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An Exploratory Analysis of Post-Secondary Student
Achievement Comparing a Web-Based and a Conventional Course
Learning Environment

By

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ABSTRACT

This exploratory study investigates aspects regarding how student achievement, learning style, and interaction differs in comparing a Web-based compared to a campus-based classroom environment. A total of 75 participants were enrolled in the same course taught simultaneously by the same instructor on a university campus and by distance. The Web-based learning environment was created using an instructional design model published by Ross (1998). Both groups received similar treatments including identical assignments, examinations and course material. Weekly, on-line "chat sessions" compensated for in-person lectures. Students' course-related tasks were tracked in a logbook. Learning style was measured using the Gregorc Mind Style Delineator (1982) and learning outcomes were measured by a 40-question multiple-choice post-test examination. To control for and measure entry-level knowledge, a pre-test comprising of identical questions was administered at the beginning of the 13-week course. Pre and post-surveys were used to collect a number of variables used for the purposes of data analysis.

Results revealed that: 1) 'By Distance' students achieved significantly higher on the post-treatment examination than the 'On-Campus' group; 2) While all

learning styles were equally accommodated on-line, Concrete
Random (CR) learners achieved significantly poorer when
learning face-to-face; 3) There was a higher level of
student-instructor interaction reported by the 'By
Distance' group while overall time spent on course-related
learning was significantly higher for the 'On-Campus'
group; 4) Of all measured variables, collaboration was a
significant predictor of achievement for the 'By Distance'
group; and 5) 'By Distance' students who were more
realistic about potential barriers to course performance at
the outset of the semester were more likely to achieve
higher than those who were not. Implications and
recommendations for post-secondary distance program
designers and facilitators are included.

ACKNOWLEDGEMENTS

Finally I would like to thank the course participants, without whom this study would not be possible.

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Chapter 1

INTRODUCTION

The Internet has revolutionized the way the developed world communicates, does business, socializes, and is entertained. It has transformed work and has pervaded our leisure lives as well.

It has also changed the way we educate.

Not since the Industrial Revolution has society seen such an omnipresent technological advancement. We are amidst a technological renaissance (Rezabek, 1997), with ideas flowing digitally at rapid speeds, traversing the globe and changing lives in the process.

The Internet, a network of computers able to communicate with each other through a series of electronic connections, has made its mark on society, and promises to fundamentally alter *everything* in the process (de Kerchove, 1995). With such an omnipresent technology at our doorsteps, it can be difficult to ignore the significant shift that is already transpiring in the educational system. Primary, secondary, and post-secondary institutions are re-evaluating and re-structuring the way educational programs are delivered to students--students who may not have been able

to participate in such programs were it not for the connectivity afforded by the Internet.

.   The World Wide Web (the Web), a sub-facet of the Internet, is often the sole reason schools and universities allocate millions of dollars for new computer networks and hardware (Katz, 1999). The same technology also has motivated many academic institutions to abandon conventional ways of conducting distance--and often traditional-- education programs for the promise of a more powerful and alluring means of distributing educational opportunities to its students (Katz, 1999).

Certainly, the Web as a learning technology has tremendous potential to supplant traditional means of educating distance students (Ross, 1998). However, while the Web is able to deliver material certainly more efficiently and potentially more effectively than over the telephone or television, via the post mail system, or even face-to-face in a classroom, it presents new, often overlooked, challenges to the educator (Hardy & Boaz, 1997; Palloff & Pratt, 1999). As with any new technology, there is a need to examine critically ways to ensure successful and appropriate implementation.

As computer technology becomes more ubiquitous in society, the use of the Internet to teach students at a

distance continues to burgeon (Gubernick & Ebeling, 1997).

The Web affords students the choice of learning *all* course

material and communicating with both the instructor and

other students without having to ever visit the university

campus. While the concept of learning at a distance is not

new, learning on-line in an electronic environment is.

Insofar as the Internet is the new distance learning

tool of choice for higher education (see Katz, 1999), it

remains essential that research examines the efficacy and

viability of the medium. There is no denying that

universities are moving increasingly toward Internet-based

distance education (Dunderstadt, 1999); however, a great

deal of value is being placed on the Web without researching

adequately: 1) what constitutes an effective electronic

learning environment for students; 2) what type of learner

does well or poorly within a computer-based learning

environment; and 3) how well or how poorly the Internet as a

learning medium compares to the conventional classroom.

This study examines aspects of the efficacy of teaching

distance education programs using the Web as the learning

environment of choice. It seeks to investigate the impact of

student individual differences such as learning styles,

background computer skills, and prior knowledge on learning,

interaction, and attitudes when taking a course over the

Internet. To examine the changing paradigm in higher education today, this study will also compare learning and interacting in a conventional classroom course compared to the same course offered over the Internet. As will be discussed in this dissertation, with *proper* development and implementation of courses on-line, learning over the Web may, in fact, be superior to learning in a conventional classroom.

If confirmed by further research, this study may pave the way for the advancement of an on-line paradigm for higher education.

Chapter 2

THEORETICAL RATIONALE

Background

The Changing Face of Distance Education

Ten years ago authors such as Cookson (1989) suggested that multimedia advents such as video and audio conferencing would revolutionize the field of distance education. No one at that time would have ever envisaged the idea of using a world-wide network of computers to deliver distance programs. Yet, ten years later, colleges and universities have made it clear that the Web as a distance learning medium is a substantial entity into which time, money and resources are being invested at unprecedented rates (Katz, 1999; Laws, 1996).

The Web continues to gain popularity as an instructional medium for post-secondary institutions wishing to offer programs via distance education (Palloff & Pratt, 1999). Learners can choose to take courses and, in many instances, entire educational programs from a distance. Distance learning opportunities contribute greatly to today's post-secondary educational programs (Farrington, 1999). According to Graves (1999), distance education allows academic institutions to extend their course offerings to

new students who otherwise would not have been able to

participate in such programs.

Gubernick and Ebeling (1997) wrote:

Over 1 million students are now plugged into virtual
college classrooms, compared with 13 million attending
brick-and-mortar schools. That number of cyberstudents
is expected to more than triple by the turn of the
century (on-line).

At one time, however, distance education was seen only

as a viable and valued alternative to conventional classroom

instruction when students were not physically able to attend

class in-person (Abrami & Bures, 1996; Amundsen, 1993;

Barnard, 1992). Today, this is no longer the case, as

communication and information technologies continue to

improve (Middleton, 1997). Connick (1997) wrote:

The wedding of distance education, instructional
technology and telecommunications into a powerful new
educational structure has served as the catalyst for an
educational paradigm shift that is well underway
(p.10).

Distributed education is a term used to describe many

forms of distance education today because learners no longer

need to be geographically "distanced" from the campus or the

instructor in order to take electronic courses as a distance

student (Dede, 1996; Palloff & Pratt, 1999; Ross in Clower, 1998).

For example, the Community Rehabilitation and Disability Studies program at the University of Calgary offers some of its undergraduate degree courses fully over the Internet. While most of the students take the courses from across Canada, some students are from the University of Calgary, and choose to take the courses strictly for scheduling purposes. In these instances, for example, the learner can meet face-to-face with the instructor when necessary or choose to use Email to communicate questions or concerns. "The student can be 500 miles away--or in the next room--from the course website server" (Ross in Clower, 1998).

Hence, university distance education programs will continue to evolve and be redefined in direct response to the nature of the kinds of learners who choose to participate in such pursuits (Ross in Clower, 1998).

The Changing Face of Higher Education

According to Farrington (1999) professors are beginning to realize that, indeed, "one size does not fit all" (p.86) when it comes to teaching today's students. Farrington goes further to suggest that it is "intuitively illogical" that

the lecture-recitation method is seen as best for all

subjects and all students (p.86). Despite research showing

individual differences in the college classroom to impact

learning outcomes, "few, if any, classes are ever designed

by first posing the question of how students might best

learn" (p.86).

It would appear that the same concern expressed by

Farrington (1999) could be applied to the Web-based learning

environment. Few course websites are created in consultation

with an educational technologist well-versed in learning

theory and instructional design principles (see Ross in

Clower, 1998). When considering the fact that the electronic

course environment may be the only way for students to

access and learn material, it becomes apparent just how

integral it is to know the learning needs of the course

participants prior to designing and implementing the

instructional website. Egan and Gibb (1997) stressed the

importance of assessing the needs and background knowledge

of students before the beginning of the course in an effort

to employ teaching strategies that are commensurate with

students' diverse and unique experiences.

Indeed, today's undergraduate population is comprised

of diverse learners (Dunderstadt, 1999). According to

Dunderstadt (1999, p.4), institutions of higher education

are beginning to see a shift in demand from "just-in-case"
education to "just-in-time" education to today's "just-for-
you" education. Dunderstadt described *just-for-you* education
as learning programs that are carefully tailored to meet the
specific learning needs of the student. Because there will
be a continued shift from classroom-based instruction to
network-based electronic instruction, Dunderstadt wrote:

> …faculty members of the twenty-first century college
> or university will find it necessary to set aside their
> roles as teachers and instead become designers of
> customized learning experiences (p.7).

There is no denying that teaching at a distance is
fundamentally different than teaching face-to-face (Cyrs,
1997a; Garrison, 1989); nonetheless, many institutions
provide no training to their distance educators on ways to
use the medium effectively. Cyrs (1997b) went further to
suggest:

> Institutions that perpetuate this myth [teaching by
> distance is similar to teaching on-campus] and do not
> provide training for their novice instructors will not
> survive in the growing student consumer market (p.15).

Indeed, the Higher Education "consumer market"
continues to change. The United States (US) Bureau of the
Census, 1994 (cited in Haehl, 1996) projects that by the
year 2004, the majority of degrees granted by post-secondary
institutions in the US will be to adults aged 30-44 years

old. While post-secondary enrollment by traditional students under the age of 25 is steadily decreasing, enrollment by non-traditional students over 25 continues to increase and will continue to do so indefinitely (US Bureau of Census, 1994 in Haehl, 1996).

Adult students have a number of learning needs that separate them from their traditional student counterparts. Most choose to take degrees part-time because of hectic schedules, which often include family and work responsibilities (Benjamin, 1995). For many adult learners, distance education is a viable alternative to on-campus attendance.

Haehl (1996) wrote: "adult students are the growing majority on campuses, yet universities are woefully slow in responding to the needs of this population" (p2). Needs of adult learners include: learning how to coordinate effectively work, family and school schedules (Merriam & Caffarella, 1991); the desire to take an active role in their education (Merriam, 1993); the need to construct meaning from their education (Merriam, 1993); and the need for customized educational programs (Conroy, 1991; Crotty, 1995; Merriam & Caffarella, 1991).

The Web, as a distance education medium, can engender customizable and equalized learning experiences (Boulet,

1995; Dean, Biner & Coenen, 1995; Isman, 1997; Ross &

Schulz, 1999b). Current research on Internet-based distance

education indicates the inherent ability of this relatively

new form of instruction to engender instructional innovation

as well (Doreen et al., 1994; Isman, 1997). Haehl (1996)

contended that Internet-based distance education by its very

nature fosters andragogy (or the art, science, and process

of helping adult students learn) and learner empowerment. By

shifting the focus from educator-as-disseminator of

information to educator-as-facilitator of learning

information, Web-based instruction enables students to take

control of their education and formulate learning goals,

objectives, and plans (Bates, 1993; Hiemstra, 1994).

Justification for Study

Inasmuch as the web has tremendous potential to reach

traditional and non-traditional students, research examining

distance education programs offered over the Internet is

only just beginning to transpire. Although there are

numerous studies that compare telecourse, audioconferencing

and other forms of electronic distance education to

conventional course environments (Kabat, 1994; Klesius,

Homan, & Thompson, 1997; Pugliese, 1994), there is a dearth

of research that investigates Web-based--or more broadly

Internet-based--versus conventional course learning

environments. Specifically, research has not studied

adequately the effects of student individual differences on

achievement or attitudes in comparing conventional and on-

line courses.

Many of the studies that do compare achievement between

students enrolled in distance education and conventional

courses most often use students' final course grades as a

measure of learning outcome (e.g., Goodyear, 1995; Johnson,

1993; Riddle, 1995; Sisung, 1993). Such an evaluative

measure is subject to a number of statistical biases

including: 1) the instructor's preference for learning

medium; 2) the nature of assigned tasks; and 3) the nature

of the grading system. Hence, there are few studies that

measure learning outcomes in a truly unbiased and valid way.

In addition to achievement issues, there are no studies

to date that compare adequately the nature of students'

learning experiences between the two methods of instruction

in order to determine the efficacy of learning on-line.

Research indicates that distance students perform equally

well to their on-campus counterparts when comparing final

course grades (Goodyear, 1995; Sorensen, 1995); however,

there is a need to examine and compare variables such as

total time spent on learning-related tasks and student

interaction in order to gain insight into the nature of students' learning experiences.

Moreover, there are no well-conducted studies that investigate the effects of learning style, one of the most significant individual differences that exists (Gregorc, 1982b), on student performance when taking a course via the Internet. Haehl (1996) wrote: "attending to learning style characteristics of the distance learner is almost non-existent" (p. 12), yet such an individual difference can impact learning from computer technology (Ross, 1997; Ross & Schulz, 1999a).

The lack of research addressing specifically the nature of students' learning behaviors on campus versus on-line is noteworthy. Studies have indicated the potential effectiveness of learning over the Internet (Schutte, 1997); however, there is a need for research seeking to investigate quantitatively why students may do better on-line so that future distance education courses created for Internet delivery can be designed more effectively.

Research in the area of student individual differences and performance in a Web-based distance education environment could also be useful for educators wishing to circumvent potential student failure. Results from this

study may be used to identify "at risk" students so that specific intervention strategies can be employed.

Purpose of the Study

This exploratory study seeks to investigate the following research questions.

1. What are some of the characteristics of on and off-campus student learners?

2. In comparing Web-based distance education to conventional education:

  2a. Are there differences in student achievement?

  2b. Are there differences in student attitudes toward the instructor and course?

3.How does learning style (as measured by the Gregorc Style Delineator) relate to:

  3a. Achievement

  3b. Interaction with instructor and students

4. In comparing Web-based distance education to conventional education, are there differences in:

  4a. Student-student interaction;

4b. Student-instructor interaction; and

4c. The amount of time (in hours) spent on course-related learning?

5. Of the following variables, which contribute(s) to achievement?

- Learning style

- Time spent on course-related tasks

- Technology barriers to accessing course website

- Course satisfaction

- Comparison to conventional instruction

- Perceived course performance barriers

- Previous experience with computers

- Interaction with others

Using the Ross Model for Web-based course development (Ross, 1998) this study will attempt to determine the benefits, as well as the potential pitfalls, to learning over the Web. It is hoped that the findings will contribute to the design, delivery and facilitation of future Web-based courses.

Definition of Terms

Distance Education--The California Distance Learning Project

cited in Palloff and Pratt (1999) identified the following

key elements of distance education:

- The separation of teacher and learner during at least the majority of each instructional process;

- The use of educational media to unite teacher and learner and carry course content;

- The provision of two-way communication between teacher, tutor or educational agency, and learner; and

- Volitional control of learning by student rather than by distance instructor (p.5).

Learning Style--There are a number of definitions which

describe the somewhat complex, multi-dimensional construct

known as learning style. Gregorc (1979) defines learning

style as:

> ...distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates (p. 234).

Entry-Level Domain Knowledge--Course-specific knowledge

students possess at the beginning of the semester is often

referred to as domain knowledge (Portier, & Wagemans, 1995).

Alexander (1992) defined domain knowledge as:

...an individual's prior knowledge. It is that segment of
an individual's existing conceptual knowledge that is
related to a specific study area (p. 35).

Learning Outcomes (Achievement)--For the purposes of this

study, student achievement was measured by a 40-question

final examination at the end of the semester.

World Wide Web (The Web or W3)--Developed originally as a

knowledge pool where a small group of project collaborators

and scientists at CERN (a Physics laboratory in Switzerland)

could share resources and ideas with others.

With the advent of hypertext browsers such as NeXTStep

followed by NSCA's Mosaic and then Netscape, the Web became

accessible to--and used by--the world.

The Web stands for a number of ideas including:

- The idea of a boundless information world in which
  items have a reference by which they can be retrieved;

- The address system (URL) which...make this world possible
  despite many different protocols;

- A network of protocols (HTTP) used by native W3 servers
  giving performance and features otherwise not
  available;

- A mark-up language (HTML) which every W3 client is
  required to understand, and is used for the
  transmission of basic things...; and

- The body of data on the Internet using all or some of
  the preceding listed things (Berners-Lee et al., 1994;
  p. 43).

Web-Based Learning Environment ('By Distance' group)— This

is a hypermedia-based course environment that uses

attributes and resources of the Web to facilitate learning

at a distance (Relan & Gillani, 1997).

Conventional Classroom ('On-Campus' Group or Face-to-Face)—

This refers to courses that are taught in a physical

classroom environment where students and the instructor meet

regularly and engage in face-to-face learning sessions.

Distributed Learning—defines learning which is characterized

by place and time independent interactions between the

educator/tutor and the students/tutees (Willis & Dickson,

1997).

Chapter 3

LITERATURE REVIEW

Introduction

This chapter delves into salient literature relating to the field of distance education. The first section explores learning style as an important measure of student individual differences. The Gregorc Style Delineator is examined and studies relating to learning style and distance education are discussed. The second section illustrates the evolution of educating students by distance. Three models are detailed, taking the reader from the mid-1800s system of correspondence school to present-day innovations in Internet-based learning.

The nature of distance learning is the fourth section of this chapter. This section explores student success factors, communication issues at a distance, and comparative distance learning research. Following this broad-based discussion, Web-based distance education is covered specifically. The on-line learning environment and issues that arise with Web-based instruction are examined. In addition, a model for conceptualizing Web-based distance education, the Tri-Modal Model, is detailed. The chapter concludes with a comprehensive summary.

Cognitive Learning Styles: Theoretical Development

According to Jonassen and Grabowski (1993), individual

differences such as learning style play a significant--but

often overlooked--role in learning and instruction. Student

traits such as learning style determine, to some degree, how

well an individual is able to learn (Jonassen & Grabowski,

1993). Awareness of such individual differences can ensure

educators are sensitive to their role as facilitators of

student learning, and according to the authors:

> ...this awareness may provide educators with a better
> understanding of difficulties that arise for certain
> learners in relation to specific tasks (p.9).

The *Gregorc Style Delineator*

As one measure of learning style, The *Gregorc Style

Delineator* (1982a) is a self-scoring battery based on

Mediation Ability theory which states that the human mind

has channels through which it receives and expresses

information most efficiently and effectively (Gregorc,

1982b). According to Gregorc (1982b), the term "mediation

abilities" describes a person's capacity to use these

channels.

Mediation Abilities

The *Style Delineator* focuses on two types of mediation abilities in adult individuals: perception (the means through which one is able to grasp information) and ordering (the means through which one arranges, systemizes and disposes of information). The two dimensions of ordering are referred to as sequential and random; the two qualities of perception are known as abstractness and concreteness (Gregorc, 1982c).

According to Gregorc (1998: telephone interview), there are countless other individualities that are not measured by the battery, but which, nonetheless, impact human behavior. For example, a person can have an inductive or deductive reasoning preference, be a separative or an associative individual, and operate as an introvert or extrovert. For ease of administration, however, The *Style Delineator* focuses on perception and ordering as two of the more salient measures of learning style.

Abstractness allows the individual to comprehend that which is not visible to the senses. Data can be mentally visualized, grasped, and conceived through the faculty of

reason. Individuals who are strong in concreteness use the physical senses to comprehend and mentally register data.

Sequential individuals perceive and organize data in a linear, methodical fashion, and can express themselves in a precise manner. Furthermore, discrete pieces of information can be categorized naturally. In contrast, randomness disposes the mind to organize information in a nonlinear and multidimensional fashion. This quality enables individuals to deal with, and process, multiple data simultaneously.

Gregorc combines these abilities to create four mediation channels of mind styles: Concrete Sequential (CS), Concrete Random (CR), Abstract Sequential (AS) and Abstract Random (AR) (Table 1). Gregorc believes that individuals have, to a certain degree, characteristics of each category, but most individuals tend to show a stronger orientation toward specific channels.

Table 1

Gregorc Mind Styles According to Mediation Channels

Mediation Channels	*Sequential*	*Random*
Concrete	**CS**	**CR**
Abstract	**AS**	**AR**

The *Gregorc Style Delineator* scores are obtained by ranking four words at a time ('1' indicating "least like me", '4' indicating "most like me"). Ten categories of four words determine the scores for each of the four mind-styles. Each word corresponds to a particular mediation channel, and when summed, they give a measure of a person's propensity for operating within specific learning channels.

Gregorc (1982a) divides the scores received on The *Style Delineator* into three levels: 1) Strong orientation towards qualities associated with the particular channel (or pointy-headedness), indicated by a score of 27-40; 2) Moderate ability, indicated by a score range of 16-26 on any one mediation channel; and 3) Minimal capacity (stubby pointedness), indicated by a score of 10-15 in a specific channel. According to Gregorc (1985) approximately 60

percent of the channel's characteristics are observed in people with a score of 27 or over; hence, 27 has been selected as the cut-off point for "pointy-headedness". Another major cut-off point, 15, has been identified as an indication of "stubby pointedness" because very few of the channel's characteristics are observed in people with scores below 15 (Gregorc, 1982a).

Learner Characteristics

People who are dominant CS are usually practical, thorough, well-organized and prefer quiet, structured environments. CS individuals tend to perceive reality as the concrete world of the physical senses, and think in a sequential and orderly fashion. The CS can detect the most minute details, working with the exactitude of a machine (Gregorc, 1982a). The CS student is a perfectionist and prefers being told what to do (Butler, 1984). These learners do not like to go against the norm, view work as a job assignment, and enjoy being physically involved and active in lessons.

AS people consider themselves as evaluative, analytical, and logical individuals with a preference for mentally stimulating, orderly, and quiet environments. The AS has an academic-type mind that is driven by a thirst for

knowledge. To an AS knowledge is power, and the ability to synthesize and relate concepts enables the AS to transmit ideas (both through the spoken and written word) intelligibly and eloquently. AS learners thrive on teachers who are experts in their area of interest, learning well through lecture-style teaching (Butler, 1984).

AR individuals are highly focused on the world of feeling and emotion and are sensitive, spontaneous, attuned, person-oriented people. Thought processes of AR individuals tend to be nonlinear, multidimensional, emotional, perceptive, and critical. AR people prefer active, free, and colorful environments. ARs thrive on building relationships with others and, as learners, dislike extremely structured assignments (Butler, 1984).

Finally, CR individuals process information in three-dimensional patterns and think intuitively, instinctively, impulsively, and independently. CR people prefer competitive, unrestricted, and stimulus-rich environments. CR learners can be risk-takers and can easily jump to conclusions, often correctly. Such individuals are divergent thinkers, thriving in environments that engender exploration. The CR learner does not need many details to solve a problem, instead operating according to personally constructed standards (Butler, 1984).

Overall, everyone has the capacity to learn within each

of the above channels; no one is a "pure type" (Gregorc,

1982b, p 41). Therefore, The *Style Delineator* is a tool

which:

> provides an individual with a key to understand
> better the subtle and potent qualities of the
> mind, (his/her) behavior, the behavior of
> others and the demands placed upon individuals
> by his/her environment (Gregorc, 1982b, p.41).

Learning Styles in Computer-Based Distance Education

According to Wood, Ford, Miller, Sobczyk, and Duffin

(1996), merely knowing one's learning style can help at-risk

computer users adapt better to the technology, provided that

learners are given a number of intervention strategies which

can be employed when encountering difficulty.

Fauley (1991) wrote that learning style can influence

the way students approach learning from the computer. Some

learners can find computer-based instruction

"dehumanizing...and cruel" (p. 34), as these learners

require personal attention, interaction with others, and

human intervention throughout the learning process. Learners

who can work relatively well alone enjoy the opportunities

that learning from the computer provides (Fauley, 1991).

While research by Fauley can be applied to computer-aided learning tasks that require "human-to-computer" interaction, the same research may not hold true to Web-based learning where students use the computer to engage in "human-to-human" interaction. Such a concept is applicable to the present study. How learning styles impact performance in technology-based distance education courses remains questionable.

For example, Gee (1990) investigated the effects of learning preferences on post-secondary students' success in a distance education course. Students identified as being independent thinkers were found to be more successful in the course than those who desired working with others throughout the learning process. The author recommended that a learning style inventory be given to help instructors meet the needs of the students, aid course designers in developing innovative instructional design methods, and assist advisors in helping students make informed decisions. This view is shared by James and Gardner (1995).

However, Foell and Fritz (1995), using field dependent and field independent measures of learning style, found no significant difference in attitudes towards a telecourse taught on campus and by distance. This is also consistent with research done by Nelson (1985).

Furthermore, Riley (1993) found all learning style groups (as measured by the Canfield Learning Style (1980, 1988) to perform equally well in a telecourse environment. As well, attitudes towards the course instructional environment did not differ significantly based on learning style.

Dawson (1991) investigated the influence of learning style (measured by the Gregorc Style Delineator) on student performance in an electronic distance education (EDE) program. Learning style was not significantly related to students' attitudes toward the course or their performance as measured by final grades in the course. The author suggested that:

> The study's results support the notion that students taking university classes in an EDE environment can achieve and experience course satisfaction regardless of mediation style or teaching style (p.8).

In summary, it is not entirely clear whether learning style plays a significant role in the Web-based distance learning environment. What remains clear is that more research is necessary.

Distance Learning: Constructing A Historical Framework

According to Kerka (1996), distance learning models are currently being shaped by emerging technologies such as the Internet and, more specifically, the Web. Indeed, such technologies are transforming the way distributed education programs are conducted by supplanting traditional, 19th century transmission modes, such as mail correspondence and the telephone.

Although distance education is poised to move exclusively towards a technology-based transmission system (Kerka, 1996), it is necessary to examine historical means of educating students who are at a distance. Whether students learn with the aid of the telephone, fax machine, computer terminal, or pencil, the goal remains the same: to learn course-related material independently from the conventional classroom.

Distance Education Models

The following three distance education models are presented chronologically in an attempt to illustrate the natural progression from largely print-based, asynchronous communication to electronic-based, synchronous communication

modes of delivery. It should be noted that each model is still in use to some extent around the world. Although the Internet is quickly becoming the preferred way to teach students at a distance (Connick, 1999), many higher education institutions continue to instruct students using correspondence education, telecourse learning, and the telephone (Olgren, 1997; Ostendorf, 1997).

Model One: Correspondence Education (mid 1800s-1960)

According to Nipper (1989), distance education, in its earliest form, was facilitated by mail correspondence between the tutor and the tutee. Characterized by the distribution of print curricular material, this mode of delivering educational opportunities to students became popular in the mid-1800s due in part to advancements in the rail and mail systems. Holmberg (1989) suggested that distance education had roots as early as the mid-1780s, although what is commonly viewed as correspondence education was not widespread until the mid-1800s.

Model one relied heavily on the mail and train systems that became more efficient in the latter part of the 18th century. Communication was asynchronous, and often weeks to months separated student-instructor correspondence; hence, focus was placed on pre-set curriculum and on instructor-led

tutoring (Kaufman, 1989). The tutor was responsible for setting assignment due dates, answering any of the students' questions and marking students' submitted work.

Holmberg (1989) wrote that as a term "correspondence education" was seen as limiting in its scope and richness; as a result, newer terms such as independent study, home study, and external degree programs emerged in the 20th century.

Model Two: Multimedia Distance Education (1960-present)

The second generation of distance learning combined the use of print material with broadcast media (namely audio and video technologies) and some early forms of computer-aided instruction (Nipper, 1989). Seamons (1987) used the term Electronic Distance Education (EDE) to describe the application of electronic technologies to delivering education at a distance.

Like Model One, students complete correspondence material independently and according to a preset sequence of instruction. However, unique to this model is the use of technology to facilitate course learning. With the movement towards Model Two, no longer did students have to rely on the mail system to communicate with the instructor; rather questions and comments could be shared synchronously over

the phone or using the fax machine, something which

contributed greatly to student empowerment (Kaufman, 1989).

The following delivery techniques are common to Model

Two:

- Radio/audio cassettes: According to Douglas (1993) radio and audio cassette transmission, while still used as a popular means of disseminating course material (especially in parts of Latin America and Africa), has been largely replaced by television and video.

- Television systems: Students are able to watch and listen to the instructor who is broadcast either live or on videotape to students. Television courses can be asynchronous or synchronous (one-way video, two-way audio).

- Telephone systems: Telephone conferencing is another common way to deliver course material. Either a one-to-one or a one-to-many dialogue can be conducted using the telephone conferencing system, allowing the instructor to synchronously convey course material and discuss issues with students.

- Facsimile Machines: Used to either augment or supplant the mail system, the fax machine has allowed assignment and other course material to be exchanged between student and instructor at a very quick rate.

- Computer technology: Some distance education programs use computer-aided instruction (CAI) as a way to educate students. CD-ROM programs containing course material in a multimedia textbook format are mailed to students who use the program either to supplement textbook instruction or to serve as the sole form of instruction. Some distance education programs may combine CAI with computer-managed instruction (CMI), placing the computer program in charge of the student's learning and grading.

As can be seen, both models focus primarily on the distribution of teaching/learning material to the students. Teaching is often didactic, with little attention paid to epistemology (Keegan, 1990). The students and instructors have predefined roles, and, because of the nature of the technology, both are allowed little room to diverge from such roles.

Model Three: Computer-Mediated Communication (1990-present)

Third-generation models are largely based on communication facilitated by computer technology. Email, bulletin board systems, the Internet, and the fax machine are all tools students use to conduct asynchronous and synchronous communication with the instructor (Sherry, 1996). According to Harasim (1989, p.50) third-generation distance education models are based largely on "asynchronous, place independent, many-to-many interactive communication."

On-line, electronic learning environments engender peer-to-peer and peer-to-instructor collaboration and democratic forms of learning (Harasim, 1989). Moreover, students are expected to take an active role in the learning process and construct meaning from multiple sources such as

textbooks, peers, the educator, and Internet resources (Harasim, 1989).

Kaufman (1989) suggested that third-generation distance education models are transforming the face of distance education programs by placing more of an emphasis on student-centered, self-paced, collaborative, and "just-in-time" learning opportunities.

It is clear that the Internet is changing the way distance education programs are conducted as we reach the beginning of the next century. While the possibility exists for a fourth-generation model to emerge as the face of distance learning continues to evolve, what remains certain is that electronic media such as the Internet will continue to revolutionize the way distance education is conceptualized.

The Nature of Distance Learning

In exploring the broad field of distance education, this section will investigate: 1) What factors are involved in contributing to student success or failure in a distance environment; 2) How communication between the distance

educator and student changes; and 3) How distance learning compares with conventional classroom learning.

Learning in a Distance Environment

Success in a distance education course requires the student to be a motivated, independent learner who can effectively manage time and pace learning to meet the demands of the course (Coggins, 1988; Eastmond,1992; Sadiq, 1996; Wagner, 1995). Frew and Weber (1995) and Coggins (1998) found that prior experience with distance education improved the likelihood of success in future courses.

According to Eastmond (1992), many adult students taking distance education courses have difficulty completing their coursework due to factors such as anxiety towards technology (consistent with Kirkwood & Jegede, 1994), the lack of social opportunities presented, and the need for more instructor guidance. Gee (1990) wrote that educators who are aware of at-risk learners may be able to circumvent potential failure by putting in place specific intervention programs that are based on assessment of learning styles and personality types. In this way, such learners could be identified and possibly monitored throughout the course to better ensure success.

Researchers have stressed the importance of distance education orientation programs to help students cope with the new learning medium and to explore individual differences that can contribute to success or failure in the distance learning environment (Atman, 1988; Barbrow, Jeong, & Sara, 1996). Ehrman (1990) went further and posed the question: "To what degree should learners of a given learning style configuration be encouraged or discouraged from enrolling (p. 19)?"

While it may be advantageous to use individual differences to help monitor potential at-risk distance students, discouraging certain students to enroll in a distance course based purely on learning or personality styles should not become common practice. This could be viewed as biased, unfair "pigeonholing" and misuse of individual difference data.

Empirical Studies

Research investigating variables that are related to distance student success has uncovered some notable findings.

Biner, Blink, Huffman and Dean (1995) researched the influence of personality factors on success in a telecourse versus a traditional campus learning environment. Using the

16 Personality Factor Questionnaire, results from the 449
course participants revealed significant differences in the
personality profiles of the off-campus and on-campus groups.
Specifically, telecourse students were more emotionally
stable, trusting, compulsive, passive, and conforming than
were the on-campus students. Furthermore, the researchers
found that the most successful distance education students:
"are those individuals who are resourceful and prefer to
make their own decisions" (p.56).

A study conducted by Dille and Mezack (1992) also found
significant results with learning style and distance
education (in addition to several other individual
differences). The researchers sought to identify predictors
of success or failure in telecourse learning environments.
The Kolb Learning Style Inventory (1976) was used to collect
learning style information from students, and the Rotter's
Internal-External Locus of Control Scale was used to
identify students' beliefs about the nature of the learning
environment. A demographical survey was also given to
students.

Results from the sample of 151 telecourse learners
revealed that while learning style was not a predictor of
success for those students who persisted, the cognitive
trait was related to course withdrawal. Specifically,

students with higher scores in the Concrete Experiential category, a learning style that relates better to people and has a higher sensitivity to feelings of others (Kolb, 1984), were more likely to drop out of the course. The authors suggested that the nature of telelearning precludes the opportunity for social interaction between students, their peers, and the instructor.

Another significant predictor of persistence was locus of control (also see study by Stone, 1992). Students with a higher internal locus of control were more likely to persist in the course, which is a finding that makes intuitive sense considering the importance of self-motivation when learning at a distance.

Variables that appeared to be directly related to success in the course were demographical in nature. Of those students who persisted, older, married students faired better in the course than did younger, divorced participants. Mitigating life circumstances adversely affected students' ability to cope with the demands of the distance learning environment. Students with external pressures such as raising children in isolation may have been unable to monitor their own learning, and as a result may have been unable to persevere.

Results from a study by Purgliese (1994) were not

consistent with those from Dille and Mezack (1992). A total

of 306 students were surveyed by telephone to determine

psychological variables that contributed to telecourse

persistence. Locus of control, loneliness levels, dyadic

communication apprehension, and communication competence

were examined. In comparing performance, none of the

variables was significant. The author concluded by

suggesting:

> Telecourses appear to be a social equalizer when it
> comes to receiving course credit. While some may claim
> that telecourses depersonalize education, it can be
> argued that they minimize the potential for instructor
> bias toward the more socially skilled (p. 30).

Communication and Interaction

The finding by Dille and Mezack (1992) can be applied

to the computer-mediated communication environment. Research

has shown that in an on-line chat room environment, students

who are introverted and shy are more likely to participate

in electronic discussions than in face-to-face discussions

(Pratt, 1996). Communication in a more anonymous environment

may be viewed as less threatening to students and may

therefore break down barriers caused by personality factors

such as introversion (Pratt, 1996).

Electronic communication opportunities can act as a viable alternative to in-class meetings (Davies, 1997). The author wrote: "high tech, high touch makes the distance education model both humanistic and efficient" (p.68). The development of learning communities on-line may also assist students with the learning of course material (Harasim, 1989; Palloff & Pratt, 1999).

Shale (1990) defined two types of communication interactions that could occur in a distance environment. Vertical interactions are those that transpire between the educator and the course participants, whereas horizontal interactions take place between students and other members of the course community.

Moore (1989) defined three types of interaction: student-student, student-instructor and student-content. He postulated that distance education courses in the last decade of this century would focus more on student-student interaction, a novel concept for distance education in the late 80s.

In the Web-based course learning environment, unlike the teleconferencing environment to which Shale (1990) and Moore (1989) were referring when creating their definitions of communication, there is a blending of interactions. The nature of Internet "chatting" can blur the boundaries

between tutor and tutee and result in an egalitarian, nurturing environment (Ross in Clower, 1998). Moreover, computer-mediated communication provides students with an opportunity to interact with content while collaborating with the educator and other students; hence, it is proposed that a new model for communicating on-line be developed that blends interaction together rather than keeping them disparate entities.

Comparative Distance Education Research

Numerous studies have been conducted which attempt to compare students' grades taught by distance and in the conventional classroom (Anderson, 1994; Goodyear, 1995; McClure, 1996; Schlosser, 1994). Kearsey, Lynch & Wizer (1995) argued that the on-line classroom is as effective learning medium and rivals the conventional classroom. It would appear that most studies confirm this finding.

For example, Goodyear (1995) investigated student grades taught by television versus in the conventional classroom. Using historical data, the researcher concluded that there were no significant differences in final grades between the two groups. The study used a sample of 791

students and studied grades across three courses to improve

generalizability.

Results from the study by Goodyear (1995) are

consistent with a report by Russell (1995) who detailed non-

significant results of 248 studies in distance education.

Russell was attempting to illustrate the futility of

comparing on-campus and distanced students by compiling a

number of comparative studies that have transpired over the

last 70 years.

However, it should be noted that not one of the studies

cited by Russell (1995) looked specifically at Internet-

based distance education taught using the Web. Most were

either comparing telelearning or taped video lessons versus

conventional education, a markedly different form of

distance learning than Web-based instruction. Watching a

professor on the television is akin to watching a lecture

passively as part of a face-to-face meeting, so it would be

expected that the two forms of instruction led to comparable

achievement between distance and campus groups.

Schutte (1997) asserted that the Web is a potentially

powerful and rich learning environment. In his study

comparing Web-based versus conventional education, it was

found that the distance group scored significantly better on

the 100-question final exam than did the on-campus group.

The groups were separated by a 20-point spread (20%), indicating both statistical and practical significance for on-line course educators. However, the study by Schutte has some fatal flaws that may have contributed to such remarkable disparities in performance.

Most noteworthy of these oversights by the researcher relates to experimental treatment; the two groups had markedly different course expectations. Whereas the on-campus group met for one lecture and had one homework assignment weekly, the Web-based students met four times and had four assignments weekly. Such methodological flaws may have contributed to drastic achievement differences between the two groups.

Hence, there remains a need for a well-conducted study to investigate the effectiveness of Web-based learning as compared with conventional classroom instruction. This section has illustrated the very large "gap" in the literature that may be filled by the results of the present study.

Web-based Distance Education: An Overview

According to Simonson (1997a) web-based distance education is "one of the most dramatic of recent technology-

based innovations in higher education" (p.24). The author

contended that while research has shown distance learners to

perform as well as their on-campus counterparts, there

remains a need for research to investigate how students

spend their time learning on-line.

Learning over the Internet is markedly different from

more traditional forms of distance education. Unlike

previously-used methods to conduct distance education, the

Internet can break down distance barriers (Moore & Thompson,

1990; Moore, 1995). According to Brown (1996):

> Fiber optics and the mooted expansion of computing,
> communication and information systems into 'every' home
> threatens to erode the idealized model of the
> distanced, detached and critical student (p.23).

The use of the Internet as a distance learning medium

has made its mark on higher education (Wolcott, 1996).

Willis (1994) posited that distance education and the

advancements of technology-based learning would change the

face of education and the nature of how students learn.

Since this article was published in 1994, the Web has

continued to evolve, and now is seen as a tool for

conducting research, collaborating and sharing resources

with others, and on-line course dissemination by

institutions of higher learning (Katz, 1999).

The Tri-Modal Model of Web-Based Course Delivery

In an effort to help conceptualize the various forms of Web-based learning offered by post-secondary institutions, Wilkinson and Ross (1997) developed the tri-modal model of web-based course delivery. The model examines three ways course material can be presented on-line.

Full Internet Delivery

According to Wilkinson and Ross (1997), full Internet delivery lends itself to the inquiry-based learning model where course instructors become facilitators of students' growth and development as learners and researchers. Such courses use the Internet as the primary vehicle for delivering all material on-line. Students remain at a complete distance from the campus throughout the course semester, as all learning material and course communications are available using the Internet.

Internet-Enhanced Delivery

Content can be presented through a combination of techniques such as video, textual or audio conferencing over the Internet, on-line learning resources (eg., the course

outline, assignments, related links, and Email lists) and weekend face-to-face workshops. According to Wilkinson and Ross (1997), using a combination of classroom-based and Internet-enhanced lessons helps to create a balanced approach to distance education for the student. Students can benefit from the social and collaborative opportunities that in-person workshops provide, while having the Internet serve as a course-enhancing resource tool (Wilkinson & Ross, 1997).

Internet-Supported Delivery

Although the Internet is still used to provide students with supplementary course information, Internet-supported classrooms present content primarily through in-person workshops and on-campus classes. Using this particular modality, the Web becomes a resource area for students where tools such as the course outline, reference links, instructor's Email, and related course newsgroups are presented. The course homepage links the instructor and the students between classes. Important information relating to the course may be posted on the Web site for students to read, or relayed to students using Email.

This study uses Model One (Full Internet Delivery) as the basis for educating students at a distance; all learning and communications transpired over the Internet.

A Balanced View of Learning On-Line

There is no denying the inherent ability of the Web to reach and teach students. The following is a summary of some of the benefits of learning on-line outlined in the literature:

- The Web is a flexible, dynamic learning environment (Hackbarth, 1997; Ross & Schulz, 1999b).

- It allows for multimedia-presentation of information (Palloff & Pratt, 1999; Ross & Schulz, 1999b);

- With its presentation of content in a non-linear fashion, the Web "...could easily be considered the ultimate constructivist learning environment" (McManus, 1997, on-line)

- Material can be viewed irrespective of geographic location or time of day (Carl, 1991; Duguet, 1995; Ross in Clower, 1998).

- The Web can be cost-effective over time (Farrington, 1999). Use of the Web to disseminate course material to students can help to offset budget cuts to higher

education and reach a greater number of students
with fewer resources expended.

- Learning on-line can give the student access to a
  potentially rich, collaborative, and powerful
  learning environment (McGreal, 1997; Milheim, 1996;
  Pennell, 1997; Wagner, 1997).

As with any technology, however, there is a need to
examine both the benefits and the limitations. Some of the
potential pitfalls of learning on the Internet include:

- A greater chance of students getting lost in
  hyperspace (Castelli, Colazzo, & Molinari, 1996);
- Initial financial cost and preparation time when
  creating courses on-line (Dillon & Walsh, 1992; Ross
  & Schulz, 1999b);
- Often shoddy or inadequate course learning
  environments that pass for full Internet course
  delivery systems (Ross & Schulz, 1999b);
- Not all courses are suitable for distance delivery
  (Dillon & Walsh, 1992);

- Computers can intimidate faculty who are often leery of new and emerging technology (Olcott & Wright, 1995; Olcott, 1997);

- Academic and government leaders are still skeptical as to the efficacy of Web-based distance learning (Olcott, 1997);

- Departments and Faculties often make the mistake of purchasing the computer equipment and infrastructure first before having an adequate or viable vision of how to use the technology (Olcott & Wright, 1995; Olcott, 1997); and

- Because the learner is separated from the instructor, the chance for academic procrastination is greater (Wilkinson & Sherman, 1990).

Course Development Issues

Indeed, course design factors continue to be an issue with many institutions that are simply participating in the "race" to bring the electronic classroom to the students (Ross, 1998). Moore (1993) wrote:

> Many teachers consider the conventional classroom to be an ideal teaching-learning environment and they seek to reproduce it for their distance learners…it is a very immature view…and reflects the field is in its infancy (p.2).

Norris (1997) stated: "Many online course environments represent ways we 'digitize' existing practices rather than use technology to do things differently" (p.4). The frequency of "digitized traditional practices" is not surprising when authors such as Abrahamson (1998) asserted that "one of the goals of distance education is to achieve parity with traditional on-campus classroom education practices" (p. 38).

While providing students with quality educational opportunities remains essential, the on-line course creator's goal should be to develop *new* ideas of what it means to teach and learn, thereby moving away from the Industrial model that has dominated the educational system for hundreds of years (Garrison, 1997; Morgan, Dingsdag, & Saenger, 1998; Zvack, 1991).

As Harasim et al. (1996) discussed, in order for students to become contributing members of a knowledge-based workforce that values collaboration, critical thinking, and resourcefulness, educators--and indeed institutions of higher learning--must break free of the traditional view that they are islands, disconnected from the students, other institutions, and society as a whole. According to the authors, the ivory tower image no longer should be a goal

towards which universities strive. This is not consistent with post-Industrial views of higher learning.

An example of how technology is contributing to the post-Industrial shift that is occurring in higher education in the area of student "connectivity". Opportunities provided for on-line, synchronous collaboration may result in the formation of a virtual community of learners (Abrahamson, 1998). Unlike some conventional classrooms where students, sitting facing the instructor, fervently write notes and listen in unison to the "sage on stage", the on-line learning environment can allow students to feel part of the classroom discussions (Palloff & Pratt, 1999)--a remarkable phenomenon considering that they may be separated geographically.

Garrison (1997) argued that computer conferencing can improve students' motivation to learn, while Brody (1995) suggested that improved student collaboration in an electronic learning environment can actually contribute to greater academic success (see also Thomerson and Clifton, 1996). Garrison (1997) wrote:

> Distance education will increasingly rely on electronic
> communication technology such as computer conferencing
> which is becoming a part of mainstream higher education
> (p.9).

Interestingly, in an earlier article published by Kirby and Garrison (1990), the authors contended that university resistance to distance education stemmed mostly from distance programs' inability to foster instructor-led communities of learners. It was believed that a respectable and traditional education could be provided solely by the university campus experience. Now, with the prolific use of computer-mediated communication and Internet technology, it would appear that these concerns have been at least partially addressed.

Electronic communication is just one facet of the on-line learning experience and its contribution to the changing paradigm in higher education. Another post-Industrialist shift that can be engendered with Web-based distance education is the movement toward student responsibility for learning. Traditionally, students have relied on the instructor for the answers to their questions. As a distance learning tool and medium, the Web is a vast resource that can provide students with a wealth of learning opportunities and information. No longer does the educator need to know *everything*; rather it is more important to know how and where to access information, so that students can construct meaning for themselves (Palloff & Pratt, 1999). Dillon and Walsh (1992) postulated:

…by definition, distance education implies nothing less
than a massive restructuring of the organization of
education. The needs of a learning society require that
our educational system transfer the ownership of
learning from the hands of educators to the hands of
the learners. This is the promise of distance
education(p.38).

Chapter Summary

Institutions of higher learning have begun to evolve as

educational technologies make their presence known to

society. Distance education has changed with the emergence

of new technological innovations, but institutions of higher

education still lag behind.

It is evident, from the research and literature

examined in this chapter, that more inquiry is needed to

understand fully the efficacy of learning in a Web-based

environment. Although research shows mostly non-significant

performance differences of distance versus conventional

classroom learners, there remains the need for research to

examine Web-based distance education as a specific learning

medium.

Learning styles, an important individual difference,

can influence achievement in a distance learning

environment, as some research has illustrated. However, no

research has looked sufficiently at learning styles when interacting within a Web-based course.

Learning and teaching on the Internet presents new challenges for the educator and the student. These challenges are not insurmountable, and, if addressed adequately, the Web can be a powerful and dynamic learning medium. As with any educational technology, a balanced view of the capabilities of the Web should be taken when preparing to teach at a distance.

Three models for Web-based instruction were presented that give the educator a choice when using the Internet to reach and teach students. This study uses a Full-Internet delivery strategy to teach students at a distance.

The next chapter explores a model employed for designing and implementing the Web course environment under investigation in this study.

Chapter 4

DEVELOPING THE ON-LINE COURSE ENVIRONMENT

Introduction

If distance education is to gain widespread acceptance,
it should not be necessary for any group of learners to
compensate for different, possibly lesser,
instructional experiences. Thus, those developing
distance educational systems should strive to make
meaningful the learning experiences of all students no
matter how they are linked to the resources or
instruction required. Those institutions that cannot,
or will not,…will ultimately be relegated to a
secondary and peripheral place in the distance
education field (Simonson, 1997b, p.109)

Research indicates that student success in an on-line

distance education program depends greatly on the quality of

the course environment (Ross & Schulz, 1999b). Despite the

influence of the instructional environment on student

learning and attitudes, studies in the field of Internet-

based distance education neglect to mention or describe the

nature of the on-line course environment (eg., Schutte,

1997). To validly measure whether there are significant

differences between traditional and web-based courses, it is

imperative that the on-line environment be instructionally

sound and maximize the resources afforded by Internet

technology.

While Stan and Milheim (1996) argued that the Internet is a potentially powerful and rich learning medium, too often distance education courses offered over the Web are nothing more than electronic textbooks which force students to navigate through a plethora of content, and thereby fail to utilize the medium effectively (Peraya, 1999; Ross, 1998; Ross & Schulz, 1999b). Palloff and Pratt (1999) and Simonson (1997b) stressed the importance of modifying traditional teaching and learning practices when conducting courses and communicating in cyberspace. Gagne (1985, 1987) wrote of the need to employ sound instructional design principles when developing educational technology applications.

In an attempt to provide instructional design guidance to universities wishing to create more effective Web-based learning environments intended to be delivered fully on-line, I developed and published an instructional checklist (Ross, 1998). The checklist details 87 items believed to be integral for fostering distance learners' success.

The checklist, and some of the contents of this chapter, were first published in the International Electronic Journal for Leadership in Learning, and have been used in this dissertation with permission from the editor of the journal.

The Instructional Environment In the Framework of Ross'

Model

The course used for this study considered the majority

of the items found on the checklist. Some of the items were

deemed inapplicable for the purposes of this study, while

others could not be implemented for logistical reasons. When

totaled the course adhered to 65 of the 87 items with 10

items being not applicable for the purposes of this study.

This chapter delineates the features found on the course web

site.

Student Tools

When creating the on-line course environment, it was

imperative that students were provided with tools to help

with managing course information. The course web site

contained seven tools detailed in the checklist.

Glossary: This tool can be useful when a large amount of

textual content is placed on-line. To give students a sense

of the word in context, glossary items were linked to their

original location in the text. Because only ten words

appeared in the glossary and because no words were difficult

to pronounce, the search tool and the pronounce tool were deemed not applicable for the purposes of this study.

Index: Akin to a table of contents, the index tool provided learners with a brief overview of the major topics of discussion. Lists were not made expandable or contractible as there was not enough material on-line to warrant such a tool.

Bookmarking: This feature allows learners to return to the area of the course last visited before log-off. Bookmarking can quickly orientate the learner each instructional session. However, bookmarking was not possible because students were not asked to log-on or log-off each learning session.

Searching: The search tool is especially important in courses with vast amounts of information and resources, as it can help learners find specific information quickly and efficiently (Ross, 1998). The course web site had an extensive searching feature. To give the learner more searching flexibility and power, the web site allowed for Boolean operators (and, or, not), and provided the ability

to search the course site or the entire Internet for the term in question.

Related Links Page: An extensive links page was created to help students make connections to existing resources on the Internet. Students were also able to submit their own links to the instructor or course developers via Email.

Notebook: An electronic notebook with a print and edit feature was not implemented for the purposes of the study.

On-Line Help: The course web site provided students with an extensive and always-accessible on-line help section. The pages covered areas that most often pose problems to learners while on-line, and included the course facilitator's Email address.

Collaboration Tools

Some individuals prefer learning in social situations (Butler, 1984; Fauley, 1991; Gee, 1990). However, this may be a problem when having to learn course material in relative isolation at a distance. Unless collaborative experiences are created and encouraged on-line, the social learner may become disillusioned and unmotivated to achieve

(Johnson, 1996; Sarasin, 1998). The checklist contains three areas that emphasize collaborative learning while on-line: asynchronous communication, synchronous communication, and class lists. The course web site provides students with all three features.

Asynchronous Communication: Like mailing a letter and having to wait for a response from the recipient, asynchronous communication systems can fragment and decontextualize a conversation. However, such a system of communication can provide learners with a record of previous discussions (in the form of posts), and can allow the student to respond to questions or comments regardless of how much time has elapsed since the original post. For the purposes of the study, a course *bulletin board group* using O'Rielley's WebBoard™ 3.0 software was created to provide learners with a relatively efficient way of communicating with others in the class.

Another way students were encouraged to become involved in course-relevant discussions was by participating in a subject-relevant course *listserv*. A listserv is a discussion group that uses the Email medium to communicate. A question or a response given by a user is automatically disseminated to all subscribed members of the group. Similar to a

newsgroup, a listserv provides subscribers with
opportunities to engage in topic-relevant, asynchronous
. discussions.

Synchronous Communication: Whereas asynchronous
communication can fragment the natural flow of a
conversation, synchronous communication systems allow for
learners to discuss course issues in *real-time*. Although
learners use the keyboard as the means of participating in
course discussions, on-line synchronous text "chatting" can
be compared with telephone-facilitated conference calls.

The course website provided students with subject-
specific "chat" rooms, allowing multiple users to
communicate textually with each other. The course
instructor, who acted as a moderator for debates and as a
facilitator for course lecture sessions, led all weekly
course chat sessions. A written transcript was posted
weekly on the course website for those who may have missed a
live chat session or for those students wanting to review
materials.

Class Lists: To foster learner collaboration and
socialization on-line, a class list with students' names and
their Email addresses was created on the course web site.

This list was useful for students who needed to contact others throughout the course semester.

Testing and Recordkeeping

Testing and recordkeeping functions allowed learners and instructors to monitor performance throughout the course. The course web site included one feature detailed on the checklist.

Quick Quizzes: For the purposes of this study, there were no quick quizzes as recommended in the checklist. Because on-campus students were not given such quizzes, providing on-line information may have biased achievement comparisons between the two groups.

Essay Submission Forms: On-line submission forms, which simplify the submission process for learners who are not computer-literate, allow students to submit quickly their essay assignments to the instructor. This feature was implemented for the purposes of the study.

Functionality

The following checklist features focus on improving a site's functionality. Site maps, user tracking and multimedia technology were included in the on-line course.

Site Map: According to Hammond (1989) students can become disoriented in hyperspace. The idea of not knowing where one is when on-line can severely affect learning (Castelli, Colazzo, & Molinari, 1996). The course website provided students with a detailed, hierarchical and clickable structure of the course web site accessible from anywhere in the course. Especially for students who think in an unstructured, non-linear manner--and who may be more likely to follow links to places that may not necessarily be related to the lesson at hand--an on-line map can help these individuals stay oriented and on-track.

Tracking: A server-created tracking system was used to monitor access to the web site. While the system did not track individual users, it did allow the course instructor to monitor areas of the course visited by students.

Better Use of Multimedia Technology: Many course learning environments rely heavily on text to present content. While

uploading pre-existing text allows for rapid development of course pages, it does little to stimulate and engage students in the learning process. Providing properly employed audio and video streaming can enhance the learning experience for course participants who are auditory or visual learners (Filipczak, 1995; Ross & Schulz, 1999b; Sarasin, 1998).

Streamed video is becoming commonplace on the Web as bandwidth and video compression algorithms improve. The software program *Real Media*™ was used to stream lengthy audio and video segments directly from the web page. The clips played without any download time, thereby maximizing the students' time and resources.

The instructor recorded approximately 12 half-hour audio segments, detailing information included in on-campus lectures. In addition, six module introduction videos were recorded and streamed on-line. A number of video case studies were also recorded and used for assignment purposes. These videos were shown to on-campus students as well.

User Interface

The following suggestions focus on the needs of the learner, an often forgotten, yet essential, part of the design and delivery process (Gunawardena & Boverie, 1992).

Consistency of Layout: The course web site was designed by an experienced instructional designer, web graphic specialist, video/audio specialist, and programmer. Emphasis was placed on making the navigation environment straightforward and visually appealing.

The course web site was deemed to have a consistent and intuitive interface by a pilot group of 30 students who took the course for credit two semesters prior to the study's commencement. Survey results illustrated 92% of respondents were satisfied or completely satisfied with the course learning environment. Several revisions were made to course material, but the structure of the site remained the same for the purposes of this study.

User Feedback: Feedback in the form of roll-overs (a feature which highlights a button so that the user knows it is clickable) and link descriptions, instead of link locations in the bottom of the browser window, were used in the course

site to help the novice computer user with navigation on-
line.

Reasonable Load Time: Course pages were designed such that
load time was minimized. Waiting any more than two minutes
(using a 28.8 bps modem) for a page to be completely
downloaded constitutes unreasonable load time, as excessive
waiting could lead to learner frustration (see Ross, 1998).
None of the course pages exceeded this time frame when
tested.

Appropriate Use of Media: New multimedia technologies can
enhance the way material is delivered to learners; however,
it is important to question how and where multimedia is
incorporated (Ross, 1998). The course instructor was asked
to audio record all lectures and only provide video
summaries when online case studies warranted multimedia
illustrations of curriculum.

New Window for External Browsing: A simple, yet potentially
powerful instructional design feature the site used to help
students remain oriented in hyperspace, was to make external
site links load a new browser window. This allowed students
to explore their current thought pattern, yet have the

option at any time to return to their course pages. This

dual-browser window feature can be helpful in allaying

students' fears of getting lost on-line (Ross,1998).

Non-Technical Features

This section details non-technical features as listed

on the checklist.

Student Handbook: Course registrants were mailed a student

handbook. Such a resource is believed to help orientate the

learner prior to the course's commencement.

The student handbook included information such as:

1. Course overview;
2. Course chat room times;
3. Class Email list;
4. Plug-in information (how to download and use browser
   plug-ins such as *Shockwave*™);
5. Course map (structure detailing sections of course and
   topical areas);
6. Frequently asked questions to address fears and
   misconceptions about on-line learning; and
7. Information on minimum computer system requirements
   (Ross, 1998; p. 16).

In addition to a course handbook, students were also

given a CD-ROM complete with all of the plug-ins and

software required for the course. In this way, students did

not have to complete lengthy and often complicated downloads from the Internet; all required technology was in one place and could be installed with two mouse-clicks.

Orientation Day: Bonne (1996) wrote that orientation days can help anxious distance education learners adapt to the new learning situation. This is consistent with Milheim (1991). Orientation days were not deemed methodologically appropriate for the purposes of this study.

Student Survey: Administering an on- or off-line pre-survey of students' fields of experience and attitudes towards web-based learning is a relatively non-technical, simple, yet effective, way to help the instructor flag those students who may be at-risk for doing poorly (see Ross, 1998). Survey results could potentially be used to adapt instruction to meet learners' needs.

An extensive pre-survey was administered to distance education students for the purposes of the study (Appendix B). Because of the nature of the research study, the instructor did not have access to the survey results, and hence, modifications could not be made to adapt course material for individual learning needs.

It may also be a good idea to administer a post-course survey (Ross, 1998). Learner feedback can be incorporated into help section entries, and frequently mentioned concerns not addressed in the on-line help can be added. If there are concerns relating to design or delivery flaws, then the instructor may wish to revamp the problem areas for the next year's class.

A post-course on-line evaluation was administered to students in the pilot study group after the winter 1998 semester. The survey results were used to help the instructor identify key issues that affected the pilot group and make modifications in preparation for the study. For the purposes of this study, a more extensive paper-and-pencil survey was administered to students (Appendix B).

Computer-as-Tool: Students learn materials in different ways (Filipczak, 1995; Sarasin, 1998). While visual learners may process information best when presented with images and text, auditory learners learn best by hearing the material. Kinesthetic learners require their bodies to be involved in the activity, whereas tactile learners like to involve touch as part of the learning process.

It is apparent that the computer simply cannot meet the needs of every course participant, regardless of how content

is delivered (Ross, 1998). There are limits to what a
student can do with the "machine" (see Gregorc, 1985). To
meet the needs of the greatest number of learners, it was
suggested that course facilitators design activities that
give students choices in the way they learn course material
(Ross, 1998). It may be unfair to require *all* content
learning to take place on-line. Options should be available
for students to construct their own learning through other
off-line experiences.

Distance learners were provided with numerous
opportunities to learn off-line for the purposes of this
study. Case study development and self-directed projects
enabled students to reflect without being "tied" to
technology. In this way, the computer was used as a tool to
facilitate student learning, even though it was still the
primary delivery medium for the virtual classroom.

Group work can be a highly motivating and effective
learning tool (Bowen, 1995; Sarasin, 1998), especially for
those students who may be having trouble with learning from
the computer and/or who are inherently social individuals
(Ross, 1997). I recommended that, whenever possible,
students who voice dissatisfaction with the computer should
be allowed to work collaboratively on assignments, thereby

shifting the focus to learning with others while using technology.

The educator in this study gave on-line students the option to collaborate for their major paper. Students could make use of the chat rooms or bulletin board system to exchange assignment feedback with others.

Assessing Learning Styles-- A number of self-scoring learning style batteries exist that help students quickly identify the way they learn best. As was discussed in Chapter 3, knowing one's learning style is a powerful tool when using technology.

Students were given the Gregorc Style Delineator learning style inventory early in the semester. The results were not shared with the educator due to the study's ethical and methodological constraints; however, the educator was told the importance of varying his teaching style to meet the needs of all learners in the classroom.

Summary

Overall, the web site environment adhered to the major principles as outlined by the checklist I created. While some features could not be included due to the constraints of the study, the most essential aspects of the checklist model were implemented.

It is hoped that the nature of the students' on-line learning environment has been clarified by the information presented in this chapter. The next chapter will explore the methodology used in this study.

Chapter 5

METHODOLOGY

Design

A causal-comparative design was used as the choice

research technique for the study (Coldeway, 1989). According

to Borg and Gall (1983), this type of methodological design

allows for the analyzing of relational data between

specific, identifiable variables.

Research Questions

This exploratory study investigated the following research

questions.

1. What are some of the characteristics of on- and off-

campus student learners?

2. In comparing Web-based distance education to conventional

education:

    2a. Are there differences in student achievement?

    2b. Are there differences in student attitudes toward

    the instructor and course?

3.How does learning style (as measured by the Gregorc Style

Delineator) relate to:

3a. Achievement

3b. Interaction with instructor and students

4. In comparing Web-based distance education to conventional education, are there differences in:

4a. Student-student interaction;

4b. Student-instructor interaction; and

4c. The amount of time (in hours) spent on course-related learning?

5. Of the following variables, which contribute(s) to achievement?

- Learning style

- Time spent on course-related tasks

- Technology barriers to accessing course website

- Course satisfaction

- Comparison to conventional instruction

- Perceived course performance barriers

- Previous experience with computers

- Interaction with others

Participants

A convenient sampling method was used for the purposes
of the study. Thirty-nine students enrolled in the on-campus
version participated in the study, while 36 Web-based course
learners chose to participate in the study (n = 75). A
grading incentive of 10% was offered to students in exchange
for their consent to participate; hence response rates were
100% from each group. Participants' demographical
information appears in Chapter 6.

Treatment

In the winter of 1999, the University of Calgary's
Community Rehabilitation program offered the undergraduate
half-course, *Law and Disability,* fully on-line via the Web
to students across western Canada. At the same time, a group
of on-campus students at the University of Calgary were
enrolled in a conventional version of the same course. The
same instructor, who is a practicing lawyer and experienced
sessional instructor with the Community Rehabilitation
program, taught both the on-line and conventional courses.

Web Environment

The course website was carefully constructed to provide students with many of the same learning opportunities provided to on-campus students (Chapter 4). For example, the instructor placed lecture summaries on-line in addition to other content that was covered in the conventional classroom. Conversely, video resources and other web resources such as links and case study reports used in the on-line environment were made available to students in the conventional classroom. In this way, students in both groups had similar exposure to *course content*, and thus, valid assessment of learning outcomes between groups could be made.

Insofar as the Web has tremendous potential to enrich learning experiences (Ross & Schulz, 1999b), it was difficult to equalize the treatments in both groups. While each group had one instructor-led session conducted per week and were given the same notes, assignments and examinations, the on-line group had a number of supplemental resources and tools built into the on-line environment (see Chapter 4). One of this study's goals was to compare directly learning on-line and in a conventional classroom; hence, maximizing the resources afforded by the Web was essential in order to validly assess the nature of the Web as a learning medium.

The website learning environment adhered to most features included in the distance education course creation checklist (Chapter 4) I created (Ross, 1998), and was deemed instructionally sound by a pilot group of 30 students who had taken the course on-line previously, and two learning technologists in the fall of 1998.

Classroom Environment

Students met in a small classroom once a week for 3.5 hours over a 12-week period. The instructor taught the course in a lecture format with opportunities provided for class discussion and debate. Students were seated around large tables, a method used to improve collaborative opportunities.

Experimental Set-up

Each student who participated received a research package that consisted of all material necessary to fulfill the requirements of the study (Appendix B). To ensure that data were not influenced by course-related experience, students were asked to complete a pre-treatment survey and test material before commencing the first class. On-campus data were collected before the first lecture, and mail-in deadlines ensured distance students adhered to the same

important guidelines. Similar deadlines ensured that post-treatment data were completed and collected immediately proceeding the last class.

To reduce instructor bias the researcher did not share the goals of the study with the instructor. Indeed, even the researcher entered the study with no previous biases, as most of the literature has shown no significant differences to exist between achievement levels of face-to-face and distance education students (Chapter 3).

Instruments

Surveys

Pre and post-treatment surveys were used to question course participants in both treatment groups (Appendix C). Designed primarily to measure student attitudes and experiences with the learning process, the surveys also collected demographical information necessary for investigating the research questions.

Because no adequate survey instruments existed at the time of conducting this study, the researcher created four instruments, each with an intention of collecting data germane to this study's goals.

The survey instruments were each pilot tested on a group of five students to test for content validity. The

surveys were also reviewed by two professors from the University of Calgary for examination of the clarity of survey items. Small revisions based on the feedback received were made to the surveys.

It should be noted that where applicable the questions were collapsed into single variables for analysis purposes; hence, groupings of questions on the survey were necessary.

'On-Campus' Group Surveys:

While the 'On-Campus' pre-survey collected demographical information only, the post-survey collected students' beliefs about the nature of the learning environment in comparison with other courses). This variable was collected to: 1) investigate the instructor's level of competence; and 2) compare results with the 'By Distance' group to determine students' perception with the learning environment.

'By Distance' Group Surveys:

The pre-survey collected the following information.

1. Demographics--Questions included: student's year of program, age, gender, learning style scores, and computer access from home.

2. Computer Usage--As a measure of computer literacy, students were asked to provide an estimate (in hours per week) related to the following tasks: Email, word processing, faxing, Web use, games and other applications.

3. Motivations--Students were asked to rank pre-determined reasons why they were taking the course.

4. Perceived Barriers--To measure students' awareness of barriers that may influence performance in the distance course, students were asked to rate the following variables (using a 5-point Likert-type Scale): computer access, computer experience, learning style, personality style, time (schedule), motivation, work style and other.

Post-survey questions were separated into the following sections:

1. Barriers to Accessing Course Website--To measure the influence of technology barriers, students were asked to rate the following variables (on a 5-point Likert-type Scale): computer speed, modem speed, amount of computer RAM, amount of hard drive space, Internet Service Provider, and other influences.

2. Student Satisfaction--Students were asked to rate
   (using a 5-point Likert-type Scale) the following
   variables believed to measure satisfaction related
   to the course learning experience: content,
   audio/video and layout of website; instructor's
   facilitation abilities; level of student-student
   and student-instructor interaction; learning at a
   distance; and computer access to the course
   website.

3. Comparison with Conventional Classroom
   Instruction--5 point Likert-type questions were
   asked to be rated by students relating to the
   following variables: Communication with the
   professor and other students; motivation; time and
   performance factors; course environment; and
   learning modality preference.

4. Short Answer Qualitative Responses--Short-answer
   questions asked students to discuss the advantages
   and disadvantages of learning at a distance, as
   well as factors that contributed to performance in
   the course. Students could also make other
   comments related to their experiences in the
   distance course.

Learning Style Battery

As a measure of cognitive learning styles, The *Gregorc Style Delineator* was administered to participants. The self-scoring inventory creates individual profiles based on four mediation channels: Concrete Sequential (CS), Concrete Random (CR), Abstract Sequential (AS), and Abstract Random (AR). A score over 27 in any one mediation channel reflects strength in that area.

A standard alpha coefficient measuring The *Delineator's* reliability ranges from 0.89 to 0.93 (Gregorc, 1982b). Although his findings have not been supported by other research studies, The *Gregorc Style Delineator* is in wide use today as a measure of cognitive learning style (O'Brien, 1992).

The Gregorc Style Delineator was selected, in part, for the following reasons (adapted from Schulz, 1993, p.3):

- Easy to administer;
- Easy to interpret;
- Self-scoring battery;
- Relatively quick to administer and complete;
- Inexpensive;
- Discrete, easily reportable scales; and
- Validity and reliability measures have been partially supported by research (e.g., Gregorc, 1982a)

For some analyses, the subject's highest score recorded was used as an indicator of dominant learning

style. Where appropriate, subjects with two or more tied high scores were placed into a fifth learning style category: 'Split'.

For regression analyses, and to improve validity and reliability, learning style was also used as a continuous variable. All four scores were entered into the analyses in these instances and were used as correlates with other variables.

Student Logbook

Students were asked to record course-related learning in a detailed course logbook (Appendix D). Participants were informed of the importance of keeping the log current and were instructed to complete an entry after each course-related task. Frequent, unannounced spot checks were conducted by the researcher to ascertain whether students were keeping their books up-to-date. In only one instance out of 12 spot checks did a student receive a warning to update the logbook. In this case, the student was behind one week.

The following variables were collected and compared between groups:

- Listening to lectures
- Studying

- Peer collaboration
- Instructor collaboration
- Assignment preparation
- Navigating through web site (on-line group only)
- Chat room discussions (on-line group only)
- Other (explained by student)

Variables were collected and analyzed according to time and frequency factors.

Time:

a) Total hours spent on course learning--For this factor, time spent on all variables was totaled for an overall group time figure.

b) Total hours spent on each variable collected--This factor was measured by summing the total time spent on each variable category (e.g., studying, chat room discussions, etc.).

Frequency:

c) Number of variable events recorded-- This factor was established by tabulating the number of events recorded for each variable under investigation.

d) Total number of events recorded--For this factor, the total number of events reported by each study group was summed and compared.

Pre- and Post-Treatment Learning Outcomes Assessment

To validly assess learning outcomes, two 40-question multiple-choice examinations were administered to participants (Appendix E). Questions sampled from all levels of Bloom's Taxonomy (Bloom, 1956) ranging from simple recall to more complex application and evaluation questions. Both the pre-test and the post-test were comprised of the same content questions. Because there was a 12 week lapse between both tests, and because students were not aware that the post-test was made up of the same question types, it was not necessary to address the issue of student learning from the pre-test (pre-test effect). To establish construct validity, the exam was prepared by the course instructor, an expert in the field, a practicing lawyer, and a seasoned sessional instructor with Community Rehabilitation and Disability Studies. Reliability analysis of the examination yielded an overall Cronbach (1951) alpha score of .87, well within the acceptable region for the nature of this study.

Student Course Evaluation

A standardized University-wide course evaluation was used for the purposes of this study (Appendix F). A series of Likert-type questions pertaining to course satisfaction,

instructor relations, and other meaningful information were included. Both treatment groups completed the survey.

Independent Measures

1. Learning Style--Students' dominant and least dominant learning style scores were related to course performance (final grades) and select survey questions.

2. Student Attitudes--A series of survey questions were designed to assess students' attitudes towards their learning environment (on-campus versus on-line). Results from the questions were compared to determine how attitudes affected dependent measures.

3. Domain Knowledge--A pre-test measured students' entry-level content knowledge and was used as an indicator of domain knowledge possessed. The 40-question pre-test score was used as a covariate to examine the effects of domain knowledge on learning outcomes.

4. Learning Modality--The impact of learning at a distance versus face-to-face was used as an independent variable.

5. Computer experience--Distance students' background experiences with computer technology were measured by several pre-survey questions averaged into a final overall score for this variable.

6. Perceived Barriers--Barriers such as accessing the course website were measured by survey items.

Dependent Measures

1.Learning Outcome-- Achievement levels were measured by students' post-test score, as measured by a 40-question multiple choice examination, and by students' final course grade recorded.

2.Patterns of learning--Students' course learning behaviors were measured by students' logbooks. Comparison between groups were made based on the following variables:

2a. Total time and total number of events recorded overall.

2b. Total time and total number of events recorded for each variable measured by logbook.

3. Student exit attitudes towards the:

3a. course (measured by course evaluation);

3b. instructor (measured by course evaluation); and

3c. learning at a distance/on campus (measured by survey)

While this list of variables should be considered comprehensive, it is not exhaustive. Furthermore, it should be noted that for certain analyses, dependent variables became independent variables and vice versa. Table 2 provides an accurate and exhaustive list of variables and their associated research questions.

Table 2

Methodology Summary According to Research Questions

Research Question	Test	Variables	Analysis
2a. Does achievement differ in comparing on-campus and by distance students?	Difference in achievement between treatment groups	IV = 'On-Campus', 'By Distance' Covariate = Pretest DV = achievement	ANCOVA
2b. Are there differences in student attitudes in comparing groups?	Difference in attitudes toward instructor between treatment groups	IV = 'By Distance', 'On-Campus' DV = treated respectfully, delivered with enthusiasm	ANOVA
3a. How does learning style relate to achievement?	Difference in achievement between treatment groups and dominant learning styles.	IV = 'On-Campus', 'By Distance', CR, AS, AR, CS, Split Covariate = Pretest DV = achievement	Multivariate General Linear Model
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'On-Campus' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'On-Campus' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'By Distance' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'By Distance' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses

Table 2

Methodology Summary According to Research Questions...Continued

Research Question	Test	Variables	Analysis
3b. Are there learning style differences in student-student interaction; student-instructor interaction?	Difference in satisfaction with peer/instructor collaboration with dominant learning style and treatment groups	IV = 'By Distance', 'On-Campus', CS, CR, AS, AR, Split DV = peer collaboration, instructor collaboration	Multivariate General Linear Model
4a,b Are there differences in the amount of time (in hours) spent on course-related learning?	Difference in time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = time spent listening to lectures, peer collaboration, studying, instructor collaboration, assignment prep.	t-test
4c. Are there differences in the amount of time?	Difference in total time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = total time spent	t-test
5. Which variables contributed to achievement?	Relationship between total time spent and achievement for 'On-Campus' group	IV = total time spent DV = achievement	Linear Regression Analyses
5. Which variables contributed to achievement?	Relationship between barriers to access and achievement for 'By Distance' group	IV = computer speed, modem speed, amount of RAM, amount of hard drive space, ISP DV = achievement	Linear Regression Analyses
5. Which variables contributed to achievement?	Relationship between satisfaction and achievement for 'By Distance' group	IV = lectures, learning environment, chat rooms, instructor's facilitation abilities, interaction, learning at a distance, computer access DV = achievement	Linear Regression Analyses

Table 2

<u>Methodology Summary According to Research
Questions…Continued</u>

Research Question	Test	Variables	Analysis
5. Which variables contributed to achievement?	Relationship between a student's comparison to conventional classroom and achievement for the 'By Distance' group	IV = communicate with prof more, communicate with peers more, more motivated, prefer distance learning, more time to work on course material, better because on internet, accommodate needs DV = achievement	Linear Regression Analyses
5. Which variables contributed to achievement?	Relationship between perceived barriers and achievement for 'By Distance' group	IV = computer access, computer experience, learning style, personality style, time (schedule), motivation, working style DV = achievement	Linear Regression Analyses
5. Which variables contributed to achievement?	Relationship between computer usage and achievement for 'By Distance' group	IV = total hour spent on Email, word processing, faxing, www, games, other applications DV = achievement	Linear Regression Analyses
5. Which variables contributed to achievement?	Relationship between total time spent and achievement for 'By Distance' group	IV = total time spent DV = achievement	
5. Which variables contributed to achievement?	Relationship between total interaction and achievement for 'By Distance' group	IV = total interaction DV = achievement	Linear Regression Analyses

Chapter 6

RESULTS

Introduction

This chapter is divided into three sections. The first section explores the descriptive data collected from survey material. The second section uses inferential statistics to examine the remaining research questions posed. The final section delves into the qualitative data collected from short-answer survey questions. Major themes that emerged from the data are discussed.

Significance for all statistical tests conducted was set at the $p < 0.05$ level. Data were analyzed using SPSS 7.0 for Windows and BMDP IV.

Descriptive Statistics

Research Question 1: What are some of the characteristics of on and off-campus student learners?

To reduce redundancy, only those statistics not reported in other sections of this chapter will be detailed in this section.

Participant Demographics

Characteristics of participants were very similar when comparing the two treatment groups. Table 3 displays students' year of program and ages.

Table 3

Comparative Demographics Between Treatment Groups

	Campus								
	On Campus			By Distance			Total		
	N	M	SD ·	N	M	SD	N	M	SD
Program Yr.	39	3.3	.47	36	3.3	.48	75	3.3	.47
Age	39	28.3	6.9	36	26.8	6.6	75	27.6	6.7

Students, on average, were in their third year of the Community Rehabilitation program, and were around 27 years of age. These numbers are consistent across both groups improving the comparability of the samples.

Of the 75 students, only four were males. The large number of females enrolled in the courses is consistent with Community Rehabilitation general enrollment figures, and is not considered atypical.

Dominant Learning Style Breakdown

Table 4 illustrates the dominant learning style of students in the 'On-Campus' and 'By Distance' groups.

Table 4

Dominant Learning Style Of Students In the Treatment Groups

Dominant Learning Style	Number of 'On-Campus' Students	Number of By Distance	Total Number of Students
CS	10	7	17
AS	7	5	12
AR	9	7	16
CR	9	12	21
Split	4	5	9
N	39	36	75

Most students in this study appear to fall under a more Concrete Random style of learning. 'On-Campus' students were relatively evenly distributed across all learning styles (with the exception of the Split category). The 'By Distance' group shows some dispersion; more students tended to be Concrete Random, while less students were Abstract Random.

Computer Access

Students in the 'By Distance' group claimed to have home computers with Internet connections at home. Hence,

access to the course website was not an issue for any of the participants in this study.

Number of Distance Education Courses Taken

Students enrolled to take the course at a distance were somewhat inexperienced with the distance student role. Only 43% claimed to have taken one course by distance, and only 8% had taken more than two courses. Close to 30% had never learned at a distance before.

The next section explores the remaining research questions using inferential statistics.

Inferential Statistics

This section is outlined according to the following:

1. Differences related to achievement between the treatment groups ('By Distance' and 'On-Campus') and learning style are explored.

2. Analysis uncovers the possible relationship between learning style and achievement for each treatment group.

3. Differences are investigated between the treatment groups and time spent engaged in course-related tasks.

4. Analysis probes into possible variables that might be related to achievement for each treatment group.

Research Question 2a: Achievement Difference Between Treatment Groups

Analysis of covariance (ANCOVA) was performed on the two treatment groups: 'On-Campus' and 'By Distance' using post-test scores of achievement as the dependent variable and pre-test scores as the covariate.

The hypothesis of equal slopes was accepted $(F[1,75]=8.25, p=0.14)$ and that of zero slope was rejected $(F[1,75]=8.74, p=0.01)$, which indicated that ANCOVA was an appropriate model for data analysis.

Controlling for pre-test influences, there was significant group effect on post-test scores $(F[2,73]=8.30, p=0.001)$. Table 5 illustrates this finding.

Table 5

ANCOVA Achievement Analysis for Both Treatment Groups

Source	SS	DF	MS	F	Sig
WITHIN CELLS	204.27	73	2.84		
'ON-CAMPUS'	23.55	1	23.55	8.30	.00
Model	23.68	2	11.84	4.17	.01
Total	227.95	75	3.08		

ANCOVA results reveal that the 'By Distance' group performed significantly better on the 40-question post-test than did the 'On-Campus' group. Descriptive information indicates that the 'By Distance' group recorded a final mean score of 35.28, while the 'On-Campus' group obtained a final exam average of 33.15.

Table 6 identifies these differences.

Table 6

Mean Difference in Achievement Between Treatment Groups

		N	M	SD
Achievement	'On-Campus'	39	33.15	2.06
	'By Distance'	36	35.28	1.11

To help elucidate the differences that existed between
treatment groups, the following figure has been created.

Achievement By Treatment Group
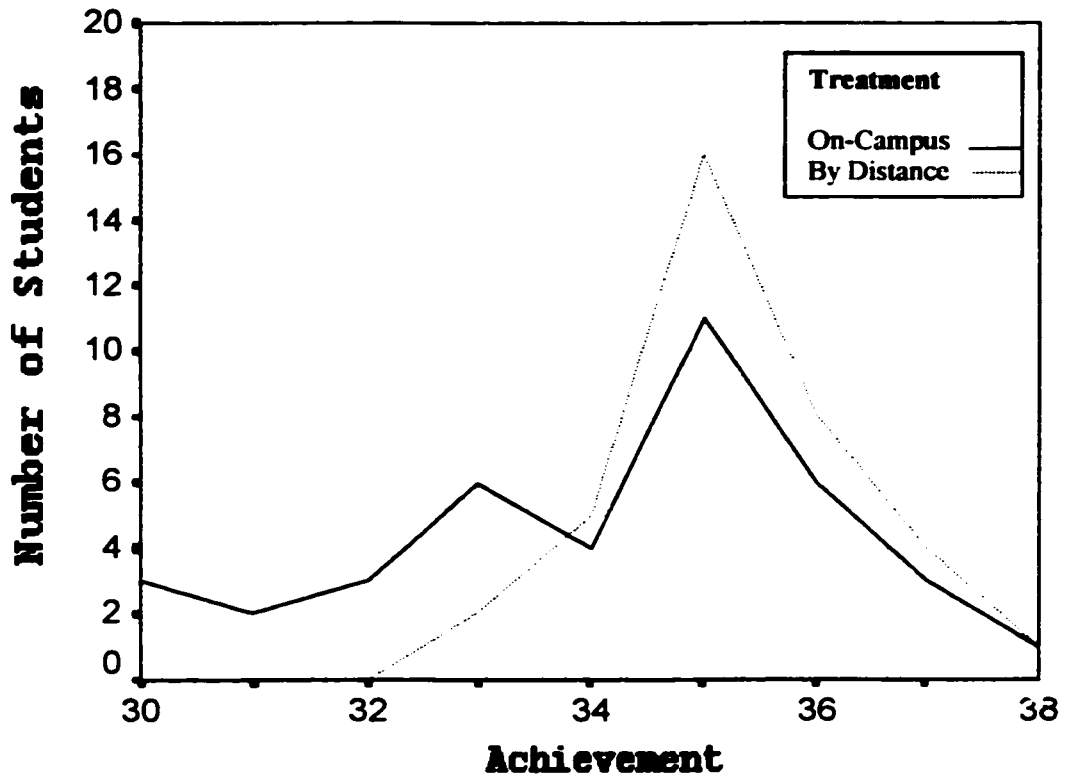
Figure 1. A comparative analysis of achievement differences
between 'On-Campus' and 'By Distance' treatment groups.

In summary, it would appear that achievement between the two treatment groups was significantly different. The 'By Distance' group recorded a higher post-test mean score than did the 'On-Campus' group.

Research Question 2b: Attitudinal Differences Between Treatment Groups

An ANOVA was performed to determine whether a difference existence between the treatment groups on attitudes towards the instructor. Attitude toward the instructor was measured according to whether the student felt that they were treated respectfully and if the course material was delivered with enthusiasm. Descriptive statistics for these two variables for each campus group are found below in Table 7.

Table 7

Descriptive Statistics of Attitude Toward the Instructor
Between Treatment Groups

		N	Mean	Std. Deviation
treated respectfully	On Campus	39	5.36	.84
	By Distance	36	5.78	.83
	Total	75	5.56	.86
delivered with enthusiasm	On Campus	39	5.21	.80
	By Distance	36	5.72	1.00
	Total	75	5.45	.93

An ANOVA found that a difference did exist between

groups with both attitudinal measures. See Table 8 for

results of this analysis.

Table 8

ANOVA of Attitude Toward the Instructor Between Treatment
Groups

		Sum of Squares	df	Mean Square	F	Sig.
treated respectfully	Between Groups	3.283	1	3.283	4.682	.034
	Within Groups	51.20	73	.701		
	Total	54.48	74			
delivered with enthusiasm	Between Groups	5.005	1	5.005	6.133	.016
	Within Groups	59.58	73	.816		
	Total	64.59	74			

The 'By Distance' group felt that they were treated more respectfully than did the 'On-Campus' group. The 'By Distance' group also felt that course material was delivered with more enthusiasm.

Research Question 3a: Influence of Learning Style on Achievement Between Treatment Groups

Learning Styles and Achievement--Both Treatment Groups Combined

An ANOVA was performed using the five dominant learning styles (CS, CR, AS, AR, and Split) as independent variables and achievement as the dependent variable. A pre-test of achievement was found not to be a significant covariate F $(1, 75) = 0.02$, $p = 0.90$.

A significant difference in achievement was found in comparing learning style groups $F(4, 75) = 4.73$, $p = 0.01$.

A post-hoc examination revealed between which groups the differences in achievement existed. Table 9 delineates between-group comparisons, while Table 10 summarizes the post-hoc test.

Table 9

Multiple Comparisons Dependent Variable: Achievement

(I) DOMINANT	(J) DOMINANT	Mean Difference (I-J)	Std. Error	Sig.
CS	AS	-.679	.524	.199
	AR	.546	.482	.262
	CR	1.333	.455	*.005
	Split	1.931E-03	.571	.997
AS	CS	.679	.524	.199
	AR	1.225	.529	*.024
	CR	2.012	.505	*.000
	Split	.681	.611	.269
AR	CS	-.546	.482	.262
	AS	-1.225	.529	*.024
	CR	.788	.461	.092
	Split	-.544	.576	.348
CR	CS	-1.333	.455	*.005
	AS	-2.012	.505	*.000
	AR	-.788	.461	.092
	Split	-1.331	.549	*.018
Split	CS	-1.931E-03	.571	.997
	AS	-.681	.611	.269
	AR	.544	.576	.348
	CR	1.331	.549	*.018

*The mean difference is significant at the .05 level.

Table 10

Tukey Post-Hoc Test for Achievement and Learning Style Group

Learning Style	Mean Score	SD	Post-hoc significance
CS	35.02	0.34	p <0.01 with CR
CR	33.69	0.30	P <0.01 with CS
			P <0.01 with AS
			P <0.02 with Split
AS	35.70	0.40	P <0.02 with AR
AR	34.48	0.34	P <0.01 with AS
Split	35.02	0.30	P <0.02 with CR

A Tukey's post-hoc test revealed a higher achievement score for CS compared to CR; AS compared to AR; AS compared to CR; and Split compared to CR. It would appear that, in general, CR students had more difficulty with the final examination than did the other learning style groups.

In summary, results indicated that when treatment groups were analyzed together, learning style was significantly related to achievement.

Learning Styles and Achievement—'On-Campus' Group

A regression analysis was performed using the 'On-Campus' group to determine if learning styles could be used as predictor variables for achievement.   For the 'On-Campus'

group all learning styles scores were entered as continuous

predictor variables, with achievement scores as the

dependent variable. See Table 11 for the model summary and

Table 12 for the ANOVA for learning styles and achievement

for the 'On-Campus' group.

Table 11

Model Summary for Learning Styles and Achievement for 'On-Campus' Group

	R	R Square	Adjusted R Square	Std. Error of the Estimate
Model 'By Distance'	.27	.07	-.04	1.14

Table 12

ANOVA for Learning Styles and Achievement for 'On-Campus' Group

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	48.95	1	48.95	16.15	.001
Residual	112.12	37	3.03		
Total	161.07	38			

A significant regression was found $F(1,37) = 16.15$, $p = 0.01$. Table 13 reveals between which learning style group

differences existed.

Table 13

Coefficients for Learning Styles and Achievement for 'On-Campus' Group

		Standardized Coefficients	t	Sig.
Model	Std. Error	Beta		
(Constant)	.94		40.02	.000
CR	.03	-.55	-4.01	.000

Specifically, data indicated a significant negative relationship existed between level of CR and achievement $t(39) = -4.02$, $p = 0.01$. In other words, those students who were more likely to think in the Concrete Random mediation channel were less likely to do well on-campus.

Combined Mediation Channels--'On-Campus' Group

Four new learning style scores were calculated using the four dimensions of the Gregorc Learning Styles. These variables were: total random (CR + AR), total concrete (CR + CS), total sequential (AS + CS), and total abstract (AR + AS). The four new variables were entered into a regression equation as possible predictor variables for achievement for the On-Campus group.

A significant negative relationship was found, $F(1,37) = 12.59$, $p = 0.001$, between total random and achievement $t(37) = -24.28$, $p = 0.0001$. Data indicated that when learning on-campus, those students who were more likely to

think in the random mediation channel, as a whole, were less likely to do well in the course taught.

Overall, it would appear that learning style could be used as a valid predictor of performance in the 'On-Campus' group.

Learning Styles and Achievement--'By Distance' Group

Learning style did not significantly correlate with achievement in the 'By Distance' group F (4,31) = 0.61, p = 0.65. R = 0.27 R2 = 0.08 adjR = -0.04. Table 14 details the model summary of learning style and achievement for the 'By Distance' group.

Table 14

Model Summary of Learning Style and Achievement for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
By Distance .27	.07	-.04	1.14

Data indicated that all learning style groups performed equally well on the 40-question post-test examination when learning at a distance.

Combined Mediation Channels- 'By Distance'

Four new learning style variables were created by adding the scores for each Gregorc category. This created

the variables total concrete, total abstract, total

sequential, and total random. A total learning styles

variable was also created by collapsing the scores over all

Gregorc learning style categories. These five new variables

were used as predictors for achievement for the 'By

Distance' Group. See Table 15 for the model summary and

Table 16 for the ANOVA for the total learning styles and

achievement for the 'By Distance' group.

Table 15

Model Summary for Total Learning Styles and Achievement 'By
Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance'			
.251	.06	-.02	1.12

Table 16

ANOVA for Total Learning Styles and Achievement 'By
Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.73	3	.91	.71	.54
Residual	40.49	32	1.26		
Total	43.22	35			

A significant relationship was not found between these
variables and achievement $F(3,32) = 0.71$, $p = 0.55$.

In summary, data analysis indicated that the new
learning style groups created were not significantly related
to achievement for the 'By Distance' group. It would appear
that all learning style groups performed equally as well
when learning via the Web.

**Research Question 3b. Learning Style Influences on Student-
Student and Student-Instructor Collaboration**

A multivariate analysis was used to determine whether
there were differences in time spent interacting with peers
and the instructor. The independent variables used were
dominant learning style (CS, CR, AS, AR, Split) and
treatment groups ('By Distance' and 'On-Campus'). See Table
17 and 18 for descriptives, Table 19 for the Multivariate

General Linear Analysis, and Table 20 for the post-hoc tests
of dominant learning styles and time spent in collaboration.

Table 17

Descriptives of Dominant Learning Styles and Time Spent on
Peer/Instructor Collaboration

Dependent Variable	Dominant	M	SD
Peer Collaboration	CS	3.23	.39
	AS	3.67	.46
	AR	3.07	.40
	CR	3.16	.35
	Split	3.50	.53
Instructor Collaboration	CS	1.50	.33
	AS	1.37	.40
	AR	1.32	.34
	CR	2.80	.30
	Split	1.17	.45

Table 18

Descriptives of Treatment Group and Time Spent on
Peer/Instructor Collaboration

Dependent Variable		M	SD
Peer Collaboration	'On Campus'	3.00	.26
	'By Distance'	3.65	.27
Instructor Collaboration	'On-Campus'	1.05	.23
	'By Distance'	2.21	.24

Table 19

ANOVA of Dominant Learning Style and Treatment Groups with
Collaboration

Source	Dependent Variable	Sum of Squares	df	Mean Square	F	Sig.
DOMINANT	Peer Collaboration		4	.80	.17	.86
	Instructor Collaboration	31.31	4	7.83	4.87	.00
TREATMENT	Peer Collaboration	6.92	1	6.92	2.46	.10
	Instructor Collaboration	22.66	1	22.66	12.18	.001
DOMINANT * TREATMENT	Peer Collaboration	2.15	4	.53	.21	.93
	Instructor Collaboration	14.38	4	3.59	1.92	.11
Error	Peer Collaboration	163.79	65	2.52		
	Instructor Collaboration	121.54	65	1.87		
Total	Peer Collaboration	975.00	75			
	Instructor Collaboration	452.25	75			
Corrected Total	Peer Collaboration	174.66	74			
	Instructor Collaboration	211.04	74			

Table 20
Post-Hoc Tests of Dominant Learning Styles and Collaboration

Dependent Variable			Mean Difference	Std.Error	Sig.
Peer	CS	AS	-.41	.60	.96
		AR	.11	.55	1.00
		CR	-1.40E-02	.52	1.00
		Split	-.38	.65	.97
	AS	CS	.41	.60	.96
		AR	.52	.61	.91
		CR	.39	.57	.95
		Split	2.78E-02	.70	1.00
	AR	CS	-.11	.55	1.00
		AS	-.52	.61	.91
		CR	-.13	.53	.99
		Split	-.49	.66	.94
	CR	CS	1.40E-02	.52	1.00
		AS	-.39	.57	.95
		AR	.13	.53	.99
		Split	-.37	.63	.97
	Split	CS	.38	.65	.97
		AS	-2.78E-02	.70	1.00
		AR	.49	.66	.94
		CR	.37	.63	.97
Instructor	CS	AS	7.84E-02	.52	1.00
		AR	.13	.48	.99
		CR	-1.59	.45	*.00
		Split	.19	.56	.9
	AS	CS	-7.84E-02	.52	1.00
		AR	5.21E-02	.52	1.00
		CR	-1.67	.49	*.01
		Split	.11	.60	1.00
	AR	CS	-.13	.48	.99
		AS	-5.21E-02	.52	1.00
		CR	-1.72	.45	*.00
		Split	5.90E-02	.57	1.00
	CR	CS	1.59	.45	*.00
		AS	1.67	.49	*.01
		AR	1.72	.45	*.00
		Split	1.78	.54	*.01
	Split	CS	-.19	.56	.99
		AS	-.11	.60	1.00
		AR	-5.90E-02	.57	1.00
		CR	-1.78	.54	*.01

* The mean difference is significant at the .05 level.

Data analysis revealed that CR learners compared with other learning style groups, spent more time interacting with the instructor in the 'By Distance' treatment group. Peer interaction between learning style groups did not differ significantly in comparing 'On-Campus' and 'By Distance' treatment groups.

Research Question 4a,b: Differences Between Treatment Groups in the Amount of Time Spent on Course-Related Learning Activities

An analysis was conducted to investigate whether there were notable differences in the amount of time students spent conducting course-related activities. Table 21 presents descriptive information revealing differences between treatment groups. Table 22 presents the Independent Samples Test of time spent between the groups.

Table 21

Descriptive Statistics of Time Spent Between Treatment Groups

Activity	Group	N	M	SD
Listening to Lectures	'On Campus	39	25.74	1.76
	'By Distance'	36	23.58	2.33
Peer Collaboration	'On Campus	39	3.00	1.41
	'By Distance'	36	3.56	1.63
Studying	'On Campus	39	4.87	1.42
	'By Distance'	36	3.64	1.27
Instructor Collaboration	'On Campus	39	1.09	.76
	'By Distance'	36	2.56	2.06
Assignment Preparation	'On Campus	39	4.87	1.82
	'By Distance'	36	2.81	.75

Table 22

Independent Samples Test of Time Spent Between Treatment Groups

	t	df	Sig.(2-tailed)	Mean Difference
Listening To On-Line Lectures	4.54	73	.000	2.16
Peer Collaboration	-1.58	73	.118	-.56
Studying	3.95	73	.000	1.23
Instructor Collaboration	-4.14	73	.000	-1.47
Assignment Prep	9.38	73	.000	3.07

'On-Campus' students spent significantly more time than 'By Distance' students with listening to lectures t(73) = 4.55 p = 0.015, studying t(73) = 3.96, p = 0.0001, and with assignment preparation t(73) = 9.38, p = 0.0001. 'By Distance' students spent more time with instructor

collaboration than did 'On-Campus' students $t(73) = -4.15$, $p = 0.0001$. There was no significant difference in time spent with peer collaboration between 'On-Campus' and 'By Distance' students.

Research Question 4c. Differences Between Treatment Groups in Total Time Spent on Course-Related Activities

To investigate whether differences existed in the amount of total course learning time between 'On-Campus' and 'By Distance' students, a t-test was performed using the tabulated totals from students' logbooks. Table 23 shows descriptive statistics on the two totals and Table 24 illustrates the demographics and significance between the groups' means, respectively.

Table 23

Descriptive Statistics of Total Time Spent Between Treatment Groups

		N	M	SD
Total Time Spent	'On Campus'	39	39.58	3.02
	'By Distance'	36	35.14	4.20

Table 24

Independent Samples Test of Total Time Spent Between
Treatment Groups

	t	df	Sig.(2-tailed)	Mean Difference
Total Time	5.28	73	.000	4.44

It would appear that 'On-Campus' students spent more
total time engaged in course-related learning ($\underline{M}$ = 39.58, $\underline{SD}$
= 3.02, $\underline{N}$ = 39) than 'By Distance' students ($\underline{M}$ = 35.14, $\underline{SD}$ =
4.20, $\underline{N}$ = 36) $\underline{t}$ (73) = 5.28, $\underline{p}$ = 0.001.

**Research Question 5: Which variables contributed to
achievement?**

'On-Campus' Group Regression Analysis

#1 Total Time Spent on Course-Related Activities

For the 'On-Campus' group, total time spent was
measured according to logbook time recorded doing: lectures,
studying, assignment preparation, instructor collaboration,
and peer collaboration. These variables were used as
possible predictors for achievement. See Table 25 for the
model summary and Table 26 for the ANOVA of time spent and
achievement for the 'On-Campus' group.

Table 25

Model Summary of Time Spent and Achievement for 'On-Campus' Group

	R	R Square	Adjusted R Square	Std. Error of the Estimate
Model 'On Campus'	.31	.10	-.03	2.09

Table 26

ANOVA of Time Spent and Achievement for 'On-Campus' Group

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.36	5	3.27	.74	.59
	Residual	144.71	33	4.38		
	Total	161.07	38			

A regression analysis did not produce a significant correlation between total time spent on course-related activities and achievement $F_{(6, 32)} = 0.89$, $p = 0.51$. Hence, the total time spent on course learning was not a valid predictor of achievement.

'By Distance' Group Regressions

#1 *Barriers to Access*

Five survey-item questions that represented potential barriers to accessing the course material over the Internet were used as possible predictors to achievement. They were as follows:

- Computer processing speed,
- Modem speed,
- Amount of RAM,
- Amount of computer hard drive space,
- Internet Service Provider

See Table 27 for the model summary and Table 28 for the ANOVA of barriers to access for the 'By Distance' group.

Table 27

Model Summary of Barriers to Access over Internet for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance' .163	.026	-.205	1.37

Table 28

ANOVA of Barriers to Access over Internet for 'By Distance'
Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.07	5	.21	.11	.99
Residual	39.59	21	1.88		
Total	40.66	26			

A regression analyses failed to find significant
correlations between barriers to access and achievement
$F(5,21) = 0.11$, $p = 0.99$. Therefore, technology, in this
study, was not a significant factor in hindering student
performance.

#2 Student Satisfaction

A measure of student satisfaction with various elements
of the course was used as a predictor for achievement in the
'By Distance' group. Student satisfaction was measured
using nine variables including satisfaction with:

- Website content
- Website audio/video lectures
- Website learning environment
- Website chatrooms
- The instructor's facilitation abilities
- Level of student-student interaction
- Level of student instructor interaction
- Learning at a distance
- Computer access to the course website

Refer to Table 29 for the model summary and Table 30 for the ANOVA of student's satisfaction and achievement for the 'By Distance' group.

Table 29

Model Summary of Student's Satisfaction and Achievement for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance' .564	.31	.07	1.09

Table 30

ANOVA of Student's Satisfaction and Achievement for 'By Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.70	9	1.53	1.24	.29
Residual	29.43	25	1.17		
Total	43.14	34			

A regression analyses failed to find significant correlations with these variables and achievement $F(9,25) = 1.29$, $p = 0.29$.

Of particular interest, however, was the contribution of the variable student-instructor interaction, $t = -2.13$, $p = 0.04$. Table 31 illustrates this finding.

Table 31

Coefficients of Student's Satisfaction and Achievement for
'By Distance' Group

	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	3.75		9.97	.00
Web Site Text	.29	.25	1.32	.19
Audio/Video Content	.33	-.10	-.54	.58
Web Site's Learning Environment	.42	.35	1.83	.07
Chat Rooms	.58	.18	.71	.48
Instructor's Facilitation Abilities	.28	-.04	-.21	.83
Student-Student Interaction	.43	-.25	-1.29	.20
Student-Instructor Interaction	.31	-.40	-2.13	.04
Learning At A Distance	.33	-.13	-.68	.50
Computer Access To Web Site	.44	-.18	-.76	.45

Data revealed that the level of student-instructor
interaction (which was reported to be higher for the 'By
Distance' group when compared to the 'On-Campus' group)
significantly related to achievement and, hence, could be
said to be a valid predictor of performance in the final
examination.

 # 3 Comparison to Conventional Classroom Instruction

A student's comparison of distance learning to
conventional classroom was used as a possible predictor to

achievement. This comparison was measured according to

seven variables including whether they:

- communicated more with the professor
- communicated more with their peers
- were more motivated
- preferred learning at a distance
- spent more time working on course material
- did better because it was offered on the internet
- found that the on-line course better accommodated their needs.

See Table 32 for the model summary and Table 33 for the

ANOVA comparison for the 'By Distance' group.

Table 32

Model Summary of Comparison to Conventional Classroom and
Achievement for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance' .226	.051	-.145	1.19

Table 33

ANOVA of Comparison to Conventional Classroom and
Achievement for 'By Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.20	6	.36	.25	.95
Residual	41.02	29	1.41		
Total	43.22	35			

A regression analyses failed to find significant
results between comparison to conventional classroom
instruction variables and achievement $F(6,29) = 0.26$, $p =$
0.95. Therefore, students' attitudes towards the distance
learning medium did not contribute significantly to
achievement.

4 Perceived Learning Barriers

The following pre-survey questions, speculated as
possible barriers, were used as possible predictors of
achievement:

- Computer access
- Computer experience
- Learning style
- Personality style
- Time (schedule)
- Motivation
- Work style

See Table 34 for the model summary and Table 35 for the
ANOVA of the perceived barriers and achievement for the 'By
Distance' group.

Table 34

Model Summary of Perceived Barriers and Achievement for 'By
Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance'			
.66	.44	.29	.95

Table 35

ANOVA of Perceived Barriers and Achievement for 'By
Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	18.98	7	2.71	3.03	.01
Residual	24.16	27	.89		
Total	43.14	34			

A regression analyses using these variables as predictors of achievement produced significant results $F(1,33) = 10.01$, $p = 0.01$. In particular, Time (schedule) was positively correlated with achievement $t = 2.50$, $p = 0.02$. Table 36 shows the significance of each variable.

Table 36

Coefficients of Perceived Barriers and Achievement for 'By Distance' Group

	Std.Error	Standardized Coefficients	t	Sig.	Correlations	
		Beta			Zero-order	Partial
Constant	1.46		23.40	.00		
Computer Access	.35	-.20	-1.30	.18	-.22	-.25
Computer Experience	1.05	.20	1.30	.20	.41	.24
Learning Style	.20	-.16	-.93	.34	.05	-.18
Personality Style	.28	.19	1.20	.22	.24	.23
Time	.14	.43	2.50 *	.02	.48	.43
Motivation	.44	-.13	-.93	.37	-.18	-.17
Work Style	.45	-.17	-1.1	.25	-.18	-.21

A significant positive correlation existed between perceived time barrier and achievement. It would appear that students, who reported potential problems accommodating their distance education course schedule in the pre-survey, were more likely to do well on the final examination. In other words, a perceived busy schedule at the start of the semester was positively correlated with achievement.

5 *Computer Usage*

The pre-survey asked students to estimate (in hours) their total weekly usage of computer-related applications. Total number of hours spent on various computer applications was measured and used as possible predictors of achievement in the 'By Distance' Group. These variables included:

- Email
- Word processing
- Faxing
- The Web
- Games
- Other related applications

A regression analyses did not reveal any significant relationships between these variables and achievement $F(6,28) = 1.76$, $p = 0.14$. Table 37 for the model summary and Table 38 for the ANOVA for the total number of hours spent on the computer and achievement for the 'By Distance' group.

Table 37

Model Summary of Total Number of Hours Spent on Computer and Achievement for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
By Distance .52	.27	.11	1.01

Table 38

ANOVA Total Number of Hours Spent on Computer and Achievement for 'By Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	11.70	6	1.95	1.76	.14
Residual	30.97	28	1.10		
Total	42.68	34			

In summary, data analysis indicated that students' background experience with computer technology at the start of the course neither contributed to nor compromised their learning experience in this distance course. It would appear that computer experience was not influential on achievement.

#6 Total Time Spent on Course-Related Learning

Students' total time spent with all aspects of the course, according to log time recorded, was used as a possible predictor for achievement for the 'By Distance' group. See Table 39 for the model summary and Table 40 for

the ANOVA of total time spent and achievement for the 'By

Distance' group.

Table 39

Model Summary of Total Time Spent and Achievement for
'By Distance' Group

	R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance'	.144	.021	-.008	1.12

Table 40

ANOVA of Total Time Spent and Achievement for 'By Distance'
Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	.90	1	.90	.72	.40
Residual	42.32	34	1.24		
Total	43.22	35			

A regression analyses did not produce a significant

correlation between this variable and achievement $F(1,34)$ =

0.72, p = 0.40. Hence, the amount of time students spent

engaged in course-related tasks as a whole did not

significantly contribute to achievement.

#7 Collaboration

The next part of the analysis looked specifically at the influence of student collaboration as measured by the logbook files. A variable was created (by summing the scores for student-student and student-instructor interaction) that represented students' summed interaction during the distance course. This new variable, named 'Total Interaction', was used as a possible predictor of achievement for the 'By Distance' group. See Table 41 for the model summary, Table 42 for the ANOVA, and Table 43 for the coefficients of total interaction and achievement for the 'By Distance' group.

Table 41

Model Summary of Total Interaction and Achievement for 'By Distance' Group

R	R Square	Adjusted R Square	Std. Error of the Estimate
'By Distance'			
.36	.13	.10	1.05

Table 42

ANOVA of Total Interaction and Achievement for 'By Distance' Group

	Sum of Squares	df	Mean Square	F	Sig.
Regression	5.60	1	5.60	5.06	.03
Residual	37.62	34	1.10		
Total	43.22	35			

Table 43

Coefficients of Total Interaction and Achievement for 'By Distance' Group

	Standardized Coefficients		t	Sig.	Correlations	
	Std. Error	Beta			Zero-order	Partial
(Constant)	1.65		23.60	.00		
Total Interaction	.188	.360	2.25	.03	.36	.36

A significant positive correlation was found between 'Total Interaction' and achievement $F(1,34)$ = 5.06, p = 0.03, t = 2.25, p = 0.01. Analysis revealed that one of the reasons for students 'By Distance' performing better than 'On Campus' students may have been because of on-line collaboration opportunities. This analysis also suggested that 13% of the variance in the achievement scores was accounted for by 'Total Interaction', a significant finding.

Qualitative Analysis

In addition to collecting quantifiable information, the survey also contained a section for qualitative data collection. Short-answer questions were used to provide students with an opportunity to express their views regarding their course learning experiences. This section will present some of the more salient comments written by students. Where applicable, comments have been organized according to themes that emerged from qualitative data analysis.

Major Themes

Theme 1--<u>Students liked the flexibility of working by distance</u>.

Comment 1: "I found that I could continue working at my job, tend to the kids and still receive credit towards my degree."

Comment 2: "I could not have done this course if it was not offered over the Internet by distance."

Comment 3: "Although I would have preferred taking this course face-to-face, I am fortunate to have had the opportunity to take part in this course and this degree at a distance. It was really nice to have such flexibility while working. I never thought I'd be so tied to computers, seeing that I used to be afraid of them. Now all I do all day is sit in front of one…These courses are great for me."

Analysis Summary

Survey closed-ended data revealed that students most often cited taking the course because of scheduling, and not because it was offered at a distance. Open-ended qualitative data was consistent with this finding. Clearly, students felt that the course "fit" into their lives and were appreciative of the opportunity to learn at a distance.

Theme 2--Distance students found the Web medium to have potential to enhance learning.

Comment 1: "I liked the course website. It was great to have the videos and audio clips available. I enjoyed being able to have all the material within my reach at any time."

Comment 2: "I have taken classes on campus and found this one to be more productive…I felt in control of my learning more."

Comment 3: "To me the Internet is amazing because I can do my research for my papers, learn from the course website and communicate with others all in the same environment…I really liked being so connected throughout this course.

Analysis Summary

Open-ended analysis illustrated students' appreciation for the Web as a learning medium. As a whole, the class enjoyed learning via the Internet, and often wrote of its inherent power as a learning tool.

There were no comments that mentioned the course website being detrimental to learning. Problems related to instructional design of the website were either not encountered or not mentioned in the open-ended part of the survey.

Theme 3--<u>The technology (bandwidth and hardware) still needs</u> <u>to catch up with the capabilities of the course website</u>.

Comment 1: "The videos were great…when they worked. I have a 14.4 modem and it was trying at times to get connected to the website and take advantage of all of the features."

Comment 2: "I found the chat room sessions to be frustrating. My computer froze up sometimes, forcing me to quit and restart. I missed lots of discussions because of this. Thank goodness for the chat transcripts!"

Comment 3: "My service provider always kicked me off mid-way through a three-hour chat session or something else important I was doing on-line. It was maddening to have to reconnect and miss something important that happened while I was getting back on the Internet. This was not fun! And the problem is I don't know how to rectify this problem for future distance courses."

<u>Analysis Summary</u>

Students, as a whole, had the technological capabilities to access the course website; however, there

were some unanticipated problems with course access
including Internet provider issues, slow modem connections,
and problems with accessing JAVA-supported chatrooms. While
these problems did not hinder learning outcomes as measured
by post-test achievement, they did cause some understandable
frustration for students.

Theme 4--Communicating in the Web environment was effective
in creating a sense of community.

Comment 1: "The chat sessions were valuable to me. I
got to ask the instructor questions and hear what others in
the class had to say about certain issues."

Comment 2: "The best part of learning on-line…was the
chat sessions. I looked forward to my once a week seminars.
It allowed me to connect with others in the class…I didn't
feel lonely like I have in other distance education courses
I've taken."

Comment 3: "The chat session really helped to clarify
things for me. I thought it was better than in-class
lectures I have taken part in…it [the chat sessions] was
really helpful to bring the course content to life."

Comment 4: "I liked the course bulletin board system. It was great to post a comment and have others respond to it. It gave me more insight into my opinions."

Analysis Summary

Collaborative, synchronous chat sessions were consistently cited by students as being beneficial in engendering learning and communication. Learners were often "indebted" to the weekly seminars for keeping them connected in what could have been an isolating environment. While mentioned less than the chat sessions, the course asynchronous bulletin board system was also received favorably by the participants.

Results from the open-ended questions are consistent with analysis of the survey's closed-ended questions. Data revealed the significant contribution collaboration made to achievement.

Theme 5--The instructor was an effective on-line facilitator.

Comment 1: "I think the instructor was great. He really used the chat sessions to get us all involved…I liked the

issues that arose in the chat sessions and bulletin board postings."

Comment 2: "This was a good course. The instructor really knows how to teach at a distance...much more effective than previous teachers I've had [at a distance]."

Comment 3: "[The instructor] was good at teaching using the Internet. I felt that I was really connecting with him during the chats and even through Email. The course videos helped me get a sense of what he looked like so I could create a mental picture of him when he lectured online."

Analysis Summary

It is clear from the majority of student comments that the educator was effective at using the medium to its full potential. Distance students consistently wrote of his "insightful" and "enlightening" chat sessions.

Uncategorized Responses

While most comments could be categorized according to major themes, some could not. This section will present some comments which were atypical but, nonetheless, germane to this discussion.

One student, in response to frustration experienced in chatroom sessions commented:

"I absolutely loathed the chat sessions. I could not follow conversations for more than a few minutes. People were hyper, constantly butting-in comments and not letting the professor finish his thoughts. I think it was like watching a lecture with 20 people talking in front of you…except I couldn't say 'Be quiet' like I'm used to doing in a lecture theatre on campus…There needs to be more stringent guidelines for on-line chats…Common decency should not be lost when chatting on-line!"

This student has identified a significant issue related to Web-based teaching. Conducting effective chat sessions is an under-researched area that requires more attention. The next chapter will address this student's comment in detail.

While most students found the distance communication environment to be beneficial, one student commented:

"What options are there for students who can't type good? The chatrooms rely on my typing speed which is pathetic. I couldn't keep up with the discussions so I

ended up being silent most of the time. This may have
affected my mark to do with course participation… I
wish they would come up with some other way to give
thoughts over the Internet than by typing. It's not
fair to those who can't do it very good."

Current Internet technology is quite limited in that
the majority of communication interactions are textually-
based in nature; hence, proficient use of the keyboard is
often necessary. However, recent innovations in the use of
Internet telephone and speech-to-text technologies may help
the slow typist overcome barriers to conducting effective
conversations on the Web.

Another student appeared to be frustrated with the lack
of communication experienced with the instructor:

"I was frustrated with the fact that I felt out of the
loop. I had to constantly Email the professor to ask
about things I could have simply known about if this
course was on-campus. Then, the real frustration set in
when I spent days waiting for a response to a question
that should take seconds to answer…There needs to be
some sort of standard or something when it comes to

instructors responding to their Email in an appropriate

amount of time."

This student raised an important concern for the on-

line instructor: the issue of Email etiquette, a topic that

will be discussed further in the following chapter.

These comments, while being atypical of the survey

results as a whole, raise salient issues for on-line

instruction. Recommendations stemming from these comments

have been included in Chapter 9.

Chapter Summary

This chapter explored the research questions first

posed in Chapter 1 of this study. Significant results were

found in a number of analyses. Students at a distance

performed significantly better than students learning on-

campus. Furthermore learning style was related significantly

to achievement; 'On-Campus', CR students performed poorer on

the post-test than did other learning style groups.

In looking at the 'On-Campus' group, data analysis

indicated that learning style was more significantly related

to achievement than time spent on course-related learning

tasks. The 'By Distance' group showed markedly different results. Whereas distance students spent less time engaged in course-related learning, they spent more time with instructor collaboration. Also related positively to achievement were the variables of collaboration and perceived scheduling problems. Learning style was not related to achievement for the 'By Distance' students.

Qualitative analysis confirmed the results found using quantitative analysis. Students, as a group, were satisfied with the instructor and the learning medium.

To summarize quantitative findings that appear in this chapter, Table 44 has been created.

Table 44

Summary Table Including Research Questions and Their Related
Analysis

Research Question	Test	Variables	Analysis	Significant Results
2a. Does achievement differ in comparing on-campus and 'By Distance' students?	Difference in achievement between treatment groups	IV = 'On-Campus', 'By Distance' Covariate = Pretest DV = achievement	ANCOVA	'By Distance' > achievement
2b. Are there differences in student attitudes in comparing groups?	Difference in attitudes toward instructor between treatment groups	IV = 'By Distance', 'On-Campus' DV = treated respectfully, delivered with enthusiasm	ANOVA	'By Distance' > treated respectfully, delivered with enthusiasm
3a. How does learning style relate to achievement?	Difference in achievement between treatment groups and dominant learning styles.	IV = 'On-Campus', 'By Distance', CR, AS, AR, CS, Split Covariate = Pretest DV = achievement	Multivariate General Linear Model	Pretest = NS 'By Distance' > achievement CS>CR, AS>AR, AS>CR, Split>CR Treatment Group x Dominant Learning Style
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'On-Campus' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses	CR -> achievement
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'On-Campus' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses	Total R -> achievement
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'By Distance' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses	NS
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'By Distance' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses	NS

Table 44

Summary Table Including Research Questions and Their Related
Analysis...Continued

Research Question	Test	Variables	Analysis	Significant Results
3b. Are there learning style differences in student-student interaction; student-instructor interaction?	Difference in satisfaction with peer/instructor collaboration with dominant learning style and treatment groups	IV = 'By Distance', 'On-Campus', CS, CR, AS, AR, Split DV = peer collaboration, instructor collaboration	Multivariate General Linear Model	'By Distance' > 'On-Campus' for instructor collaboration CR > CS, AS, AR, Split for instructor collaboration
4a,b Are there differences in the amount of time (in hours) spent on course-related learning?	Difference in time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = time spent listening to lectures, peer collaboration, studying, instructor collaboration, assignment prep.	t-test	'On-Campus' > listening to lectures, studying, assignment prep. 'By Distance' > instructor collaboration
4c. Are there differences in the amount of time?	Difference in total time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = total time spent	t-test	'On-Campus' >
5. Which variables contributed to achievement?	Relationship between total time spent and achievement for 'On-Campus' group	IV = total time spent DV = achievement	Linear Regression Analyses	NS
5. Which variables contributed to achievement?	Relationship between barriers to access and achievement for 'By Distance' group	IV = computer speed, modem speed, amount of RAM, amount of hard drive space, ISP DV = achievement	Linear Regression Analyses	NS
5. Which variables contributed to achievement?	Relationship between satisfaction and achievement for 'By Distance' group	IV = lectures, learning environment, chat rooms, instructor's facilitation abilities, interaction, learning at a distance, computer access DV = achievement	Linear Regression Analyses	NS

Table 44

Summary Table Including Research Questions and Their Related
Analysis...Continued

Research Question	Test	Variables	Analysis	Significant Results
5. Which variables contributed to achievement?	Relationship between a student's comparison to conventional classroom and achievement for the 'By Distance' group	IV = communicate with prof more, communicate with peers more, more motivated, prefer distance learning, more time to work on course material, better because on internet, accommodate needs DV = achievement	Linear Regression Analyses	NS
5. Which variables contributed to achievement?	Relationship between perceived barriers and achievement for 'By Distance' group	IV = computer access, computer experience, learning style, personality style, time (schedule), motivation, working style DV = achievement	Linear Regression Analyses	Time(schedule) -> achievement
5. Which variables contributed to achievement?	Relationship between computer usage and achievement for 'By Distance' group	IV = total hour spent on Email, word processing, faxing, www, games, other applications DV = achievement	Linear Regression Analyses	NS
5. Which variables contributed to achievement?	Relationship between total time spent and achievement for 'By Distance' group	IV = total time spent DV = achievement		
5. Which variables contributed to achievement?	Relationship between total interaction and achievement for 'By Distance' group	IV = total interaction DV = achievement	Linear Regression Analyses	Total interaction -> achievement

Chapter 7

DISCUSSION

Introduction

This study investigated the effectiveness of a Web-based distance learning environment compared to a conventional face-to-face instructional situation. A number of interesting findings stemmed from data analyses, and in this chapter, the research questions posed will be revisited and discussed in detail. The chapter concludes with a summary table for quick reference.

Research Questions Revisited

Research Question 2:   In comparing Web-based distance education to conventional education:

2a. Are there Achievement Differences?

Data analysis, when controlling for pre-test knowledge disparities, found that the 'By Distance' group scored significantly higher on the post-test when compared to the 'On-Campus' group. Although only two points separated the final group averages, low standard deviations contributed to

statistical significance. In practical terms, a two-point difference may not appear to be that considerable or meaningful; however, it has theoretical significance at this point.

While the study by Schutte (1997) has both theoretical and practical significance (20% achievement difference between on-campus and on-line students), the research methodology remains questionable (see Chapter 3).

This present study attempted to equalize the two groups' exposure to content and assignments in order to reduce the effect of external, confounding variables. Both groups met for class discussions once a week for 3.5 hours and had equal testing and assignment expectations. While it was desirable to equalize all aspects of the learning environments, doing so would have failed to tap into the potential of the Web and, thus, may have compromised the validity of the results. Therefore, the 'By Distance' group had more tools available for learning (eg., an asynchronous bulletin board system and reference links to other sites on the Web).

Results from this study contrast somewhat to the report by Russell (1995) who noted no significant differences in distance versus conventional course delivery strategies. In looking at over 200 studies in the area, the author stated:

> While this documentation speaks volumes about the
> futility of these studies, it also acknowledges the
> fact that the questions about the comparative impacts
> of the technologies remains of paramount importance.
> This publication will remain a work in progress until
> it is apparent that the lessons contained herein have
> been heeded (p. 1).

However, as was mentioned in Chapter 3, the compilation

by Russell did not look at Web-based learning, a vastly

different way of learning by distance compared to

teleconferencing or audioconferencing technologies.

2b. Are there differences in student attitudes toward the

instructor and course?

'By Distance' students reported feeling more respected

by the professor, and also reported that the educator had

more enthusiasm when conveying course content. Qualitative

data supported this statistically significant finding. 'By

Distance' students consistently wrote that the course

facilitator was an effective instructor, and contributed to

their achievement in the course (Theme 5 in Chapter 6).

While 'On-Campus' results indicated that the educator

was effective in conveying course content, they show the

disparities that existed between treatment groups. Respect

and enthusiasm variables may have differed between groups

due to the influences of chat sessions. Students may have

felt more connected to the instructor, something that may have contributed significantly to differences between treatment groups. (Chat-related communication issues will be explored further in the latter part of this chapter.)

In terms of attitudinal considerations, research by Palloff & Pratt (1999) found the instructor's attitudes toward the Web-based distance learning environment to be of paramount importance. The authors contended that knowledge of the Web medium is essential when conducting on-line learning. Teaching practices must be modified if effective learning is to transpire (Palloff & Pratt, 1999). It would appear that results indicated the instructor was effective at bridging the gap that existed between the virtual campus and the students in this course.

While the instructor appeared to be effective, a student's anecdotal comment related to the instructor's lack of Email etiquette raises a salient issue related to electronic learning. The student commented that she felt out of touch from the instructor at times, and was disturbed by the untimely responses to her Email queries. When teaching on-line, the educator should make explicit the way Email will be handled so that students are aware of the process at all times. Respect for students' learning needs when

teaching at a distance should be of utmost importance for the on-line facilitator.

Research Question 3.How does learning style (as measured by the Gregorc Style Delineator) relate to:

3a. Achievement

3b. Interaction with instructor and students

As revealed by the data, all learning styles performed equally well in the 'By Distance' group. In contrast, the 'On-Campus' CR learning style group achieved lower final test scores than did the other learning style groups. Figure 2 elucidates these differences.

Achievement Differences Between Groups
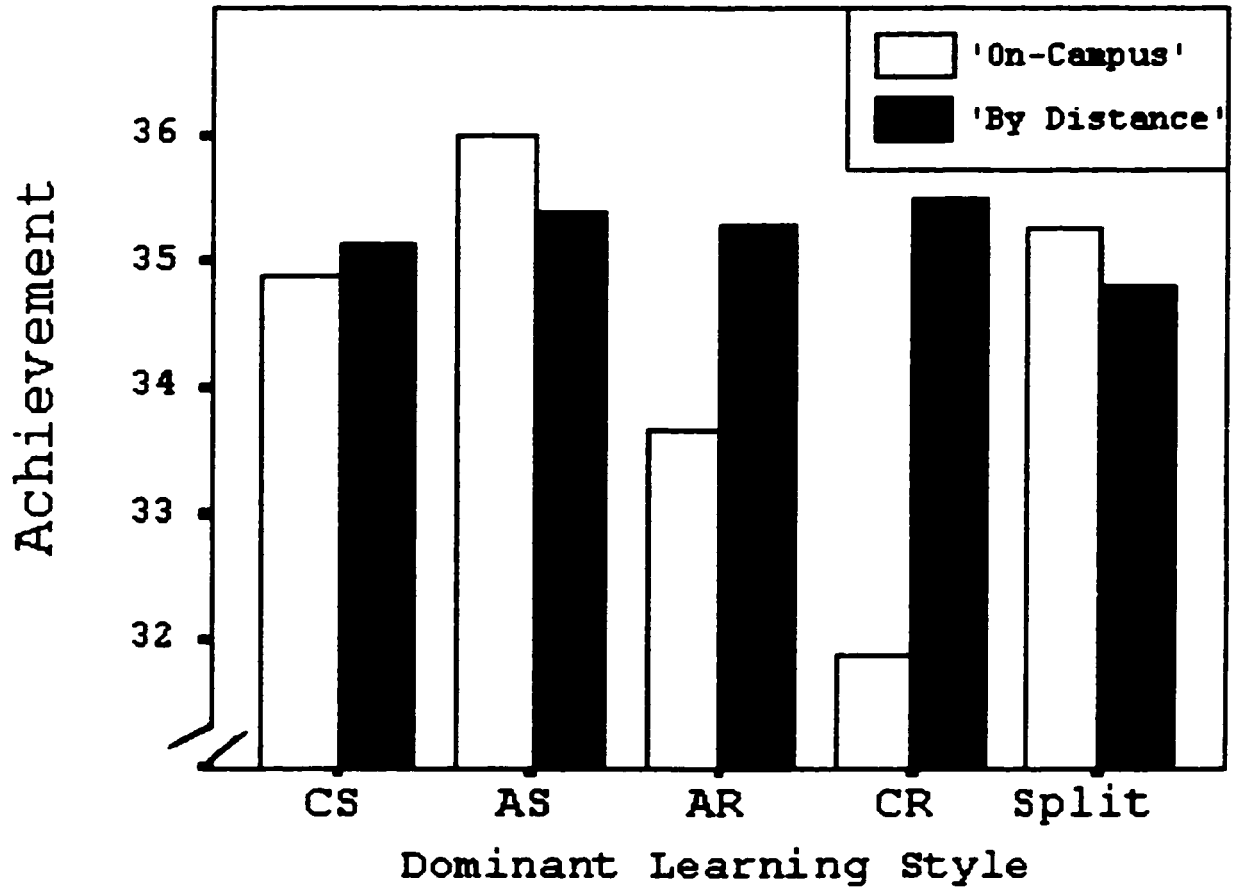
Figure 2. Achievement differences between learning style groups and treatment groups.

It may be postulated that CR learners did better on-line than on-campus due to improved opportunities for instructor collaboration. Butler (1984) suggested that the CR student enjoys interacting with the educator, discussing

course-related issues and working through material relatively independently. The distance environment provides independent learning opportunities and enables the student to approach the instructor for questions or sharing of information (Palloff & Pratt, 1999). Such an environment may have helped distance CR learners to make better sense of course material than their campus-based counterparts.

Of noteworthy significance is the ability of the on-line learning environment in this study to equalize opportunities for all students, regardless of learning style. Findings from this study are congruent with studies by Coggins (1988), Dawson (1991), and Riley, (1993), but contrast with findings from Gee (1990). However, it should be noted that none of these studies investigated learning via the Internet.

While the instructor made some effort to modify instruction when teaching face-to-face, it is apparent that not all learning styles found the campus environment to be accommodating. Results from this study are consistent with Drysdale (1997), who found CR learners to be more likely to withdraw from University in their first year of study. Ross, Drysdale and Schulz (2000) found that in studying 18 university courses, CR (and Random learners in general) achieved lower in courses using the lecture approach to

teaching—an approach used most frequently by the course facilitator in this study.

It is possible that the on-line course environment could compensate for performance disparities often seen in post-secondary university courses such as the ones examined by Ross, Drysdale and Schulz (2000). Results appear to indicate that such was the case for CR learners who participated in this study.

Research Question 4. In comparing Web-based distance education to conventional education are there differences in:

    4a. Student-student interaction?

    4b. Student-instructor interaction?

Analysis revealed significant differences between the two treatment groups. 'By Distance' students reported higher levels of student-instructor interaction than did the 'On-Campus' group.

Distance education research conducted using telelearning, audioconferencing, and other media-supported tools found that student isolation was a common barrier to effective learning environments (Purgliese, 1994). It would

appear that in this study computer-mediated communication supported by on-line chatting, Email, and bulletin board systems provided students improved connectivity with the course instructor. The 'On-Campus' group, while having opportunities to see the instructor during office hours or after class, reported far fewer interactions with the course facilitator. This could stem from the egalitarian nature of the Internet (see Ross in Clower, 1998). Students may have been more inclined to Email the instructor or interact with him because it was seen as less intimidating or less imposing than in-person contact.

Furthermore, chatroom discussions were conducted in a seminar format, where students could interject periodically and pose questions or share views with the instructor. This may have allowed those students, who would be less inclined to participate in the traditional classroom, to make their views be heard on-line. In the process of sharing with others in the electronic environment, the students may have become more comfortable and amicable with each other and the instructor, thereby leading to improved collaboration and relations with each other. This supposition is consistent with views of Hassenplug and Harnish (1998) and Palloff & Pratt (1999).

Harasim (1989) stressed the need for student-instructor and student-student interaction in order to process course material meaningfully. Hirumi and Bermudez (1996) found that relatively few courses taught over the Internet had specific and explicit strategies for supporting communication opportunities, both synchronously and asynchronously. A lack of online resources for communication could pose a problem for those students whose learning style requires social interaction in order to thrive (Butler, 1984).

A study by Ross (1997) found that AR learners may be at-risk for doing poorly when learning from computer-aided instruction (CAI). In the study, learners were given a pre-test, interacted with a computer program and then were given a post-test comprising of the same test items as the pre-test. ANCOVA results indicated an interaction effect between learning style and achievement; whereas CR, AS, and CS learners improved from pre-test to post-test, AR students performed poorer, indicating some sort of "unlearning" or "cognitive interference" took place during the CAI session.

This present study found the 'By Distance' group achievement to be consistent across learning styles. In contrast to the study by Ross (1997), learners in this study were given social opportunities within the CAI (or in this case Web-based) environment.

Indeed, when learning on the Internet, the computer for the AR learners may have been secondary to the learning goals. AR performance was not significantly different than the other learning style groups. It is posited that the lack of significant differences between the learning style groups stemmed from the ample collaborative opportunities presented in the Web-based course environment. Hence, the findings from this study may be viewed as consistent with views shared by Ross (1997) in that the author recommended:

> Opportunities for group work should be provided to those students who are hesitant to work alone on the computer. Research has shown that AR students enjoy working with others and sharing ideas during the learning process. Since the focus shifts from working with a machine to working with others collaboratively while using a machine, the potentially negative effects of CAL may be mitigated (p. 99).

Interaction results from this study are somewhat consistent with findings by Schutte (1997). The author found student-student interaction to be greater for the Web-based course participants compared to students on-campus. While the study did not indicate how interaction variables were measured, the author suggested that peer collaboration led to higher learning outcomes recorded by the distance group.

It may be argued that 'On-Campus' students may not have included student-instructor interaction if it occurred as

part of the weekly lectures (although the logbook explicitly

stated to do so). Failing to report such classroom

occurrences may have contributed to statistically

significant differences between the 'On-Campus' and 'By

Distance' groups. However, on-line students, in completing

the post-survey questions reported that they *perceived* they

interacted more with others; hence, both perception and

actual reported events were consistent with the 'By

Distance' group.

It may also be argued that group Emails or other forms

of mass communication may have been perceived by distance

students as individual contact with the instructor. While

this may be the case in some instances, it could not have

contributed to statistically significant differences between

the two groups. Only thrice did the instructor Email the

entire group. It is highly doubtful that reporting one or

two 5-minute Email "conversations" would have made much of

an impact on the overall results, when logbook scores were

tabulated according to hours.

In summary, results indicate that the 'By Distance'

group spent significantly more time that the 'On-Campus'

group engaged in course-relevant communication with the

instructor and other students. Logbook results and survey

questions answered point toward improved collaboration when learning on-line.

4c. The amount of time (in hours) spent on course-related learning?

It would appear that the 'On-Campus' group spent significantly more time engaged in course learning tasks than did the 'By Distance' group. Analysis revealed that the 'On-Campus' group spent more time with lectures, assignment preparation, and studying than did the 'By Distance' students. While distance learners spent a greater portion of time collaborating than did student learning in the campus environment, they still reported lower overall time spent on course-related tasks.

It is not surprising to see the differences between the lecture categories. Students in the on-line environment had 12 short 30-minute lecture summaries, while students on-campus had 12, 3.5-hour sessions (Recall, however, that on-line weekly 3.5-hour chat sessions compensated for this apparent disparity). Of noteworthy importance is that the 'On-Campus' group spent more time overall than did the 'By Distance' group, even though the 'By Distance' group had two more logbook variables to report. Website navigation and listening to on-line lecture summaries were additional

variables not available to the 'On-Campus' group; yet, total time spent with course learning was higher for students learning in the conventional classroom.

Revisiting the 'studying' logbook variable, data indicated that classroom-based students spent more time preparing for the final examination than did distance learners. One possible explanation for this could be that chat sessions enabled students on-line to integrate concepts better, which may have reduced overall study time for this group. Rebel (1987) espoused the virtues of group learning in an electronic environment. This research supposition is also consistent with Harasim (1989), who suggested that collaboration in a distance environment contributes to:

> ...higher order learning through cognitive restructuring or conflict resolution, in which new ways of understanding the material emerge as a result of contact with new or different perspectives (p.55).

Of importance here is the fact that on-campus students spent more time with course activities but achieved less. Just why this may have occurred is explored below.

Research Question 5. What variables contributed to achievement differences?

'On-Campus' Correlates

      Multiple regressions were conducted to investigate what variable(s) was/were most related to achievement when learning on-campus.

      While total time spent was not a significant predictor of performance, learning style was. In particular, the dominant CR learning style was negatively related to achievement. This is consistent with earlier findings, which showed CR learners to do poorer than other learning style groups.

'By Distance' Correlates

      Achievement was significantly different between treatment groups. Unlike other studies (such as Schutte, 1997), this study delved into the data for possible explanations as to *why* there were performance disparities.

      Multiple regression analyses were performed, and results indicated that of the variables: learning style, time spent on course-related tasks, barriers to access, course satisfaction, comparison to conventional instruction,

perceived barriers, previous computer experience, and interaction with others, both student-student and student-instructor interaction contributed significantly to 'By Distance' achievement. It would appear that students were able to make better sense of course material when having the opportunity to communicate with others through the bulletin board system, Email, listserv, and synchronous chat sessions.

Schutte (1997) reported that peer collaboration may have contributed to the 20% difference in achievement recorded by the Web-based participants in his study; however, the researcher did not do any type of regression analysis to prove his theory that interaction contributed to improved test scores.

Harasim (1989) found that learning takes place best when it is in the context of a social culture. Dillon and Walsh (1992) suggested that distance education requires the instructor to establish a personalized, empathic rapport with the students in order to foster a positive learning environment. Smith (1991), in response to the movement toward teleconferencing, stated that student involvement is essential and should be made part of every distance learning environment. This is consistent with statements made by Nipper (1989) and Christensen (1991).

Lentell (1994) wrote that:

…however splendid the printed texts, and however
refined the quality measurement tools [in distance
education] it is the relationship between the tutor and
the learner that determines success or failure (p.50).

A study by Gibson and Graff (1992) found that the most
significant barrier that affected distance students'
performance and contributed to withdrawals was the feeling
of isolation and having few opportunities for discussions or
social interactions.

While interaction related most with achievement,
interesting results were found with the 'perceived barriers'
variable. It would appear that those students who were more
aware of potential barriers performed significantly better
than students who were not as likely to identify barriers at
the outset of the course. Data revealed that 'By Distance'
students who viewed limited time schedules as being a
possible barrier at the outset of the study were more likely
to do well; in fact, results indicated that these students
performed significantly better than students who may not
have been as realistic about the time commitments necessary
to complete the course by distance.

This finding is consistent with research conducted by
Haynes and Dillon (1992), who wrote:

If students perceive the media to be less demanding
then they tend invest less mental effort and therefore
this may contribute to lower achievement scores [in a
distance education environment] (p. 43).

It is logical that students who are aware of potential

barriers such as time scheduling may be more likely to gauge

their learning and attend to overcoming such barriers

throughout their course learning experience. The students in

this study may have been more attuned to the

responsibilities that learning at a distance required. While

student confidence in overcoming perceived barriers is

desirable, it may still be necessary, as a course

facilitator, to stress the need for being aware of the

potential for time problems when learning by distance.

There is no denying that factors such as student

personality style and life circumstances may adversely

affect performance in distance courses (McAlpin, 1997). The

nature of the learning environment requires a great deal of

self-monitoring and motivation (McAlpin, 1997). What is

clear from the results of this study is that students should

approach the distance learning task with a realistic account

of the potential mitigating variables that may impact

performance.

One final note worth mentioning is the fact that

computer experience was not a correlate with student success

in the on-line environment. This contrasts findings by
Diebel, McInnis, and Edge (1998). Studies have shown
computer anxiety to adversely affect performance when
learning from the computer (Brudenell & Stewart, 1990;
Marcoulides, 1988). In this study, the potentially
confounding variable of computer experience was not found to
be significant. It would appear that: 1) Students who signed
up for the distance learning course were already computer
savvy; 2) Students were willing to learn about the
technology in order to accomplish course goals; or 3)
current technology makes the Web accessible to those who may
not have prior experience.

Descriptive data from survey questions revealed that
overall, students were familiar with the technology, but not
at an expert level; indeed, many were novices. Hence, it may
be that students invested time and energy into learning the
medium in order to achieve the desired goals. On-line help,
instructor monitoring, and technical support throughout the
semester may have circumvented any possible negative impact
on achievement.

As Palloff and Pratt (1999) contended:

Students participating regularly in an on-line course cannot help but improve their ability to use technology. As they engage with the machine, they learn more about word processing, logging on to the Internet, and using a browser. By the end of an online course, a complete novice is likely to have gained enough skill to continue to engage with technology with some degree of confidence (p.137).

Chapter Summary

This exploratory study found significant results for several of the research questions—results that invite further research. Table 45 details the results according to research questions and the associated significant literature examined in this chapter.

Table 45

Summary of Research Questions With Related Results and Discussion

Research Question	Test	Variables	Analysis	Significant Results	Discussion
2a. Does achievement differ in comparing on-campus and by distance students?	Difference in achievement between treatment groups	IV = 'On-Campus', 'By Distance' Covariate = Pretest DV = achievement	ANCOVA	'By Distance' > achievement	Congruent with Schutte (1997) Contrast with Russell (1995). Entry-level domain knowledge did not influence post-test results.
2b. Are there differences in student attitudes in comparing groups?	Difference in attitudes toward instructor between treatment groups	IV = 'By Distance', 'On-Campus' DV = treated respectfully, delivered with enthusiasm	ANOVA	'By Distance' > treated respectfully, delivered with enthusiasm	Influence of on-line chatting and the personable environment it created.
3a. How does learning style relate to achievement?	Difference in achievement between treatment groups and dominant learning styles.	IV = 'On-Campus', 'By Distance', CR, AS, AR, CS, Split Covariate = Pretest DV = achievement	Multivariate General Linear Model	Pretest = NS 'By Distance' > CS>CR, AS>AR, AS>CR, Split>CR Campus x Dominant Learning Style	Butler (1984) suggested CR learners enjoy independent work environments. Drysdale (1997) found CR learners to have difficulty in higher education courses taught on-campus.
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'On-Campus' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses	CR -> achievement	Consistent with Drysdale (1997) and Butler (1984).
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'On-Campus' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses	Total R -> achievement	Consistent with Drysdale (1997) and Butler (1984).

Table 45

Summary of Research Questions With Related Results and
Discussion...Continued

Research Question	Test	Variables	Analysis	Significant Results	Discussion
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'By Distance' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses	NS	Consistent with Dawson (1991).
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'By Distance' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses	NS	The distance learning environment was able to accommodate all learning styles equally. Consistent with Dawson (1991).
3b. Are there learning style differences in student-student interaction; student-instructor interaction?	Difference in satisfaction with interaction with dominant learning style and treatment groups	IV = 'By Distance', 'On-Campus', CS, CR, AS, AR, Split DV = peer collaboration, instructor collaboration	Multivariate General Linear Model	'By Distance' > 'On-Campus' for instructor collaboration CR > CS, AS, AR, Split for instructor collaboration	Survey questions confirm satisfaction with instructor collaboration. CR students felt they collaborated more with instructor. Consistent with Butler (1984).
4a,b Are there differences in the amount of time (in hours) spent on course-related learning?	Difference in time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = time spent listening to lectures, peer collaboration, studying, instructor collaboration, assignment prep.	t-test	'On-Campus' > listening to lectures, studying, assignment prep. 'By Distance' > instructor collaboration	Consistent with Schutte (1997) and Palloff & Pratt (1999) Distance learners felt more connected to the instructor from chat sessions and Email.
4c. Are there differences in the amount of time?	Difference in total time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = total time spent	t-test	'On-Campus' >	Unexpected results considering the by distance group achieved significantly better than the on-campus group.

Table 45

Summary of Research Questions With Related Results and Discussion...Continued

Research Question	Test	Variables	Analysis	Results	Discussion
5. Which variables contribute to achievement?	Relationship between total time spent and achievement for 'On-Campus' group	IV = total time spent DV = achievement	Linear Regression Analyses	NS	Indicates that time was not a significant contributor to achievement.
5. Which variables contribute to achievement?	Relationship between barriers to access and achievement for 'By Distance' group	IV = computer speed, modem speed, amount of RAM, amount of hard drive space, ISP DV = achievement	Linear Regression Analyses	NS	Hardware Barriers did not affect achievement. Illustrates that computer technology did not affect performance.
5. Which variables contribute to achievement?	Relationship between satisfaction and achievement for 'By Distance' group	IV = lectures, learning environment, chat rooms, instructor's facilitation abilities, interaction, learning at a distance, computer access DV = achievement	Linear Regression Analyses	NS	Illustrates that student satisfaction did not impact performance in course.
5. Which variables contribute to achievement?	Relationship between a student's comparison to conventional classroom and achievement for the 'By Distance' group	IV = communicate with prof more, communicate with peers more, more motivated, prefer distance learning, more time to work on course material, better because on internet, accommodate needs DV = achievement	Linear Regression Analyses	NS	Comparison variables were not influential on achievement.

Table 45

Summary of Research Questions With Related Results and
Discussion...Continued

Research Question	Test	Variables	Analysis	Significant Results	Discussion
5. Which variables contribute to achievement?	Relationship between perceived barriers and achievement for 'By Distance' group	IV = computer access, computer experience, learning style, personality style, time (schedule), motivation, working style DV = achievement	Linear Regression Analyses	Time(schedule) -> achievement	Perception of barriers contributed to greater achievement. Consistent with Haynes & Dillon (1992) comments about relationship between perception of barriers and mental effort exuded.
5. Which variables contribute to achievement?	Relationship between computer usage and achievement for 'By Distance' group	IV = total hour spent on Email, word processing, faxing, www, games, other applications DV = achievement	Linear Regression Analyses	NS	Previous experience with computers did not significantly affect final achievement. Contrasts studies by Marcoulides (1988).
5. Which variables contribute to achievement?	Relationship between total time spent and achievement for 'By Distance' group	IV = total time spent DV = achievement	Linear Regression Analysis	NS	Consistent with Schutte (1997) Interaction was most related variable to achievement.
5. Which variables contributed to achievement?	Relationship between total interaction and achievement for 'By Distance' group	IV = total interaction DV = achievement	Linear Regression Analyses	Total interaction -> achievement	Consistent with Harasim (1989) who suggested electronic communication improves learning.

Chapter 8

LIMITATIONS AND OPPORTUNITIES FOR FUTURE RESEARCH

Limitations

As with most any empirical study, a number of

limitations emerged as this study progressed. Some of these

limitations may affect the validity, reliability and

generalizability of results. It should be reiterated,

however, that this study was meant to serve as an

exploration of a number of research questions; future

research studies should address some or most of these

limitations in order to improve the robustness of the

findings.

1. Assessing learning style requires inventory-takers to

    have a clear understanding of themselves and the world

    around them. The Gregorc Style Delineator uses a self-

    report format that relies completely on recipients to

    judge themselves correctly.

2. The Gregorc Style Delineator is based on ranking words.

    Some students may guess at the meaning of words, while

    others may rank the words on the basis of how they

would "like to feel" or how they think others may view
them.

3. Although every effort was made to ensure students
   understood the mechanics of the Gregorc Style
   Delineator, final learning style scores may.be
   incorrect. Some individuals may fail to rank the words
   correctly (i.e., 4-3-2-1). Instead, they rank their
   first choice with a score of 1 and they give their
   fourth choice a rank of 4.

4. O'Brien (1991) reported much lower reliability
   coefficients than those published by Gregorc for the
   Style Delineator. Alpha coefficients in O'Brien's study
   ranged from 0.51 to 0.64. However, O'Brien stated:
   "while substantially lower than the coefficients
   originally reported by Gregorc, the reliability indices
   were within an acceptable range" (p. 14).

5. This study used a course that was taught in a non-
   traditional post-secondary field with a specific
   student population; hence, it is difficult to
   generalize results to unrelated courses offered on-line
   or on-campus.

6. Students were not randomly assigned to the treatment groups.

7. This study used a relatively small sample size of 75 students, both limiting the kinds of quantitative analyses that could be conducted and reducing the generalizability of results.

8. It is difficult in educational research to select random samples. This study relied on volunteers, a limitation because these individuals may not be representative of the greater student population.

9. To reduce the scope and breadth of the study, analyses were limited to quantitative methods. While inferential statistical procedures show significance with numerical data, there remains the need for qualitative analyses to shed light on the nature of students' learning experiences. This study limited qualitative analyses to short-answer questions on post-treatment surveys.

10.   To examine interaction patterns, participants were required to complete regularly student logbooks, a

potential limitation. While every effort was made to reduce the amount of time participants were required to complete the logbook, the task may have been viewed as burdensome by some volunteers. Students may have missed documenting certain interactions due to forgetfulness, or they may have lumped what were supposed to be individual events as one recorded event. Some may have fabricated entries to make up for lost weeks, while others could have invented extra events to look busier than they really were.

11. This study focused on one group of students during one semester of study. It is therefore difficult to generalize results to other courses taught over the Internet.

12. This study was quasi-experimental in nature. The researcher did not have control over the independent variables and students were not randomly assigned to treatment and control groups; therefore no specific cause and effect relationships could be determined.

13. This study assumed truthful and candid responses from participants in answering the survey questions.

Furthermore, the survey was not tested for reliability factors.

Suggestions for Future Research

This study has some significant implications for traditional and distance education programs. The following recommendations are suggested for future research:

1. A study should be conducted which uses all 87 points of *Ross' Wish List for Distance Educators* (Appendix A) as opposed to the 65 items implemented for the purposes of this study. It would be interesting to see if interaction and achievement differences between web and traditional education programs would be more pronounced than what was observed in this study.

2. Future research should look qualitatively at students' experiences with learning on-line and in the conventional classroom. For example, students commented repeatedly on their surveys that they felt extremely involved in the web-based course. Interviews should be conducted with

both groups to ascertain what factors contributed to such feelings.

3. A study should be conducted that looks qualitatively at how the instructor's role changes when facilitating on-line versions or traditionally taught courses. Such a study would be beneficial for professors wishing to adapt course material and delivery styles for the Internet.

4. To improve reliability, future research examining learning patterns on-line should use web audit trail files to track and record student behaviors. Certain portions of student logbook files could be generated automatically by the web server, improving the reliability of results.

5. There is a need for more empirical research in the relatively new area of web-delivered distance education programs. This study should be replicated with a larger sample size and using more generalizable first-year courses such as Biology, Physics, and Political Science.

6. This study was exploratory in nature. There remains the need for sound experimental studies to be conducted in

the area. Specific hypothesis testing is recommended to improve the power of statistical results.

7. This study found that the traditional classroom may not be as accommodating to the learner as the Web. A future study should be conducted which investigates what variables contribute to the disparities in achievement found to exist between learning style groups.

8. This study found the web to enhance student-student and student-instructor collaboration markedly above that of the classroom. Most correlated to this finding were the on-line chat rooms. Future research should explore ways for the educator to conduct effective synchronous chat room sessions. Currently, there is little research in this area while sources abound for the conventional classroom educator.

9. A study should be conducted which compares student learning and interactions in a course created *using Ross' Wish List for Distance Educators* (Appendix A) to a course delivered using another instructional design model.

10.A qualitative study should investigate instructor's
   attitudes toward teaching on-line and in a conventional
   classroom. Results could shed light on how educator's
   motivation affects student achievement.

Chapter 9

CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This study examined the effects of student learning and interacting over the Internet using the conventional classroom for comparative purposes. It was found that the Web enhanced collaboration and accommodated students' individual learning styles better than face-to-face instruction. In comparing on-campus with distance students, it would appear that the 'By Distance' group scored higher on the post-treatment examination when controlling for entry-level domain knowledge. However, while all learning styles appeared to be accommodated on-line, such was not the case in the conventional classroom under investigation. Achievement results revealed disparities between final performance outcomes of learning style groups in the 'On-Campus' classroom. CR learners scored significantly lower on the final examination than did the other three learning style groups.

Hence, it would appear that in this study, the on-line learning environment was a more effective learning medium than the traditional classroom. If future research finds

similar results, then resistance to distance education by academic institutions may be quelled.

Conclusion

According to Katz (1999), today's post-secondary institutions are having to cope with a new environment in which information technology is becoming a more powerful and ubiquitous learning tool. Indeed, emerging technologies such as the Internet have caused universities and colleges to reconceptualize the role of education in the last part of the 20th century (Farris, 1993). Part of this restructuring includes the need to do things *differently*. To survive and prosper, institutions of higher learning will have to shift from relying on traditional methods of educating the student population--a population that is changing demographically.

Distance education programs, using the Web as the learning medium, continue to draw the attention of post-secondary institutions wishing to capture more "market share". Results from this study appear to indicate that investing time, resources, research, and most importantly money into developing more effective on-line course environments may be a wise decision considering the potential of the Internet for equalizing learning

opportunities and reaching students who may otherwise be denied a higher education.

However, "Technology by itself is neutral…It is essential that we place pedagogy above technology" (Thornberg, 1992; p.49). There remains a need to focus greater attention on the distance educator's skills and on developing more effective on-line course environments; the technology merely acts as a medium to convey information.

At this point, the Web as an instructional environment is in its infancy. Developments to improve transmission speed, interface interactivity, and multimedia capabilities will enhance further the learning environment provided to students. Virtual campuses will burgeon and prosper once the Web's capabilities catch up to its popularity.

To ensure, then, that the inherent power of the Internet is harnessed and wielded for the benefit of the student, further research on ways to create--and to determine the impact of--more *learner tolerant* on-line learning environments is necessary. As I wrote:

In the "race" to develop on-line worlds which seek
to bring the classroom to the home environment,
the learner who possesses a number of individual
differences should not be overlooked...If schools
are going to move towards a web-based model of
distance education, then more "tolerant" learning
environments need to be constructed. Just as the
educator must evaluate critically the methods and
delivery style used in the traditional classroom,
so the on-line course facilitator must continue to
move beyond the idea of using one format to teach
many learners. Too many minds are at stake to go
off-course while on-line (Ross, 1998; p.20).

Recommendations for Post-Secondary

Distance Education Programs

The following recommendations are guidelines for the
successful facilitation of web-based post-secondary distance
education programs. Because the use of the Internet to
deliver distance education is increasing rapidly, *it remains*
essential for programs to create and deliver educationally
sound learning environments for students. The following
recommendations are designed to help program administrators,
course developers, educators, and students make maximal use
of the findings of this study.

1. Course Learning Environments-- In an effort to create
   more "tolerant on-line learning environments" (Ross,
   1998), course developers are encouraged to implement as
   many features as possible from *Ross' Wish List* (Appendix
   A). Opportunities for collaboration, judicious use of
   multimedia technology, and well-designed user interfaces
   are some of the ways to ensure learners are accommodated
   on-line.

2. On-Line Collaboration Opportunities-- This study found
   that all learning styles were accommodated on the Web. To
   help ensure equalization in future courses, it is
   recommended that on-line course instructors provide a
   minimum of weekly scheduled on-line chat seminars so that
   students--especially those who are sequential learners--
   have a chance to attend virtual lectures. There should
   also be an opportunity for AR and other CR learners to
   informally "chat" about topics as they relate to course
   material. Just as the face-to-face educator must vary
   teaching styles to meet the needs of all learners in the
   classroom, so too should the on-line educator strive to
   provide diverse learning experiences for the distance
   student.

3. The Need for Continued Teaching Development--

   Interestingly, this study found that students' learning

   style impacted learning outcomes in the classroom. Some

   students performed better or worse depending on the

   "relatively innate and permanent cognitive trait" (Ross,

   Drysdale & Schulz, 1999).

   It is therefore essential that teaching faculty

   study in detail ways to accommodate all learning styles

   in the conventional classroom. There are still many

   classes that are taught in singular delivery fashions

   that can jeopardize student achievement and ultimately

   lead to student drop-outs (Drysdale, 1997, Ross, Drysdale

   & Schulz, 2000).

4. Making the Transition From the Campus to the Web--

   Institutions should provide workshop development for

   faculty on how teaching and learning changes on-line.

   Faculty are encouraged to move at their own pace through

   the levels of the Tri-Modal Model for web-based course

   delivery (Wilkinson & Ross, 1997). Starting at a full-

   course-delivery-level may be a daunting task for the

   educator with little experience using the Web to teach

   course material (Ross & Schulz, 1996).

5. The Efficacy of the Web as a Learning Medium--
   Institutions are encouraged to continue pursuing
   initiatives that bring the campus to the students using
   the web as the delivery medium. Results from this study
   point to the potential efficacy of the Internet as a
   delivery medium. Not only can the Web accommodate all
   learning styles if properly designed, it may also enhance
   student-student and student-instructor interaction. In
   this way, the Web may in fact be more effective than the
   conventional classroom, and hence, it may afford students
   a richer and more powerful learning experience.

6. The Need For Clearly Defined Guidelines For Effective On-
   Line "Chatting"-- One of the most under-researched areas
   at the moment is how educators can lead effective on-line
   seminars for courses conducted over the Web. Chatrooms
   can be a powerful replacement for the on-campus classroom
   if they are used properly. The course instructor who
   participated in this study had taught the on-line version
   of his course before and was aware of some of the issues
   involved with chat room seminars. While experience is the
   greatest teacher, it remains essential that guidelines,
   stemming from research, be published for the beginning

and experienced on-line educator. Learning by trial-and-error may not be fair for the student or the educator.

7. <u>The Need for Email Protocols</u>-- Educators who instruct over the internet should be expected to set up guidelines for responding to participants' Email questions. It should be made explicit as to how the issue of Email will be addressed, so that students can feel they are being treated fairly.

8. <u>Effective Evaluation Measures</u>-- Universities interested in improving the quality of their on-line distance learning programs should consult with educational technologists well-versed in instructional design principles and learning theory. Course learning environments should be reviewed and evaluated periodically by focus groups comprised of students and faculty, so that constant revision to the instructional quality can be made.

Table 46 summarizes all facets of this study for quick reference. To conserve space, results and analysis have been combined into one column.

Table 46

Summary of Research Questions With Related Results,
Discussion, and Implications

Research Question	Test	Variables	Significant Results	Discussion	Implications
2a. Does achievement differ in comparing on-campus and by distance students?	Difference in achievement between treatment groups	IV = 'On-Campus', 'By Distance' Covariate = Pretest DV = achievement	ANCOVA 'By Distance' > achievement	Consistent with study by Schutte (1997). Contrast with Russell (1995). Entry-level domain knowledge did not influence post-test results.	If replicated, this study may pave the way for on-line paradigm in higher education.
2b. Are there differences in student attitudes in comparing groups?	Difference in attitudes toward instructor between campus groups	IV = 'By Distance', 'On-Campus' DV = treated respectfully, delivered with enthusiasm	ANOVA 'By Distance' > treated respectfully, delivered with enthusiasm	Influence of on-line chatting and the personable environment it created.	Educators need to become well-versed in how to lead effective on-line chat seminars
3a. How does learning style relate to achievement?	Difference in achievement between treatment groups and dominant learning styles.	IV = 'On-Campus', 'By Distance', CR, AS, AR, CS, Split Covariate = Pretest DV = achievement	Multivariate General Linear Model Pretest = NS 'By Distance' > CS>CR, AS>AR, AS>CR, Split>CR Campus x Dominant Learning Style	Butler (1984) suggested CR learners enjoy independent work environments. Drysdale (1997) found CR learners to have difficulty in higher education courses taught on-campus.	There remains the need for addressing learning styles in the conventional classroom. Students may be adversely affected by traditional stand-and-deliver strategies.
3a. How does learning style relate to achievement?	Relationship between learning styles and achievement for 'On-Campus' group	IV = CS, CR, AS, AR DV = achievement	Linear Regression Analyses CR -> achievement	Consistent with Drysdale (1997) and Butler (1984).	Educators need to vary teaching to ensure that they are reaching all learning styles in classroom.
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'On-Campus' group	IV = total R, total C, total S, total A DV = achievement	Linear Regression Analyses Total R -> achievement	Consistent with Drysdale (1997) and Butler (1984).	Educators need to vary teaching to ensure that they are reaching all learning styles in classroom.

Table 46

Summary of Research Questions With Related Results,
Discussion, and Implications

Research Question	Test	Variables	Significant Results	Discussion	Implications
3a. How does learning style relate to achievement?	Relation between learning styles and achievement for 'By Distance' group	IV = CS, CR, AS, AR DV = Achievement	Linear Regression Analyses NS	Consistent with Dawson (1991).	When designed effectively, On-line environment may be able to accommodate learners better than on-campus environment.
3a. How does learning style relate to achievement?	Relationship between new 'dominant' Gregorc learning styles and achievement for 'By Distance' group	IV = total R, total C, total S, total A DV = Achievement	Linear Regression Analyses NS	The distance learning environment was able to accommodate all learning styles equally. Consistent with Dawson (1991).	When designed effectively, On-line environment may be able to accommodate learners better than on-campus environment.
3b. Are there learning style differences in student-student interaction; student-instructor interaction?	Difference in satisfaction with collaboration with dominant learning style and campus groups	IV = By Distance, 'On-Campus', CS, CR, AS, AR, Split DV = peer collaboration, instructor collaboration	Multivariate General Linear Model 'By Distance' > 'On-Campus' for instructor interaction CR > CS, AS, AR, Split for instructor interaction	Survey questions confirm satisfaction with instructor interaction. CR students felt they collaborated more with instructor. Consistent with Butler (1984).	On-line chatting may have allowed the CR learner easier access to the instructor for questions and discussion-- A feature of Web-Based instruction.
4a,b Are there differences in the amount of time (in hours) spent on course-related learning?	Difference in time spent between campus groups	IV = 'On-Campus', 'By Distance' DV = time spent listening to lectures, peer collaboration, studying, instructor collaboration, assignment prep.	t-test 'On-Campus' > listening to lectures, studying, assignment prep. 'By Distance' > instructor interaction	Consistent with Schutte (1997) and Palloff & Pratt (1999) Distance learners felt more connected to the instructor from chat sessions and Email technology	Chat room discussions may have led to deeper learning by students. Distance courses should require regular chat sessions to ensure student success.

NOTE TO USERS

Page(s) not included in the original manuscript are unavailable from the author or university. The manuscript was microfilmed as received.

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Table 46

Summary of Research Questions With Related Results,
Discussion, and Implications...Continued

Research Question	Test	Variables	Significant Results	Discussion	Implications
4c. Are there differences in the amount of time (in hours) spent on course-related learning?	Difference in total time spent between treatment groups	IV = 'On-Campus', 'By Distance' DV = total time spent	t-test 'On-Campus' >	Unexpected results considering the by distance group achieved better than the on-campus group.	Quantity of time spent on learning may be less important than quality of time.
5. Which variables contribute to achievement?	Relationship between total time spent and achievement for 'On Campus' group	IV = total time spent DV = achievement	Linear Regression Analyses NS	Indicates that time was not a significant contributor to achievement.	Learning style and not time spent with course led to achievement disparities.
5. Which variables contribute to achievement?	Relationship between barriers to access and achievement for 'By Distance' group	IV = computer speed, modem speed, amount of RAM, amount of hard drive space, ISP DV = Achievement	Linear Regression Analyses NS	Hardware Barriers did not affect achievement. Illustrates that computer technology did not affect performance.	Reduces the influence of potentially confounding variables of computer technology; hence "noise" is reduced when studying other variables.
5. Which variables contribute to achievement?	Relationship between satisfaction and achievement for 'By Distance' group	IV = lectures, learning environment, chat rooms, instructor's facilitation abilities, interaction, learning at a distance, computer access DV = Achievement	Linear Regression Analyses NS	Illustrates that student satisfaction did not impact performance in course.	Students, overall, were satisfied with the course environment. This reduces confounding influences of the course learning environment.

Table 46

Summary of Research Questions With Related Results,
Discussion, and Implications

Research Question	Test	Variables	Significant Results	Discussion	Implications
5. Which variables contribute to achievement?	Relationship between a student's comparison to conventional classroom and achievement for the 'By Distance' group	IV = communicate with prof/ peers more, more motivated, prefer distance learning, more time to work on course material, better because on internet, accommodate needs DV = achievement	Linear Regression Analyses NS	Comparison variables were not influential on achievement.	Students learning on-line were not affected by the medium in comparing it with conventional classroom instruction. The Web environment neither contributed to nor compromised students' achievement.
5. Which variables contribute to achievement?	Relationship between perceived barriers and achievement for 'By Distance' group	IV = computer access, computer experience, learning style, personality style, time (schedule), motivation, working style DV = achievement	Linear Regression Analyses Time +> achievement	Perception of barriers contributed to greater achievement. Consistent with Haynes & Dillon (1992) comments about relationship between perception of barriers and mental effort exuded.	Students should be encouraged to take a realistic and candid look at barriers in their lives that may influence learning at a distance. Educators should discuss need for effective planning.

Table 46

Summary of Research Questions With Related Results, Discussion, and Implications

5. Which variables contribute to achievement?	Relationship between computer usage and achievement for 'By Distance' group	IV = total hour spent on Email, word processing, faxing, www, games, other applications DV = Achievement	Linear Regression Analyses NS	Previous experience with computers did not affect final achievement. Contrasts studies by Marcoulides (1988).	It would appear that student computer experience is improving. Computer phobia issues may become less influential as students become more computer-savvy.
5. Which variables contribute to achievement?	Relationship between total time spent and achievement for 'By Distance' group	IV = total time spent DV = achievement	Linear Regression Analysis NS	Consistent with Schutte (1997) Interaction was most related variable to achievement.	
5. Which variables contributed to achievement?	Relationship between total interaction and achievement for 'By Distance' group	IV = total interaction DV = achievement	Linear Regression Analyses Total interaction + > achievement	Consistent with Harasim (1989) who suggested electronic communication improves learning.	

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Search Process

The researcher used the following key words to search the ERIC and Psych Lit databases (both on CD-ROM) and CARL UNCOVER database (on Internet): Gregorc, learning styles and computer; learning styles and distance; cognitive styles and computer; cognitive styles and distance; individual differences and computer/distance, distance and conventional; distance and traditional; distance and comparison; distance education effectiveness; world wide web and distance; internet and distance; communication and distance; social and distance; computer-mediated communication and distance; computer conferencing and distance; interaction and distance.

In addition, the researcher obtained a number of sources from article reference lists, professors and other colleagues and from personal article/book libraries.

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APPENDIX A

ROSS' WEB-BASED COURSE EVALUATION CHECKLIST

APPENDIX A: ROSS' WEB-BASED COURSE EVALUATION CHECKLIST

FEATURES	YES	NO	NA	NOTES
Student Tools:				
Glossary				
Searchable				
Linked to Origins in Body Text				
Words Pronounced				
Course Content Indexed				
Expandable or Contractible Lists				
Indicates What Pages Completed				
Bookmarking/Resume Session				
Searching				
Boolean Operators				
Search for Internal/External Site(s)				
Related Links Page				
Links are Categorized				
Links are Current				
Links Can Be Searched				
Form for Submitting Links				
Note Book Management				
Edit Book's Contents	·			
Print Book's Contents				
Export Text				
On-Line Help				
Extensive				
Available At All Times				
Webmaster's Email Provided				
Collaboration Tools:				
Asynchronous Communication				
Newsgroups				
Listservs				
Bulletin Board System				
Threading				
Sorting (by topic, poster, etc.)				
Post URL/Graphic				
Synchronous Communication				
Chat Rooms				
Transcripts Generated				
Supports Multiple Users				
Private Rooms Can Be Created				
Shared White Board				
Class Lists				
Student Pictures/Interests				
Student Email Addresses				

FEATURES	YES	NO	NA	NOTES
Testing and Recordkeeping:				
On-Line Gradebook				
Class Statistics				
Student Statistics				
Quick Quizzes Provided with Answers				
Multiple Choice Questions				
Short Answer Format				
Timed and Scored				
Submission Forms for Essays				
Functionality:				
Site Map				
Available At All Times				
Clickable Map				
Extensive				
Student Tracking				
Shows Pages Visited/Not Visited				
Total Time Logged In				
Available to Instructor				
Multimedia				
Video				
Streamed (No Download)				
Audio				
Streamed				
Course Messages Area				
Lecture Files Available				
Animations/Shockwave™				
User Interface:				
Consistency of Layout				
Intuitive (e.g.. Self-Explanatory Icons)				
User Feedback (e.g.. Roll-overs)				
Adaptive Interfaces				
Based on Learning Style				
Based on Formative Evaluations				
Based on Field of Experience				
Based on Assignment Preference				
Appropriate Use of Media				
New Window for External Browsing				
Reasonable Load Time				

FEATURES	YES	NO	NA	NOTES
Non-Technical Features:				
Print Version of Student Handbook				
Face-To-Face Orientation Day(s)				
Student Survey/Feedback On-Line				
Computer-As-Tool Philosophy				
Off-Line Learning Materials				
Off-Line Assignments				
Learning Styles Assessed/Interpreted				
Total: _____				

APPENDIX B

DISTRIBUTED   MATERIAL FOR   'ON-CAMPUS' AND

'BY DISTANCE' STUDENTS

APPENDIX B: LETTER OF TRANSMITTAL BY DEPARTMENT HEAD

Dear Community Rehabilitation Student:

As you may know, Community Rehabilitation Studies is exploring new ways of delivering educational opportunities to students. Over the last several years, we have expanded our program to include students from throughout Alberta and across Canada. Both the BCR ACCESS program and the Pan-Canadian M.Ed. program allow students to learn at a distance using Internet technology.

While our program has been extremely successful, we are interested in researching ways to improve it. Recently Community Rehabilitation Studies, in association with Media Learning Systems, received a substantial grant from the Office of Learning Technologies in Ottawa to conduct research on our web-based distance education courses. As part of this research, Jonathan Ross, a PhD student at the University of Calgary and primary investigator, will be conducting a comparative analysis between a course taught on-campus versus the same course taught over the World Wide Web. This study will further our understanding of the issues involved in moving towards an on-line paradigm in higher education.

I ask for your cooperation in this research project, as the more participants we have, the more accurate and reliable the findings will be. If you choose to participate, please read the information letter and instructions contained in this package. There you will find what is expected of you as a study participant.

The whole study should take less than three hours of your time. As a token of our appreciation, all participants will receive a 10% bonus added to their final grade for their efforts.

If you have any questions, comments or concerns, please contact the researcher, Jonathan Ross at *40-0538 or myself at *20-2985. You may also visit me at EDT *15 or Jonathan at EDT *40 if you have any questions you would like addressed in person.

Thank you for your time, and I do hope you can find the time to participate.

Sincerely,

Dr. Nancy Marlett
Director, Community Rehabilitation Studies
Faculty of Education

APPENDIX B: INSTRUCTIONS FOR PROSPECTIVE PARTICIPANTS

Enclosed, please find the following items:

1) A consent letter, a letter from the Director, and a release form to be signed
2) A 40 question pre-test
3) A pre-survey
4) A post-survey
5) A three-paged log book
6) A course evaluation form
7) The Gregorc Learning styles inventory with a learning style information sheet
8) A 10% coupon to be applied to your final grade
9) Two university-addressed stamped envelopes

Should you decide to participate in this study, please do the following:

TO BE DONE RIGHT NOW (**Deadline for submission:January 12, 1999**):

1) Fill out and sign the consent form;
2) Write the pretest. (Remember to circle all answers in the test booklet);
3) Complete the presurvey;
4) Complete the learning styles inventory; and
5) Send items 1-4 in one of the enclosed envelopes. Either mail or submit the envelope in person to EDT 415, Community Rehabilitation Studies Main Office.

TO BE DONE AT THE END OF THE SEMESTER (**Deadline for submission: April 20, 1999**):

1) Return the **completed** log book;
2) Complete the post-survey;
3) Complete the course evaluation
4) Redeem your 10% coupon; and
5) Send items 1- 4 in the second envelope provided. Either mail or submit the envelope in person to EDT 415, the Community Rehabilitation Studies Main Office.

PLEASE ADHERE TO ALL STIPULATED DEADLINES IN ORDER TO REDEEM YOUR 10% COURSE COUPON. Failure to do so may result in invalid coupons.

Thank you for your cooperation and your participation in this very important study.

APPENDIX B: LETTER OF CONSENT

This form confirms the consent of _____ to participate in the research project entitled "A comparative analysis between conventional versus web-based distance education course environments". This study will be conducted by Jonathan Ross under the supervision of Dr. Ian Winchester in the Graduate Division of Educational Research.

I have been informed, to the appropriate level of understanding, about the purpose and methodology of this research project, the nature of our involvement and any possible risks to which I may be exposed by virtue of my participation.

I agree to participate in this project by doing the following:
1. Complete the preliminary survey which will collect demographical information about me; attitudes towards certain topics; and other information necessary for project analysis;
2. Complete a learning styles assessment battery;
3. Complete the post-project questionnaire which will assess my attitudes and other information necessary for project review;
4. Complete a 40-item multiple choice pre-test; and
5. Complete a time sheet indicating hours spent learning course-related material.

I understand and agree that:
1. My participation is voluntary and that I have the right to withdraw from this research at any time;
2. The researcher has a corresponding right to terminate my participation in this research at any time;
3. All data will be kept in a secure place inaccessible to others;
4. Data will be disposed of three years after the completion of the project; and
5. Confidentiality and anonymity will be assured through the assigning of numbers to each participant.

In return for my participation, **10 bonus percentage points** will be applied to my final course grade.

The risks involved in partaking in this study are no greater than those experienced in everyday life.

I have read the consent form and I understand the nature of my involvement. I agree to participate within the above parameters. I understand that this research will be used for a dissertation and eventual publication in a scientific journal.

Name: _____

Date: _____

Signature of Participant: _____   Telephone Number: _____

APPENDIX B: LETTER OF TRANSMITTAL FROM RESEARCHER

Dear Prospective Participant:

I am completing a PhD in Educational Technology at the University of Calgary. As part of this research, I will be conducting a comparative analysis between a course taught on-campus versus the same course taught over the World Wide Web. This study will further our understanding of the issues involved in moving towards an on-line paradigm in higher education.

You will be asked to complete two **surveys** containing questions which ask for your opinions about, experiences with, and background information relating to the course material and delivery method. Each survey will take about 5-10 minutes to complete. One will be administered at the beginning of the course, the other at the end of the course.

Second, you will have the opportunity to take a **learning styles assessment** which will help you identify the way(s) in which you learn best. The results from the assessment will also be used for research purposes. In no way will your learning style profile be publicized or shared with others. The *Gregorc Style Delineator* is a self-scoring learning style assessment tool which takes about 5 minutes to complete. For those who are interested, learning style profile information will be available on my web site at: **http://www.ucalgary.ca/~jross/gregorc.html**.

Third, you will be asked to complete a 40-question **multiple choice pre-test** which **will NOT BE USED FOR COURSE GRADE/CREDIT**. This assessment is for research purposes only and will take about 20-30 minutes to complete.

Finally, you will be encouraged to keep track of the amount of hours spent doing course-related tasks by filling out a detailed **time sheet as regularly as possible**. The time sheet will be collected **AT THE END OF THE COURSE** and will be used only for the purposes of this study. The student log book will take about 1-2 hours of your time over the course of the semester.

It should be noted that **in no way will any information collected be linked to you**. You will be assigned a number and all information will be grouped and analyzed according to the number. Furthermore, all information collected will be **analyzed after final course grades are assigned**. Also realize that all information collected will at **no time be shared with the course instructor**.

By participating in this study, you will not only help to further research in the area of distance education, you will also learn more about yourself and the ways in which you learn best. You will also receive a **10%** credit to be applied to your final course grade.

If you choose not to participate in this study, it will have no bearing on the way the instructor will grade your performance. The information is for research purposes only.

If you have any questions, comments or concerns, please contact the researcher, Jonathan Ross at *40-0538 or my supervisor Dr. Ian Winchester at *20-5627. You may also contact the Office of the Vice-President (Research) at *20-3331 and/or the office of the Chair of the Education Joint Research Ethics Committee at 220-5525.

At this time, I would like to refer you to the instructions sheet included in this package. There you will find the sequence which you should follow as a study participant.

Thank you kindly.

Sincerely,

Jonathan Ross, MSc.

APPENDIX C

SURVEY MATERIAL

APPENDIX C: INTERNET STUDENT'S PRE-SURVEY

Part I: Demographics

1a. Student ID Number: _____

1b. Year of Program: _____

1c. Age:_____

1d. Gender: _____

1e. How many courses have you taken by web-based distance education? _____

1f. Learning Style Scores (from the Gregorc Style Delineator):
CS_____
AS_____
AR_____
CR_____
   Total = 100? (if not, go back and check your calculations on the Style Delineator)

1g. Do you have a computer at home? _____

1h. If you answered "No" to question 1g, from where do you plan to access the course web site?_____

Part II: Computer Usage
For the following computer usage questions, please estimate the total number of hours per week.

HOW MANY HOURS <u>PER WEEK</u> DO YOU USE A COMPUTER FOR:

2a. Email   _____
2b. Word processing   _____
2c. Faxing   _____
2d. World wide web   _____
2e. Games   _____
2f. Other applications(combined)   _____

Part III: Motivations

Please check all that apply in the first column. Then, rank each checked item in the second column (1=first reason, 2 = second reason, etc.)

I AM TAKING THIS COURSE AT A DISTANCE BECAUSE:

3a. It's required	_____	_____
3b. It's offered at a distance	_____	_____
3c. I want to learn about the course's subject matter	_____	_____
3d. It fits into my schedule	_____	_____
3e. I prefer distance learning over campus-based learning	_____	_____
3f. Other_____	_____	_____

Part IV: Perceived Course Performance Barriers

You are about to take the course <u>Disability & the Law</u> over the Internet. Please rate each of the following possible barriers to success in this course on a scale of 1 to 5.
(1=Will Not Affect my performance in course, 3 = Undecided. 5 = May Significantly Affect my performance in the course)

	NA		U		SA
4a. Computer Access	1	2	3	4	5
4b. Previous Computer Experience	1	2	3	4	5
4c. Learning Style (CS,AS,AR,CR. visual. auditory. etc.)	1	2	3	4	5
4d. Personality Style (Introvert vs. Extrovert. etc)	1	2	3	4	5
4e. Time (Schedule)	1	2	3	4	5
4f. Motivation	1	2	3	4	5
4g. Work Style (Independent vs. Dependent learner, etc.)	1	2	3	4	5
4h. Other_____	1	2	3	4	5

APPENDIX C: INTERNET STUDENT'S POST-SURVEY

a) Name: _____   a1) Student ID Number: _____

Part I. Barriers to Accessing Course Website
We would like to know if you had any difficulties accessing course material over the Internet. Please rate each barrier in terms of its significance
(1=Did Not Affect my accessing course material, 3 = Undecided. 5 = Significantly Affected my access to course material)

	NA		U		SA
1a. Computer Speed	1	2	3	4	5
1b. Modem Speed	1	2	3	4	5
1c. Amount of Computer RAM	1	2	3	4	5
1d. Amount of Computer Hard Drive Space	1	2	3	4	5
1e. Internet Service Provider	1	2	3	4	5
1f. Other (Please specify)	1	2	3	4	5

Part II: Student Satisfaction
For the following list of items, please rate each one in terms of your overall level of satisfaction.
(1= Extremely Dissatisfied, 3 = Undecided, 5 = Extremely Satisfied)

	ED		U		ES
2a. Web Site's text content	1	2	3	4	5
2b. Web Site's audio lectures	1	2	3	4	5
2c. Web Site's learning environment	1	2	3	4	5
2d. The instructor's facilitation abilities	1	2	3	4	5
2e. Level of student-student interaction	1	2	3	4	5
2f. Level of student-instructor interaction	1	2	3	4	5
2g. Learning at a distance	1	2	3	4	5
2h. Computer Access to the course web site	1	2	3	4	5

Part III: Comparison with Conventional Classroom Instruction
The following items ask you to compare your on-line learning experience with similar face-to-face, conventional classroom learning experiences.
(1 = Strongly Disagree, 3 = Undecided, 5 = Strongly Agree)

COMPARED TO CONVENTIONAL COURSES I HAVE TAKEN I:

	SD		U		SA
3a. Communicated more with the professor in this course.	1	2	3	4	5
3b. Communicated more with my peers in this course.	1	2	3	4	5
3c. Was more motivated to do well in this course.	1	2	3	4	5
3d. Spent more time working on this course.	1	2	3	4	5
3e. Did better in this course	1	2	3	4	5
3f. Found the on-line environment to better accommodate my individual learning needs.	1	2	3	4	5
3g. Preferred learning at a distance.	1	2	3	4	5

Part IV: Short Answer

1. What do you think were some of the benefits of taking this course at a distance?

2. What do you think were some of the drawbacks of learning over the Internet?

3. What factors do you think contributed to your performance (good or bad) in this course?

4. Elaborate on any thoughts you have towards learning over the Internet:

APPENDIX C: CAMPUS STUDENT'S PRE-SURVEY

Part I: Demographics

1a. Student ID Number: _____

1b. Year of Program: _____

1c. Age: _____

1d. Gender: _____

1e. Learning Style Scores (from the Gregorc Style Delineator):
CS_____
AS_____
AR_____
CR_____
    Total = **100?** (if not, go back and check your calculations on the Style Delineator)

APPENDIX C: CAMPUS STUDENT'S POST-SURVEY

Part I: Demographics

a) Name: _____   a1) Student ID Number: _____

Part II: Comparison with Other Courses
The following items ask you to compare your learning experience with similar classroom learning experiences.
(1 = Strongly Disagree, 3 = Undecided, 5 = Strongly Agree)

COMPARED TO OTHER COURSES I HAVE TAKEN I:

	SD		U		SA
2a. Communicated more with the professor in this course.	1	2	3	4	5
2b. Communicated more with my peers in this course.	1	2	3	4	5
2c. Was more motivated to do well in this course.	1	2	3	4	5
2d. Enjoyed coming to class more in this course.	1	2	3	4	5
2e. Spent more time working on this course.	1	2	3	4	5
2f. Did better (gradewise) in this course.	1	2	3	4	5

APPENDIX D

STUDENTS' LOGBOOKS

APPENDIX D: DISTANCE STUDENT'S LOGBOOK

Name:_____   **ID#**_____

INSTRUCTIONS: Please fill out the logbook as thoroughly and regularly as you can (on a daily or semi-weekly basis). This is essential for the valid assessment of your participation in the course. If you forget to log some of your activities, it is still very important that you estimate the time spent on each activity, even if this means estimating the amount spent in each activity on an approximate basis. Please keep this to a minimum and by all means, DO NOT FILL OUT THE LOG BOOK THE LAST DAY OF THE COURSE BASED ON MEMORY. This will jeopardize the findings of the study, and could lead to your disqualification from the study.

On days when you do more than one course-related task, please report as separate events on separate lines (see example). You may append additional pages to the logbook as needed.

REPORT ALL TIMES IN TERMS OF HOURS.
15 minutes = 0.25 hours,
half an hour = 0.5 hours,
45 minutes = 0.75 hours, etc.

For **NATURE OF ACTIVITY COLUMN**, please select one of the following codes:

L- listening to on-line lectures
W- course web site navigation/visiting related web sites on the Net
C- chat room discussions
S- studying for examinations
A- assignment preparation
P- peer collaboration (Email/discussion forum interaction
I- instructor collaboration, meetings, or asking of questions
O- other (please explain)

	Date	**Time Duration**	**Nature of Activity**
example	Oct 12	1.5	S
example	Oct 13	0.5	L
example	Oct 13	0.5	I

APPENDIX D: CAMPUS STUDENT'S LOGBOOK

Name:_____   **ID#**_____

INSTRUCTIONS: Please fill out the log book as thoroughly and regularly as you can (on a daily or semi-weekly basis). This is essential for the valid assessment of your participation in the course. If you forget to log some of your activities, it is still very important that you estimate the time spent on each activity, even if this means estimating the amount spent in each activity on an approximate basis. Please keep this to a minimum and by all means, DO NOT FILL OUT THE LOG BOOK THE LAST DAY OF THE COURSE BASED ON MEMORY. This will jeopardise the findings of the study, and could lead to your disqualification from the study.

On days when you do more than one course-related task, please report as separate events on separate lines (see example). You may append additional pages to the log book as needed.

REPORT ALL TIMES IN TERMS OF HOURS.
15 minutes = 0.25 hours,
half an hour = 0.5 hours,
45 minutes = 0.75 hours, etc.

For **NATURE OF ACTIVITY COLUMN.** please select one of the following codes:

S- studying for examinations
L- class lectures attended
P- course-related peer collaboration/meetings
I- instructor collaboration/meetings/asking questions (even in class)
A- assignment preparation
O- other (please explain)

	Date	**Time Duration**	**Nature of Activity**
example	Oct 12	1.5	S
example	Oct 13	0.5	L
example	Oct 13	0.5	P

APPENDIX E

SAMPLE TEST QUESTIONS

APPENDIX E: NINE SAMPLE TEST QUESTIONS

1.   "Consent" is a defence to an assault action, whether civil or criminal. Consent must be freely given. Obviously consent is not effective when it has been obtained by threats of physical force, fraud as to the nature of the act, or because the perpetrator is in a position of authority over the victim. In a recent Canadian case, a university student agreed to participate in a medical research study. He consented to being injected with a drug which was the subject of the study. He freely signed a document evidencing his consent. The only question he asked was how much was being paid for participating. He was paid the honorarium before being injected. He was not told that the drug was a new serum which had never been tested on humans before nor that there was considerable risk in participating in such a study. The student developed as serious illness and became disabled as a result of the injection of the drug. Does the student have a right to sue the university?

[a]   Yes, because his consent was not given with appreciation of all the risks. To be legally valid the consent must be an informed consent. The individuals conducting the test were legally obliged to fully inform the student of all the risks associated with the test. Their failure to do so negates any consent that was given. The fact that a release was signed and a fee paid is irrelevant in these circumstances.

[b]   No. Even if the full extent of the risk was not revealed to the student, he signed a release and was paid money to participate in the study. It is not suggested that the student had any form of mental disability which adversely affected his ability to understand what he was consenting to. He clearly consented to participate in the study without asking questions and thus assumed any risk of harm.

[c]   It depends on the policies of the University in question.

[d]   None of the above.

2.   The doctrine of informed consent incorporates three essential elements. These are:

> a]   the patient must be competent to give consent, the patient must have full knowledge of nature of the procedure being consented to, and the consent must be voluntary

> [b]   the patient must be told of any major risks, must not be forced or tricked into giving consent and must have had legal advice before any procedure is carried out

> [c]   adequate information must be given to the patient before the procedure is carried out, they must have had the opportunity to consult with any person that they trust before consenting, and the consent must be free and voluntary

> [d]   All of the above

3.   "Competent to consent" means

> [a]   that the patient has the capacity to understand and appreciate the nature of the proposed treatment, including the risks and benefits of undergoing or foregoing it.

> [b]   that the patient is legally an adult person and does not suffer from any mental handicap which affects their intellectually ability

> [c]   that the patient is over the age of 18 years and is therefore deemed to be competent in law to make decisions for themselves

> [d]   None of the above

4.   One of the most basic and important common law concepts pertaining to disabled and handicapped persons is the doctrine of "pares Patrice". The doctrine of pares Patrice refers to:

[a]   the role of the sovereign as the guardian of persons who are unable to take proper care of themselves or are under some form of legal disability, whereby the sovereign is authorized to make and enforce decisions about what is believed to be in the best interests of such persons

[b]   the legal right of parents to make decisions on behalf of their minor child(ren) when the child(ren) is/are under 18 or is/are still dependent on the parent(s) for the necessities of life

[c]   the right of individuals who are interested in the welfare of disabled persons to apply to the court to be named as the disabled person's guardian

[d]   the power of the government to intervene on behalf of any person who is in need of protection

5.   Once a guardian has been appointed to act for a legally incompetent person, the guardian has the power to

[a]   authorize any form of health care treatment which the guardian deems necessary or desirable

[b]   authorize therapeutic health care treatment that is in the best interests of the incompetent person

[c]   authorize routine health care, but any major surgery or serious form of treatment must be first approved by the court

[d]   None of the above

6.   Which statement(s) is/are correct?

[a]   The Charter of Rights and Freedoms limits parental authority. While Section 7 of the Charter protects parents' liberty to nurture their child, and thus make health care decisions for the child, this "right" does not apply where the exercise of parental liberty seriously endangers the survival of the child. The state retains the power to intervene to protect children whose lives or health is in jeopardy.

[b]   Section 7 of the Charter guarantees life, liberty and security of the person and thus parents have an unlimited right to nurture their children and make decisions on their behalf including decisions such as the termination of life support treatment. The state may not intervene unless a child has been neglected by its parents.

[c]   Both of the above, depending on the situation.

[d]   Neither of the above, regardless of the situation.

7.   Which statement is more correct?

[a]   The law regarding guardianship is very precise and carefully applied. Because disabled and handicapped persons need protection, a guardian may only be appointed in situations recognised by statute and precedent. After their appointment, the guardian may only act in accordance with express legal rules and the wording of the court order authorizing their appointment.

[b]   As new situations develop and existing law is found not to be applicable, the courts are said to have an inherent pares Patrice jurisdiction to act in such a manner as to protect persons whose decision-making abilities are impaired since they are unable to independently care for themselves or to protect their property.

8.   Which statement(s) is/are correct?

[a]   Section 7 of the Charter protects the right to personal autonomy over important decisions intimately affecting our private lives. While protection may be necessary, dependent adults are entitled to the least restrictive form of such protection.

[b]   Guardians must act in the best interests of dependent adults in the same manner as a parent makes decisions on behalf of their child. This benign paternalism and resulting restriction of personal autonomy is both necessary and legally justified in order to protect handicapped and disabled individuals.

[c]   Both of the above, depending on the situation.

[d]   Neither of the above, regardless of the situation.

9.   In general, before a court makes an order appointing a guardian for an incompetent adult, the court must be satisfied that:

[a]   all of the required affidavits, medical or psychological reports, and other documents have been properly filed.

[b]   the individual who is the subject of the application is legally incompetent.

[c]   the criteria set out in the legislation has been proven and it would be in the best interests of the subject individual for a guardian to be appointed.

[d]   all relatives and persons concerned with the well-being of the subject individual are in agreement with the appointment of a guardian.

APPENDIX F

STUDENT COURSE EVALUATION

UNIVERSITY OF CALGARY

Universal Student Ratings of Instruction Instrument

The information you provide on this rating instrument is intended for use by students to aid them in selecting courses, by Deans and Department Heads to assess Instructors, by instructors to assist them in improving instruction, and by the University for administrative research purposes. Therefore it is essential that you answer the questions carefully. If you have concerns about the course or instruction that are not addressed by this instrument, please speak to the Department Head or Dean.

You are asked to provide your ID number so that the University can access relevant statistical data (e.g. major, year, gender, age). Your ID will NOT be revealed to the instructor(s) receiving the summary information from the responses to the items on the instrument. Instruments which do not include an ID number that would indicate you are a student registered in the course or course component will not be considered.

Your participation in this evaluation process is gratefully acknowledged by the Students' Union, Instructors and Administration of the University.

1.

Course Name: _____ Section: _____

MARKING INSTRUCTIONS

- Use an HB pencil only.
- Make dark marks that fill the oval completely.
- Erase cleanly any mark you change.
- Make no stray marks.

Incorrect Marks Ø Ø ⊖ ⊙

Correct Mark ●

2. Print your student ID number in boxes and mark corresponding ovals:

[ ] [ ] [ ] [ ] [ ] [ ]

(ovals 0 through 9 for each column)

3. Type of Course/Course component being evaluated:

- ○ Lecture
- ⊙ Laboratory
- ○ Practicum
- ○ Seminar
- ○ Tutorial
- ○ Distance Education
- ○ Other

Instructors(s) being evaluated (if applicable)

_____

4. FOR YOU THIS COURSE/COURSE COMPONENT IS:

- ○ A program requirement
- ○ Required, but a choice among several
- ○ An option or elective

5. THIS COURSE IS:

- ○ In the department or program of your present or intended major/specialty
- ○ Not in the department or program of your present or intended major/specialty
- ○ Neither of the above because your major/specialty is unknown

6. PERCENT OF CLASS SESSIONS YOU HAVE ATTENDED IN THIS COURSE/COURSE COMPONENT:

- ○ 0-20%
- ○ 21-40%
- ○ 41-60%
- ○ 61-80%
- ○ 81-100%
- ○ Not Applicable

7. COMPARED TO OTHER UNIVERSITY COURSES OF THIS TYPE (e.g. lecture, lab, practicum, distance education), THE WORK LOAD FOR THE COURSE/COURSE COMPONENT BEING EVALUATED IS:

- ○ Much Lower
- ○ Lower
- ○ About the Same
- ○ Higher
- ○ Much Higher

8. BASED ON THE FEEDBACK THAT YOU HAVE RECEIVED TO DATE (IF ANY), WHAT GRADE DO YOU EXPECT TO GET IN THIS COURSE/COURSE COMPONENT?

- ○ A
- ○ A-
- ○ B+
- ○ B
- ○ B-
- ○ C+
- ○ C
- ○ C-
- ○ D+
- ○ D
- ○ F
- ○ Pass/completed requirements
- ○ N/A

RATING INSTRUCTIONS

- Please rate only the course/course component (lab, lecture, segment, etc.) as requested.
- Base your ratings on your expectations for courses of similar type and size (e.g. large lecture, small lecture, multi-instructor courses, practicum, labs, or distance education courses).
- Please rate each item independently of the others.

	Unacceptable	Very Poor	Poor	Satisfactory	Good	Very Good	Excellent	N/A
1. The overall quality of instruction was:	○	○	○	○	○	○	○	○

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree	N/A
2. The course outline or other descriptive information provided enough detail about the course (e.g., goals, reading list, topics covered, assignments, exams, due dates, grade weightings).	○	○	○	○	○	○	○	○
3. The course as delivered followed the outline and other course descriptive information.	○	○	○	○	○	○	○	○
4. The course material was presented in a well-organized manner.	○	○	○	○	○	○	○	○
5. Student questions and comments were responded to appropriately.	○	○	○	○	○	○	○	○
6. The course content was communicated with enthusiasm.	○	○	○	○	○	○	○	○
7. Opportunities for course assistance were available (e.g., instructor office hours, out-of-class appointments, e-mail, telephone, websites).	○	○	○	○	○	○	○	○
8. Students were treated respectfully.	○	○	○	○	○	○	○	○
9. The evaluation methods used for determining the course grade were fair.	○	○	○	○	○	○	○	○
10. Students' work was graded in a reasonable amount of time.	○	○	○	○	○	○	○	○
11. I learned a lot in this course.	○	○	○	○	○	○	○	○
12. The support materials (e.g., readings, audio-visual materials, speakers, field trips, equipment, software, etc.) used in this course helped me to learn.	○	○	○	○	○	○	○	○

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree	N/A

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