to the course that will take into consideration:

- The time it will take to make the changes,
- The feasibility of the modifications with respect to achieving the learning goals,
- The urgency of the alterations,
- The resources available to make it happen (including budget and my expertise).

This list will not be what traditional literature on the subject has produced, a listing of unproven possibilities, of potential remedies for the symptoms my course is exhibiting. It's time to turn these possibilities into assurances, and these remedies into cures. In other words, in this thesis, each and every recommendation will be turned into a concrete action!

Phase Three – Implementation / Action Research

"No action without research, no research without action" (Kurt Lewin, 1890-1947)

The third, and final phase of this thesis' methodology involves the implementation of the recommendations from phase two, and the subsequent re-evaluation of the procedure's effectiveness, or lack of. It is in this phase that action research cycles will be used to refine the interventions to a point where one would hope that the results are deemed successful.

Just What is Action Research?

Kurt Lewin (1890 – 1947) is renown for his impact in the field of social psychology, particularly in the in experiential learning, group dynamics, and action research. Lewin strongly believed in the fact that one's behaviour could only be properly explained within the context where it took place. That means that in research, one must first analyse the whole before being able to differentiate, and consequently, understand the parts that make it. Only then can one properly evaluate the environment, identify the problems, and plan interventions to remedy the situation. This means that a close relationship, to the point of partnership, may be necessary to fully understand the environment in which the research is taking place. Furthermore, the only way to know if an intervention is the correct one, action must be taken, and the results of that action must be closely monitored in order to

make timely adjustments if and when they are necessary. Lewin himself best summarized these notions as he proclaimed, "No action without research, no research without action". That means that the aim of this procedure is not to perform an action in hopes of developing a better understanding, nor conducting research with the aim of performing an action, but to do both in a single process.

An action researcher is an agent of change. So are the participants in such a methodology. They are the individuals who take present situations and transform them into a different future. They are practical problem solvers. Action research developed its roots from the scientific method when it began to be applied to the educational field back in the late nineteenth century during the Science in Education Movement (Masters, 1995). Kurt Lewin is credited as being the "inventor" of modern action research when he put forth his action theory in the mid 1940s. His argument was that researchers could not expect to make effective changes in a social situation without directly involving practitioners from that world at every step of the investigation.

Dick (1997) describes action research as being a family of research methodologies that simultaneously pursue action and research outcomes. That is, it brings about an action to change something, while at the same time, increases a researcher's understanding of that phenomenon. Kemmis and McTaggert (1988) illustrate the process as one of collective self-reflection embarked upon by participants who want to improve and better understand their own practices. Other researchers will depict action research as a design that helps the researcher/practitioner understand the problem, develop strategies for solving it, and

then transform those strategies into best practice procedures (Wang-Chavez et al., 2001). Interestingly enough, Reigeluth and Frick (1999) believe that when used in the context of instructional technology, action research can also be referred to as a continual formative evaluation process.

Regardless of whose definition I read, four basic themes were prevalent when characterizing action research (Masters, 1995):

- The empowerment of the participants
- Collaboration through participation
- The acquisition of knowledge
- Social change

In action research, everybody affected by the procedure (stakeholders), are also involved in the process. It is not possible to conduct any social research without the participation of human beings. We have individuals conducting the research, individuals who are being researched, as well as individuals for whom the research is being conducted (in this case, I could argue that this individual is one and the same!). For action research to succeed, collaboration amongst the stakeholders is critical. It is through this partnership that the researcher becomes enlightened. It is during that time that they construct their understanding of the culture they are investigating, as well as the problem with which they are faced. Only then can they ascertain a controlled intervention to apply to the situation. The design of a successful intercession may not be an exact science, but the

researcher must make an informed decision before proceeding to action if the goal is to be systematic social improvement.

Action research is a method that is very popular in educational settings since a practitioner who commences such a venture seeks improvement in their own practice, in their understandings of these practices, and of the situation in which they practice (Carr & Kemmis, 1986). In a mutual-collaboration, or participative, action research project, such as this one, the nature of the problem is defined in the situation itself. Therefore, there is an exploratory element to the study, as the researcher must first identify the relevant issues before proceeding with interventions. Based on a historical-hermeneutic philosophy, the knowledge produced by this procedure is descriptive in nature, and resides in the active mental constructions of individuals through their interactions with external contexts (Masters, 1995). Successful projects are the ones in which researchers form cooperative relationships with the practitioners so that their concerns are accurately expressed. The practitioners are also actively involved in the planning of actions, as well as in the reflection on the value and the consequences of the outcomes of prior actions. Researchers serve as facilitators for practitioners in the development of their "practical" reasoning (Carr & Kemmis, 1986).

Conventional experimental practices, like the scientific method, have developed principles that guide their conduct. Although they may be proper for some research methodologies, they restrain any actual transformations. Therefore, Dick (1997) proposes

that action research have its own principles that set it apart from other methods. Action research is typically:

- Cyclic – similar steps in similar sequences
- Participative – clients and informants are partners, or at least active participants
- Qualitative – deals more with language, less with numbers
- Reflective – critical reflection throughout the process is vital

According to Carr and Kemmis (1993) action research entails three minimal requirements. First of all, the subject of the study must be social in nature and conducive to change. Secondly, the action research methodology must be composed of systematic and interrelated cycles of planning, acting, observing, and reflecting. And finally, an escalating circle of participation should develop throughout the venture.

One of the major advantages of using an action research methodology is its responsiveness. The flexibility that is allowed within this protocol is an attribute that is crucial in environments that have emerging needs, such as is the case in distance education. Conventional research methodologies tend to sacrifice this responsiveness in order to maximize its replicability (Dick, 1993). The cyclic nature of the procedure allows the researcher to modify later cycles, and in doing so, challenge (create a dialectic), refine, and test earlier interpretations. As a result, the inherent nature of the sequences adds rigour to the system as a whole (Dick, 1997). Through participation, researchers develop a greater devotion to change. Thus, actions are easier to implement if

the researcher is motivated to see them through. Qualitative research tends to be more suited for responsiveness. The use of language makes it easier for participants to become involved, sometimes to a point where the researched can even become a co-researcher. The reflective stage is important due to the fact that it links one cycle with the next one, thus forming the bond that holds the chain of action research cycles together. All human beings, not only practitioners, need to become competent in taking action, and at the same time, reflect upon their actions and learn from them (Argyris & Schon, 1974).

In my case, the online environment, as well as the course itself, is entrenched in social-constructivist principles, in which learning is seen as an active and social process. Therefore, it is through a student's interactions with the online material, with the facilitator, as well as with fellow students that knowledge is acquired. By making interventions within those practices, one would assume that a change in the learning experience would occur, a fundamental assumption of action research (Zuber-Skerritt, 1992). In choosing a participative action research methodology, I had the flexibility to alter my interventions, a way of making changes throughout the process instead of only at the end, and more importantly, it gave the students, teachers, and other stakeholders an opportunity to contribute to the process of change, and thus the overall improvement of this online course.

Method - The Cycles

Lewin's theory of action involved a procedure consisting of a systematic cycle of steps, each of which was composed of a plan, an action, and an evaluation of the result of that action (Kemmis and McTaggert, 1988). Dick (1997) adds that the crucial step in each cycle is that of reflection, since it is at that stage that the planning of another cycle, using informed decisions, takes place. A reflective practitioner is able to combine the knowledge they have acquired from experience, practical skills, tacit knowledge, and all the implicit knowledge acquired from previous reflective stages, and combine them to create or recreate a plan of action (Argyris & Schon, 1974).

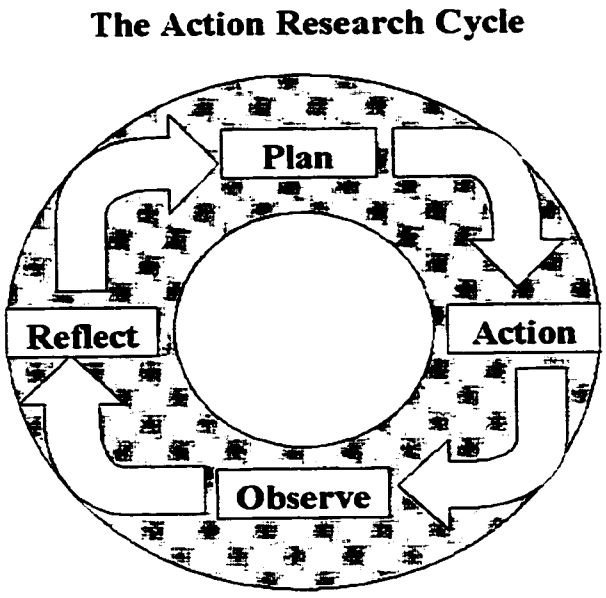


Figure 2 – The Action Research Cycle

Phase 1: Plan

This phase consists of the analysis of the problem and of the development of an informed and strategic plan for action. If this is the initial cycle, the origin, the researcher must first be firmly entrenched in the field and have identified an issue that needs their attention. If this is not the first cycle in the chain, then the researcher must use prior results to make adjustments in the next plan.

Phase 2: Action

At this stage, the plan that was concocted in phase 1 is implemented.

Phase 3: Observe

In this phase, data is collected and recorded. This can be accomplished through several means, including the interviews, focus groups, and plain old observations.

Phase 4: Reflect

Based on the results from the previous action, the researcher reflects upon what has been accomplished, discusses the results with the stakeholders, and determines what can be modified or improved in the previous action. This, of course, leads to another planning

stage, and another cycle ensues. Of course, at any point, the researcher may decide that no further cycles are necessary; in other words, the intervention was successful enough not to warrant further action at this point in time. Or, they may scrap the chain and try a different approach entirely.

Final Thoughts about Action Research

Perhaps the best way to describe action research is to delineate what it is not (McTaggart, 1997). Action research is...

- Not a practitioner's routine. It is more collaborative and systematic in collecting evidence and in planning change.
- Not "simply" problem solving. It is also problem posing. It is motivated to improve and understand the world by changing it and learning how to improve it based on the effects of the previous interventions.
- Not research done on other people, but rather by individuals on their own work in order to improve what they do. It does not treat people as "objects" and instead encourages cooperation between "knowing subjects" as agents of change and improvement.
- Not a method for policy implementation. It helps develop one's own understandings of what is happening as a guide to action.
- Not the "scientific method" since the researcher themselves are subjects and action research is concerned about changing situations, not interpreting them.

In employing this methodology, the researcher recognizes the fact that the entire process is theoretically limitless. Changes in the course continue to take place as this thesis is being written, and alterations will proceed afterwards as well. New issues will be identified, new techniques will be used, new research will be conducted, and the list of successful practices will be adjusted and expanded.

Summary of the Results of Phase One

With the ensuing government cutbacks, the Faculty of Arts and Science's department of Academic Technology was trying to find ways to use its expertise to help reduce costs. One idea that had been kicked around was the possibility of offering a common, faculty-wide course using computer technology. The rationale was that by eliminating the burden of having to teach a common course, professors would be able to concentrate on their specialty subjects and not have to "waste" their time and resources reinventing the wheel. In addition, the economies of scale would suggest that by eliminating a teaching position, as well as by increasing the student-teacher ratio, expenses would be cut drastically.

In the spring of 1995, the faculty's Dean gave the go-ahead to put together a pilot project whereby a common course that was offered in several departments within the faculty, would be delivered faculty-wide with the aid of computer technologies. After a quick survey of the courses offered in each of the faculty's departments, it was found that introductory statistics was a common subject in most of them.

The department wanted to make use of a delivery-method that was compatible with several platforms since the university housed a steady mix of operating systems. Speed was also a factor, so they did not want to invest in a program offered by CD-ROM, nor had the resources to put together a custom program. Since this was a pilot project, they also wanted to leave the door open for alterations to the material, as well as have the opportunity to add components as they were put together. The flexible, multi-platform,

easy to program World Wide Web seemed to be the best option. Despite the fact that Internet access was not as common then as it is now, the feelings were that students who did not have access to the World Wide Web would come to school and make use of the brand new computer facilities where all the resources they needed could be found.

Two graduate students were hired to put the course together under the supervision of the project leader. The user analysis consisted of the examination of all of the course outlines for introductory statistics in the faculty. The project leader also lamented the trouble they had gone through to get the information since several professors were less than enthusiastic to share their information, in fact some were outright hostile. It was generally felt that this technology would never replace classroom instruction and that it was an attack on their employment. This is a sentiment that is still shared at the faculty level with regards to offering courses via the Internet, and is one of the many reasons why the methodology had never been tried before. On the other hand, some teachers were quite open to the idea, to the point of being relieved in some cases. These individuals saw this as an opportunity to get back to teaching their specialty subjects, and fully cooperated with the project team by providing them with their own notes and references

When all of the information was collected, the common elements from the outlines were pooled together, the statistical content was researched from selected textbooks and course notes, the pieces of the Website were slowly combined, and a volunteer pilot group was secured. In the winter of 1996, INTE 298s – Discover Statistics became Concordia University's first Web-based course.

Other interesting things uncovered during the interview, included the fact that the content was still being worked on as the course went on. To be more precise, the content was being published a week before it was needed by the students to complete their assignments. Also, there was no feedback provided for the assignments that were handed in since nobody was available to mark them! No teaching assistant had been assigned to the course, and the instructor was too busy with other courses and administrative functions to take care of it. No immediate help was available to students when they needed it, unless they were able to catch the teacher at their office, which was a rare feat. It was hoped that the students would be able to make use of the resources at their disposal to make up for any deficiencies in the course material. Luckily, most of the students knew each other, and were able to share pool their resources together and turned the course into a collaborative project. Mind you, as a participant in that course, I knew that the real end-result was that a few students, who had experience in the subject matter, served as tutors for the rest of the class when all other avenues failed.

As for the assessments, both the midterm, as well as the final exam was done in-house, meaning that students had to be present at a certain place and time to write them. Since all of the course participants were on-campus students, it was decided that this would be the simplest assessment method. The project leader admitted that they would have to find viable alternatives in the future if this course was to become a "true" distance course, and that invigilation and the authenticity of the work submitted were issues that concerned them. Students were awarded full marks for handing in their assignments, and due to the

shortage in staff, were not marked. The lack of feedback and availability of a content expert was at the root of the poor evaluation the course received at the end of the semester. I'm sure that was something I wrote in my evaluation to them as well...

From the document analysis, it was found that many of the courses did indeed share common themes. However, each had their own twist on the content since it was relevant to their particular fields. For instance, the psychology statistics dealt more with quantitative, parametric studies, whereas sociology focused on qualitative methods. Discover Statistics simply took the most popular aspects out of all of them and put together a Web site that was a mix of text and low-level graphics in an organized architecture. The site featured many outside links to related and non-related materials, but these were often too complicated for introductory statistics, went to sites that no longer existed, or were linked to supplemental materials that did not work (PowerPoint slides). The home page was a clutter of pull-down menus and non-descriptive icons, and loaded quite slowly from home computers. This was especially due to the background image of the page, which was complimented with a large graphic of a flag laden with the title of the course (Figure 3). This very slow-loading graphic was located at the very top of the page, so students typically waited for the picture to load before scrolling down to the text. For a screen shot of the first version of Discover Statistics' Home page, please see Appendix D.

Figure 3 – Graphic appearing on top of INTE 298s Home page

Summary of the Results of Phase Two

Students - Communication

The lack of feedback from the instructor was by far the most prominent complaint voiced by the students in the course. The majority of communication that took place in the class was verbal, and amongst peers. However, since most of the students enrolled in the course were in the same program of study, they were also in the same classes and easily formed study groups to support each other. When teaching assistants were brought in the following semester, the majority of communication continued to be face-to-face, but at least there was the option of going to someone who was knowledgeable in the subject matter and available during their office hours (25 hours a week). Students felt that this saved them tremendous amounts of time that they would otherwise be "wasting" trying to figure how to work out a problem. The teaching assistant would not give them the answer straight-away, but instead would act as a coach, or ask pointed questions to try to help them recall past solutions from similar exercises. Or, the tutor would go through a step-by-step solution with the student for a similar problem. The telephone was also a popular medium of communication, but it was rare that help was available when students needed it since the offices were normally closed by that time (many students did their work at night).

The lack of face-to-face interactions, both with the teacher, as well as with fellow students, was a popular complaint made by the learners. Many expressed feelings of

isolation, especially when they were having trouble with a certain problem and could not turn to anyone for aid. Some admitted that they were too shy to approach others about their problems, or too stubborn to seek aid.

Feedback was also a major issue amongst the learners since they not only had trouble getting in touch with the course instructor when they needed help, but that the amount of time they had to wait for a reply (when leaving a message) was often quite frustrating. Therefore, the speed of the response needed to be improved, as did the availability of the course facilitators.

Students - Technical

Although most of the students had some sort of experience with computers, it was rare that this expertise extended beyond simple word processing. In order to succeed in this course, students would have to learn basic Web browsing, some minor spreadsheet functions, as well as word processing. Even if this was not a big deal for several of the learners, there were several students each semester that lacked basic computer skills and needed extra help in order to get started with the course. This proved to be quite frustrating for the student who was falling behind early in the course, as well as for the course facilitator who would eventually be called upon to aid the struggling learner.

For students who were completing the course from home, the Internet connection that they used was also a cause for concern. With the cost of high-speed connections being unaffordable for many individuals, students would be dialing in with a standard modem

connection. This meant that they had very limited bandwidth capabilities. Consequently, download time was a major complaint for several users who would have to sit patiently as their computer monitor would progressively display bits and pieces of the information they needed.

Of course, enrolling in an online course means that the users are at the mercy of the network and server on which the data is stored. Server crashes meant that the materials are not accessible by the students, another cause of frustration and complaints among the respondents.

Students - Usability

The major complaint with regards to the usability of the course Web site was the accuracy of the content. There were many errors that were pointed out by the users throughout the term, both typos, as well as calculation errors. This led to many frustrating nights for the learners, as they would try to figure out why they would repeatedly get an answer that differed from the one in the text.

Another concern was the length of the amount of material that the student would have to go through in one sitting. Many complained about the fact that they did not like staring at a computer monitor for an extended period of time. Unfortunately for them, the sections within each chapter could easily extend for several screens, which meant that users became very familiar with the vertical scroll bar. The process was deemed quite monotonous, especially since it was straight reading from the screen. Students could not "play" with the numbers presented to them in any way. Many expressed their

disappointment about the fact that no hard-covered book was assigned for the course, especially since they did not see a difference between what they were currently doing, and flipping through the pages of a standard text. In other words, this course was simply a textbook that was offered in an online environment. However, the common theme remained the same with regards to the online content, there was too much information to absorb in one sitting.

Consequently, many students attempted to print out the course content so that they would not have to rely on their Internet connection, let alone the computer they were using. This led to many problems ranging from the time needed to download and print each individual section, the running out of memory on their printer, as well as the text being cut-off along a given margin. Aside from the students who insisted on having a physical textbook, other students wanted to get their hands on additional resources to help them with the course material.

Getting to the information that one wanted also turned out to be a daunting task. In situations where the subject is not found in a major header, the student would literally have to scroll through screens upon screens of text and graphics until they found what they were looking for. There was no quick way to find important terms within the text, and the glossary was a little too complicated for their understanding of math.

Students felt that the course Web site design was very cluttered and confusing. The main page, which consists of a plethora of drop-down menus accompanied by a non-

descriptive icon, confused some learners to the point where they did not know where and how to begin their instruction. This confusion sometime led to annoyance when the user would get lost in the Web site without quite knowing how they got there and how to go back. As an example, several students found that a link for the "Home" page was not always visible for them to click on and start over.

Students - Instructional Design

Another frequently made comment was the fact that the problems and examples found throughout the "e-book" were not always relevant to the student's field of study. This was a concern for students who wanted to see the use of statistics in practice, especially in their respective disciplines. It was also mentioned that this might serve as a motivational tool for some of the students enrolled in the course since they would better understand what statistics could do for them in the future.

Students who were not always able to be on campus complained about the fact that they felt neglected and disadvantaged. They did not get the same opportunities to make use of the resources in order to succeed in the course. This included access to the library, private tutoring from the course facilitator, as well as technical aid. The nontraditional students, who could never make it to school during the facilitator's office hours, also expressed this concern.

Teachers - Communication

Teachers expressed frustration in having to repeat themselves in quantities that were unheard of when they were in a traditional setting. In a classroom setting, they could make an announcement once and the class is considered informed. In this case, the only way to communicate important information to the class is by posting it on the homepage of the Web site. However, they noticed that they would invariably get dozens of phone calls from students who obviously had missed the message.

Phone calls were also considered a very time-consuming activity, especially when playing "tag" with a student who had previously left a message. Although e-mail was also an option, these calls typically dealt with more pressing matters, or with complicated issues that could not be resolved via text. Long distance calling was also a factor that had to be considered throughout the semester. These costs were not considered significant when the course began, but as the amount of students from out-of-town increased, long-distance calling became more popular. Although the instructor was often responsible for the costs, students were also suffering from the escalating amount of their phone bills if they lived out-of-town. The nature of these phone calls ranged from simple questions with regards to administrative issues, to much more complicated content-related problems.

Teachers - Technical

The instructor often found himself acting as a personal computer tutor with some of the students due to their lack of technical skills in that area. Be it teaching them how to navigate the Web, or saving files to their floppy disk, or using Microsoft Excel's statistical functions, the teacher invested a significant amount of their time in computer instruction, let alone statistical issues. Since there was no prerequisite for the course, the teacher acknowledged the fact that many students would be lacking in certain technical areas, and consequently, time and effort would have to be devoted in this area if these individuals were to survive the semester. Luckily, most of the students had had some sort of computer experience, and the crux of the tutoring focused on special applications such as Word and Excel.

Consequently, it was also discerned that the Web-based course instructor must possess significant computer skills themselves. Not only must these skills involve typing (for answering e-mails), but also basic hardware and software troubleshooting, knowledge of HTML and "Netiquette" (what to do and what not to do in Web communication). In addition, the online instructor must also be proficient in multimedia editing if they are to make their own changes on the Web site.

Teachers - Usability

The course instructor has expressed frustration over three issues in particular. The first problem revolves around the fact that information is not easily found within the Web site. For instance, referring a student to a particular section in the online content usually involves several failed attempts via a particular hyperlink, before finally scrolling to the proper spot. Even then, trying to explain to the student exactly where this section is within the text is not obvious to either party.

The second problem is a direct consequence of the first in that the lack of direction makes it very easy to "lose" oneself in the Web site. Dead ends and mouse clicks on the "Home" and "Back" buttons were a common occurrence when navigating within the site. This was especially noticeable on the pages where several hyperlinks were available, especially if they sent the user to external Web sites (outside the domain).

Another very annoying predicament were the numerous, but not obvious, text and calculation errors that were scattered throughout the content. These included simple typos, as well as errors in calculations done to solve practice problems. This was also a source of frustration on the part of the teacher, who sometimes would have to address the error to the entire class in order to quell further questions about it. On the other hand, the instructor appreciated the fact that some of the students were not afraid to challenge the content and force the teacher to revisit that segment of the text and make changes if they are necessary. In other words, the students acted like independent editors to the Web site.

Teachers - Instructional Design

Perhaps the most blatant issue with regards to the instructional design of the course was the fact that there were no clear learning objectives present throughout the site. Although course objectives existed in the course outline, none of these were presented within the online text. This could have served as a measuring stick for the learners who wanted to assess their knowledge, especially if a summary was included at the end of each section. These objectives could also have served as a motivational aspect for the students if they were presented with them at the beginning of each section so that they would be prepared to fulfill them from the get-go.

Self-assessment opportunities would also have been an added bonus, especially in a self-paced course. This would give the learner the chance to instantly test their knowledge about a given subject before going on to the next section. This could also be a motivational tool for learners who do not have great confidence in their statistical abilities. If done correctly, failed assessments could be supplemented with constructive criticism (where to find the answer, or why it was wrong). Although the solved problems that were scattered throughout the e-book were quite useful, there never seemed to be enough to prepare the learners for the multitude of possible problems that they could be faced with in statistics. Furthermore, the learners did not always properly use the pre-solved questions since many of them would skip directly to the solution without thoroughly testing their practical knowledge.

These self-assessment opportunities would also bring in an element of interactivity. In other words, with built-in activities within the content, students would be given an occasion to learn by doing something, another motivational tool. As it stands, interactivity within the Web site is limited to sporadic hyperlinks that do not necessarily have anything to do with the content in question. In other words, the current version of the course is nothing more than an online version of a regular textbook.

The instructor also pointed to the fact that the students do not have many opportunities to help themselves throughout the course. Although group work is encouraged, especially with the assignments, no concrete support is provided for it. This was probably due to the fact that the first version of the course was done onsite with students from the same program. In other words, the students likely knew each other and could easily arrange to help each other when needed. This was not the case for other students, especially the ones who are completing the entire course from off-campus (true distance education students).

Lastly, the instructor admitted to the fact that there was a marked lack of extra resources available to the students. Other than the online content, no extra materials had been assigned or recommended. Extra resources, especially free ones, could only benefit the learner. A resourceful student could easily find other textbooks or seek help outside of the course if needed, but not all of the pupils are that responsible. Sometimes they must be presented with a viable list of alternatives that have been pre-screened by the instructor. At least then they would have something to turn to when extra aid is needed

and the instructor is not readily available. In addition, figuring out the facts on their own would serve as a strong confidence booster for the learners.

Recommendations for Action

Communication

Recommendation	Action
Get voice mail *To give students an opportunity to leave messages for the instructor to return when they are able to do so.*	Cycle 1
Get an e-mail address and fax number. *To enable asynchronous message possibilities as well as an alternate way to submit work.*	Cycle 1 and 2
Include a Frequently-Asked Questions page on the Web site *To alleviate repetition from the teacher and give students a way to find answers to their questions on their own.*	Cycle 1
Have regular office hours *So that students have a concrete opportunity for synchronous communication with the instructor (and INTE 296 team)*	Done
Implement a toll-free phone number for students to use *To cut down on the extra costs incurred by learners who are from out-of-town*	Future
Include a personal welcome message to each student via e-mail *To help counter feelings of isolation*	Cycle 1
Include a photo of students, as well as of the instruction team. *To help counter feelings of isolation and to encourage group work.*	Future
Offer both synchronous, as well as asynchronous communication opportunities. *To give students ample communication choices*	Cycle 1

Offer students weekly messages on the Web site. *To keep the communication loop open and counter isolation*	Done
Include a message board so that students are given a chance to answer their own questions (help themselves). *Increase feedback speed and group work.*	Cycle 1
Instructor should reinforce early attempts at participation *To reward and encourage students who exhibit good practice techniques.*	Done
Make use of certain symbols to express more complicated expressions in mathematics. *Since many students do not have the proper fonts installed on their machines to make use of the "real" symbols.*	Cycle 2
Host an orientation session for the students at the beginning of each session. *To go over housekeeping issues, as well as to give the students a sense that they are not alone in this course.*	Cycle 3

Table 2 – Communication Recommendations

Technical

Recommendation	Action
Offer both high, as well as low bandwidth applications. *So that students with low-bandwidth connections have the same learning opportunities as everyone else.*	Cycle 5
Offer a technical tutorial to students who do not possess the computer skills necessary to be independent with the course. *Offer this at the beginning of the semester as an optional workshop for students who think that they lack the necessary skills.*	Cycle 3
Include On-line tutorials for specialized applications that are used throughout the course (i.e.: Microsoft Excel).	Cycle 3

Table 3 – Technical Recommendations

Usability

Recommendation	Action
Offer students a "Print-Friendly" version of the online content. *To accommodate students who insist on printing the "book".*	Cycle 5
Break the content down into more manageable chunks. *To alleviate the cognitive load during a typical sitting.*	Cycle 3. 5
Include a search feature within the online book. *To give learners and instructor a quicker way to find the information they seek.*	Cycle 4
Make the content more scannable by including bulleted lists. clearly identifying keywords. and by keeping the vertical scrollbar to a minimum. *To make the pages more pleasant to the eye. as well as to make it easier to find specific subjects.*	In progress
Have the links within the online book open in new browser windows. *So as not to break the student's momentum (lose their place in the text).*	Cycle 4

Table 4 – Usability Recommendations

Instructional Design

Recommendation	Action
Offer students different types of problems and content. *To conform to their individual learning styles.*	In progress
Establish clear learning objectives at the beginning of each section. *To give learners a preview of the upcoming content.*	Done
Include a summary of the content at the end of each section. *To highlight the important concepts learned in the sections. as well as to give the learners a chance to self-assess the attainment of the learning objectives.*	In progress

Offer students additional statistical resources (online and offline). *To give learners added opportunities to enrich their own learning.*	Cycle 4
Avoid deep hierarchies within the Web site. *To limit the notion of being "lost in hyperspace".*	In progress
Use relevant examples within the content. *To give the students from different programs a chance to see practical examples of applied statistics in their field.*	Cycle 4
Offer students more opportunities to self-assess their knowledge. *Using auto corrected quizzes and pre-solved problems to give learners a chance to determine the extent of their comprehension of the subject matter.*	In progress
Provide Web site users with ways to determine where they are at any given point in time. *To alleviate the feelings of being "lost in hyperspace".*	Cycle 5
Make sure that "true" distance education students are not disadvantaged in any way. *Any instructional activity added to the course must be equally accessible to students who are off-campus.*	Cycle 3
Include interactive elements within the course content. *To take advantage of the Web's capabilities and to enhance the content so that it is not simply an online version of a textbook.*	Cycle 4

Table 5 – Instructional Design Recommendations

Based on the recommendations that were made at this point, the action cycles will focus on five main issues:

1. The lack of communication with the instructor
2. The quality and speed of the feedback
3. The lack of face-to-face contact
4. The lack of interactivity within the "textbook"
5. The feelings of information overload

For the other recommendations that were made, some were incorporated right away (hence "Done"), as was the case in the establishment of office hours. Others are "In progress", meaning that the action cycles are under way, but have not developed sufficiently enough to report any significant findings. The "Future" action describes a recommendation that will be implemented at a later time.

Chapter Four: The Action Research Cycles

Problem 1.0: Lack of Communication with the Instructor.

Cycle 1.1: Voice mail – an untapped resource?

Plan and Action: One of the problems identified was the fact that, despite my office hours, I was hard to reach when my aid was needed. This was also noticed when I would walk into the office and marvel at the pile of Post-Its that greeted me, courtesy of the receptionist. It became quite frustrating trying to understand which calls were genuine problems, and which were less urgent (information they could have figured out had the students read the course outline). Since my budget, as well as my schedule at the time, did not permit me to increase my availability at the office, I had to find another way to sift through the messages in order to get back to the students who needed my help the most urgently. I thought that activating the voice-mail feature of my phone might solve the problem, and at the same time, alleviate the receptionist's burden. My rationale was that the students who called me outside of my office hours would be able to leave me a detailed message of their problem, thus making it easier for me to prepare the return call. So, I activated the feature and weighed the results.

Observe and Reflect: Students seemed to like the fact that they now had a choice to leave a message, or hang up and call back during the office hours, which were reiterated during the message I left for them. The receptionist did not have to waste the Post-Its on

me anymore, but instead of a small pile of colourful paper awaiting my attention, I looked forward to the voice message system telling me how many message were waiting for me. To this day, I still think that the system took great pleasure in adding that dramatic pause just before telling me that I had 22 "new" messages. Of course, of those, 9 were marked "urgent" and really were not, and 7 were hang-ups. In addition, my call back would likely go to another voicemail, or the student and I would play phone tag for a few days. The students who had a voice mail system of their own would make the task a little easier for me, especially if their message for me was clear, since I could leave a fairly detailed answer on their end and that would usually do it. However, in statistics, describing formulae over the phone, or how to read the normal distribution, especially if it is to a machine, is not the easiest thing to do. I did not have time to structure my thoughts, and consequently, my message, in a concise (I have had the machine flat line on me several times) and understandable manner for such complicated material, which usually had me end the message with "give me a call and I'll clarify it further". Voice mail was an improvement, but not enough for either party (student and teacher). Was there another asynchronous method that I could use?

(Please go to Cycle 1.2)

Cycle 1.2: E-mail – If I get it, will they come?

Plan and Action: Electronic mail may have seemed like the obvious plan of attack, but at the time, it was far less popular than it is today. Since the students were using the Internet to access their course materials, it should only be logical to assume that they could also have access to e-mail services, especially if they were connecting from home since they needed an ISP to do so. If not, the University could issue them an account on their system. By implementing e-mail, I hoped to be able to cut down on phone tag scenarios which were getting just too time consuming and frustrating, and at the same time, have a medium that would enable me to respond to complicated questions in a coherent and structured manner. Of course, there I wanted to resolve the "not so urgent" calls, as well as steady line-up of answer machine hang-ups. The course e-mail address (298s@alcor.concordia.ca) was launched, and I re-evaluated the results.

Observe and Reflect: The University indeed supported the protocol, and issued accounts to all the students who wanted them. In fact, for many students, it was the first time they had ever experienced e-mail, and most were eager to get involved. Students who already had e-mail accounts with their ISP were happy to get to use them. Although the end-result was a step in the right direction, there were still a few problems that arose with the adoption of e-mail. First of all, new users with the Concordia system had the unenviable task of figuring out how to make use of the text-based PINE e-mailing system. For many, finding characters like "~" and "^" on the keyboard was frustrating enough, although getting to that point was quite a feat for many who were still struggling

with their randomly-constructed assigned password that looked something like "&6pll(O". Did I mention that the password is case-sensitive? Another problem was the fact that users had no clue how to attach their documents to send to me, or how to view the ones that were sent to them. The file management system was just not easy enough for the students to use without extensive training, and there was not time for that.

That's when the phone started ringing again, and we were back to square one with these individuals. Now for the students who had accounts with their ISP, things went smoothly...if they stayed at home. As soon as they were away from their home computer, like when they set foot on campus, they would be unable to access their e-mail accounts because they could not dial into their service provider. For those who were able to use their e-mail accounts, or were eventually able to do so, things went rather smoothly. An increasing amount of e-mails would come trickling to my Inbox, and the voice mail messages had reduced significantly. I observed students exchanging e-mail addresses, along with their phone numbers, which was a first for me, and this medium began to be used as a collaboration tool among them. The students also began sending in their assignments via that route as attachments, although most still preferred to hand it in to me personally, especially if they had class nearby. So, in retrospect, the intervention was partially successful, it reduced my voice mail load, students were getting the answers they wanted from me, and phone tag had all but disappeared. However, there were still a few refinements and adjustments that needed to be made. Some would be have to be on the technical side (please go to Cycle 3.2.2), others would focus on new communication

mediums to encourage increased levels of collaboration (please go to Cycle 1.3.2), or and yet another would try to solve this ongoing e-mail issue (please go to Cycle 1.3.1).

Cycle 1.3.1: Web-based e-mail systems: What's so Hot about it?

Plan and Action: I started noticing a trend during my traditional "whose got e-mail?" role call during the orientation session. What I have been noticing is that every semester, an increasing number of students are raising their hands. When I probed a little more, I found out that many of the students had a free Web-mail account with providers like Yahoo, Hotmail, and the like. I thought this was a great idea since these e-mail systems can be accessed from anywhere an Internet connection can be found, as long as a GUI Web browser client was installed on the machine. Furthermore, this system would allow students to access their assignments (had they e-mailed them to me) and make the necessary modifications they needed as soon as they got their feedback from me. Otherwise, they would have had to wait until they got home, and by then, their task might not be as clear as it was when I had spoken to them earlier in the day. So, to increase communication with me, I preached using this free and easy-to-use e-mail service (using passwords they can remember and type on their own), and urged everyone to give me their e-mail addresses so that I could send announcements and other class-wide information in this fashion, hoping to find a quick way of alleviating the "general information" calls I was getting. So, I preached the use of the free, Web-based e-mail service for everyone who wanted to use it as an alternative communication protocol during the orientation session.

Observe and Reflect: This was also a popular choice for the students who quickly, and eagerly wanted their own e-mail addresses. Although the University's service was basically free, the usernames were assigned based on the student's name (e.g. "pl_deve"), and the students liked the fact that the free service allowed them to pick their own (e.g.: "hotmale@hotmail.com", "funkyboss@yahoo.ca"). I noticed that e-mail traffic increased significantly, and students were happy with the speed of the feedback they were getting. Where the amount of messages increased, I also noted that the complexity and length of the messages shortened.

The collection of the e-mail addresses gave me a means to communicate to the entire class simply by sending a mass e-mail to everyone. This could be a quick and dirty way for me to address issues that have been brought up on several occasions by the learners (clarifications, errors in the online textbook, etc...). I thought this was worth a try since, until that point, I had put class announcements on the Home page as a scrolling marquee. This was limiting in that I could not, and did not want, to post a message saying "the following errors have been fixed: Module 3, Chapter 2, when dealing..." It was used more for announcements like "Final Exam date set for May 22nd from 9:00am to 12:00pm in CC-401" (Figure 4).

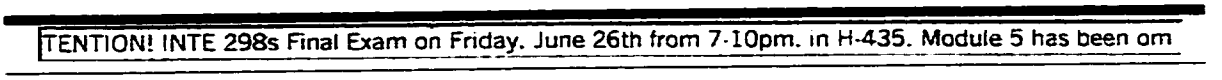


Figure 4 – Scrolling marquee from INTE 298s Home Page

The other phenomenon that I was noticing was that several replies that I was sending back to the students, particularly if they were using a free Web-based e-mail address, were bouncing back to me with "could not find the service provider" errors. However, I didn't think much of it at the time.

The next logical step, always to increase communication between the students, and myself was to use a mass mailing list to send out information to the learners on a semi-regular basis (I tried to do it weekly), that would include solutions to problems that have been encountered, clarifications of the content, as well as announcements and other house keeping issues. (Please go to cycle 1.4.1).

Cycle 1.4.1: Using Mailing Lists: Abusing the CC field.

Plan and Action Using the e-mail addresses that I collected at the beginning of the class, I started out by sending a welcome message to everyone enrolled. In the message, I repeated some of the information from the orientation session (for the students who missed it), and added in some more details with regards to logging in procedures, office hours, and lab hours. The messages were not large, especially since I was well aware that Web mail addresses commonly had a 1 MB limit on the size of the files it could send and receive.

Observe and Reflect: This was a total disaster. No sooner had I sent my out my mass e-mail did my Inbox start filling up with bounced e-mails...most due to the fact that "no

service provider could be found". Of the messages that were "returned to sender", some were due to typos on my part (for example, putting ".com" instead of ".ca"), while others were because of bad Inbox management on their part ("filled to capacity"). However, the curious thing about the "no service provider" and "connection refused" messages that had come back to me was that every single one of them was destined for a free Web mail address (Figure 5)!

```
    **********************************************
    **       THIS IS A WARNING MESSAGE ONLY      **
    **  YOU DO NOT NEED TO RESEND YOUR MESSAGE   **
    **********************************************

The original message was received at Thu, 6 Jun 2002 11:32:44 -0400 (EDT)
from [redacted]

   ----- Transcript of session follows -----
<[redacted]@hotmail.com>... Deferred: Connection refused by mx07.hotmail.com.
Warning: message still undelivered after 4 hours
Will keep trying until message is 5 days old
```

Figure 5 – Example of "Bounced" e-mail message

After doing some extra sleuthing, I found out that the new and improved security settings on the Web mail addresses, although they could be adjusted and customized by the user, prohibited e-mails to be sent to the Inbox as a way to filter out the increasing amount of "Spam" mail. The only way to get around this would be for the student to add my e-mail address to their list of Contacts in the e-mail system, or to have them decrease their security levels. I just did not think that this was worth the trouble, so I went back to posting the info on the Web site.

Cycle 1.5.1: Web-based e-mail at Concordia: Surprise!

Plan and Action The University's e-mail system ("Alcor") had always been a text-based system. Alcor users outside of Concordia could use it by running a Telnet client. However, the PINE system was still a problem for the users, especially in the delivery of files as attachments, and of the viewing of those same files (students would have to use the internal FTP client to do the file transfers). I thought I had run out of options with regards to the e-mailing, although it remained intensely popular, when Concordia quietly launched its Web-based version of Alcor! This system included all of the features that the free services employed, including the important file-browsing characteristic that allowed for easy file attachments. Passwords were still going to be a problem, but the latest versions of the some of the Web browsers now allowed for passwords to be saved on home machines, or to be "remembered" by the system. This seemed to me a marvelous solution to the communication problems, especially since I could tap into the University system and download a list of everyone's pre-generated usernames, thereby avoiding having to collect them, or making typos since I would simply me copying and pasting the information into my database. So, I decided to implement an edict whereby having an Alcor e-mail address was now mandatory.

Observe and Reflect: The students, especially those who had been using their e-mail addresses for an extended period of time, reacted to this decree with mixed emotions, especially since they would have to pay a minimal fee (an annual $3.50). However, when I explained to them the advantages that this would bring to there course involvement, the

fact that they could forward the messages, as well as the similarity of the Alcor system to the one they were using, they reluctantly conceded and registered for their accounts. There was still a problem with orientation with the system, especially for new e-mail users, but overall, there seemed to be much less incidences of communication breakdowns, or of the playing of "phone tag". Students were content with the replies they were getting (quality and speed), and about the fact that they all had access to their messages at school, as well as at home (if they had an Internet connection, which an increasing amount of them did).

Cycle 1.3.2: Message Board: A House Keeping Service.

Plan and Action: Although e-mail was working well, I thought that another CMC method might be more suited to answer the common questions that students were having (FAQs). If I was able to cut down on the "generic" questions that I was being asked, the ones that were available on the course outline for example, I could concentrate my energies on content questions and let the "House Keeping" issues take care of themselves. A FAQ page was a possibility, but I wanted the page to be dynamic and not have to constantly update it with the latest issues. Also, I had always wanted to involve other students in the class in the question-answering process, a way to expand and enrich our "learning community". My rationale was that if a question was posted to the class in general, chances are that a student who was online at the time would be able to answer it before I had a chance to even see it. After all, I was outnumbered sometime by a 150:1 margin! Therefore, I included a message board on the Web site for students to post and

answer questions, and for me to post solutions and comments for the frequently asked ones. I would intervene and add in my "two cents" if I saw that it was needed within the student discussions, and also to show that I was constantly monitoring them.

Observe and Reflect: It turned out that the message board ended up being a good tool for students needing help getting started with assignments, or when they got stuck at a particular question. Those who used it found it quite useful. The problem was that not many people were using it. Instead, they still preferred to send me a direct e-mail. My office hours had increased to a daily 9-5 routine, and since I was constantly monitoring my e-mail messages, replies were quite quick. However, I still had the same problem with regards to the same questions being asked, or the ones that could have been answered by anyone who bothered to read! I ended up copying some of the good questions I was getting and pasting them myself to the message board, along with my reply. These included tips for assignments, as well as technical issues. So, in retrospect, the message board was serving the FAQ purpose, although not as dynamically as I would have liked, nor at the speed with which students needed help, especially after office hours. I needed another medium that could do this a little faster, maybe even in real time. (Please go to Cycle 1.4.2)

Cycle 1.4.2: Chat Room: Who wants to chat about stats?

Plan and Action: With chat clients like MSN Messenger becoming increasing popular, I thought that a similar communication system, already integrated into many of the students' Internet lives, would be a beneficial tool for prompt feedback for statistics problems, especially if used outside of my office hours. With an integrated chat system, students would be able to log on and pose questions, or discus problems, with other class members in a synchronous fashion. Also, instead of calling me, they could log into the chat session and pose their questions that way, at least during office hours, and get an instant reply.

Observe and Reflect: The students asked questions and discussed problems all right...questions like, "Where are you going out tonight?" and problems regarding their boy/girlfriends! It was very rare that any statistical materials came up during the chat sessions since the "chat" culture in these "chat room veterans" had taken over. During the session I participated in one night, when I logged in under a pseudonym, I asked two questions with regards to calculating z-scores to the three students who were logged in. The first one was categorically ignored, even after I repeated it, and the second one was answered with a "dunno". I left the chat room, logged in as myself, and the chat room members dissipated. I logged in a few more times after that to measure the traffic, always during the evenings since I knew that there was no traffic during the day (students would just call me or drop by my office). I finally removed the option the following semester and have not gone back since. I considered other synchronous technologies, such as audio

or video conferencing, but that would require extra peripherals on the student's side. I think that videoconferencing will be too complicated and expensive to implement, at least amongst students, and the bandwidth required for it to run smoothly too great for learners who are still dialling in with modems. However, in the near future, I would like to experiment with audio conferencing, if I could find a way to make it more "statistics" oriented first.

Possible Future Actions: Audio conferencing over IP.

Epilogue for Problem 1.0 – Lack of Communication with the Teacher.

If a student wants to get a hold of me, they have the choice of several communication mediums. Some are computer-mediated, while some use "older" technologies. I found that students would rather use a medium that they are comfortable with, as opposed to the ones where I would impose my "will" by forcing anyone to use a given protocol (like e-mail). However, in my defense, this is an Internet course, so students are expected to use the medium one way or another.

The speed of the feedback is still an issue that has to be dealt with. By being prompt in the feedback, and by giving students an option to use either synchronous, as well as asynchronous methods of communication, the learners will be able to seek aid when they need it, or worst case, be able to pose their question while it is still fresh in their minds. I spend (at least) the first hour of each workday responding to e-mails. It gives me

something to do as I sip my coffee, and at the same time, the routine has helped me keep my "unread" messages in my Inbox to a minimum.

It is up to the instructor to be true to their office hours, or at least have another form of communication that is available for the times that they are not in the office. Students sometimes base their study schedule on a teacher's office hours, just so they have that safety net if they need it. In addition, the surge in the number of "non traditional" students, especially during the summer session, had me thinking twice about the usual 9-5 routine since students were working the same time as I was. I am seriously considering altering my schedule to work late one evening a week. I rectified part of the problem by altering my lunch break and having it sometime after 1:00pm since I found that some "working-learners" sometimes used their lunch hours to work on their statistics course, especially if the Internet connection at work was better than the one they had at home.

Another, more extreme measure, is getting a cell phone. Although I balked at giving my cell phone number to my students (although I know of a few teachers who do), I do have my work phone forwarded to the cell when I step out of the office. Sure, it may infringe a bit on my "free" time, but I figured it had saved me the trouble of calling them back, which I would have to do eventually anyways. It's also a good way to have your workplace pay for your cell, while you get to use it for free on evenings and weekends!

Successful Communication Practices in INTE 296

(in order of success, where success is defined as a viable solution to the problem posed and subsequent satisfaction levels of the stakeholders):

- In Person (During office hours, synchronous)
- Telephone (During office hours, synchronous)
- E-Mail (anytime, asynchronous)
- Message Board (anytime, asynchronous)
- Voice Mail (anytime, asynchronous)

Problem 2.0: Quality and Speed of Feedback

Cycle 2.1: E-mail: Is there anything you can't do?

Plan and Action: Quality refers to the depth of the description that is provided in the feedback, whereas the speed takes into consideration how quickly the students get a response on their work. Students have to complete eight assignments and one midterm exam before writing the final at the end of the semester. Despite the fact that many of the assignments can be completed with the aid of a computer (such as with spreadsheet software like Microsoft Excel), many students still opted to hand in their work, especially if they had classes near my office. If assignments were handed in on paper, I would correct them on the paper and wait for them to come pick them up. However, for students who were not always in the area, this was a problem. Although they found ways to hand in their work, sometimes a few assignments at a time, there would be a prolonged delay in the feedback they would receive. If they were unable to come and pick up their corrected assignment during office hours, I would usually get a phone call and would gladly leave their work with the security guard as I left for the evening. It was the feedback process that was slow, not the fact that they would have to pick up their assignments per se, because most had made a photocopy (at my request) before handing in their work. Phoning them was an option, but I would have the same problems with regards to details of explanation and phone tag that I did in Cycle 1.1. Since I had already implemented e-mail as a viable communications protocol, I started sending feedback that way, and encouraging the students who did not want to drop off their work to send me

their assignments using that protocol as well.

Observe and Reflect: E-mailing assignments became a popular choice for many of the students. I had seen a marked increase in the number I was getting every semester, and was starting to develop a knack for correcting them on screen. I would have the top two-thirds of my screen displaying the assignment, while the bottom third was for the e-mail I was composing back to the student with their feedback. This system was far from bullet proof. First of all, as was indicated in Cycle 1.2, I received many complaints from students not knowing quite how to attach files, or how to read attached files. Or, in many of their cases, how to use e-mail period. This had to be addressed, probably prior to starting off the course (please go to Cycle 3.1). Another problem had to do with the complexity of the e-mail. How was I to show a student how a formula worked? Or how to use a tree diagram? These are not issues that could be dealt with easily in an e-mail environment. I had to find a way to explain these concepts using that medium (please go to Cycle 2.2.1), or failing that, find another communication medium that would do the job. (Please go to Cycle 2.2.2)

Cycle 2.2.1: Using Symbols: Codebreakers

Plan and Action: Since e-mail feedback was becoming an increasingly popular, I had to find new and create ways to describe complex statistical situations, such as using a formula, and tree diagrams. Since I could not incorporate graphics into my e-mail since most of the students could only read ASCII or MIME (not HTML), not to mention the size of the message, I had to find an alternate way of describing simple, but common symbols like exponents (x^2), Greek letters (Σ, α), and inequalities ($\leq$). I could not assume that the end-user would have the same fonts installed on their machines, so I could not use the symbols per se, nor convert them to graphics. Over time, I countered this by developing my own version of statistical shorthand, and implemented them into the messages by defining them as I went along. For example: x^2 was described as x^2, $\leq$ as <=, and Σ as "E". In other words, Σx^2 would translate to Ex^2 (Figure 6).

Observe and Reflect: It may not have been, but the point was for students to understand what I meant, and as long as I described them somewhere in the document, they more or less did. As the semester went on, and e-mails between the students and I increased in frequency, they caught on and would use them in their own e-mails. However, it was still a hurdle to overcome, and it did not solve more "graphical" solutions like the tree diagram, or shapes of distributions. Furthermore, if anything, this complicated the e-mail further for me since it made the process even longer, instead of being able to copy and paste an image directly into the body of the message. The amount of e-mail was also increasing, and I soon found myself spending more time correcting

assignments and e-mailing the feedback than ever before. In fact, it was getting to a point where I longed for paper assignments again. In fact, sometimes I would print out to an assignment that seemed too complicated to do via e-mail! A step backwards, I know, but I was inundated with assignments submitted via e-mail and was having trouble keeping up. Consequently, I found myself cutting corners like suggesting to a student to come in and see me for their feedback (if I knew they were around campus), or telling them to refer to a particular section in the book and give it another go. In other words, in order to keep the speed of the feedback acceptable, I found myself sacrificing its quality. How was I to maintain quality and speed of the feedback? Luckily, the faculty had purchased some new technology that I thought I could employ to solve the problem.

(Please go to Cycle 2.3.1)

I started number 2 and 3 only Could I please have a feedback on those?

2) P(A) = 0 85, P(B) = 0 95, P(+ | A) = 0 002, P(+ | B) = 0 005

P(+) = [P(A)*P(+ | A) + P(B)*P(+ | B) = 0 00645

P(A | +) = P(+ | A) * P(A) / P(+) = 29 46%

P(B | +) = P(+ | B) * P(B) / P(+) = 73 64%
[Patrick Devey] You have to split the solution up for the two methods Please refer to the textbook in Chapter 2, Section 3 where there is a question about false positives using Bayes' theorem The "breast cancer" question is solved in much the same way as this question is answered.

Since P(B | +) > P(A | +), we should adopt the new one.

3a) P(F) = 90/150 = 60%[Patrick Devey] yes

b) P(F | C) = 70/150 = 46.67%[Patrick Devey] no ...given that an individual is from the city means that you are looking at a total of 110 people, not 150

c) P(F | not C) = 20/40 = 50%[Patrick Devey] yes

d) P(not C | not F) = 20/60 = 33 33%[Patrick Devey] yes

e) P(F |C) = 70/110 = 63 64% and P(F) = 60%. Since they are not equal, these events are dependent [Patrick Devey] perfect!

Figure 6 – Sample Feedback using "Symbolic" Language

Cycle 2.2.2: The Fax is in!

Plan and Action: Students have been handing in their assignments in person, e-mailing them to me, and also faxing them in if they had access to the machine. This was especially popular during midterm examination time when students completing the take-home exam would find that they were running late (with regards to the submission deadline), and there was no way they were going to recopy everything to send via e-mail. Since the work was done on paper, I generally corrected it on paper, but as far as feedback was concerned, what would happen if I faxed it back to them?

Observe and Reflect: The hassle of setting up the cover page, making sure that the job went through (that it was received at the other end), as well as the legibility of the document, especially if it had been done pencil, made it very tough to provide feedback in this fashion on a regular basis. However, on "special" occasions, I would send a student's midterm exam, assignments, or any other document to them this way if it were requested. The major advantage of using a fax was that I did not have to type anything since my writings and drawings can be done freehand. However, since not many students had direct access to a fax machine, this method became a "back up" plan, to be used only if needed by the students. The more technologically resourceful students were finding other ways to send their documents to me, and I thought that I should look into doing the same in some instances.

(Please go to Cycle 2.3.2)

Cycle 2.3.1: A SmartBoard: Is it Smart enough to do my corrections?

Plan and Action: It was going to replace the Black/White board, the latest in presentation technologies. It was a touch-sensitive, character-recognizing, computer-compatible "Smart" screen, and I had one! My new job as the administrator of the Arts and Science Learning Centre gave me the unique opportunity to "play" with some of the latest educational technology. The SmartBoard was one of those toys I thought I could use. According to the latest version of the software, I was able to import, among other formats, Word and Excel files onto the board. The idea here was that I could pick up the "virtual" red pen, and correct the assignment right there on the board, save it with my "graffiti", and send it back to the student. No need for "special" language in the e-mails, no need to waste paper, and best of all, no degradation in the quality of the feedback, nor in the speed at which I could correct it...at least not in theory.

Observe and Reflect: This is still a work in progress. It seems that as soon as I have to scroll down the page, my writings disappear or the "acetate" does not scroll with the rest of the page. In addition, there were some problems with using the "merge" feature (to bring the assignment's text and my markings into a single file). This all seems to be a software problem that will likely be corrected in future versions of the software. The other difficulty I have is standing for a prolonged period of time trying to correct hours of assignments on the board. If I'm not blocking the projector's light (meaning that I can't see what I'm doing), I'm struggling to write small enough to fit beside the appropriate question I'm correcting. New versions of the SmartBoard, in particular, the SymPodium

(a desktop version of the board), look promising. In addition, the newest version of the SmartBoard came bundled with a few more features that I think may be worth looking into.

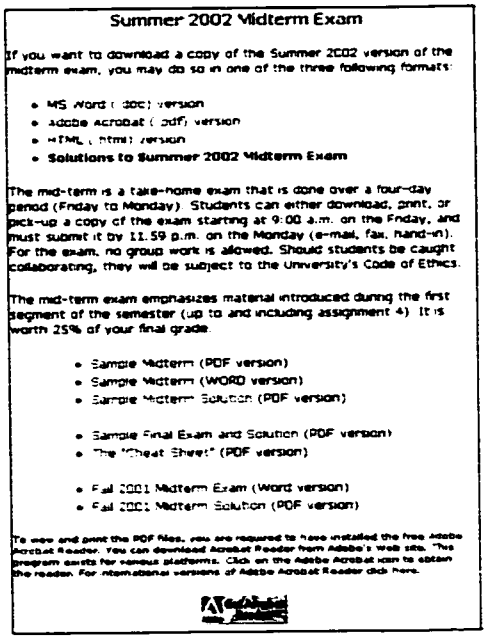
Cycle 2.3.2: And Along Came a Scanner...

Plan and Action: During the midterm exam, a student who had done their work on paper, and who could not drop off their work in person, had to find another way to send it to me. With the deadline looming, they turned to their tech know-how and came up with a solution: scan the pages and send me the images as an attachment via e-mail. I thought that this was an interesting way of doing it, but this is not something that I thought many of my students would be able to do on their own. In addition, the sheer size of the document that was sent to me caused it to be split into two separate e-mails. Also, I did not particularly enjoy having to manually open each and every scanned page in my image editor to correct the exam. In fact, it was too time-consuming to do so. I congratulated the student in question for their insight, and kindly asked them to hand in the original copy at their earliest convenience.

However, this event gave me an idea that I thought I could draw upon for feedback purposes. Until then, I had made the midterm solutions, the sample exam and its solutions, as well as other hand-drawn documents (like the formula sheet), available to the students at the University's Copy Centre. What if I offered these same documents as scanned files via the Website? I would have to find a way so that everything fit into one

file (as opposed to having one per page), and that the size was reasonable. I also had to think about compatible software that was on the student's machines, especially those doing the work at home (we had an image editor in the lab). I settled on using Adobe Acrobat as a plug-in at this point, hoping that if it was not already installed on their machines, that students could download it themselves, especially since I provided a direct link to Acrobat's download page (Figure 7).

The reasoning here is that this would eliminate a need to have to provide detailed feedback to each and every student on their midterm exam since the detailed solutions were now downloadable. Also, Adobe Acrobat allowed me to integrate all of the scanned pages into one document, and the size of the file was quite manageable. I would have done the same for the assignments, but they are handed in at the student's own pace, not at one that I set for them, so the solutions would be a give away.


Summer 2002 Midterm Exam

If you want to download a copy of the Summer 2002 version of the midterm exam, you may do so in one of the three following formats:

- MS Word (.doc) version
- Adobe Acrobat (.pdf) version
- HTML (.html) version
- **Solutions to Summer 2002 Midterm Exam**

The mid-term is a take-home exam that is done over a four-day period (Friday to Monday). Students can either download, print, or pick-up a copy of the exam starting at 9:00 a.m. on the Friday, and must submit it by 11:59 p.m. on the Monday (e-mail, fax, hand-in). For the exam, no group work is allowed. Should students be caught collaborating, they will be subject to the University's Code of Ethics.

The mid-term exam emphasizes material introduced during the first segment of the semester (up to and including assignment 4). It is worth 25% of your final grade.

- Sample Midterm (PDF version)
- Sample Midterm (WORD version)
- Sample Midterm Solution (PDF version)

- Sample Final Exam and Solution (PDF version)
- The "Cheat Sheet" (PDF version)

- Fall 2001 Midterm Exam (Word version)
- Fall 2001 Midterm Solution (PDF version)

To view and print the PDF files, you are required to have installed the free Adobe Acrobat Reader. You can download Acrobat Reader from Adobe's web site. The program exists for various platforms. Click on the Adobe Acrobat icon to obtain the reader. For international versions of Adobe Acrobat Reader click here.

Figure 7 – Screenshot of "Exams" page from INTE 296 Web site

Observe and Reflect: Students were quite happy with the fact that they could view detailed solutions without having to go to the University to buy them. However, the legibility of the script was not the best, especially if the solutions were in pencil, and sometimes it would cut off if I got too close to the edge of the paper. Downloading Adobe Acrobat was a pain for students with slow connection speeds, even if the file was not that large to start with (< 10 MB). This was, nonetheless, something to consider revising in the future.

Epilogue for Problem 2.0: Quality and Speed of Feedback

E-mail continues to be the best way to provide timely feedback to the students, especially if their assignment was submitted that way because you can then assume that they are proficient with the protocol to make use of other features within the message, like hyperlinks. Although I could not include a graphic in the message, I could always provide a hyperlink within the message that would send them to an anchored spot within the e-book. The other way I was able to do it was that if an assignment was sent to me using Microsoft Word, I then assumed they had access to the software, and could use the same program to create the reply. Or, type my reply in a different coloured font. But this was all still very time-consuming.

Bringing in Adobe Acrobat files was not a bad idea in that it standardized the way I started providing feedback through documents. In the past, the exams/assignments were always offered in three formats: Word 97, Word 2000, and in HTML. This was quite

annoying for me since not only did I have to make three copies of everything, but also the formatting in each version would differ, especially when I included numbers in tables, or images. At least in Acrobat, I could rest assured that the format would stay the same, as long as the plug in was available on their machines. The downside was the downloading and installation of the software. Even though I provided the link to go get it, the 28.8 modem gang would not be happy about it. This type of feedback is limited to documents that the entire class can have access to, likely for reviewing solutions on their own.

The SmartBoard's new features warrant further investigation. One of those new characteristics is a dynamic screen capture application that follows the movements of whatever is being done on the board and creates a mini-movie of it. Furthermore, I can narrate the sequence, thus creating a virtual tutorial. On the downside, this would require considerable bandwidth that not all students would be able download it. But, this is a feature that could be interesting to look into in the future.

In the future, for personal feedback, I would like to see if a standard HTML mail protocol could be used. That way, I could easily include small pictures with the reply by doing a simple copy and paste procedure. The students, using the same protocol, could view my feedback, and do the same at their end for questions or collaboration efforts with their peers. Or another possibility would be to include the other students in the feedback by having the assignments posted for the general populace to compare and critique, but I think that although it would bring in an important constructivist factor, it would just open the door for scrounging. Another possibility would be to give students unique, but similar

problems, such that each learner would have to do their own work...however, this may prove to be a nightmare for me since I'd be stuck doing solutions for all of them!

Successful Feedback Practices in INTE 296

- Come and Pick it up (only if the student was regularly on campus)
- E-Mail (with the "special" language when needed)
- Fax (for those who have access to it, but as a "back-up" solution)
- Download .pdf file from Web site (for general solutions available to the class)

Problem 3.0: Lack of Face-to-Face Contact

Cycle 3.1: Orientation Session: And you are?

Plan and Action: One of the major complaints expressed by the students was the fact that they missed the face-to-face contact, or at least seeing somebody. They felt isolated from the class, especially if they did not have partners to help them with assignments. Although some dropped by during my office hours and got their face-to-face interactions then, those who could not come during the regular office hours, for whatever the reason, felt left out. There was also the fact that the students wanted a chance to see and interact with students in their class. This would give them a chance to form learning groups, or at least give them the impression that they were part of a larger learning community. And, of course, they wanted to know the answer to a multitude of questions, hopefully without having to read the 4-page course outline!

For the teacher, it was very frustrating having to repeat the same introduction to every student who had not logged into the Web site and downloaded and read the course outline. Maybe it was asking or expecting too much from them. Many of the students enrolled in the course were not very computer literate and seemed to need an extra hand to get started. Some students were quite nervous about the course format, and enrolled in the course because it was a core course for their program, not because they wanted to take advantage of the online environment. These students were especially clueless when the course began and constantly needed to be reassured that they would "survive" the

class. Others needed the reassurance because they had a math phobia, or had been out of school for a while, and had always been in an objectivist environment where they could sit back and let someone do the talking. They were not looking forward to taking the reins of their own learning...in fact it terrified them! Personally, for the teacher, it would be an opportunity to put a face to the name, something I always enjoyed doing so that I would be able to say "Hello" if I recognized one of my students in or around the school.

In order to accommodate both groups, I thought that setting up a "first and only class" orientation session would help out. First, the students would get to look around them and actually see that they are not alone, instead of just reading about it. Also, it would put a face to my name, so they could recognize me and know who I am. For the teacher, it would be a chance to add a personal touch to the class, something that seems to be lacking at the University where many students complain that they are being treated like just another number. Since the class was split into two sections, I held two orientation sessions.

Observe and Reflect: A huge success! The orientation session gave me an opportunity to go over the entire course outline with the class, answering questions, and clarifying statements as I went along. Using the computer and projector in the classroom, I was able to show the students how to log onto the site, as well as give them a quick tour, showing them where all the major features were. I explained the minimal requirements for their computers at home, where and how to get their e-mail accounts, and basically every other bit of information that I could think of that they would need to get started in the course.

The amount of trouble that I saved the students, not to mention myself, was incredible. The time I had normally spent explaining how the course works, be it by phone, by e-mail, or in person, was reduced dramatically. Students seemed satisfied with the information they got, and consequently, most were able to get started with the course materials within the first week. The students who were nervous or had added concerns, would come and see me at the end of the session to present their issues as I stuck around to talk to them afterwards.

However, despite the face-to-face session, I still had several students who were struggling to get off the ground with their work and had fallen behind because of it. Aside from the students who had missed the orientation session (Please go to Cycle 3.2.1), the students who were beleaguered seemed to be lacking the computer skills to get started (using e-mail, how to type in a Web address, etc...). It seemed as though I had overlooked the fact that not everyone enrolled in this course was proficient with computers. In fact, some were just plain awful. To give some concrete examples: they would insert their diskettes the wrong way, or they would not know how to double-click with a mouse. They were lacking basic computer skills. There was no doubt that these students would need an extra hand, and because there was no prerequisite for the course (like minimal computer skills), and it was too late for them to drop it and take a "regular" class (if they even had the option to do so), they would be hopeless unless I did something about it (Please go to Cycle 3.2.2).

As the semester wore on, I received an increasing amount of requests for more "orientation-type" gatherings. Some students wanted to meet every week, and others just once in a while. I explained that this would go against the "distance" course we were trying to establish, and that if they really wanted to more face-to-face sessions, my office hours were posted on the Web site. Many students did come to see me at my office. Some came with their groups, others were alone, but all were asking similar questions about similar concepts. I took this as a sign that modifications and elaborations were needed in those particular sections of the Web site, so I made some changes, added some more examples, and e-mailed the class with some tips for approaching those concepts in a practical manner. The requests for tutoring continued, as did the visits, and although I did not mind tutoring the students (that was my job, after all), it was the repetition that got to me. Answering the same questions over and over again constantly tested my patience. As the final exam approached, the students, especially those who had been procrastinating all semester, were desperate for answers to their questions, and would literally expect me to teach them the course from A-Z in a one-hour tutorial session. I could not take this anymore and finally caved in (somewhat). (Pleased go to Cycle 3.2.3).

Cycle 3.2.1: Virtual Orientation: Introduction to e-Statistics

Plan and Action: For the students who missed the orientation session, and there seemed to be many every semester, I needed a way to pass on the same information that I did, and at the same time, give them the same "face-to-face" opportunity that the other students had. I wanted something that I did not have to redo every semester, so it could not involve specific dates or events, and at the same time, something that would showcase the course for what it is, a complete online introductory statistics course. My department had begun experimenting with digital video editing that summer, and we thought it would be interesting to shoot a mini introduction video for the current and potential students explaining what the course was about, and how it was to be taught. So with a camera crew in tow, off we went around the island of Montreal, stopping at specific locations like the Montreal Stock Exchange, Loto-Québec, and the Montreal Casino, to introduce the major topics that would be covered in the course (Figure 8).

I anticipated that there would be a bandwidth problem, especially for the slower connection speeds, so I avoided using .avi or .mov files. Instead, it was compressed and offered as a streaming video using the Real Player. Just like I did for the Adobe Acrobat, I included a direct link to Real.com's download section if students wanted to get it. The video was completed and uploaded to the Web site within one week of its filming.

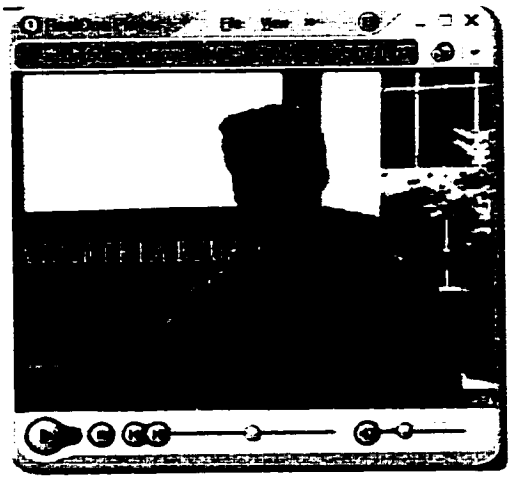


Figure 8 – Screenshot of Orientation Video

Observe and Reflect: The video itself turned out to be a very great public relations tool since I was getting phone calls about it from students interested in the course, and higher-ups within the University were stopping me in the hallway to say they had seen me in the video. I was pretty happy with the feedback I was getting before the course started, but was not too sure how good of an orientation tool it would be. I made sure to direct the students who had missed the orientation session to the online video and asked them to call me if they had any questions after reading through the course outline. The reaction I got then, which was repeated in the course evaluation that semester, was the fact that they liked the online video a lot. They liked the fact that they could control the pace of it (using Real Player's controls), and the sound was good. A few students complained about the fact that the video was choppy, and in some cases would freeze or disappear all together, and I suspect that the bandwidth problem was surfacing. The common critique was that there were not enough of them and they openly wondered why. (Please go to Cycle 3.3.1).

From an instructor's stand point, the video accomplished the "face to the name" problem, but it did not help me in disseminating important and common information. I appreciated the fact that the students enjoyed it, and I enjoyed making it, but from a pedagogical standpoint, it was not alleviating the tedious answers to the familiar string of questions that always started with, "When do we have class?"

Next Probable Action: Making a customized and reusable online orientation session.

Cycle 3.2.2: Computers can do that?

Plan and Action: Whether it was because of a flaw in the design of this course, or because cutting through the red tape was too tough a task, the fact that there was no prerequisite for this course meant that anyone could enroll in it. In other words, regardless of a student's computer skills, or lack thereof, they were allowed to register for this course. Now in their defense, some of them had no choice because, believe it or not, this was a required course for their program of study, they had no other option. It was online stats or bust, and it was my job to make sure that it they did not burst! Now don't get me wrong, I was not doing this only for their benefit. In some cases, I was trying to save our University computer labs! Regardless of my motives, I felt compelled to do something about the situation, because I was the only one who could intervene before they fell too far behind.

I started by writing a list of tasks that a student enrolled in this course must be able to do in order to eventually complete the course. The list started with basic tasks like turning the computer on, logging into the system, and making the mouse cursor move around, to more "complicated" techniques like entering a Web address, saving work to a diskette, and composing an e-mail. Since I was pressed for time that particular semester, I had the students make appointments to come meet with me for 30 minutes to 1 hour so that we could go through the motions together. I had the student follow along on their own computer as I took them through the step-by-step procedure for accomplishing the basic tasks they would need in the course.

Observe and Reflect: There's no question that this private tutoring was needed. Sometimes I would notice that as we went along, a student would be suddenly "remembering" how to do things. I suppose they needed to build their confidence back up and with me acting as their safety net, they were picking up the pace as we went along. Those were the easy tutorials. Then you had the other skill level, and things were a little more complicated. They literally needed someone to sit with them and talk them through each and every step. One hour was not going to do it for them, and I had the rest of the class to take care of. Thankfully, these cases were rare (I have had a grand total of two so far), and what I ended up suggesting to them was either to meet with me on a weekly or bi-weekly basis, or better yet, to hire a personal tutor.

Regardless of the wearisome procedure this was, it had to be done in some cases. Progress was made, but in hindsight, had a prepared in advance, I would have been done

the tutorial as a group instead of on an individual basis, just to be more efficient. I could increase the tutorial length to two hours, and chances are, maybe some of the students participating in the optional session would pool their resources and work together throughout the course.

Next Probable Action: Group computer tutorial session

These episodes got me thinking about other "unwritten" prerequisites that the students may be lacking. It reflected upon the nature of some of the problems I have had to correct in the past, as well as the other computer applications that would be beneficial in this course, but not crucial. In fact, the more I thought about it, the more I liked the idea of addressing the problem. (Please go to Cycle 3.3.2).

Cycle 3.2.3: The Tutorial: How do you do that again?

Plan and Action: With the repeated requests for more face-to-face opportunities, as well as the common content issues that had repeatedly surfaced as the semester winded down, I concluded that the most efficient was of dealing with this was to hold a pre-exam tutorial. I did not want this session to be one of those "traditional" lectures where I would attempt to summarize the entire course in a 3-hour period. Nor did I want the students to passively sit on their hand for the entire session. I wanted them to actively participate by doing the calculations with me, asking me questions, and answering some of the questions that their classmates would pose.

The students had no problem with this. All they wanted was an opportunity to work with me on solving some of the common practical problems they would encounter during the final exam. They did not expect me to cover everything about the course, nor did they expect that by simply attending this session they would succeed in their final exam.

In an attempt to accommodate as many students as possible, I hosted the tutorial session on the University's official "make-up" day. This was a day that was purposely sandwiched between the last day of classes and the first day of exams to give students an extra class if it was needed. Since it was issued at the teacher's option, and it rarely was, I took the chance and booked a classroom. I then put together a "sample problem sheet" based on the types of questions that had been troublesome to the learners over the course of the semester. The goal of the tutorial was to have the students pose me questions in a relaxed and unstructured environment, and in order to get the ball rolling, they could request that a certain problem from the problem sheet be solved. I would then go to the blackboard (Stone Age stuff) and solve the question in a step-by-step format, but using the students to do the calculations and to suggest the next course of action after each step. This, of course, was all to be done so that I did not have to see the same errors reoccurring as I corrected their final exams.

So, my mind made up, I posted the notice on our Home page, sent a general e-mail to the entire class, and invited everyone who wanted to join me to do so.

Observe and Reflect: The tutorial, much to my chagrin, was probably one of the best-liked features of the course. According to a few of the students who attended, this was one of the main reasons why they did so well in the exam. Others said they appreciated the opportunity to ask me questions as we went along due to the casual nature of the get-together. Some students admitted that they just liked to be reminded of the fact that they were not alone in the class.

As for me, this session, although exhausting, was fruitful since it was a golden opportunity to correct common mistakes before I had the unenviable task of correcting them on the final exam. This also avoided me having to individually meet each and every pupil and have to repeat the same things continually, so it was a huge time-saver as well. So in a sense, I'm glad I did this, but on the other hand, there were many students who missed out, and expressed their remorse about it, especially after the final exam. I realized then that this was an unfair advantage for students who lived near the campus and did not have other commitments...the "traditional" students. If INTE 296 was going to succeed and thrive as a true distance course, then I had to find ways to give everybody equal opportunities to attend the session, or at least get the same instruction from it.

The next semester, after I had finished the orientation session, a few students approached me and asked why a tutorial date was not mentioned. This took me by surprise because I had not brought up anything about a tutorial during the orientation session. When I asked the students about it, they responded that they had heard about the tutorial through friends who had previously taken the stats course, and were urged by them to insist that I host

another one. Now, not only did I not want to deprive students who were the "true" distance students, but I also was concerned about the advantages of students who attended the class in the previous semester! How could I accommodate both parties? (Please go to Cycle 3.3.1).

Cycle 3.3.1: More Videos: More Face, More Fun!

Plan and Action: With the continued requests for more "face time", coupled with the relative success of the introductory video and the recent "tutorial" craze, I thought I could solve all of the issues by videotaping and digitizing an entire tutorial session. That way, the students who missed the tutorial would have a way of experiencing it, and for the students who attended, they would have a chance to relive the moment as often as they wished. In addition, students enrolled in the following semesters would have a method of practicing problems with my assistance whenever they wanted to. Moreover, the students who thrived in a more visual environment would have added elements to the Web course that they could enjoy.

From my point of view, this would be a chance to add some instructional material using a new and exciting medium, and at the same time, save me some eventual trouble with regards to the explanation of those problematic subject areas.

With all of these potential benefits in mind, and with a camera crew in tow, and a wireless microphone attached to my shirt, I performed for the camera in front of a live

studio audience. The very next day, the video was ready to show to everyone, using the same streaming technologies to display it (Figure 9).

Observe and Reflect: This intervention received mixed reactions from the students. On the plus side, it gave them a chance to review the session and concentrate on areas where they felt weak. For the students who complained about missing the session, they were surprised and elated that they had a way to view them. Overall, the idea was with much approval and was a definite plus for the course.

On the other hand, for those students who actually sat through the entire two and a half hour session did so by staring at a small box on their computer monitor the entire time. The main complaint I got from them, other than the length of the "show", had to do with the fact that the problems solved during the course of the session were in a random order, all coming from the "Problem Sheet" that I had handed out. Although you clearly hear the number of the problem being solved, and you hear me read it out loud for everyone (which I did for the benefit of the folks at home), it would have been nice to see the question somewhere, especially the numbers that were given. Being conscious of the presence of the camera, I tried to repeat everything that was said by the students, as well as read out the numbers that I would write on the board. Although this had made things more manageable, the randomness with which I solved the problems made the video quite chaotic. Mind you, students would be able to control what they were seeing by using the plug-ins controls, but since they did not know where they were going in the video, it made things quite frustrating for them.

An issue that I had with the project, although more on the pedagogical side, had to do with the fact that the video was currently found in the "Tutorials" section of the Web site. That meant that when students would be perusing the online textbook, they would have no idea that they had extra materials to consult at their leisure. For instance, if a student just completed a section on Bayes' Theorem and conditional probability, they would have no idea that a portion of the video is devoted to solving a typical Bayes' Theorem problem unless they went through the entire tutorial (Please go to Cycle 3.4.1).

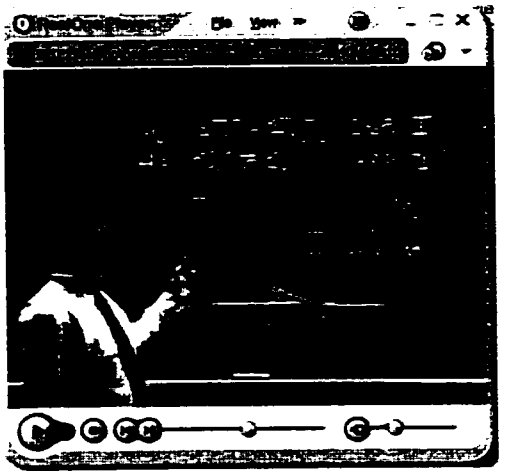


Figure 9 – Screenshot of Tutorial Video

Cycle 3.3.2: Extra Tutorials: Stuff you forgot from High School

Plan and Action: During the few months spent completing this course, students will be asked to draw upon some skills that they may have neglected over time, especially if they are returning to school after some time off. Also, due to the fact that I did not want to waste time explaining these long-lost concepts when I could be focusing instead on

statistics, I needed a way to for these students to learn or re-learn the material on their own. This was especially true for basic math (order of operations, adding fractions, etc...), and using Microsoft Excel.

I decided to have two text-based tutorials produced. These were searchable Adobe Acrobat documents that could serve as a quick reference for the learners who needed refreshing on the subject. The links for these resources were made available on the Home page under the "Tutorials" tag.

Observe and Reflect: The Excel tutorial was mentioned a few times by the students as being helpful with the completion of their assignments, especially when it came to using some of the more obscure statistical formulae, as well as with the graphing functions. The "Basic Math" tutorial was less popular, but the students mentioned that they appreciated the extra reference should they need it.

Cycle 3.4.1: Chaos to Order and Back

Plan and Action: In order to alleviate the confusion and chaos, I started by making sure that the "Problem Sheet" was available to download and was clearly associated with the tutorial video. This sheet was offered in Adobe Acrobat's portable document format. I then sat through the video myself and noted the time codes for each question that I solved. At the time, I did not have the capabilities of video editing, so instead I made a list of links that pointed to sections in the video. This was basically a way to fast-forward to a spot you wanted within the video. For instance, in one of the problems, I dealt with the calculation of z-scores then found its probability using the Normal Distribution table. For that problem, which may have been number "2" on the problem sheet, I named it "Normal Distributions", and had it linked to that portion of the video.

Furthermore, I not only put all of the links in the Tutorials section, along with the problem sheet, but I also made the appropriate links within the textbook as well. In other words, at the end of the section dealing with Normal Distributions, I inserted a blurb to notify the learner that a video existed on the subject, and would link them to the Tutorials page to activate it and get the relevant question from the problem sheet.

Observe and Reflect: Navigation was improved significantly, and there was a marked increase in the amount of students who became aware of the videos. With the problem sheet now available, and the ability to jump to relevant sections, I noticed that the video was becoming a common tool that students were using throughout the course, instead of

just at the end of it. But the way it was divided was not the best way of doing things since the video would simply continue from that point on, not stopping until it reached the end of the tutorial session. In other words, it was up to the student to halt the session or they would be stuck listening to me a whole lot more! But this was a minor issue that I could solve when I had the software and know-how to do it. Nevertheless, this was progress. However, despite the improvement to the usability and of the media, another major issue was brought to my attention. This had been voiced by the students, and noticed when I looked at the video as well.

When I would write on the blackboard, it was extremely tough to see what was going. In fact, had the individual operating the camera not zoomed into the board every once in a while, nothing would have been seen. Sometimes the videotaping was too active, and the students were having a very difficult time seeing what was written on the board with it moving around. They would have to pause the stream, and sometimes use the zoom features to try and make out the characters. This was also true for anything that went up onto the overhead projector (such as the tables). The glare that came off the screen would sometimes cause a complete "white-out". (Please go to Cycle 3.5.1).

Cycle 3.5.1: A Smart Move for Tutorials?

Plan and Action: I had to find a way to make my blackboard scrawl legible for the viewers. Despite my natural tendency to write big, it was the clarity of the camera picture, coupled with the quality of the streaming that was at fault. I thought about taking digital pictures of the board when I had finished a problem, or moving the video camera up so that it could focus more on the board, and less on me. But I scrapped all of those ideas when the Smart Board got installed at my facilities. This white board would be able to digitally capture the writing I was doing, and automatically convert it into thumbnail images that could be enlarged by the user.

Even though it meant that I had to re-do the tutorial session for the camera, I figured that a second time around would be better and that I could fix the technical mistakes that I had done in the previous video. Once again, the camera crew was called in, and I used the Smart Board throughout the session.

Observe and Reflect: From a pedagogical standpoint, there was a marked improvement in the quality of the video, as well as in the interaction with the students. At one point, I even turned to talk to the camera, something I should have done a lot more of in hindsight. As for the writing on the Smart Board, or for that matter, seeing anything on the Board, the glare was worst than the overhead projector. However, with the digital pictures of my work being saved, and the slides clearly numbered for the problem that

was being solved, at least the students had a way of seeing everything that had been written, but not always in real-time (although they heard it in real-time). Future experiments will have to be done with the Smart Board to see how I can capture everything that is going on. A different camera angle, lower lighting, the Board's new capture feature, or maybe using another version of the technology would be better (Figure 10).

Nevertheless, there is still an ongoing issue that would have to be solved if I was going to continue insisting on using streaming video technologies: low bandwidth connections. For students still using dial-up modems, they experienced the usual screen freezes, choppiness, and other annoying glitches associated with high-bandwidth needs. I needed to find a way to make the experience more bearable for them so that they would not be at a disadvantage with the "high bandwidth" crew. (Please go to Cycle 3.6.1.1).

From an educational technologist's perspective, another issue was dawning on me as I reviewed the media. These videos were geared for solving a problem in a step-by-step fashion; they did not offer any concrete theory or explain why the procedure is done the way it is. These videos no doubt helped the learners with practical problem solving, but did not offer much in terms of ammunition for transferring that knowledge to different problems within the same subject area. In other words, it was too procedural and did not preach creativity when using their problem solving abilities. (Please go to Cycle 3.6.1.2).

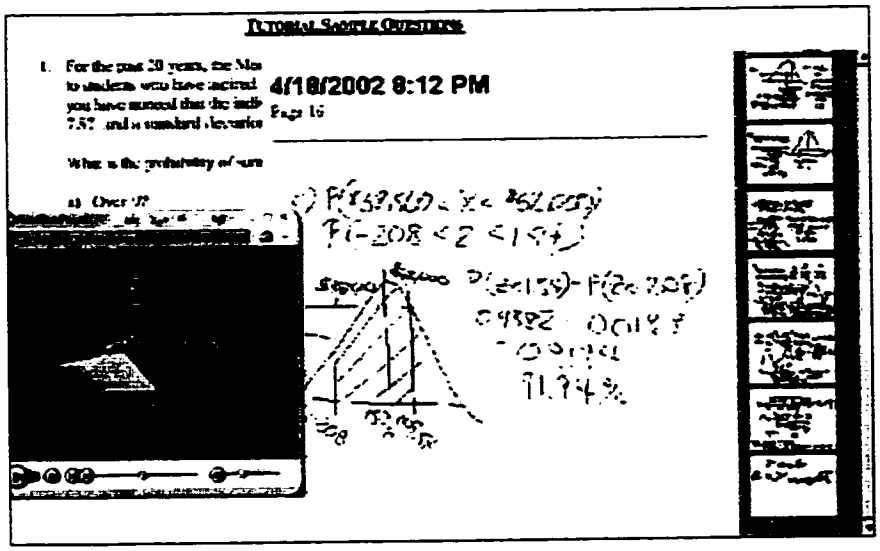


Figure 10 – Collage of Screenshots from new Tutorial with SmartBoard

Cycle 3.6.1.1: Bandwidth Blues

Plan and Action: It was getting clear to me that as the semesters went on, an increasing amount of technologies were becoming available for me to exploit. The videos had been fairly successful, and definitely warranted some further actions in the domain. Other high-bandwidth possibilities were surfacing and begged for my attention, but I always balked at implementing them because of the trouble I knew students would have (for example, videoconferencing). But regardless, embedded in the course were videos that I wanted all of the students to be able to see and experience. That meant that I had to find a way to make the videos feasible for the "dial-up modem" generation. The easy way out would be to burn the file onto a CD-ROM and offer it to the students when they registered at our offices for their accounts. In the case of the "true" distance students, the CD-ROMs could be mailed to them if they requested it. I would also take the opportunity to add Adobe Acrobat Reader and the Real Player just so they would not have to

download it. This incurred an added cost for the student that I was not prepared to instill upon them, so in the meantime, I looked for other options.

The literature, as well as my online research, had also introduced me to the possibility of "multi-bandwidth" streaming. In other words, offer a high-bandwidth stream (low compression, high frame rate), as well as a low-bandwidth stream (high compression, low frame rate). Using our standard compression utility (Cleaner), I had the video reconverted into two streams and uploaded the two versions of the video to the Web site.

Observe and Reflect: This stage is currently in progress.

(Please go to Cycle 3.7.1.1)

Cycle 3.6.1.2: Enough of Me, Already!

Plan and Action: As part of one of my Educational Technology classes, I had to produce an instructional video about a subject of my choice. Lacking any original ideas, I took advantage of the situation to produce something for the online course. I teamed up with a classmate who had a knack for video editing, and we put together an instructional video dealing with a specific topic in INTE 296. In this case, I wanted a general topic video, not one where I was simply solving a problem and was expecting the learner to follow my every move. In this one, I gave some theory, threw in some computer

animations, and tried my best to make it some edutainment. Due to the size of the file, the video was offered on a CD-ROM to a few students as a test trial. (Included in CD-ROM)

Observe and Reflect: Initial tryouts have yielded some very positive feedback. More tests are needed, as is a method of delivering it via the Web site (test with different compression rates). This stage is currently still in progress.

Cycle 3.7.1.1: Embedding the Chunks?

Plan and Action: At this point in time, I had had experience as an amateur digital video editor and now had access to the technology I needed to physically break the video up into smaller chunks that could be embedded directly into the relevant section of the text. So I took advantage of that feature and combined it with the problem that was being solved to make a "video solution" to an exercise within the text. It made for an interactive tool where the student would read the problem, maybe even attempt to solve it, then click on "See the Solution" to actually see me solve the problem in a step-by-step process.

Observe and Reflect: This stage is currently in progress.

Epilogue for Problem 3.0: Lack of Face-to-Face Contact

The feelings of isolation would be countered by face-to-face contact, at least that was the "experts" have mentioned in their recommendations. From the feedback I have been getting thus far, I would have to agree. The fact that the students were able to "see" someone was already a step forward for them since they are so used to the traditional classroom setting. In some cases, students were literally "thrown" into this mode of delivery without quite knowing what they were getting into. Teachers need to understand that not everyone is ready, or comfortable in this type of environment. In my case, in was extremely important because of the nature of the students who were enrolled in my class.

The orientation session went a long way to establishing the culture of the learning community. We were all about to embark on the same voyage. Most of the students had never participated in such a course and were admittedly nervous about it, and this session seemed to alleviate their fears, as well as answer their questions. The tutorial session, although not something I would normally have implemented in a "distance" course, was a huge hit. However, teachers must be careful not to offer too many advantages to students who are on campus versus the ones who are not. New technologies (digital video, SmartBoard) may hold the key to levelling the playing field in those regards.

The digital videos definitely added to the value of the course, and were greatly appreciated by the students who liked the fact that they could control the pace of the streaming, as well as receive some step-by-step instructions for completing problems that

were very similar to the ones they had to do in their assignments. Future technologies, such as the Smart Board, might be a beneficial tool to help the quality of the online instruction, but much work must first be done in that domain.

Successful Practices with Face-to-Face Contact in INTE 296:

- Orientation session
  - At the start of the semester
  - Housekeeping issues
- Tutorial
  - Get students involved in the session with opportunities for participation.
  - Cover traditionally problematic topics
- Other Instructional Videos
  - Must be "viewable" length (less than 15 minutes)
  - Students must be able to see what is being written
  - Embed the video, or make a link to it, in the appropriate section if the textbook so that students know that the option exists if they need it.
  - Must solve bandwidth issues for slower connections

Problem 4.0: This is just an Online Book!

Cycle 4.1: Taking Advantage of the Medium

Plan and Action: Students have regularly approached me to ask why there was no textbook that accompanied this course. These sentiments were regularly echoed in the course evaluations. When they were answered that they were being provided with a cheaper, more dynamic alternative, the common response was that this was no different from a book. I thought about my own experience with the course material, and had another look at the course Web site to evaluate their point.

The course content had been broken down into sections that were purely text-based, with the occasional table or graphic scattered within the page. At the end of each section, graphics of pointers were inserted to urge the user to go to the next section, much like turning a page of a textbook. In all fairness to the original designers, an effort was made to incorporate some form of interactivity by including some arrows that would bring the user back to the top of the Web page, instead of using the scrollbar to do it themselves. In addition, a "links" page had been included within the site that sent the user to "Interesting Web sites" that included "A Beginner's Guide to HTML", Museums and Exhibits, as well and some other Internet resources. At the very top, as well as on the bottom of the screen, icons had been created to send the learner to the assignment section, the home page, and the glossary. But as far as the content of the page was concerned, not one interactive element could be found, an immense waste of the capabilities of the medium

being used. The simplest form of interactivity within the content, but a large project nonetheless, is to make the keywords "hot" so that they point to their definition in the glossary.

Observe and Reflect: Due to the fact that the existing glossary was not specialized in statistics, but rather in generalized mathematical terms (it was quite useless), there was a very limited amount of links that could be made between the terms and their definitions. However, the effort did not go unnoticed, nor was it unappreciated by the students, but the existing definitions had to be modified into "layman's" terms and more relevant ones had to be added (Please go to Cycle 4.2.1). Another popular complaint stemmed from the fact that students did not like being redirected from the page they were in, thus forcing them to click on the "Back" button to retrace their steps to the lesson, in many cases breaking their momentum, concentration, and in some instances, getting them lost in the Web site. (Please go to Cycle 4.2.2).

Cycle 4.2.1: Glossy Glossary

Plan and Action: The glossary had to be tailored for the students that were making use of the course. The previous designers had made the mistake of including, probably what they thought was, the most complete glossary they could find. They failed to realize that bigger is not necessarily better. The information presented in this page was overwhelming and an overkill for the introductory-level statistics learners, most of whom had not done math since high school or CEGEP. Although there was nothing stopping a

learner from enriching their mathematical vocabulary, the language used was beyond a non-mathematician's comprehension, and had to be curtailed, or at least "translated". Therefore, I eliminated the terms that I knew they would not be using during the course, and began the arduous process of rewriting and tweaking the definitions.

Observe and Reflect: This version of the glossary, an "annotated" one for non-mathematicians, proved to be much more useful for the students. Many had started making use of it as a study guide for definitions in case I asked them theoretical questions during the exams. However, the time-consuming part of linking each keyword to the glossary was an arduous process that was eventually put onto the back burner as I concentrated on other interactive techniques. To compensate, I integrated a search option that allowed the users to find the definitions on their own if they existed on the site. The glossary Web page also included external links to other mathematical and statistical glossaries for those learners who would not give up! (Please go to Cycle 4.2.2). However, students who wanted more than a simple definition of a given term, but rather extra statistical resources all together, needed a quick way to find this information without going through the hassle of using a global search engine (Please go to Cycle 4.2.3).

Cycle 4.2.2: The Windows XPerience

Plan and Action: In order to keep the learner's momentum going with the content despite the fact that they chose to get clarifications for a given term, I thought that the easiest way was to have a new window pop-up, that by default, was smaller than the screen it was covering. This meant that it could be easily minimized, or kept open while the learner referred to it before going back to the content they were concentrating on. Since the glossary already used anchored hyperlinks, the smaller glossary window should be enough to provide the definition of the selected term without losing a beat with the main content.

Observe and Reflect: All worked well, and students who wanted to change their focus to the definition could maximize that screen and do their research there if they wanted to, then minimize or close it to go back to the course content. This was but a simple interactive tool, but the point is that a regular textbook could not provide this feature. Students had voiced their concerns about the fact that this was but an online textbook, and would have liked to experience something a little different when they were browsing through the content. With the simple click of the mouse, the static online book had become an interactive tool. However simple this procedure may have been, it still did something that other books could not. It also gave the learner a different and more advanced type of control of the content. Instead of the usual page flipping, students were now able to "jump" out of the text to consult tools to help them understand the information. However, how is this different from someone putting their book down to

pull out a dictionary, encyclopedia, or a thesaurus? Granted the speed at which the data could be accessed would be tremendously increased with the technology, but this was essentially the same thing (Please go to Cycle 4.3.1). The solution to the initial problem also got me thinking about other complaints that I had received about accessing extra resources while trying to maintain the flow of the learning experience (Please go to Cycle 4.3.2). The Internet also allows other media to be incorporated into the online content, a feature that is difficult to emulate in standard "text and graphics" books. The possibilities here include sound and video (Please go to Cycle 3.3.1).

Cycle 4.2.3: Other Resources

Plan and Action: In putting the content together, I organized the information in such a way so that all of it was used throughout the course. That is, students were not wasting their resources on a "textbook" where they would only be studying the first four chapters and omitting the rest. What I did not take into consideration was the fact that this partially used textbook could eventually turn into a reference manual for students who pursued a career where extra statistical study was needed. There was also the complaint about needing more explanations about a given topic or technique that prompted me to look into other sources of information to compliment my own. But why should this user-centred course rely on the course facilitator for the provision of extra explanations and exercises upon request? For students who wanted a "real" textbook, I would suggest titles from the University library. If the learner requested immediate help, I would offer them a list of hyperlinks to other Web-based statistical resources (e-books, exercises, examples).

I also figured that a listing of other statistics-related Web sites would be appropriate in order to demonstrate the uses of the practice in the field (i.e.: Statistics Canada). These extra tools were grouped together in a special "Links" Web page.

Observe and Reflect: In order to make sure that the "off-campus" student is not disadvantaged, I figured that the library books that I had recommended should also be made available to students who do not set foot on campus. To do this, I would hyperlink the textbook directly to a Web site where they can be purchased (the publisher's Web address, www.amazon.com, http://www.chapters.indigo.ca/). In fact, this would also be an opportunity to offer students books that are not found at their library (Figure 11). Granted that borrowing a book is much less expensive than buying one, it at least gives everyone an opportunity to access the same materials. The online resources were a welcome addition for the students who needed the extra materials and examples. The list continues to grow as I find other Web sites, and as students themselves send me Web addresses of other pages they found useful. This occurrence proved to be an unexpected and welcome source of information for the students, as well as myself. (End cycle)

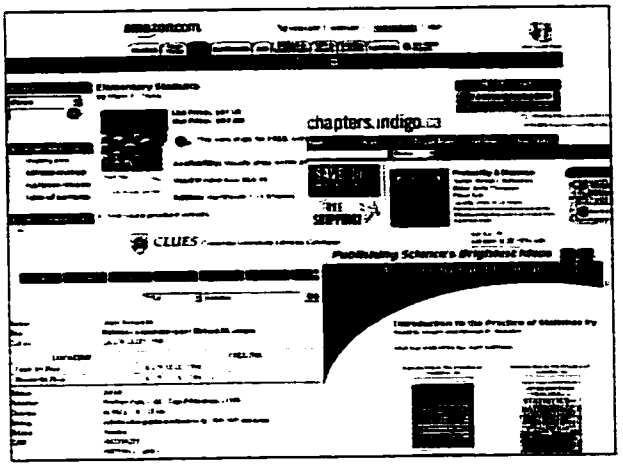


Figure 11 – Other statistical resources available to students

Cycle 4.3.1: Where is the Relevance to Me?

Plan and Action: I turned once again to the literature to help me find a way to use the vast potential of the Internet to further enhance the interactivity of the online content. According to the research, as well as from some of the comments I had received during the interview sessions with the instructor, as well as with the students, it seems as though the relevance of the information is an issue. That is, how the information presented to the learner can be applied to real-life situations in their domain of interest. This would be a large motivating factor for the site's users. The problem is that with the multitude of students, and from various programs, enrolled in this course, I could not focus on one particular subject to provide all of the examples. It was best to have an assortment of problems from different domains and hope that students could transfer the cognitive model they developed to solve similar questions from their own field. However, being pressed for time and having very limited resources to work with, I opted for another route. Instead of having customized questions awaiting them when they get to them in the content, I would try and create situations where the student could manipulate and customize their own problems. To do this, I made and provided the solution to a generic example using Microsoft Excel. When the learner clicked on the solution (chart or graph), the application would launch and the students would have a chance to modify the raw data and see how their manipulations would alter the end results.

Observe and Reflect: The students using the university computer lab especially enjoyed this interactive feature. With a click of the mouse on a given graph, Microsoft Excel would instantly launch and the users would be able to adjust the data and instantly see the results (Figure 12). This served as a motivating factor for some of the students as they took control of the spreadsheet and customized it as they saw fit. Others simply enjoyed the fact that the monotony of the text and graphics had been broken. For students who did not have extensive experience with Excel, this also proved to be a learning experience for them as they could fiddle with the formulae and charts to see how the spreadsheet was put together. Students at home, however, did not always have the best experience with the feature. First of all, not everyone had Microsoft Excel on his or her computers, and if they did, it was not always the same version. Of the learners who had access to spreadsheet software, the file association was not always arranged properly so they would have to save the file to their computer before being able to launch it (Please go to Cycle 4.4.1). Although this may seem like a simple task for seasoned Internet users, this was not always as obvious for the novices, especially when they would try to open it within their spreadsheet program (Please go to Cycle 3.2.2). Another problem stemmed from the fact that the students were not always aware that the graphs were interactive. They would have to move the mouse cursor over the image, chart, or table in order to identify the presence of a hyperlink (Please go to Cycle 4.4.2).

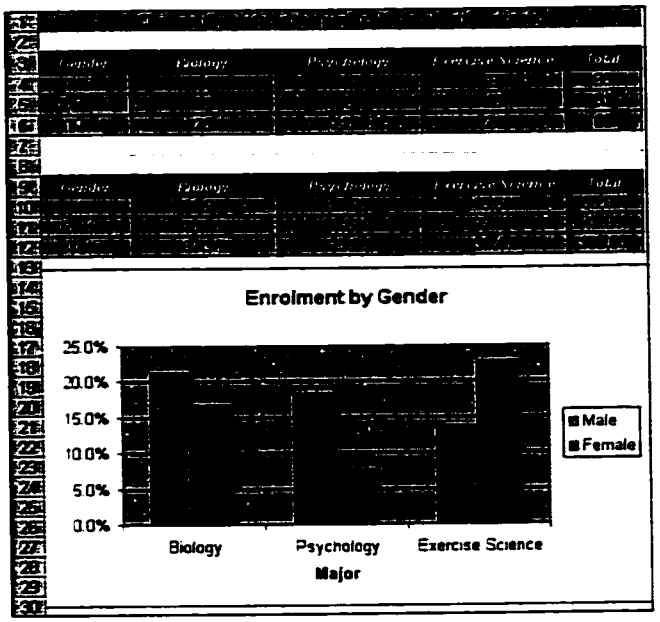


Figure 12– Interactive examples using Microsoft Excel

Cycle 4.3.2: Stable Tables

Plan and Action: In the sections on hypothesis testing, z-score probability calculations, and ANOVA, a commonly voiced complaint was that the required statistical tables were not easily and readily accessible. When a given table was needed, the user would have to scroll all the way to the top of the document (or to the bottom), select the "Math #" button (which you had to figure out represented tables), and go find the table you needed. The problem was, like the "hot word" situation, you would lose your place in the content since the table would replace it in the same window. This was less of an issue for seasoned Internet users, who would simply open a new window themselves and seek the information they wanted. However, this was not evident for everyone involved in the course. Opening a new window upon selecting a hyperlink could solve the problem, but from an instructor/designer standpoint, I had to find a place for that link to go to. The

constant use of the vertical scrollbar to get to the icon for the tables was annoying enough, and putting a direct link to the exact table that was needed would give away too much information in self-assessment situations, since identifying the proper table to use is part of the learning objectives in problem solving questions. However, an instant link to the main "Tables" page would allow the student to choose the table they needed, and in doing so, a new window would launch so that they would not lose the information they needed from the content. That way, the student would not have to find the icon for the tables, nor would they be given too much information when trying to determine the solution to a given problem on their own (in the Practice Sections). However, in the content portion itself, where the answer is given in a step-by-step format, a direct link to the proper table would save the student that extra step. So, links were made to statistical tables when and where they could be placed, but all of those links opened new windows that were smaller than the original screen so that the learner would not lose their place within the content.

Observe and Reflect: Initial feedback was quite positive, but the full implementation of this technique is ongoing.

Cycle 4.4.1: Stick to the Script!

Plan and Action: Since I certainly could not, and would not, force all of the students to use Microsoft Excel, I wanted to find other ways to integrate interactive features within the content that could be usable by everyone. The advent of Macromedia Flash

introduced a possible solution, especially since the plug-in was free to download from the company's Web site. In addition, the feature could be integrated directly in the text, or opened in a new window. The problem, however, was the time it took to put a simple interactive element together using the software, which is far from easy, especially for beginners. I did not have access to a Flash programmer, and did not have the time to learn the software on my own...at least not to the level I needed to make something useful for the course. From searches on the Internet, I came across several free JavaScript applets that performed simple statistical functions. This included finding the area under a Normal Distribution, drawing t-distributions based on a chosen sample size, and calculating binomial probabilities employing user-entered variables. For the applets in which the script was hidden, the students could be linked externally to the site that provided the feature, whereas the others could be integrated directly into the INTE 296 content. I could also have the applet open in a small browser window if I wanted to minimize the download time for the page itself. I figured that this was the most logical option and went ahead with my plans to insert links opening new browser windows with Java Script applets (which the latest browsers all support).

Observe and Reflect: In progress.

Cycle 4.4.2: Visible Links

Plan and Action: If a given graph was interactive, how was a student to realize it unless they physically moved the mouse cursor over it? This was a usability design issue

that had to be dealt with. One way to make the link more obvious was simply to include a caption underneath the figure that read, "Click here to adjust the data". It seemed like a very basic thing to do, but I felt that it was all that was needed to make the feature more visible.

Observe and Reflect: In progress.

Epilogue for Problem 4.0 – This is just an Online Book!

One of the major obstacles facing distance education courses is its perception in the community as a sub-par methodology for instruction. Although the use of Internet technologies to deliver online courses did not immediately have an effect on distance education's image, it did offer the tools to enhance the quality and the environment in which the learning took place. In order to promote the Internet as a viable tool for instruction, one had to showcase the plethora of techniques that online courses could support. The problem was, nobody knew what these practices were, nor had any models to consult when putting together a course using this delivery method. This inevitably led to instructors making Web pages to house their course notes and calling the unadorned act, "online instruction" or "e-Learning". Although the claim is not completely wrong, these teachers and designers do little to improve the reputation of online courses. Making the lecture notes or the course content accessible via the Internet does not translate into an online course, but rather an online resource. This problem can be rectified by making use of the Internet's ever-increasing capabilities to offer learners instructional events that go beyond the ability of the standard textbook.

These possibilities include audio, video, animations, and interactive environments, elements that a standard, affordable, school textbook would be hard-pressed to offer to its users. Sometimes the Web can be used to increase the efficiency with which information is gathered. For instance, "hot words" within the text could link directly to that word's definition instead of having to find a dictionary or flip to the end of the book to find more information in the glossary. In this course, instant access to statistical tables and extra problems makes the process much easier than in a standard text where the learners would have to rummage through one or more textbooks to find it. In addition, the fact that they are on the Internet gives the user instant access to a wealth of information about any subject matter. That being said, the additional resources must be presented in moderation so that the learner's focus is not overly diverted from the content at hand. Using a separate pop-up window, a user can quickly absorb the extra data, then close it and resume from where they left off.

Successful User-Computer Interaction Practices in INTE 296

- The use of "Hot Words" for instant definitions and clarifications of the content
- Customized glossaries (suitable for the level of instruction)
- Use of pop-up windows for displaying "quick facts" and tables
- Offering of teacher-approved supplemental resources, especially if online
- Data manipulation opportunities
- Integration of interactive features within the content

Problem 5.0: Feelings of Information Overload.

Cycle 5.1: Where Can I Buy the Textbook?

Plan and Action: Students had a big issue with the way the course was delivered since many of them were not comfortable with having the content presented to them on a computer screen. The students who made these comments conveyed feelings of being overwhelmed with the amount of material that was being presented to them, especially if they were not used to computers to start with. Many students expressed the desire to have a physically bound textbook that they could carry around with them, make annotations in, and give them a sense of the amount of material the course covers. Other learners simply did not like staring at a computer monitor for an extended period of time, and the way the content was presented to them, this was unavoidable. Their solution, much to my dismay, was to print everything they could. Of course, the way the online textbook was structured this meant that the students had to download each section and print them separately. This inevitably led to complaints ranging from printer problems (margins would cut off), to logistical issues such as the time it took to undergo the process, and the lack of facilities to do so. Since I needed a quick fix to alleviate the problem, I printed out a complete copy of the textbook, including the assignments and tables, and made them available to the students, at their own cost, at the university's Copy Centre.

Observe and Reflect: Despite the loss all of the content's interactivity, not to mention the fact that this intervention went against, in part, the purpose of this distance education

course, on-campus students appreciated the fact that they could easily get a "hard" copy of the textbook. They were able to make their own notes on the printouts, and students who had slow or unstable Internet connections could rely on an alternate means to access the text, thus giving them the ability to study their notes away from the computer lab. However, as is often the case, in solving one problem, several more spring up... Students who did not want to pay extra money for the printed copy, and who had access to a printer, wanted an easier way to print out their own copies of the textbook (Please go to Cycle 5.2.1). From a teacher's perspective, especially a distance educator's, a printed version of the textbook eliminated any interactivity with the content, the flexibility of the content had been abolished, and students who were not on-campus and do not have access to a printer were at a net disadvantage. The other major complaint that was voiced, by both the students, as well as by the course facilitator, was the frustration they had with finding a given subject within the text. For example, if a student contacted the instructor to ask a question about a given topic and made reference to the text, "on page 7", the instructor was clueless of the contents of that page unless they had a printed copy of the materials at their disposal (since no page numbers appear onscreen). In addition, this printed version would have to be the same one as the student's, or else the content may be on different pages, or on different areas of the same page. The solution seemed to point tp ways to alleviate the load on the students so that they would not need to rely on paper, and could communicate with the professor without "page number" confusions when asking their questions. (Please go to Cycle 5.2.2).

Cycle 5.2.1: Printer Friendly?

Plan and Action: In order to avoid the technical glitches with setting up proper margins, as well as to quell the complaints of the tediousness of printing out the textbook, a "printer-friendly" version was offered to the students. This feature consisted of the combination of the four sections that make up each chapter (there are five chapters in the online text). By selecting the print friendly link, offered at the beginning of each section, a separate window would open whereby the contents of the entire chapter would display, the proper margins would be set, and the print screen option would automatically launch. The user would then have to click on "OK" and the chapter would print itself out!

Observe and Reflect: The margins were fine, and by combining the four sections into one, I had come up with a way that would have the students print out the book by repeating the "print" procedure five times (for each chapter) instead of twenty (there are four sections in each chapter). The problem was that by combining the four sections, including all of the text and graphics, I had quadrupled the amount of time it took to download the content! And when it did eventually download, a typical printer would run out of memory during the printing process and either omit the graphics, or cease printing all together! Of course, this was only a problem for students who did not have the proper hardware to handle the job, but again, I did not want to disadvantage students who could not afford the infrastructure. I could always set-up a "low memory" printed version, but this would involve the elimination of graphics, which were essential in some cases, especially when describing a formula. Offering the printout in an Adobe Portable

Document Format (pdf) would solve formatting issues, but memory problems still persisted while testing. It was time to look for other options. (Please go to Cycle 5.3.1).

Cycle 5.2.2: Break it up!

Plan and Action: The main reason that students were printing out the textbook seemed to be because of the way that the data was being presented to them. Observations made in the lab had shown a tendency for the students to take notes as they read from the screen, but this activity would prove to be quite wearisome, especially if there is no way to "bookmark" your place where you left off. The amount of data that they were taking in during a typical sitting seemed to be at the root of the problem. It was just too much. The next logical step to take was to break the information up into more manageable pieces, a technique known as "chunking". The content was broken down into smaller subsections and students were able to choose the topic they wanted to go to from a menu found on the left-hand side of the screen.

Observe and Reflect: The content breakdown seemed to be agreeable with the students since it made the readings shorter and subsequently, there was less scrolling to do. The students also expressed the fact that they liked being able to jump into a particular section of the chapter to pick up from where they left off, but on a new screen instead of in the middle of one. They still had the option to print if they needed to, either the subsection, or the entire chapter, via the "print-friendly" version. However, they still expressed feelings of disorientation within the content of the textbook. Although they had

a menu to aid with their navigation, their current location was not evident once they had made a choice, nor was their "physical" sense of where they were within the content. In other words, they had no idea how much work they had accomplished, and how much was left to do before they completed the section. (Please go to Cycle 5.3.2). As for the "page numbering" issue, it continued to be a problem, especially in sections that required several Web pages to view. That is, sections where the content had been broken into more than one "screen" in order to minimize the vertical scrolling were still troublesome in the communication process (Please go to Cycle 5.3.3).

Cycle 5.3.1: Compacted Document (CD).

Plan and Action: Downloading time was still an issue for the textbook, as was the printer's memory problems. I did not want to lose the other features that the Web site offered, especially the interactivity and the graphics. Therefore, I took a step back and looked into the possibility of packaging the course on a CD-ROM to send to students who were lacking the infrastructure to access what they needed. That way, the download time would be reduced significantly since the data would be read from the CD-ROM drive instead of from the Internet. This had only been an option recently since the department had purchased a multi-CD-ROM printer and copier. Since this was going to incur an extra cost to the student (CD printing/copying, and shipping), I only offered it to the students who had no other options available.

Observe and Reflect: This gesture was appreciated by the handful of students who requested the service. However, although all of the core content was there, the version they received was only partly interactive (not all of the internal links had been redirected properly) and there was some missing links to external resources since Internet access was needed to fetch them. In addition, the links to Excel documents would launch, but would clash with the older versions of the software on the client computer. In a few cases, the application would not function at all since Excel was not present on the machine. Of course, it took a few technical calls to figure those problems out! From an instructor's side, these CD-ROMs were a nightmare. All of the links had to be redirected locally instead of through the Web server, and the content could not be updated, meaning that new versions of the CD-ROM would have to be published every semester, or every time a major change has taken place. Of course, the student would still need access to the Web to get the latest news and announcements, as well as participate on the discussion board and in the chat room. The fact that some students enrolled in this course, fully knowing that it was a Web-based course, without the proper hardware and software was quite frustrating. However, there was no mention in the course calendar, or in the course outline, of minimal requirements to do the work from home, or from any other location away from the dedicated computer labs that served students enrolled in the course. Therefore, this information was added in the course outline. At least this saved me some of the frustration since I could point to the course outline later in the semester to explain to the student that they had been warned about what was needed to do the course from home. As for the CD-ROM, it remained an option in extreme cases only.

Action Taken: Added minimal requirements in course outline. (End thread)

Cycle 5.3.2: Where am I?

Plan and Action: Although the Web site had a topic menu on the left-hand side of the screen, it did not show students where they were in the scope of things, especially if the menu had multiple levels to it. For example, when a given student would select "Normal Distribution" from the menu, another mini-menu would appear where they could choose "How to read the table". This would then alter the right frame of the Web site where the header "Normal Distribution" would be written on top of "How to read the table", and the content would follow. Students would complain about the fact that the left hand menu does not give them an indication of where they were, and consequently, they had to scroll through the entire menu to match the title to theirs, when they were able to find it. Therefore, I used a cheap version of a rollover button (without JavaScript) to make sure that the particular lesson was highlighted in the menu so that the student would at least see what section they were working on, how much they had done, and how much was left to do (Figure 13).

Observe and Reflect: Although this seemed more of an aesthetic feature, the highlighted buttons served a definite practical purpose. By clearly indicating what section the student was in within the menu, it gave them a better idea as to where they were in that particular section. However, the submenu items were still missing, as was the rest of the book. The menu gave the student an indication of where they were in a given section, but not in the book, nor in the Web site, per se. This same menu system did not need to

be limited to the online textbook either. This usability issue was still a problem, however there was no question that an improvement had been made. (Please go to Cycle 5.4.1).

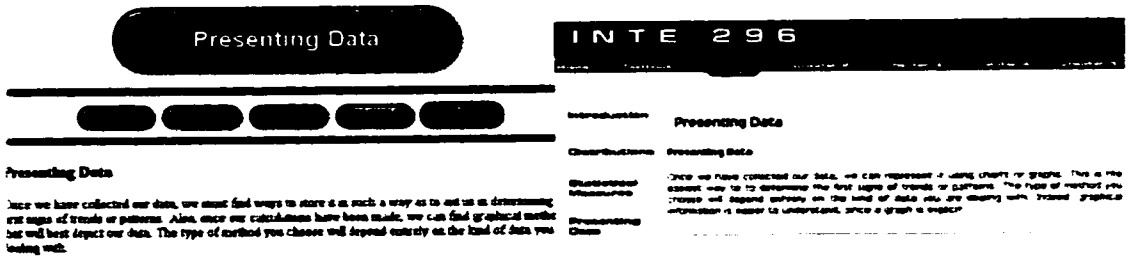


Figure 13 – INTE 296 Web site navigation before (left) and after (right).

Cycle 5.3.3: Take a Number!

Plan and Action: I needed to find a way to make referencing to the online text easier. The content had helped divide the sections up into readable chunks, but sometimes, a particular topic would extent beyond one screen of content. This would bring us right back to the "...on page..." problems, although not nearly as big an issue as before the content was divvied up. Just to add another element of precision, as well as to help the student with the impression of their progress with the material, I added "screen" numbering. I had thought about using "page" numbers, but wanted to distance myself from the look of a textbook and instead focus on the online component. Furthermore, I made sure to add to the information the number of "screens" in a given section so that the learner was aware of how much was left to go. This information was located at the bottom of the screen, and was accompanied by directional arrows to control going to the next screen, or going back a step. For example:

Figure 14 – Sample screen navigation control

Observe and Reflect: In progress. (End thread)

Cycle 5.4.1: You are Here!

Plan and Action: Although the menu was improved, it still did not show the student exactly where they were in the Web site, or in the textbook if they were in a sub-section. For example, the menu would show that they were in the Normal Distribution section, but not in the "How to read the table" sub-section, nor was the fact that they were in Module 2, Chapter 4 of the textbook. I did not want to expand the menu any further to show the different levels because this would take up half the Web page's space! In addition, it would make the screen too cluttered and confusing for a student who was trying to make sense of the content of the page. A simple solution would be to create a separate page that would do exactly that. There would be no content, just a listing in a branching format of the section and its parent levels. Or, even better, it could display the entire site, with the present location clearly indicated. In other words, I put together a link that would open up a site map that showed the user's current location, which also allowed them to select another one to go to via a direct hyperlink (a clickable map).

Observe and Reflect: This technique was also a marked improvement and students expressed their relative satisfaction with the feature. A few adjustments were needed with regards to the font sizes so that the page title was a little clearer. Another solution would have been to only label the main sections, and have the other titles pop-up on mouse-rollover (screen tip). Another idea, to clear up the clutter for larger sites, would be to

have expandable/collapsible branches to the map in order to hide sections you are not interested in so that you can zoom in on the ones in which you are. However, this procedure opened up a new window, thereby further cluttering the user's desktop and forcing them to move, close, or minimize the page so that they could continue with what they were doing. The window would serve as a distraction for the students as it would encourage more browsing, and less reading from their part. They needed a simpler way that would indicate where they were in the web site without having to open a new window to do it. (Please go to Cycle 5.5.1).

Cycle 5.5.1: Breadcrumbs?

Plan and Action: The literature review had presented me with an interesting, yet very simple way of displaying to a user where they are in the Web site. The technique calls for the use of text arranged at the top of the screen that lists the topics chosen in hierarchical order, starting with the first level "Home". It is suggested that the ">" be used to separate the words since, according to the literature, it gives an illusion of forward progress. All of the individual headings are linked to a particular section so that the user can go back to that part of the content with the click of a mouse. The last section is bolded (or highlighted) to show the student where they are at present. It is also suggested to introduce the feature with "you are here:" The text should also be in small font so that it is clear to the user that this is an accessory to the page (Figure 15).

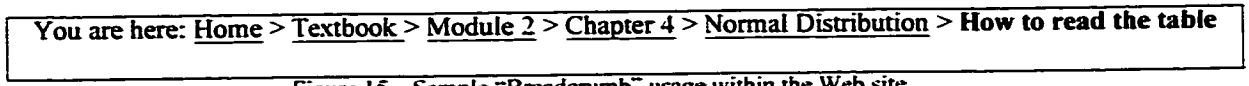


Figure 15 – Sample "Breadcrumb" usage within the Web site.

Observe and Reflect: The testing of this feature is still in progress with the students. However, from an instructor/designer point of view, the illusion that the course content is a textbook still exists. If I am trying to discourage students from printing out the screens, I must put an end to the impressions that this Web site is a book to start with. Using the term "textbook" right off the bat is probably the most blatant example of what I mean. Then through in the "Modules" and "Chapters", and the students will be scouring the bookstore for the course textbook in no time. That being said, I need a way to distance this content from a "textbook" environment as much as possible. (Please go to Cycle 5.6.1).

Cycle 5.6.1: Life's Little Lessons

Plan and Action: In order to remove the "mystique" that the online course was but a textbook, the first step was to eradicate the word entirely. The initial thought was to go with "Lectures", but since this course was not divided on a 13-week schedule (as are traditional courses) that did not seem right. Another possibility was to go with "Topics", but there were so many possible topics that the Web page would become much more confusing and cluttered to be of any use. Therefore, the "modules" and "chapters" were instead renamed as "lessons" since this did not imply a textbook, and it acted as a "lecture" since it allowed for the integration of a multitude of topics under one heading. It would also reduce the clutter of the menu since they could simply be named "Lesson 1", "Lesson 2", etc...

Observe and Reflect: It is too early to tell if the printing has been affected by this action, or if the use of Lessons reduced the "illusion" of a textbook. However, what has been expressed thus far is the fact that it is difficult to find specific topics with this system. Although the student is now able to refer to a particular screen number in a given Lesson, they would not be able to find the section on Conditional Probability without guessing in which Lesson number it is found. There are no descriptions of the Lessons, nor is there a way to quickly search the site for a given term or topic. These features would benefit all users of this site.

Possible Future Actions: Brief description of the Lessons in the Web page, keyword search of the Web site.

Epilogue for Problem 5.0 – Feelings of Information Overload

Feelings of being "Lost in Hyperspace" was a common issue brought up in the literature, and it had always been a topic brought up by students who did not know where to start, or where to go with the course Web site. The "textbook" had been made prominent in the Home page with direct links to one of the five main sections. Students logically started with the first one, and then began the slow, arduous process of scrolling through texts and tables until an icon urged them to continue to the next section. There was no hint as to how many sections were under each topic, and the vertical scroll bar was the only way to tell when the learner was nearing the end of the content for that particular section. Students could not decide how to go about their studying of the information. Some would take extensive notes as they went along, others would try to read everything on the screen first, then go back and take notes, whereas other users would scroll around the page, jumping from section to section, wondering what they should retain. Add in images, hyperlinks, tables, graphs, and a multitude of other distractions, and the students are quickly looking for ways to help focus their thoughts.

One way they were able to cope with the problem was by printing out the "textbook". This eliminated the reliance on the computer, something many learners had trouble with to start with. This also allowed them to make the content portable, as well as a way of making their own annotations on the printouts themselves. However, this convenience eliminated several things that made the online text different from its hard-covered counterpart. First of all, the interactivity had been eliminated meaning that the students

were giving up control of the flow of information, and the direction they wanted to go in. They were now bound to a sequential presentation of information that did not allow for quick glossary searches, direct links to tables, and hyperlinks to e-mail the professor. Secondly, the flexible and dynamic nature of the Web had been ignored. Students could not access the latest versions of the text unless they reprinted after every revision. All in all, I had to find a way to eliminate a need to print out the course content, and that meant dealing with the way that the information is presented to the user.

Breaking up the content into smaller portions allowed students to move from screen to screen as opposed to making the course a scrolling experience. The introduction of different navigational techniques helped the learner to realize where they were in the Web site, and also where they were with regards to the content they were studying. This helped orient them in hopes of avoiding "info vertigo". The goal of these cycles of changes was not to eliminate printing per se, but rather to eliminate the need to print caused by learners being overwhelmed by the amount of information presented to them.

Successful Content Control Practices in INTE 296

- Offering a "Printer-Friendly" version of the content
- Breaking up the content into manageable "chunks" of information
- Clearly identifying to the user the section they are currently in within the menu
- Employing a site map to aid in navigation orientation
- Using "breadcrumbs" to aid learners to retrace their steps
- Add in a keyword searching utility

Conclusion

A conclusion is purely theoretical in this case since none exist in practice. An end-point would imply that the course has ceased developing and that it remains static since no more changes are being made to it. That being said, technologies will continue to evolve, as will the practitioners who make use of them. Students are becoming increasingly computer literate, and personal computers are gradually becoming a standard in modern households, as is Internet connectivity. In order to meet the expectations of its students, as well as to prepare them for the "real world", academics will have no choice but to continue to transform its courses to conform to society's demands.

The e-Volving Practitioner was in part an exploratory study that delved into a relatively unknown area, that of online instruction. Its focus was on concrete practices that were based on recommendations made by INTE 296 stakeholders (teachers, students, other professionals) in order to validate them in a true Web-based learning environment. What was found was that many of the ideas and techniques employed had to be modified, tailored, and adjusted in order to have the desired impact within the unique context in which this course is delivered. Although not all of the successful practices contained within this thesis could be directly applied to other online courses per se, many of them could generate solutions to identified issues in similar situations. It is up to the practitioner, often the instructors themselves, to make the necessary adjustments to the intervention and to carefully monitor the results of these actions so that fine-tuning can be made when needed.

There is no pre-generated Web-course template that exists at the moment that could act as an end-all solution to the issues raised in this course, or in any other online course for that matter. There are too many variables at play that make one intervention successful in one context, whereas another fails miserably. As in any emerging field, it will be up to the practitioners to pave the way for others in their field. In other words, the instructors, Web designers, and educational technologists, will be called upon to try new techniques and approaches with their courses based on their own experience, the knowledge of others in the field, and more importantly, on the input of their students. Let us not forget, after all, that in academics, a teacher's most precious resource is not always the solution manual, but rather the minds of the pupils who are undertaking the instructional journey with them.

References

Alessi, S.M., & Trollip, S.R. (2001). Multimedia for learning: Methods and development (3rd ed.). Toronto, Ont: Allyn and Bacon.

American Federation of Teachers (2000). Distance education: Guidelines for good practice [On-line]. Available: http://www.aft.org/higher_ed/downloadable/distance.pdf

Banathy, B.H. (1992). A Systems view of education: Concepts and principles for effective practice. Englewood Cliffs, NJ: Educational Technology Publications

Barker, P. (1994). Designing interactive learning. In T. de Long, L. Sarti. (Eds.), Design and production of multimedia and simulation-based learning material. Dordrecht, Netherlands: Kluwer Academic Publishers

Bates, A.W. (1997). The impact of technological change on open and distance learning. Distance Education, 18(1), 93-109.

Bernard, R.M., de Rubalcava, B., & St-Pierre, D. (2000). Instructional design for collaborative online distance learning: The state of practice and research. Distance Education, 21(2), 260-277.

Boston, R.L. (1992). Remote delivery of instruction via the PC and modem: What have we learned? The American Journal of Distance Education, 6(3), 45-57.

Brooks, D. (2001). Web-teaching: A guide to designing interactive teaching got the World Wide Web. New York: Plenum Press.

Chickering, A., & Ehrmann, S. (1996). Implementing the seven principles. American Association of Higher Education (AAHE) Bulletin, 49(2), 2-4.

Clark, R.E. (1983). Reconsidering research on learning from media. Review of Educational Research, 53(4), 445-459.

Copley, J. (1992). The integration of teacher education and technology: a constructivist model. In D. Carey, R. Carey, D. Willis, & J. Willis (Eds.), Technology and teacher education, 681. Charlottesville, VA: AACE.

Crossman, D.M. (1987). The evolution of the World Wide Web as an emerging instructional technology tool. In B.H. Khan (Ed.), Web-based instruction (pp. 19-24). Englewood Cliffs, NJ: Educational Technology Publications.

Davie, L.E., & Wells, R. (1991). Empowering the learner through CMC. The American Journal of Distance Education, 5(1), 15-23.

Dede, C. (1996). The evolution of distance education: Emerging technologies and distributed learning. The American Journal of Distance Education, 10(2), 4-36.

Dede, C. (1991). Emerging technologies: Impacts on distance learning. Annals of the American Academy of Political and Social Science, 514, 146-158.

Donnelly, V. (2001). Designing easy-to-use Websites. Toronto, ON: Addison-Wesley.

Driscoll, M. P. (2000). Psychology of learning for instruction (2nd ed.). Needham Heights, MA: Allyn & Bacon.

Gillani, B.B., & Relan, A. (1997). Incorporating interactivity and multimedia into web-based instruction. In B.H. Khan (Ed.), Web-based instruction (pp. 231-238). Englewood Cliffs, NJ: Educational Technology Publications.

Graves, W. (2000). The dot.xxx challenge to higher education. Syllabus, 13(10), 30-36.

Hedberg, J., Brown, C., & Arrighi, M. (1997). Interactive multimedia and Web-based learning: Similarities and differences. In B.H. Khan (Ed.), Web-based instruction (pp. 47-58). Englewood Cliffs, NJ: Educational Technology Publications.

Henri, F., & Kaye, A. (1985). Le savoir à domicile: Pédagogie et problématique de la formation à distance. Québec, QC: Téléuniversité.

Hill, J.R. (1997). Distance learning environments via the World Wide Web. In B.H. Khan (Ed.), Web-Based Instruction (pp. 75-80). Englewood Cliffs, NJ: Educational Technology Publications.

Jones, M.G., & Farquhar, J.D. (1997). User interface design for WBI. In B.H. Khan (Ed.), Web-based instruction (pp. 239-244). Englewood Cliffs, NJ: Educational Technology Publications.

Keegan, D. (1996). Foundations of distance education (3rd ed.). New York: Routledge.

Khan, B.H. (1997). Web-based instruction (WBI): What is it and why is it? In B.H. Khan (Ed.), Web-based instruction (pp. 5-18). Englewood Cliffs, NJ: Educational Technology Publications.

Kimball, L. (1995). Ten ways to make online learning groups work. Educational Leadership, 53(2), 54-56.

Konrad, L., Bundy, B., Dugdale, T., & Schuh, R. (2001). Creating an appealing Web site design [On-line]. Available: http://wiscinfo.doit.wisc.edu/ltde/orfi/wds/aesthetics.htm

Krug, S. (2000). Don't make me think! A common sense approach to Web usability. Indianapolis, IN: New Riders Publishing.

Lee, Y.B., & Lehman, J.D. (1993). Instructional cuing in hypermedia: A study with active and passive learners. Journal of Educational Multimedia and Hypermedia. 2(1), 25-37.

Marchionini, G. (1988). Hypermedia and learning: Freedom and chaos. Educational Technology, 28(11), 8-12.

Maxwell, L. (1995). Integrating open learning and distance education. Educational Technology, 35(6), 43-48.

McCormack, C., & Jones, D. (1998). Building a Web-based education system. New York: John Wiley and Sons Inc.

Newby, T.J., Stepich, D.A., Lehman, J.D., & Russel, J.D. (1996). Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media. Englewood Cliffs, NJ: Prentice Hall.

Nielson, J. (1997). How users read the Web [On-line]. Available: http://www.useit.com/alertbox/9710a.html

Oliver, R. (1999). Exploring strategies for online teaching and learning. Distance Education, 20(2), 240-254.

Palloff, R., & Pratt, K. (2001). Lessons from the cyberspace classroom: The realities of online teaching. San Francisco, CA: Josey-Bass.

Paulson, M.F. (1995). An overview of CMC and the online classroom in distance education. In Z.L. Berge, & M.P. Collins (Eds.), Computer mediated communication and online classroom (Vol. III, pp. 31-57). Cresswell, NJ: Hampton.

Picciano, A. (2001). Making connections across virtual space and time. Upper Saddle River, NJ: Merrill Prentice Hall.

Rathbun, G.A. (1999). Portraying the work of instructional designing. AECT Proceedings, 390-402.

Reeves, T.C., & Reeves, P.M. (1997). Effective dimensions of interactive learning on the WWW. In B.H. Khan (Ed.), Web-based instruction (pp. 59-66). Englewood Cliffs, NJ: Educational Technology Publications.

Relan, A., Gillani, B.B. (1997). Web-Based instruction and the traditional classroom: Similarities and differences. In B.H. Khan (Ed.), Web-based instruction (pp. 41-46). Englewood Cliffs, NJ: Educational Technology Publications.

Romiszowski, A., & de Haas, J. (1989). Computer-mediated communication for instruction: Using e-mail as a seminar. Educational Technology, 29(10), 7-14.

Rowntree, D. (1995). Teaching and learning online: A correspondence education for the 21st century? British Journal of Educational Technology, 26(3), 205-215.

Sherry, L., & Wilson, B. (1997). Transformative communication as a stimulus to Web innovations. In B.H. Khan (Ed.), Web-based instruction (pp/ 67-74). Englewood Cliffs, NJ: Educational Technology Publications.

Shotsberger, P. (1997). Emerging roles for instructors and learners in the Web-based classroom. In B.H. Khan (Ed.), Web-based instruction (pp. 101-106). Englewood Cliffs, NJ: Educational Technology Publications.

Sims, R. (1997). Interactivity: A forgotten art? [On-line]. Available: http://www.gsu.edu/~wwwitr/docs/interact/index.html

Smith, P.L., & Dillon, C.L. (1999). Comparing distance learning and classroom learning: Conceptual considerations. The American Journal of Distance Education, 13(2), 6-23.

Starr, R.M. (1997). Delivering instruction on the World Wide Web: Overview and basic design principles. Educational Technology, 3, 7-14.

Tam, M. (2000). Constructivism, instructional design, and technology: Implications for transforming distance learning. Educational Technology & Society, 3(2), 50-60.

Thomas, P., & Cresswell, L. (2000). Learning through collaboration in a distributed education environment. Educational Technology & Society, 3(3), 61-76.

Wang-Chavez, J., Branon, R., & Mikolaj, P. (2001). Facilitating Web-based interaction: Formative research on improving an online undergraduate business course. Quarterly Review of Distance Education, 2(3), 209-220.

Welsh, T.M. (1999). Implications of distributed learning for instructional designers: How will the future affect the practice? Educational Technology, 39(2), 41-45.

Westera, W. (1999). Paradoxes in open, networked learning environments: Toward a paradigm shift. Educational Technology, 39(1), 17-23.

Willis, B., & Dickinson, J. (1997). Distance education and the World Wide Web. In B.H. Khan (Ed.), Web-Based Instruction (pp. 81-84). Englewood Cliffs, NJ: Educational Technology Publications.

University of Maryland (1998). Models of distance education: A conceptual planning tool developed by the University of Maryland College for the University System of Maryland Institute for distance education. [On-line]. Available: http://www.umuc.edu/ide/modlmenu.html

Appendix A

Concordia University

On-line Learning Questionnaire

Dear Concordia Student,

We are a research team comprised of students in the Educational Technology Graduate Program at Concordia University. The following questionnaire is part of a study on instructional techniques and learner characteristics for online environments that we have undertaken as part of our course of Fundamental Methods of Inquiry. Please complete and return the questionnaire to the following email address: 648ResearchMM@education.concordia.ca

In February you will be requested to complete a second questionnaire on-line. Your participation in this study is completely voluntary. You can withdraw your participation at any time by contacting us at 648ResearchMM@education.concordia.ca. Withdrawing from this study will have no impact on your academic standing in this course or at Concordia University. Although your teacher has given us permission to conduct this study they will not know if you have participated, and if you did, how you responded. **All information collected will be strictly confidential and used for research purposes only.**

If you have any questions or concerns about your participation in the study, please feel free to contact us at the email address provided above at any time during the session.

Thank you very much for your participation!

The research team: Alexandra Olsen, Anita Gopal, Darren Rapkowski, Maisa Suhonen, Manon Fiset, Oksana Maibroda, Vasiliki Vardakis

Part I – General Information

1. Age: ❒ Under 25 ❒ 25-34 ❒ 35-44 ❒ 45-54 ❒ 55+
2. Gender: ❒ Female ❒ Male
3. First Language: ❒ English ❒ French ❒ Other
4. Student Status: ❒ Full-time ❒ Part-time ❒ Independent

The following questions pertain to your attitudes and expectations towards your online course as well as your learning styles. For each item, there is a four point scale ranging from "Definitely Agree" to "Definitely Disagree". Circle the number that best describes your attitude towards each statement. Do not spend a long time on each item: your first reaction is probably the best one. *Please answer every question – do not leave any blanks.*

	Definitely Agree	Agree	Disagree	Definitely Disagree
1. I enjoy working on an assignment with two or three classmates.	1	2	3	4
2. When I read instructions, I remember them better.	1	2	3	4
3. I prefer hearing a lecture on tape rather than reading a textbook	1	2	3	4
4. When I study alone, I remember things better.	1	2	3	4
5. I am naturally motivated to learn.	1	2	3	4
6. I have good study habits and time management skills.	1	2	3	4
7. It is easy for me to talk to strangers.	1	2	3	4
8. I find it difficult to fit facts and details together into an overall picture.	1	2	3	4
9. I feel most comfortable expressing my ideas verbally.	1	2	3	4
10. When I am concentrating on reading or writing, the radio bothers me.	1	2	3	4
11. I prefer to have someone tell me how to do something than having to read the directions myself.	1	2	3	4
12. In a large group, I tend to keep silent.	1	2	3	4
13. Following a step-by-step procedure bores me.	1	2	3	4
14. I get confused when I try to figure out graphs and charts that do not come with a written explanation.	1	2	3	4
15. I like to complete one task before starting another.	1	2	3	4
16. I find working in a group to be a waste of time.	1	2	3	4
17. It is easy for me to see the overall plan or big picture.	1	2	3	4
18. I prefer to study with others.	1	2	3	4

	Definitely Agree	Agree	Disagree	Definitely Disagree
19. I think better when I can move around.	1	2	3	4
20. I am rather shy.	1	2	3	4
21. I like having pre-set assignment deadlines.	1	2	3	4
22. I can be a successful with minimal teacher interaction.	1	2	3	4
23. I prefer to have all the course material I need to be available online.	1	2	3	4
24. I have the computer experience necessary to complete this course.	1	2	3	4
25. I think on-line courses are easier than traditional classroom courses.	1	2	3	4
26. The online environment contributes to learning.	1	2	3	4
27. It is hard to motivate oneself to learn in an on-line course.	1	2	3	4
28. Without online discussion, I will feel isolated in the course.	1	2	3	4
29. Online messages written by instructors and/or TA's will help me learn the course content.	1	2	3	4
30. Online messages written by other students will help me learn the course content.	1	2	3	4
31. I expect to do well in this course.	1	2	3	4
32. I expect to work mostly on my own in this course.	1	2	3	4
33. I am more interested in the credits I will get than in the course I am taking.	1	2	3	4
34. Reading skills are more important for DE courses than for classroom courses.	1	2	3	4
35. I need consistent teacher feedback to learn effectively.	1	2	3	4

Appendix B

Textbook

Assignments

On-Line Course Evaluation

Tables

Tutorials

Exams

Message Board

Hello! Please take the time to fill out this evaluation to help me make the necessary adjustments for future versions of the course. Your input is a valuable asset for me, as well as for your colleagues, since it helps me put together the best course possible with the resources at my disposition. Don't worry, your identity remains anonymous, however it is suggested that you complete all of the course materials prior to filling out this survey. Thanks again!

INTE 296/2 Fall 2001

KEY to assessment:

1 = I agree totally with this statement

2 = I almost totally agree with this statement

3 = I am not in a position to judge this statement

4 = I almost totally disagree with this statement

5 = I disagree totally with this statement

	1= Totally agree - 5= Totally disagree
The Instructional Objectives were reasonable?	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I was provided with the materials I needed to succeed.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The grading in this course was fair.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I was made aware of what was expected.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The course outline was followed accurately.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I always felt my work would be treated fairly.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I understood the format of this course from the beginning.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Screenshot of INTE 296 Course Evaluation Form (1 of 3)

[redacted] *1= Totally agree - 5= Totally disagree*

The course material was clear.	1 2 3 4 5
The course material was sufficient for the lesson assignments.	1 2 3 4 5
The chapters were easy to read:	
Chapter 1: Summarizing and Presenting Data	1 2 3 4 5
Chapter 2: Producing Data	1 2 3 4 5
Chapter 3: Variability and Probability	1 2 3 4 5
Chapter 4: Statistical Inference	1 2 3 4 5
Chapter 5: Analysis of Variance (ANOVA)	1 2 3 4 5
Overall the materials were well presented.	1 2 3 4 5
I had no trouble following the text.	1 2 3 4 5

[redacted] *1= Totally agree - 5= Totally disagree*

I made considerable use of the Internet site to access the text for this course.	1 2 3 4 5
I used the Internet site to obtain information other than what was in the text.	1 2 3 4 5
The Internet site was clearly laid out and informative.	1 2 3 4 5
I did most of the work for this course in the Laboratory (C203).	1 2 3 4 5
The time allotted between assignments was adequate.	1 2 3 4 5
I had all the lab time I needed (given that I used the lab).	1 2 3 4 5
I had no trouble completing this course from a site other that the University's lab.	1 2 3 4 5

[redacted] *1= Totally agree - 5= Totally disagree*

There was never any trouble getting in touch with a TA.	1 2 3 4 5
The TA was always helpful.	1 2 3 4 5
The TA was polite.	1 2 3 4 5

Screenshot of INTE 296 Course Evaluation Form (2 of 3)

The TA shared information freely and fairly.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I did not get enough access to a TA during weeks assignments were due.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I never felt pressured by the TA.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The TA demonstrated a mastery of the course materials.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The TA mislead me.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I could never get the TA to understand my questions.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I had to make appointments in order to see a TA.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5

	1= Totally agree - 5= Totally disagree
I feel that I learned alot in this course.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I felt that there was too much material in this course.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The content of this course is roughly what I expected.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The degree of difficulty is roughly what I expected.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
I would take this course again.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
The style of this course does not function well with my learning style.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Name three things you would **improve** about this course

Name three things you **like** about this course

Thanks for you time, it is much appreciated!

Submit your evaluation now!

Screenshot of INTE 296 Course Evaluation Form (3 of 3)

Appendix C

CONSENT FORM TO PARTICIPATE IN RESEARCH

This is to state that I agree to participate in a program of research conducted by Patrick Devey of the department of Educational Technology at Concordia University.

PURPOSE

I have been informed that the purpose of this research is to collect information (theoretical and practical) that could be used for the improvement of an online statistics course, INTE 296.

PROCEDURES

In order to collect the information they need, the researcher will conduct an (or series of) informal interview(s) with me so that I can share with them my experiences and expertise. This interview will be conducted at the place of my choosing, at a convenient time for me, and will not exceed one hour in length, unless I decide to continue beyond that point.

CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.
- I understand that my participation in this study is CONFIDENTIAL (the researcher will know, but will not disclose my identity)
- I understand that the data from this study may be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

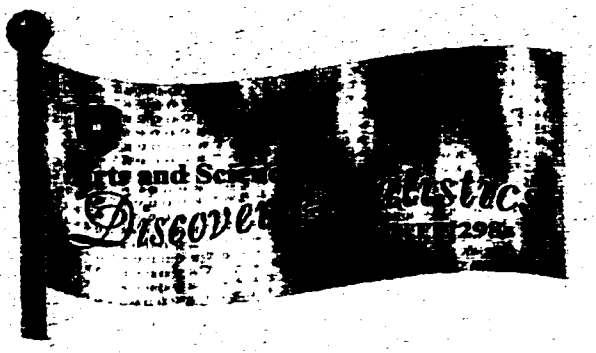
NAME (please print): _____

SIGNATURE: _____

WITNESS SIGNATURE: _____

DATE: _____

Appendix D



Click on the Flag to get general information about this course

terial but a new assignment 8 has been created to go with Module 4. The lab is open from 8:45 to 19:

Anybody interested in Chapter Summaries or Sample Exam Questions?

Course Outline

Appendices

Course Objectives | Go

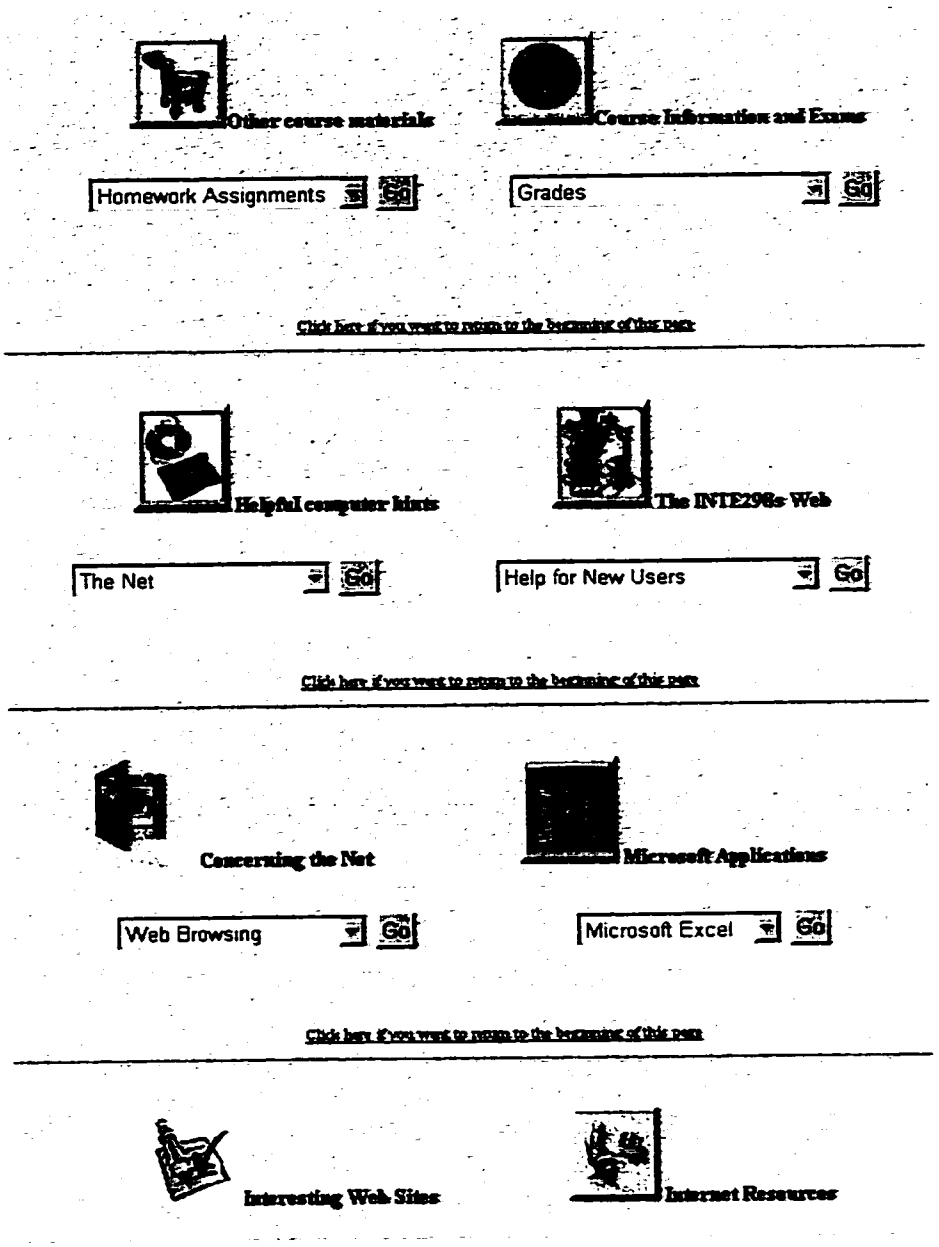
Statistics Tables | Go

Click here if you want to return to the beginning of this page

Textbook

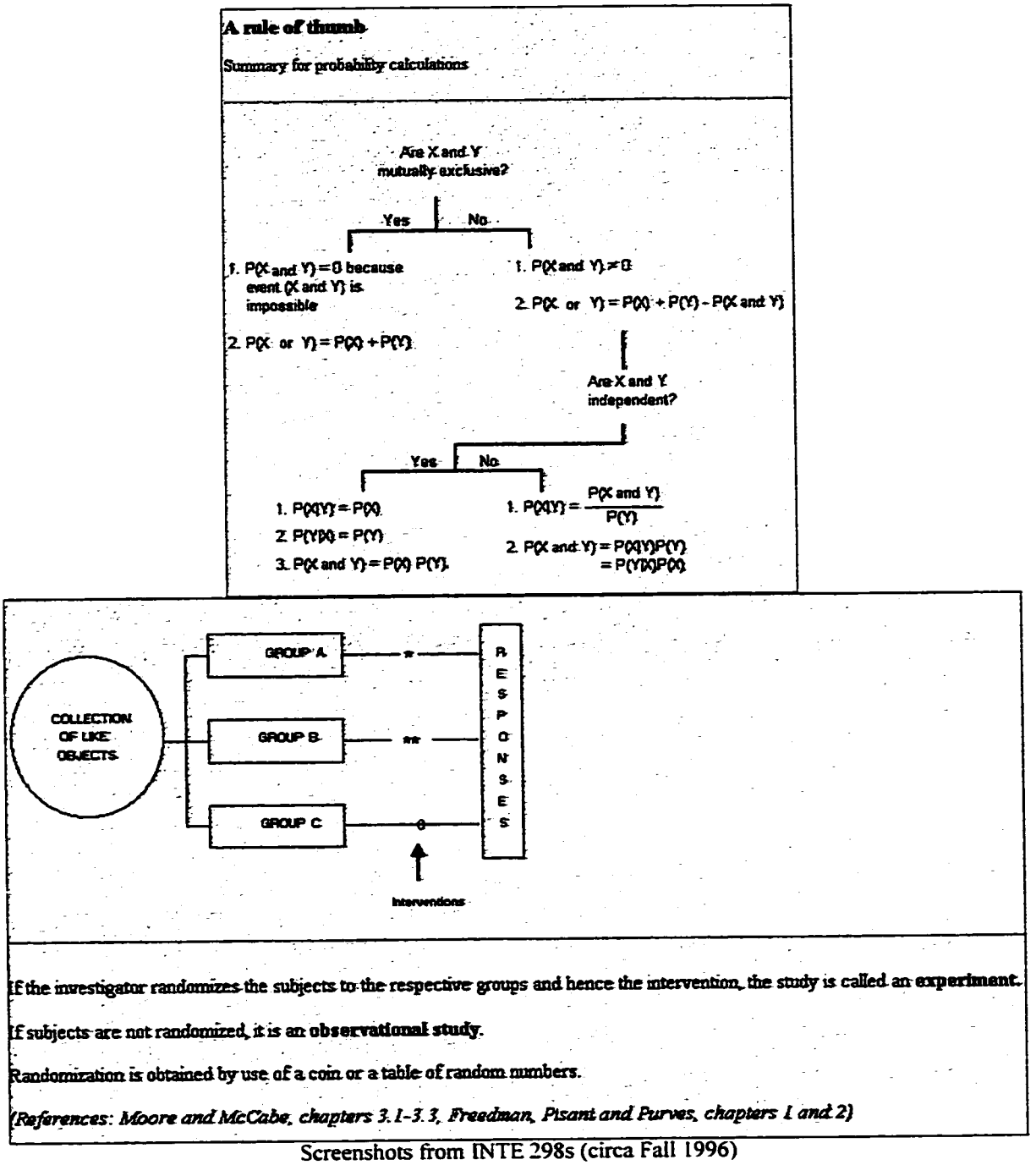
- 1. Summarizing and Presenting Data
- 2. Producing Data
- 3. Variability and Probability
- 4. Statistical Inference
- 5. Analysis of Variance - ANOVA

Screenshot of INTE 298s Home page (1 of 2)

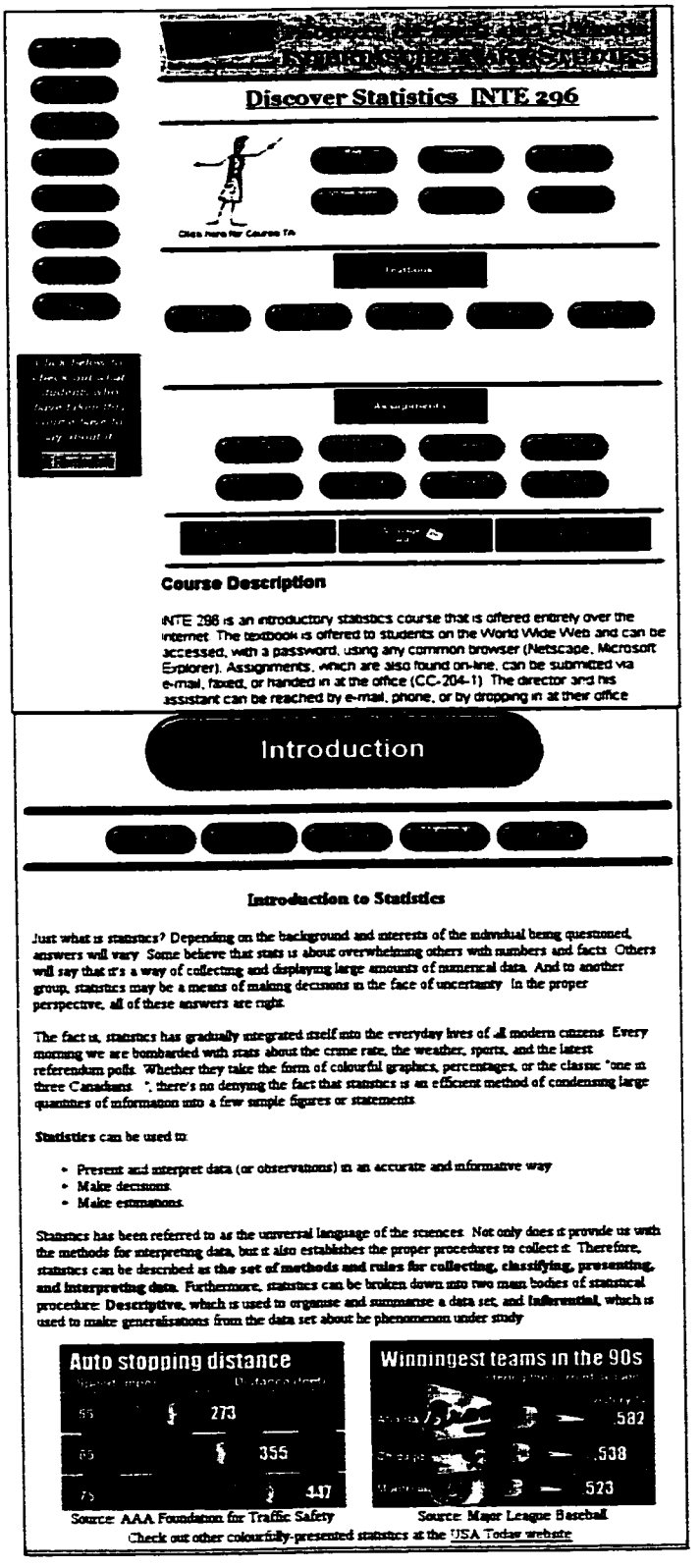


Screenshot of INTE 298s Home page (2 of 2)

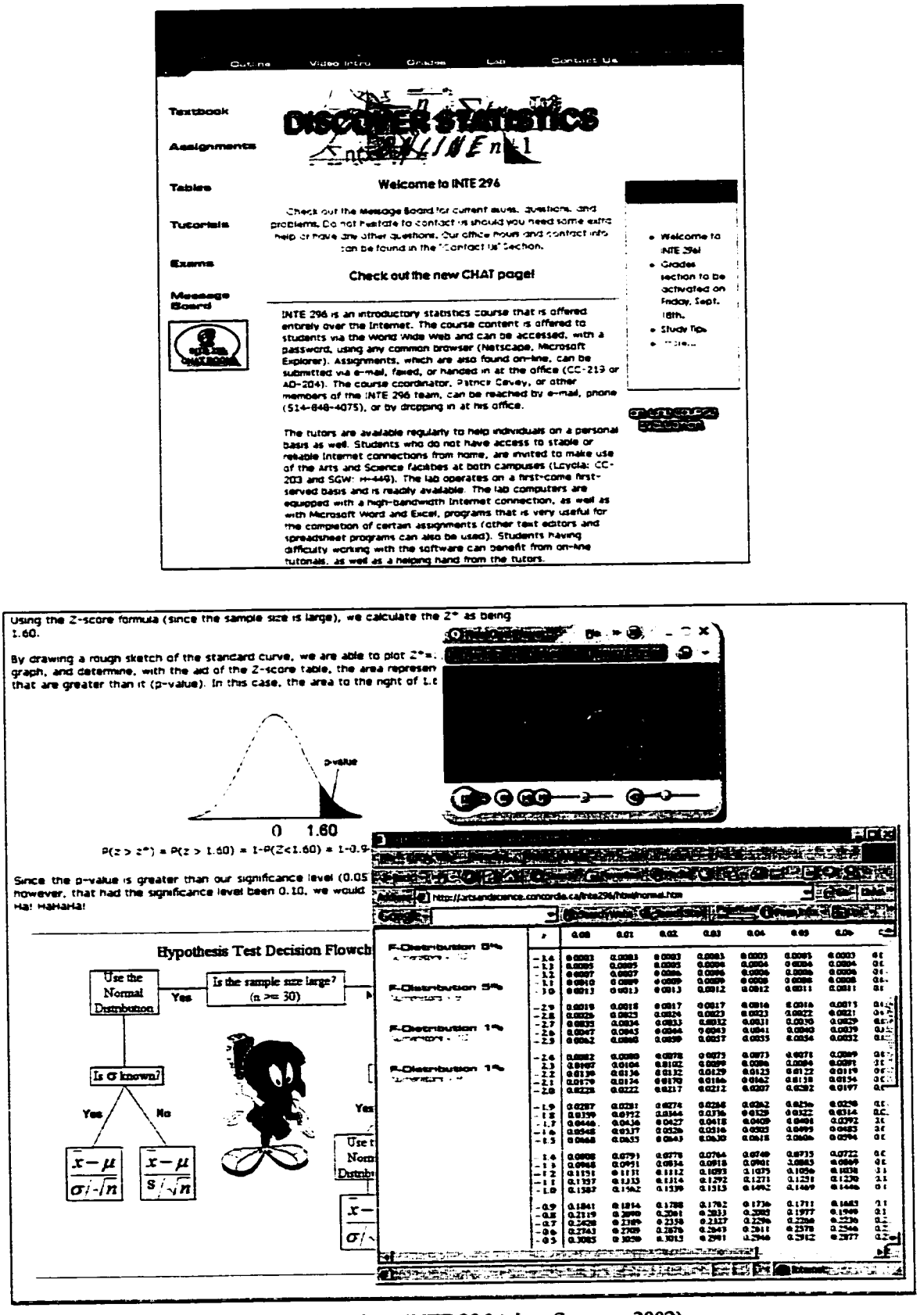
Appendix E



Screenshots from INTE 298s (circa Fall 1996)



Screenshots from INTE 296 (circa Fall 1998)



Screenshots from INTE 296 (circa Summer 2002)