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A Study of Students' Learning Styles in ITV Broadcast, Remote,
and Traditional Classrooms at East Tennessee State University

A dissertation
presented to
the faculty of the Department of Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor of Education

by
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May 2003

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Keywords: Distance Education, Learning Styles, Interactive Television

ABSTRACT

A Study of how Students' Learning Styles Affect Performance
in Undergraduate ITV Classrooms at East Tennessee State University

by

Donna Sue Crabtree

The purpose of this study was to determine if the learning styles of students enrolled in ITV sections and students enrolled in a traditional section of the same course, all taught by the same instructor, had any influence on the academic performance of the students enrolled in those courses.

A two-part survey was used to gather data for this study. The first part was designed by the researcher to gather demographic information about why each student selected the instructional form in which he or she was enrolled, as well as a student's preferences for classroom format. The second part of the survey was made up entirely of Kolb's Learning Style Inventory and was administered to determine the learning styles of the students in both the ITV and traditional classroom sections.

Data were gathered from an undergraduate course taught by one instructor that had a section of the course in a broadcast classroom, remote classrooms, and traditional classroom. One hundred-thirty-eight surveys were distributed by the instructor to students in the various classroom settings. Returned were 86 usable surveys, resulting in a return rate of 62%. Inferential and descriptive statistical procedures were used for data analysis. The Kruskal-Wallis Test was used to test for difference among midterm scores for each class site and learning style. Chi-square tests were used to test for difference in learning styles between male and female students and varying age groups.

Findings of this study indicate that there are no significant differences between the learning styles and academic performances of students in ITV distance education courses and traditional courses taught by the same instructor. Additionally, there was no significant difference between the demographic values of gender, class site, or age. The findings in this study can not conclude that while students in the remote classroom did score higher on mid-semester grades, those differences were not statistically significant and, therefore, may have occurred by chance. There are no statistically significant differences in these findings that would indicate that students in remote class sites academically achieve any better or worse than those in broadcast sites or traditional class sites.

DEDICATION

This work is first dedicated to my husband and best friend, Mark Crabtree, without his persistence and devotion, I would not have finished this dissertation. I also wish to dedicate it to my parents, Don and Darlene Case, and my godmother Ginger Mullins, who spent countless hours evaluating learning styles from the inventories I received. To my “sister” Donna Jennings, who was always willing to explain, for the second or third time, a statistical procedure. And, to my dog Tippitt, who waited patiently to go for a jog or a game of frisbee.

Each of you encouraged me to succeed and gave me your love and patience right at the times when it was needed most. Thank you for all the support and for believing in me when I did not believe in myself. I love you all, very much.

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TABLE OF CONTENTS

	Page
ABSTRACT	2
DEDICATION	3
ACKNOWLEDGEMENTS.....	4
LIST OF FIGURES	8
LIST OF TABLES	9
Chapter	
1. INTRODUCTION	10
Statement of the Problem	10
Research Questions	11
Significance of the Study	11
Delimitations	12
Limitations	12
Definitions	13
Overview of the Study.....	14
2. REVIEW OF THE RELATED LITERATURE	15
History	15
Distance Education Theory	18
Distance Education Technologies	20
Why Distance Education	22
Learning	22
Experiential Learning	25

Learning Styles	30
Kolb’s Theory and Inventory – Limitations	34
Applications of Kolb’s LSI	35
Learning and Distance Education	36
Summary.....	38
3. METHODOLOGY	40
Population	40
Research Design	40
Research Hypotheses	41
Study Instrument	42
Data Collection	42
Data Analysis	43
Summary.....	44
4. DATA PRESENTATION.....	45
Demographic Survey Data.....	46
Classroom Preference Question and Responses.....	47
Kolb’s Learning Style Inventory.....	49
Null Hypothesis Data Analysis	50
Null Hypothesis One.....	50
Null Hypothesis Two	51
Null Hypothesis Three	52
Null Hypothesis Four.....	54
Null Hypothesis Five	54
Research Questions	56
Research Question One.....	56
Research Question Two	57

Research Question Three	57
5. SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS	59
Findings	59
Conclusions	61
Recommendations	62
REFERENCES	64
APPENDICES	71
Appendix A: Approval to use the Learning Style Inventory	71
Appendix B: Kolb’s Learning Style Inventory and Profile	72
Appendix C: Demographic Survey	73
Appendix D: Data Interpretation Key	74
Appendix E: WINSTAT Data Analysis Hypothesis 1 to 5.....	75
Appendix F: WINSTAT Data Analysis Research Questions #3.....	82
Appendix G: WINSTAT Data Analysis Regression	94
VITA	96

LIST OF FIGURES

Figure	Page
1. The Lewinian Experiential Learning Model	26
2. Dewey's Model of Experiential Learning	27
3. Piaget's Model of Learning and Cognitive Development	28
4. Kolb's Model of Experiential Learning	30

LIST OF TABLES

Table	Page
1. Stages of cognitive growth	27
2. Kolb's Learning Styles	33
3. Demographic Information: Gender, Age, and Ethnicity	46
4. Demographic Information: Class Site, Class Standing, and Reason	47
5. Distribution of Learning Styles among Students	49
6. Kolb's Learning Styles	50
7. H-Test (Kruskal-Wallis) Mid-term vs. Class Site (Ho 1.).....	51
8. H-Test (Kruskal-Wallis) Mid-term vs. Learning Style (Ho 2.)	52
9. Chi-Square and Cross-tabulation: Gender vs. Learning Style.....	53
10. Chi-Square and Cross-tabulation: Age vs. Learning Style.....	55
11. Learning Styles by Class Site	57

CHAPTER 1

INTRODUCTION

Distance education, also known as “distance learning”, is not new in higher education. Providing off-campus learning to adults dates back to the 1890s, and in higher education, distance education accounts for a century old history (Rumble & Harry, 1982). Today, distance education is an increasingly popular choice for adults because it may offer a second chance at a college education. It is especially practical for those students who have time constraints due to family or work obligations, those who live long distances from the college or university, or who have physical disabilities. Very often, it is even available at a student’s place of employment. The opportunity of taking college courses without traveling to campus is the major attraction for today’s working adults. Distance education methodologies and technologies are used to support a wide variety of academic courses. These include credit and noncredit courses of study, single-day and multi-day symposia and seminars, and continuing professional education programs (*Innovations in Distance Education*, n.d.).

Statement of the Problem

There is growing demand for taking off-campus classes. However, there is minimal and contradicting research available to show if a student’s learning style is related to his or her performance in a distance-education setting. In this study, distance education is considered to be classes taken using Interactive Television (ITV). The student may be in the broadcast classroom from which the class is originating or in a remote classroom. In this case, the remote classroom may be located in Johnson City (JC), Kingsport (K), Bristol (B), Greeneville (G), Warf Pickel at East Tennessee State University (WP), or Pelissippi State Community College (PSCC). A traditional classroom setting will be used for comparison. All traditional classrooms will be located on the campus of East Tennessee State University.

Understanding learning styles can be a major step to getting the most from an educational experience. To determine the student's learning style, the researcher used Kolb's Learning Style Inventory (LSI). This inventory determines a student's learning style as stated by Kolb (1984), in that it "measures a person's relative emphasis on each of the four modes of the learning process – concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE)" (p. 68).

The purpose of this study was to investigate the learning styles of students within the traditional classroom, remote site classroom, and broadcast classroom and to determine if there is a relationship between a student's performance and learning style in these distinct settings.

Research Questions

This study focused on answering the following research questions:

1. What are the learning styles of students in traditional classroom, the broadcast classroom, and remote classrooms?
2. Do these learning styles vary by gender, ethnicity, or age in the traditional classroom, broadcast classroom or remote classrooms?
3. Among gender, ethnicity and age groups, which classroom setting and learning style has the best student performance based on mid-semester grades?

This study was conducted in undergraduate classrooms at East Tennessee State University.

Students in remote classrooms, broadcast classrooms, and traditional classroom settings were asked to complete Kolb's Learning Style Inventory and a short demographic survey.

Significance of the Study

With the separation of student and teacher, distance education creates additional challenges for students and faculty, the foremost challenge being the lack of interaction between

the teacher and students located at remote sites. The results of this study should give students information to make more informed decisions when considering enrollment in a distance education course. Faculty can use the information gathered to adapt their teaching styles and approaches for optimal student performance in the distance education classrooms. Administrators may find the information beneficial in making decisions regarding offering courses at off-campus locations.

This study may assist in showing if the instructional needs of students are being met in distance education courses by determining among student's ethnicity, gender and age group which classroom setting and learning style results in the best student performance.

Delimitations

1. This study was limited to undergraduate students in distance education classes and sections of the same course in traditional classroom settings at East Tennessee State University.
2. This study was limited to one instructor teaching an undergraduate distance education course with a section in a traditional classroom section.
3. Academic achievement for this study was based on midterm grades.

Limitations

1. Students who were enrolled in remote site classes or broadcast site classes self-selected themselves in regards to being in an ITV environment.

Definitions

For the purpose of this study, specific terminology is defined as follows:

Abstract Conceptualization Orientation: – According to Kolb, (1984) “an orientation toward abstract conceptualization focuses on using logic, ideas, and concepts” (p. 69).

Active Experimentation Orientation: – According to Kolb, (1984) “an orientation toward active experimentation focuses on actively influencing people and changing situations” (p. 69).

Broadcast site: – the classroom from which the class originates, where the instructor is.

Concrete Experience Orientation: – According to Kolb is “an orientation toward concrete experience focuses on being involved in experiences and dealing with immediate situations in a personal way” (p. 68).

Distance Education: – an educational program presented in a learning environment to which the teacher and student(s) are physically separated by distance and using technology to bridge the gap.

ITV: – Interactive television.

Learning Styles: – a preferred individual orientation toward learning.

Learning Style Inventory: – A survey instrument used to assess individual orientations toward learning (Kolb, p.67).

Reflective Observation Orientation: – According to Kolb, “an orientation toward reflective observation focuses on understanding the meaning of ideas and situations by carefully observing and impartially describing them” (p.8).

Remote site: – a class that is separated from the broadcast site by distance. Technology is used as a communication medium. There are only students at the remote site, no instructor is physically present.

Traditional classroom: – a classroom setting in which both the instructor and students are present simultaneously.

Overview of the Study

This study investigated learning styles and assessed student performance based on the student's determined learning style in a traditional classroom, broadcast classroom, and remote classroom. Chapter 1 is an introduction to the study and also provides the statement of the problem, research questions, definitions, and the overview.

A review of the related literature is presented in Chapter 2. The history of distance education is reviewed; the concept of learning styles and the types of learning styles that are relevant to this study are discussed. Relevant research studies, models and theories are identified.

Chapter 3 includes the methodology of the study, the study instrument, the research design, and procedures used to obtain the research data.

The data presentation is in chapter 4. This includes the data collected from the demographic survey and Kolb's Learning Style Inventory. The research questions and null hypothesis are reviewed and answered.

Chapter 5 includes the summary, findings, conclusions, and recommendations.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

The first section of this chapter portrays the history of distance education. The theory of distance education, distance education technologies, why distance education is used, and why students select distance education courses will follow.

Learning, models of learning, learning styles, and how to determine an individual's learning style will be identified. In addition, how learning styles can be associated with the way an individual learns will be discussed. The importance of learning in conjunction with distance education will be identified concluding with a summary of the research findings.

History

In the United States and in other areas on the globe teaching across a distance has existed for over a hundred years. Over the span of years, communication and technology have helped distance education to evolve. Historically, the earliest forms of distance education took place as correspondence courses in Europe. In 1840, Isaac Pitman, an English teacher in Britain, taught shorthand via correspondence courses. In the United States, Illinois Wesleyan University began a correspondence program in 1874. The University of Chicago introduced the first department for teaching by correspondence in 1900 (Charp, 1999).

Holmberg (1977) stated:

Historical evidence makes it fairly safe to state that distance education (in the form of “pure” correspondence study) was created to give those a chance to study who could not go to an ordinary school or university for financial, social, geographical or medical

reasons. Correspondence education was and is a means of providing adult education, based on belief in education for its own sake and also for improving social status (p.17). Correspondence study was very valuable at a time when people could not get the education and training appropriate to their ability. Correspondence education provided a chance for them to educate themselves as adults (Holmberg).

This type of education was a norm until television and radios became familiar household appliances. Distance education classes in the form of live radio broadcasts emerged in the 1920s. Seven years before television was introduced at the World's Fair in New York, the State University of Iowa began experimenting with transmitting courses (Jeffries, 2001). In the 1950s distance education courses began to be televised. Cambre (1991) stated, In the late 1950s and early 1960s, television production technology was largely confined to studios and live broadcasts, in which master teachers conducted widely-broadcast classes. Unfortunately, teachers who were expert in the subject matter were not necessarily the most captivating television talent, nor was the dull talking head medium the best production method for holding the interest of the audience.

With radio and television, the lack of two-way communication between the student and the teacher was the major drawback (Sherry, 1996).

The Articulated Instruction Media (AIM) Project was developed in the early 1960s by the Carnegie Corporation. This program was critical in the development of various methodologies used in distance education. Off-campus students were provided with instruction using correspondence, radio and television broadcasts, study guides, audiotapes, and telephone conferencing (Distance Learning, 2001). "AIM was unique in that it sought to integrate different communication mediums in order to facilitate learning" (Distance Learning, p. 99).

The AIM Project was a significant development in the pioneering of distance education. The United Kingdom founded the Open University (OU) in 1969. Students were sent learning materials via mail (Matthews, 1999). Textbooks, audio materials, and video materials were sent to each student. In addition, each student was assigned a personal tutor with whom he or she could communicate by phone. The Open University in Britain was important in raising the profile of distance education (Curran, 1997).

In the early development of correspondence study, as well as in the 1990s and today, this type of study continues to offer students significant flexibility and control over the time, place, and pace of instruction (Petrides, 2000). Since the opening of the Open University, 20 more universities were established throughout the world serving more than 300,000 students by the 1980s (Matthews, 1999). Today, the majority of universities in the United States offer some form of distance education.

Changes in distance education occurred in three phases (Distance Learning, 2001).

1. The arrival of the Postal System
2. The creation of radio, television, and video technology.
3. The introduction of the Internet and other computer technology.

The incorporation of two-way audio/video and computer-based technologies allowed students who were already enrolled in regular classes and wanted to ease their travel time by taking distance education courses. Distance education has experienced dramatic growth since its inception. It has evolved from early correspondence education using primarily print-based materials into a worldwide movement using various technologies (McIsaac & Gunawardena, 2001). Best stated by Jeffries (2001), the history of distance education shows a field that appears to be in a constant state of evolution and shows a stream of new ideas and technologies.

Distance Education Theory

“Distance education” and “Distance learning” are terms that have been used when discussing the separation of teacher and student in space or in time. Distance education is also described by Jonassen (1992) as “the volitional control of learning by the student rather than the distant instructor” (p.2). Steiner (1995) described distance education as “instructional delivery that does not constrain the student to be physically present in the same location as the instructor.” Holmberg (1986a) stated that “distance learning is basically an individual experience and has considerable potential of its own, different from, but not inferior to traditional types of education” (p.78). Keegan (1986) identified six key elements of distance education.

1. Separation of teacher and learner
2. Influence of an educational organization
3. Use of media to link teacher and learner
4. Two-way exchange of communication
5. Learners as individuals rather than grouped
6. Educators as an industrialized form

The development of a theory of distance education is based on theories of autonomy and independence from Wedemeyer (1981) and Holmberg (1986a). Wedemeyer identified several essential elements such as increased student responsibility and an effective mix of new technologies such as media types. Holmberg (1986b) described his theory towards distance education as based on the concepts of “independence, learning, and teaching” (p.161) and further stated that:

Distance education is a concept that covers the learning-teaching activities in the cognitive and/or psycho-motor and affective domains of an individual learner and a supporting organization. It is characterized by non-contiguous communication and can be

carried out anywhere and at any time, which makes it attractive to adults with professional and social commitments (p.168).

In addition, Holmberg (1986a) adds, “Meaningful learning, which anchors new learning matter in the cognitive structures, no rote learning, is the center of interest” (p.161).

When comparing students of distance education to those who enroll in traditional on-campus courses, distance learners have a tendency to be older, employed in a stable job by which they are motivated to complete coursework for employment reasons and have a family (Gibson, Hsleh, Miller, & Walsh, 1996). The most important predictor for a student to be successful in a distance education setting is motivation, though gender and learning style are also important (Gibson et al.). To be successful in distance education coursework, a student needs to be self-motivated and disciplined.

McIsaac and Gunawardena (2001) identified four theoretical constructs that provide insight to understanding how the learner is able to learn at a distance (section 13.3.1, pg. 3).

1. Transactional Distance
2. Interaction
3. Learner Control
4. Social Presence

Programs with more structure and less student-teacher dialogue are considered to have greater transactional distance. This type of distance is not determined by geography, but instead by the amount of dialogue that takes place between the student and instructor.

In agreement with other researchers, Amundsen and Bernard (1989) pointed out, “...the definitive characteristic of distance education is the separation between teacher and learner (p.7). They also added, “As a result, interpersonal communication is not a natural characteristic of distance education” (p.7). Lui and Ginther (1999) stated, “In sum, distance education establishes a system that provides learning opportunities to various groups of learners who have no access to the traditional, higher education institutions” (pg.7).

Distance Education Technologies

Distance education can involve the use of a vast range of technology, depending on the type of subject matter.

1. Voice is a one-way audio tool that includes telephone and audio conferencing;
2. Video can be one-way or two-way varying from instructional video tools to two-way interactive video;
3. Data are used to describe a wide range of computer-related instructional tools in which information is transmitted or received electronically and
4. Computer applications include computer-assisted instruction (CAI), computer-managed instruction (CMI) and computer-mediated education (CME).

Most distance education classes currently use a combination of technologies. Video technology can be used to deliver interactive instruction between students at an off-campus site and the broadcast site. Interactive video conferencing can provide real time interaction between the students and the instructor. Alternatives to video are computer-based multimedia learning, computer messaging systems, the just-in-time approach of network instructional delivery introduced by Hudspeth at Brooks Air Force Base, and internet-based classes. Salomon (1981) stated that “one value of technology in distance education is its capacity to mediate communication between the teacher and the student” (p.16).

The important factor for success, however, is that instructional needs of the students must be the primary focus and not the technology itself. This study focused on Interactive Television Programs at East Tennessee State University. ITV allows students and teachers to interact spontaneously thus alleviating many of the limitations that occur with television, video-taped, or satellite programming. One distance format growing in importance is interactive television which offers the advantages of real-time visual and audio interaction among instructor and students

(Alford & Engelland, 2001). The ITV format is popular because it allows for full interaction between students and the instructor at multiple sites. According to Becker (1999), the key economic advantage of any type of distance learning over traditional on-site schooling is that it saves student's time (p.40).

The first interactive television course was offered at East Tennessee State University in the spring of 1990. Twelve years later, more than 2,000 students are enrolled in ITV courses. There are over 120 faculty members who have taught ITV courses at ETSU. Sites at Bristol, Greeneville, Kingsport, and Knoxville receive transmissions for ITV courses. Each semester, between 45 and 55 different courses are taught using distance education technology.

In an ITV setting, the instructor location is normally in the broadcast classroom. A camera is focused on the instructor and there are typically at least two television monitors. One monitor shows the instructor what is being broadcast out to the students. The second monitor shows the instructor the remote location. For additional remote locations, there are additional monitors or the second monitor can be set to cycle through the locations at a timed intervals. At each remote location, there is at least one monitor that shows the signal from the broadcast location. Desks at the remote locations will have microphones. Interaction between the instructor and the students is slightly slower than in a traditional classroom due to transmission delay of the signal (Alford & Engelland, 2001).

At East Tennessee State University, all distance education classes have facilitators that manage remote site classrooms. These facilitators setup the classroom equipment and test for audio and video reception and transmission. They also serve as the faculty on-site representative to distribute materials to students and receive materials from them.

Why Distance Education?

Rumble and Harry (1982) said that distance-teaching universities stemmed from an “increased concern for greater equality of opportunity of access to higher education” (p.). This led to the belief that universities should provide places for adults who had missed the opportunity to attend school early in their careers.

Students enroll in distance education courses for a number of reasons. For many adults, it provides a second chance for obtaining a college education. Students already established in a career are given the opportunity to take classes through distance education because it addresses time limitations and narrows the distance that the student may be required to travel to reach the classroom. Often, employers will offer employees the chance to take courses to update their knowledge base at the employment site. This encourages students who have family obligations to still participate in courses and possibly complete a degree.

A small number of students who consider themselves to be life-long learners enroll in classes for the pure enjoyment of learning. Distance education courses are often more convenient for these students.

Learning

Learning is identified as a process that takes place inside the brain. It is called a process because it is comparable to other organic processes such as digestion and respiration (Gagne & Driscoll, 1988). It typically involves some type of interaction with the environment and, according to Gagne and Driscoll, learning is “a process that enables organisms to modify their behavior rapidly in a more or less permanent way” (p. 3).

How a person learns information or how one acquires knowledge is called cognition. Knowledge about learning can be “accumulated by scientific methods” (Gagne & Driscoll, 1988, p. 3) and then expressed as principles. Models are then derived from these principles. The cognitive learning theory, as defined by Ruttan (1998) “is a general approach that views learning as an active mental process of acquiring, remembering and using knowledge” (p.1). Ruttan also stated that learning is not directly observable but is evidenced by “a change in knowledge which makes a change in behavior possible” (p. 1). Gagne and Driscoll also acknowledged that “teachers can infer if learning has occurred from their observation of a permanent change in the learner’s behavior” (p. 3).

Phillips and Soltis (1985) identified a variety of theories of learning because there is more than one type of learning. Therefore, “We must be content to deal with a number of theories of learning, each useful perhaps in a different context” (p. 5). These theories stem from simple and complex learning, acquisition of knowledge and the mastery of skills, learning independently and in situations where a teacher is required.

“There is a possibility that different theories of learning have resulted from various investigators approaching the phenomenon of learning from different directions” (Phillips & Soltis, p. 5). To better explain this presumption, Phillips and Soltis use an old Indian folk tale as an illustration:

Three blind men were given an elephant to examine. The man who felt the tail got quite a different impression of the beast than the man who felt one of the legs, while the man who started with the trunk reached yet another startling conclusion. (p. 5).

As each blind man formed a different conclusion from what he had to examine, so it is with all scientific inquires.

Interest in how a person learns is not new. Plato was one of the first to document his perception of how a learner is able to understand something new. Plato communicated his ideas in dialogues at his teaching academy. From his dialogue *Meno* he raised the issue of how a person can understand something he or she previously did not know in this way (Plato, as cited in *Meno* translation, 1981):

I know, Meno, what you mean...you argue that a man cannot inquire either about that which he knows, or about that which he does not know; for if he knows, he has no need to inquire; and if not, he cannot; for he does not know the very subject about which he is to inquire (p. 36).

Concurrent among theorists is that learning depends upon the student having some prior knowledge or experience. Stated by Phillips and Soltis (1985), “a child who has not yet learned a language, and a computer that has not yet been programmed, cannot have anything “explained” to them” (p. 9). These researchers also stated that “according to Plato, if one does not previously know something, one cannot learn it now” and “Plato regarded learning as a rather passive process in which impressions are made upon the receptive soul or mind” (p. 11).

Gagne and Driscoll (1988) acknowledged that learning is something that takes place inside a person’s head and is a complex process. Learning typically involves interaction with the environment and “is inferred when a change or modification in behavior occurs that persist over relatively long periods during the life of the individual” (p. 3).

B.F. Skinner based his theory on the learning from the idea that learning is a function of change in behavior (Skinner, n.d.). Changes are based on an individual's responses to events that may occur in the environment.

Experiential Learning

Confucius stated, "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand" (Wiggins, n.d.). Kolb's work can be traced back to this famous aphorism. Learning, as defined by Kolb (1984) "is the process whereby knowledge is created through the transformation of experience" (p.38). He goes on to state that knowledge is "continuously created and recreated, not an independent entity to be acquired or transmitted" (p.38).

The concept of experiential learning is a cyclical pattern that involves all learning as coming from experience through reflection. Then, conceptualizing into action and continuing on to further experience. Experience plays an extraordinary role in the learning process. This is one reason why the perspective on learning is tied to its origins by the theories of Dewey, Lewin, and Piaget. These theories are the foundation of what is known as "Experiential Learning". Kolb (1984) suggested that "through the experiential learning theory a holistic integrative perspective on learning that combines experience, perception, cognition and behavior exists" (p.21). The characteristics that form the experiential learning theory are pulled from common traits of the learning models of Lewin, Dewey, and Piaget.

Lewin's model "begins with here-and-now experience" (Kolb, 1984) and data collection about the experience follows. As shown in figure 1, learning is perceived in a four-stage cycle. Kolb identified two aspects of this theory that he described as "particularly noteworthy." First,

the emphasis on “here-and-now experience to validate and test abstract concepts” and second, the research and laboratory training are based on “feedback processes” (p.21). The Lewinian model, as stated by Claxton and Murrell (1987), “stressed the importance of a person’s being active in learning” (p.25).

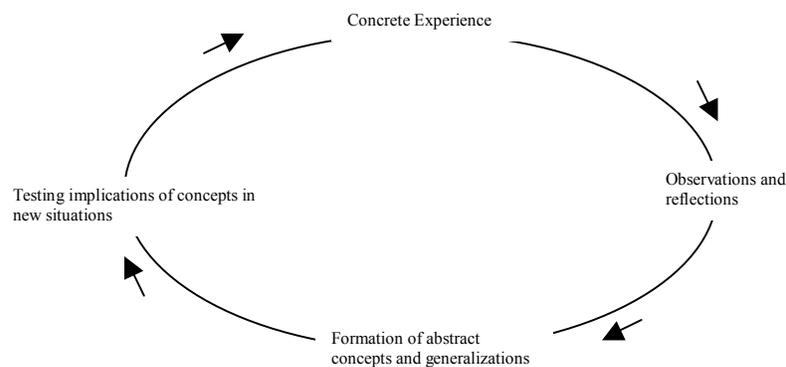


Figure 1: The Lewinian Experiential Learning Model

Note: From *Experiential Learning* (p. 21), by D.A. Kolb, 1984, Englewood Cliffs, NJ: Prentice Hall.

Remarkably similar to Lewin’s model, John Dewey’s model of learning makes greater reference to the developmental nature of learning. Dewey (1938) stated:

The formation of purposes is, then, a rather complex intellectual operation. It involves: (1) observation of surrounding conditions; (2) knowledge of what has happened in similar situations in the past, a knowledge obtained partly by recollection and partly from the information, advice, and warning of those who have had a wider experience; and (3) judgment, which puts together what is observed and what is recalled to see what they signify (p.69).

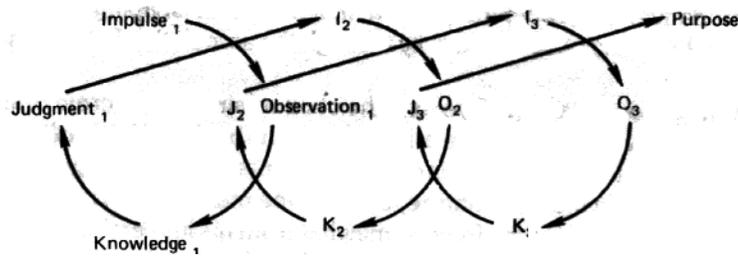


Figure 2: Dewey’s Model of Experiential Learning

Note: From *Experiential Learning* (p. 23), by D.A. Kolb, 1984, Englewood Cliffs, NJ: Prentice Hall.

According to Claxton and Murrell (1987), Dewey’s model emphasized the need for learning to be grounded in experience.

Piaget (1952), described intelligence “not so much as innate but rather the result of the interaction of the person and the environment.” He identified the key to learning as the mutual interaction of the process of accommodation, and the assimilation of events and experiences (Kolb, 1984). Piaget identified four major stages of cognitive growth as described by Kolb:

Table 1

Stages of Cognitive Growth (Kolb, 1984).

Stage 1	0 to 2 years	Child is predominately concrete in and active in his/her learning style. Learning through feeling, touching and handling.
Stage 2	2 to 6 years	Begins to develop a reflective orientation and internal actions.
Stage 3	7-11 years	Development of abstract symbolic powers. Logic of classes and relations.
Stage 4	12 to 16 years	Onset of adolescence. Representational logic and the stage of formal operations.

Piaget’s cognitive development theory as shown in figure 3 “identifies those basic developmental processes that shape the basic learning process of adults.”

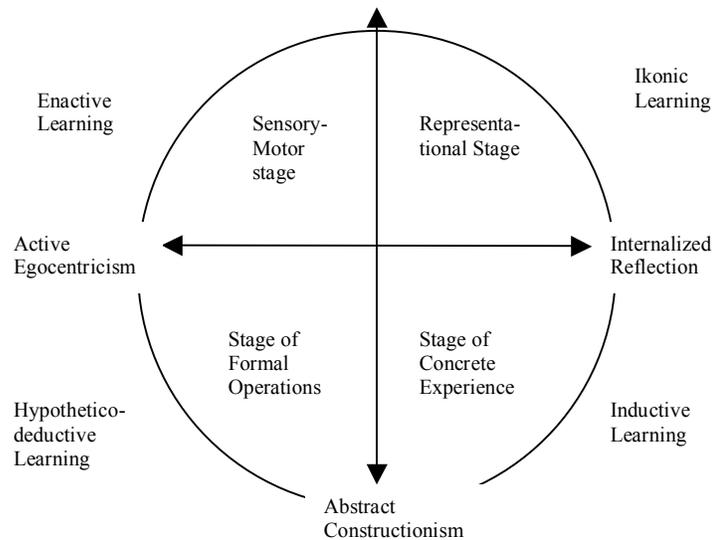


Figure 3: Piaget’s Model of Learning and Cognitive Development

Note: From *Experiential Learning* (p. 25), by D.A. Kolb, 1984, Englewood Cliff, NJ: Prentice Hall.

Kolb (1984) stated that “experiential learning theory, however, proceeds from a different set of assumptions. Ideas are not fixed and immutable elements of thought but are formed and reformed through process” (p.26). In the learning models of Piaget, Lewin, and Dewey, learning is described as a process “whereby concepts are derived from and continuously modified by experience” (p.26). Kolb further stated that if a person wants to be effective in his/her learning, four different kinds of abilities will be needed. These abilities are concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualization abilities (AC) and active

experimentation abilities (AE). “They must be able to involve themselves fully, openly, and with bias in new experiences” (p.30). Claxton and Murrell (1987) described this best:

Kolb describes learning as a four-step process. Learners have immediate concrete *experience*, involving themselves fully in it and then reflecting on the experience from different perspectives. From these *reflective observations*, they engage in *abstract conceptualization*, creating generalizations or principles that integrate their observations into sound theories. Finally, learners use these generalizations or theories as guides for further action, *active experimentation*, testing what they have learned in new, more complex situations (p. 25).

As shown in figure 4, Kolb’s theory is cyclical. There are two fundamental elements to the process. First is taking in information. The second element is processing the experience. Some people will reflect on the experience while others will be more active and change the information to fit their way of thinking. Claxton and Murrell identified the four points on the learning cycle as “modes of dealing with information or adapting to the world” (p.27). According to Claxton and Murrell, as more modes are used, learning is enhanced. They also stated that Kolb’s theory dealt more with an individual’s learning and development. Smith (2001) cited Houle as stating that experiential learning is “education that occurs as a direct participation in the events with life” (p.1). Learning is spawned by people themselves and everyday experience “is the way that most of us do our learning” (Smith, p.1).

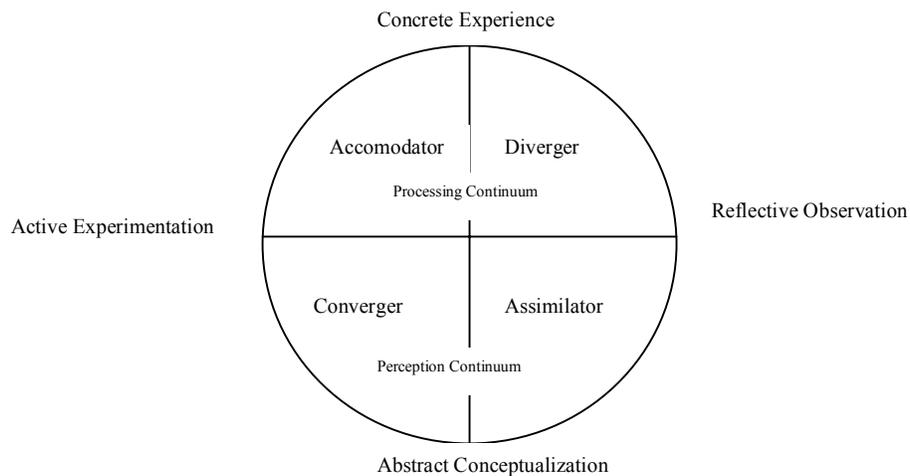


Figure 4: Kolb's Model of Experiential Learning

Note: From *Experiential Learning* (p. 42), by D.A. Kolb, 1984, Englewood Cliffs, NJ: Prentice Hall.

Learning Styles

People have different characteristics, strengths, and preferences in the way they perceive, organize, and process information. The assorted ways that people acquire knowledge are referred to as learning styles. Litzinger and Osif (1992) stated that learning styles are “the different ways in which children and adults think and learn” (p.73). Each person develops a set of behaviors or approaches to learning. Blackmore (1996) identified three processes that together create the learning process.

1. Cognition: how one acquires knowledge;
 2. Conceptualization: how one processes information;
 3. Affective: encompasses motivation, decision making, values and emotions
- (p.1).

Blackmore also stated that a number of researchers “catalogued” these ranges of learning styles in more detail, but Kolb is one of the best known in reference to learning styles (p.1).

According to Kelly (1997), there are two major benefits to understanding one’s learning style. First, it helps us to understand our areas of weakness and second, it helps us to realize our strengths. This gives students the opportunity to become more proficient. Using a learning style inventory helps students to understand their learning styles and as stated by Knox (1986), “make transitions to higher levels of personal and cognitive functioning (p.25). In addition to being beneficial to the student, knowing a student’s learning style can benefit the teacher as well. It allows the teacher to cover materials in a way that best fits the diversity of the classroom (Kelly, 1997). According to DeBello (1985), Giannitti (1988), and Miles (1987), students learn more and like learning better when taught using their identified learning styles.

The Learning Style Inventory (LSI) was created by Kolb (1984) to “assess individual orientations toward learning” (p.67). He developed this instrument with four design objectives. First, “the test should be constructed in such a way that people would respond to it in somewhat the same way as they would a learning situation” (p.67). Second, “a self-description format was chosen for the inventory” (p.68). Kolb stated that a person giving a description of his/her self image would be more powerful than not providing a personal image. Third, “the inventory was constructed with the hope that it would prove to be valid – that the measures of learning styles would predict behavior in a way that was consistent with the theory of experiential learning” (p.68). And fourth, Kolb wanted the inventory to be straight forward, brief and practical in order for those being tested to get meaning out of the inventory and have feedback on their learning styles.

According to Kolb (1984), the Learning Style Inventory measures “a person’s relative emphasis” on questions regarding each of the four modes of the learning process (p.68). In addition, there are two combination scores that measure if a person emphasizes action over reflection and abstractness over concreteness (Kolb). Kolb defined four learning modes (p.68, 69):

1. An orientation toward *concrete experience* focuses on being involved in experiences and dealing with immediate human situations in a personal way. It emphasizes feeling as opposed to thinking; a concern with the uniqueness and complexity of present reality as opposed to theories and generalization; an intuitive, artistic approach as opposed to the systematic, scientific approach to problems.
2. An orientation toward *reflective observation* focuses on understanding the meaning of ideas and situations by carefully observing and impartially describing them. It emphasizes understanding as opposed to practical application; a concern with what is true or how things happen as opposed to what will work; and emphasis on reflection as opposed to action.
3. An orientation toward *abstract conceptualization* focuses on using logic, ideas, and concepts. It emphasizes thinking as opposed to feeling; a concern with building general theories as opposed to intuitively understanding unique, specific areas; a scientific as opposed to an artistic approach to problems.
4. An orientation toward *active experimentation* focuses on actively influencing people and changing situations. It emphasizes practical applications as opposed to reflective understanding; a pragmatic concern with what works as opposed to what is the absolute truth; an emphasis on doing as opposed to observing.

Using the four learning modes, Kolb developed four basic styles of learning.

Table 2

Kolb's Learning Styles (Smith 2001)

Learning Mode	Personal Characteristics	Learning Style
Concrete Experience + Active Experimentation	<ul style="list-style-type: none"> • More of a risk taker • Performs well when required to react to immediate circumstances • Solves problems intuitively 	Accommodator
Reflective Observation + Abstract Conceptualization	<ul style="list-style-type: none"> • Excels in inductive reasoning • Concerned with abstract concepts rather than people • Strong ability to create theoretical models 	Assimilator
Abstract Conceptualization + Active Experimentation	<ul style="list-style-type: none"> • Strong in practical application of ideas • Can focus on hypo-deductive reasoning on specific problems • Unemotional • Has narrow interests 	Converger
Concrete Experience + Reflective Observation	<ul style="list-style-type: none"> • Imaginative • Good at generating ideas and seeing things from different perspectives • Interested in people • Broad cultural interests 	Diverger

Tharp (1992) stated that a student's learning style will strongly influence achievement in the classroom. Consistent with Tharp, DeBello (1985), Giannitti (1988), and Miles (1987) stated that students learn more and like learning better when they are taught through their identified learning styles. Giannitti stated further that most students can master the same content, but how they master it is determined by their individual learning style. According to Kelly (1997), "Understanding one's preferred learning style has two benefits: It helps us understand our areas of weakness, giving us the opportunity to work on becoming more proficient in the other modes or it helps us realize our strengths, which might be useful in certain social situation, such as deciding on a career" (p. 3). Tennant (1988) remarked "As a rule of thumb the model provides an excellent framework for planning, teaching and learning activities and it can be usefully

employed as a guide for understanding learning difficulties, vocational counseling, academic advising and so on” (p. 105).

Kolb’s Theory and Inventory – Limitations

Kolb pointed out the greatest limitation to his Learning Style Inventory is that the results are based on the way the learners rate themselves. Kelly (1997) stated that “It does not rate learning style preferences through standards or behaviors as some other personal style inventories do” (p.4). He also stated that “not all writers agree with Kolb’s theory” quoting Rogers and Freiberg (1994) “Learning includes goals, purposes, intentions, choice and decision-making, and it is not clear where these elements fit into the learning cycle” (p. 108).

Heron (1992) included a four page critique in his book, *Feelings and Personhood: Psychology in Another Key*, in which he pointed out that in his opinion Kolb’s theory is narrow and underdeveloped, its philosophical justification is invalid, and its phenomenal base in psychological modes is too restricted. Heron also stated, “He has to tack on other modes such as intuition and imagination in an unsatisfactory way, onto this structure to make up for its limitations” (p. 197).

Beard and Wilson (2002) reported that Kolb’s learning cycle does not illustrate the fact that empirical (i.e. experiential) thinking based on action has limitations. It may result in false conclusions, it may not help us understand and explain change and new experiences, and it may cause mental laziness and dogmatic thinking.

Despite any objections to Kolb’s theory and/or learning style inventory, no one can dispute that he has moved “the educational thought from the locus of the instructor back to the learner” (Kelly, 1997, p. 4). Development of Kolb’s ideas has led to groups of companies

transforming themselves into learning organizations (Pickles, n.d.). Kolb's experiential learning theory has been very influential in education and in management development. Pickles stated that the work of Kolb has influenced the work of many in the learning, development, and education fields.

Applications of Kolb's Learning Style Inventory

Felder (1996) listed several applications for Kolb's Learning Style Inventory. At Vanderbilt University, Sharp (as cited by Felder), associate professor of technical communications in the chemical engineering department, has administered the Learning Style Inventory to her communications classes and senior chemical engineering classes. Sharp reported that she has found that teaching students about learning styles helps them learning the course material because they are aware of their thinking processes. Also, she says it helps them develop interpersonal skills.

At the College of Engineering and Technology at Brigham Young University, a faculty training program was initiated in 1989 based on Kolb's learning styles. According to Felder, one third of the engineering faculty members, all volunteers, were trained in the concepts of Kolb's model and how to teach by using the Kolb model. They found the benefits of the program to be significant. Additional faculty at Brigham Young University have implemented Kolb's model into their curriculum using a variety of teaching methods such as group problem solving, brainstorming activities, and writing exercises.

Learning and Distance Education

Schmeck (1983), stated that people have a “predisposition to use particular strategies based on a variety of factors” to learn. Based on Schmeck’s theory, learners respond to various types of instructional technology and methods. When applied to distance learning, he predicted “that the use of different instructional techniques will affect an individual’s learning approach and capacity to learn effectively” (p.243). Therefore, identifying a student’s learning style in the distance education settings, should prove beneficial to the student and the instructor.

There have been a number of research studies focusing on different variables in the distance education setting. Of particular interest are the studies of Freeman (1995), Dexter (1995), Burkman (1994), Baker (1995), and Anderson (1994). Each of these studies involved researching distance education in an ITV setting. Dexter and Freeman found there was no significant difference in the performance between on-campus students and distance learners. Burkman and Baker found the opposite and stated there was a difference in performance between the host and remote classes.

Baker, (1995) completed a qualitative study involving distance teaching with interactive television. She focused on strategies that promote interaction with students at remote sites. Baker cited Webb (1983) as saying when students have an opportunity to give and receive explanations from the teacher and each other; they are more likely to experience higher achievement. Her findings in this study did collaborate with Webb’s findings.

Burkman, (1994) studied 54 students enrolled in two high school psychology classes. His study focused on the relationship that achievement, attitude, and individual learning styles played in an ITV course. Burkman used the learning style inventory created by Dunn and Dunn. His data analysis showed that there was a significant difference in the achievement between the host

class and the remote class. He stated, “This study is significant because it adds to the existing knowledge of learning styles preferences of learners” (p.4).

The purpose of Dexter’s (1995) research was to examine the differences between academic performance outcomes and satisfaction levels of distance learning of ITV classes as compared to students enrolled in courses taught on campus. He studied 286 campus-based students and 138 distance education students at Pikes Peak Community College. Dexter found there was no significant difference in the performance outcomes between the on-campus students and the distance learners. He also found that distance education at Pikes Peak Community College increased the full time-equivalent (FTE) student count. His findings also included that more females than males enrolled in distance education courses, females scored higher grades, and the distance learners reported that they learned just as much as in an on-campus course.

Freeman’s (1995) study focused on learning styles and outcomes for medical students enrolled in distance education courses. She found that when examining the interaction between the delivery method and the student’s learning style, no significant difference was found. Freeman stated that the impact of her study was on distance educators who may need to find ways to vary their instructional techniques and methods when using interactive television. Freeman also added that students may need to adjust their learning strategies when taking a distance education course that may be inconsistent with their learning style.

Dillon, Gunawardena, and Parker (1992) studied the attitudes and performance of university students enrolled in televised courses on-campus and off-campus. They compared the performance of students at different levels of learning. They found no significant differences in overall GPAs between on-campus and off-campus students in the lower division courses.

However, at the upper division level, they found that the students enrolled in the distance education courses outperformed the on-campus students.

Summary

Distance education has proved to be a very popular means for students' furthering their education. Students enroll in distance education courses for a variety of reasons. These include limitations on time, decreasing travel distance to the classroom and accessibility for students who did not finish a program to return and do so. Distance education courses are most often more convenient.

The objective for students enrolled in any course is to obtain knowledge. Learning is the process whereby knowledge is gained. According to Kolb (1984), a large part of learning is through experience. Dewey, Lewin, and Piaget tied experience into the learning process. Their theories were the foundation of experiential learning. Kolb's theory regarding learning is a cyclical process. Two fundamental elements exist: taking in information and processing the experience. Through his model of experiential learning Kolb developed a learning style inventory to assist people in determining the best way for them to learn. The learning style inventory identifies one's learning style.

Numerous studies exist as well as research on distance education and on learning and learning styles. However, research identified in this literature review regarding distance education and learning styles includes discrepancies in the findings. Results of some studies have indicated no significant difference in performance among distance education classes using interactive television and on-campus classes, while results of other studies have indicated that distance education students to outperform on-campus students.

The purpose of this study is to investigate if the learning styles of undergraduate students enrolled in distance education courses at East Tennessee State University are related to levels of performance. In addition, the study seeks to ascertain if there is a difference in the performance outcomes of the distance education students and students enrolled in a different section of the same course on-campus taught by the same instructor.

CHAPTER 3

METHODOLOGY

The purpose of this study is to investigate the learning styles of students within the traditional classroom, remote site classroom, and broadcast classroom and to determine if there is a relationship between a student's performance and learning style in these distinct settings. This chapter includes a description of the population, the research design, and how the data were collected and analyzed.

Population

The target population for this study was made up of 138 undergraduate students at East Tennessee State University who chose to enroll in an ITV course and students who chose to enroll in a section of that same course held in a traditional classroom setting, with both sections taught by the same professor. Undergraduate students were selected because of their accessibility and availability in sufficient numbers in the different settings. Only a sample of the total number of students in ITV classes at East Tennessee State University was studied. The findings of this research may be possible to generalize to the target population.

Research Design

This is a quantitative study. The data were collected using a two-part survey. The first part was designed by the researcher to gather demographic data and information about why each student selected the instructional format in which he or she was enrolled as well as students' preferences for classroom format. Demographic data from the students included:

1. Class site (traditional, broadcast, or remote)
2. Student's gender
3. Student's age
4. Student's ethnicity
5. Student's class standing (freshman, sophomore, junior, or senior)
6. Number of ITV classes taken
7. The reason for selecting a particular instructional format
8. Would the student prefer to be in another classroom

Questions 1 through 6, (see Appendix C for the survey) were developed in order to enable the researcher to address the research questions. Questions 7 and 8 were developed in order to provide insight as to why the student chose to enroll in the class and if he or she preferred another class.

The second part of the survey was made up entirely of Kolb's Learning Style Inventory (LSI) which was used to assess the student's learning style. The following research questions were used as a basic focus of this study.

1. What are the learning styles of students in the traditional classroom, the broadcast classroom, and the remote classroom?
2. Do these learning styles vary by gender, ethnicity, or age in the traditional classroom, broadcast classroom or remote classroom?
3. Among gender, ethnicity and age groups, which classroom setting and learning style has the best student performance based on mid-semester grades?

Research Hypotheses

- Ho 1. There is no difference in academic performance among students in the remote classroom, the broadcast classroom, and the traditional classroom.
- Ho 2. There is no difference in academic performance among students with different learning styles.
- Ho 3. There is no difference in learning styles between male and female students.
- Ho 4. There is no difference in learning style among students with different ethnicities.

Ho 5. There is no difference in learning style among students of varying age groups.

Study Instrument

Kolb's Learning Style Inventory (LSI) developed by David A. Kolb, Professor of Organizational Behavior at the Weatherhead School of Management, was used in this study. The instructor participating in the study distributed the inventory to students in the remote classroom, broadcast classroom, and traditional classroom. The learning style inventory, consisting of 12 questions, "describes the way you learn and how you deal with ideas and day-to-day situations in your life" (Kolb, 1993, p.24). The learning style of each student was determined by answers given on the inventory and scored by the researcher using the profile sheet provided by McBer and Company. Permission from Kolb and McBer and Company to use the Learning Style Inventory and the profile sheet for scoring the inventory had been granted to the researcher and may be found Appendix A.

Data Collection

The researcher contacted faculty members teaching undergraduate courses via ITV and found two instructors teaching an ITV course with a section of the same course in the traditional classroom. Only one of these instructors was used for this study due to class size.

The learning style inventory and student information survey were distributed to each student by the instructor at each site: the traditional classroom, the remote classroom, and the broadcast classroom. The survey and inventory took approximately 15 minutes to complete. The instructor recorded a unique number on each survey and recorded that number with the corresponding student so the instructor would be able to associate a mid term grade half-way

through the semester. The researcher was given a unique number previously assigned to the learning style inventory and the same number was used to identify academic performance based on grades. This procedure assured each student complete anonymity.

Data Analysis

The research questions for this study provided the basis for the analysis of the data. Using the profile provided by McBer and Company, the researcher was able to determine the learning style of each student by evaluating the responses recorded on Kolb's Learning Style Inventory thus determining the type of learner as either Accommodator, Assimilator, Converger, or Diverger.

Inferential and descriptive statistical procedures from the software package Microsoft EXCEL® and the add-in package WinSTAT® for Microsoft EXCEL version 2001.1, were used for data analysis.

The Kruskal-Wallis Test was used to test null hypothesis 1 and null hypothesis 2. As described by Vogt, 1993, this is a nonparametric test of statistical significance used when testing more than two independent samples. It is an extension of the Mann-Whitney U test, and of the Wilcoxon rank sum test, to three or more independent samples.

Null hypothesis 3, null hypothesis 4, and null hypothesis 5 were tested using the Chi-Square test. Chi-Square is a "test statistic" (Vogt, 1993, p. 34). This test is used to assess the statistical significance of a finding and used as a goodness-of-fit test. Vogt describes goodness-of-fit as "how well a model, a theoretical distribution, or an equation matches actual data" (p. 101). In addition, Cross-Tabulation was run on the data for null hypothesis 3, null hypothesis 4, and null hypothesis 5. Vogt identified Cross-Tabulation as:

A way of presenting data about two variables in a table so that their relations are more obvious. Also called a contingency table or a crossbreak table. It can be used for categorical variables only shows the joint frequency distribution of the two variables (p. 55).

In addition, regression was used. Vogt (1993), explained regression as being “any of several statistical techniques concerned with predicting some variables by knowing others (p. 192). He also stated that the “term regression originated in the work of the nineteenth-century researcher Francis Galton. In his studies of the heredity of characteristics such as height, he noted the phenomenon of statistical regression, or regress toward the mean” (p. 192).

Summary

Chapter 3 included a description of the methods and procedures used for this study. The research design was explained. The data collection and planning for the data analysis were presented.

The results of the data analysis are presented in Chapter 4. The summarization, conclusions, and recommendations including recommendations for further research can be found in chapter 5.

CHAPTER 4

DATA PRESENTATION

The purpose of this study was to investigate the learning styles of students within the traditional classroom, remote site classroom, and broadcast classroom and to determine if there is a relationship among learning styles and performance in these distinct settings. Kolb's Learning Style Inventory was used to ascertain the student's learning style and a second short survey was used to determine certain demographic information. This study was constructed on the basis of three research questions:

1. What are the learning styles of students in the traditional classroom, the broadcast classroom, and the remote classroom?
2. Do these learning styles vary by gender, ethnicity, or age in the traditional classroom, broadcast classroom or remote classroom?
3. Among gender, ethnicity and age groups, which classroom setting and learning style has the best student performance based on mid-semester grades?

The researcher contacted the distance education director at ETSU to gather information on instructors who were teaching ITV courses. From this list of more than 20 ITV courses, all were ruled out with the exception of two because the class was a graduate level course or the instructor did not have a traditional classroom section. Of the two courses left, one was omitted due to the low number of students enrolled in the sections.

Data were gathered from an undergraduate Principles of Nutrition course from the Department of Applied Human Science. This course was taught by one instructor had a section of the course in a broadcast classroom, remote classrooms, and a traditional classroom. One hundred thirty-eight surveys were distributed by the instructor to the students in the various

classroom settings. Returned were 86 usable surveys, resulting in a return rate of 62%. Students under the age of 18 were asked not to participate in the study because they are not considered adults. The Institutional Review Board guidelines must be met in order for surveys of students to occur. Omitting students under the age of 18 insured for quicker approval from the IRB.

Demographic Survey Data

Part one of the survey consisted of eight questions that addressed class site, gender, age, ethnicity, class standing, number of ITV courses taken, reason for selecting a particular instructional format, and preference to be in another classroom.

As shown in Table 3, nearly 90% of the students were female and the majority (96.5%) was Caucasian. The 18 to 21 age group held the largest percentage of students at 64%.

Table 3
Demographic Information of Gender, Age, and Ethnicity

Gender	<u>N</u> (%)	Age	<u>N</u> (%)	Ethnicity	<u>N</u> (%)
Male	9 (10.5)	18-21	55 (64.0)	American Indian	1 (1.2)
Female	77 (89.5)	22-26	11 (12.8)	Black	2 (2.3)
		27+	20 (23.2)	Caucasian	83 (96.5)
Total	86		86		86

Additional information is shown in Table 4 including class site, class standing, and reason for taking the class. The broadcast classroom held 16.2% of the surveyed students with the remote classrooms containing 41.9% among them and the traditional classroom containing 41.9%. Sophomores represented the majority of the surveyed students at 51.2% and the majority of student’s reasons for taking the course were first because it was a required class at 39.5% and the time at which the class was offered being of second importance with 30.2%.

Table 4

Demographic Information of Class Site, Class Standing, and Reason

Class Site	<u>N</u> (%)	Class Standing	<u>N</u> (%)	Reason for taking class	<u>N</u> (%)
Broadcast	14 (16.2)	Freshman	6 (6.9)	Location	22 (25.6)
Remote	36 (41.9)	Sophomore	44 (51.2)	Time	26 (30.2)
Traditional	36 (41.9)	Junior	27 (31.4)	Instructor	0 (0)
		Senior	9 (10.5)	Required	34 (39.5)
				Other:	4 (4.7)
Total	86		86		86

Classroom Preference Question and Responses

The researcher also asked the students to respond to the open-ended question: “Would you prefer to be in another classroom other than the one you are in?” The majority of the students, 70%, stated “no” they would not prefer to be in another classroom. However, 27%

replied “yes”, they would prefer to be in another classroom. And, 3.5% did not respond to this question.

Responses to the open-ended question varied. One student replied “I do not like the many interruptions of the ITV class (phones, monitors, feedback, people coming in and out of the room, etc.)” Several responses included that there was so much activity going on in the ITV classrooms, and the classrooms were very distracting. Some students reported finding it difficult to concentrate on the subject matter and remain focused on the call in the ITV classrooms.

Other students said: “I would prefer to be in the live classroom” or “I would prefer the broadcast location.” The absence of the teacher from the classroom was listed as detrimental in the responses of several students.

One student indicated that being in a remote classroom was difficult. The response was, “I feel like I can't pay attention to the television, you can't hear, nothing is ever focused, and everything looks washed-out on the television.”

Other student responses included “I do not like this style of learning” and “I don't care for this type of classroom setting”. Both of these students were located in the remote classroom site.

There were very few responses (only 14) to the open-ended question, item 8, on part one of the survey. Therefore, these responses to this item can not be said to represent the entire population.

Kolb's Learning Style Inventory

Kolb's Learning Style Inventory was distributed to the students by the instructor. The researcher scored these inventories using the profile provided by McBer and Company. The distribution of Learning Styles from the surveyed students is presented in Table 5.

Table 5

Distribution of Learning Styles among Students

<u>Learning Style</u>	<u>N</u> <u>(%)</u>
Accommodator	17 (20)
Diverger	15 (17)
Converger	21 (25)
Assimilator	33 (38)
<u>Total</u>	<u>86</u>

The highest occurrence for learning styles existed in the Assimilator category. The learning mode of the Assimilator focuses on reflective observation and abstract conceptualization. People with this type of learning style excel in inductive reasoning, are concerned with abstract concepts, and have a strong ability to create theoretical models. The explanations for each learning style can be reviewed using Table 6.

Table 6

Kolb's Learning Styles (Smith 2001)

Learning Mode	Personal Characteristics	Learning Style
Concrete Experience + Active Experimentation	<ul style="list-style-type: none"> • More of a risk taker • Performs well when required to react to immediate circumstances • Solves problems intuitively 	Accommodator
Reflective Observation + Abstract Conceptualization	<ul style="list-style-type: none"> • Excels in inductive reasoning • Concerned with abstract concepts rather than people • Strong ability to create theoretical models 	Assimilator
Abstract Conceptualization + Active Experimentation	<ul style="list-style-type: none"> • Strong in practical application of ideas • Can focus on hypo-deductive reasoning on specific problems • Unemotional • Has narrow interests 	Converger
Concrete Experience + Reflective Observation	<ul style="list-style-type: none"> • Imaginative • Good at generating ideas and seeing things from different perspectives • Interested in people • Broad cultural interests 	Diverger

Null Hypothesis Data Analysis

The result of data analysis of the five null hypotheses provided the following findings.

Null Hypothesis One

Ho 1. There is no difference in academic performance among students in the remote classroom, the broadcast classroom, and the traditional classroom.

The Kruskal-Wallis Test was completed to test for difference in average midterm scores resulting in a pvalue of 0.4399. Based on this test, the differences in the average midterm grades among the three classroom settings are not statistically significant. Null Hypothesis One was not rejected. Data are presented in table 7.

Table 7

H-Test (Kruskal-Wallis) Mid-term vs. Class Site (Ho 1.)

Class Site	<u>N</u>	Mid-term grade Mean Rank
Broadcast Classroom	14	43
Remote Classroom	36	47.361
Traditional Classroom	36	39.833

H	Degrees of Freedom	P
1.6429	2	0.4399

Null Hypothesis Two

Ho 2. There is no difference in academic performance among students with different learning styles.

The Kruskal-Wallis Test was completed to test for difference in average midterm scores resulting in a p value of 0.4188. Based on this test, the differences in the average midterm grades among the different learning styles are not statistically significant. Null Hypothesis two was not rejected. Data are presented in table 8.

Table 8

H-Test (Kruskal-Wallis) Mid-term vs. Learning Style (Ho 2.)

Learning Style	N	Mid-term grade Mean Rank
Accommodator	17	35.470
Diverger	15	48.4333
Converger	21	42.0714
Assimilator	33	46.3030

H	Degrees of Freedom	P
2.828	3	0.4188

Null Hypothesis Three

Ho 3. There is no difference in learning styles between male and female students.

Cross-tabulation and Chi-Square was run on data for this hypothesis. Based on these tests, the differences in learning styles between male and female students are not statistically significant. Null Hypothesis Three was not rejected. Data are presented in table 9.

Table 9

Chi-Square and Cross-tabulation: Gender vs. Learning Style

Accommodator		Male	Female	
	Expected Frequency	1.779	15.220	
	Cell Chi-Square	0.3411	0.0398	
Diverger		Male	Female	
	Expected Frequency	1.569	13.430	
	Cell Chi-Square	1.569	0.183	
Converger		Male	Female	
	Expected Frequency	2.197	18.802	
	Cell Chi-Square	0.292	0.034	
Assimilator		Male	Female	
	Expected Frequency	3.453	29.546	
	Cell Chi-Square	0.692	0.080	
% of Cells with E.F. < 5	Chi-Square	Degrees of Freedom	P	Contingency Coefficient
50	3.234	3	0.356	0.190

Null Hypothesis Four

Ho 4. There is no difference in learning style among students with different ethnicities.

I was unable to conduct this test and excluded ethnicity due to sample. All but two of the sample were found to be Caucasian.

Null Hypothesis Five

Ho 5. There is no difference in learning style among students of varying age groups.

Cross-tabulation and Chi-Square was run to test for difference in learning style among varying age groups. Based on these tests, the differences in learning styles among the age groups are not statistically significant. Null Hypothesis Five was not rejected. Data are presented in table 10.

Table 10

Chi-Square and Cross-tabulation: Age vs. Learning Style

Accommodator	18 to 21	22 to 26	27+
Expected Frequency	10.872	2.174	3.953
Cell Chi-Square	0.117	0.313	0.965
Diverger	18 to 21	22 to 26	27+
Expected Frequency	9.593	1.918	3.488
Cell Chi-Square	0.017	0.4398	0.075
Converger	18 to 21	22 to 26	27+
Expected Frequency	13.430	2.686	4.883
Cell Chi-Square	0.013	0.642	0.1599
Assimilator	18 to 21	22 to 26	27+
Expected Frequency	21.104	4.220	7.674
Cell Chi-Square	0.0578	0.353	0.704

% of Cells with E.F. < 5	Chi-Square	Degrees of Freedom	P	Contingency Coefficient
58	3.859	6	0.695	0.207

Research Questions

Using the data analysis from hypotheses 1 through 5, the three research questions can now be answered.

Research Question One

What are the learning styles of students in the traditional classroom, the broadcast classroom, and the remote classroom?

The broadcast classroom varied slightly by the number of each type of learning style. Convergers had the highest number of occurrences in the broadcast classroom with 5 students being identified as having a converging learning style. The Convergers were followed by the Divergers with 4 students identified as having a diverging learning style. Three students in the broadcast classroom were identified as Accomodators and three others were identified as Assimilators.

In the remote classroom students were identified with the following learning styles: 7 Accomodators, 8 Divergers, 4 Convergers, and 15 Assimilators.

The traditional classroom included students with the following learning styles: 7 Accomodators, 3 Divergers, 12 Convergers, and 15 Assimilators. Both the traditional and remote classrooms had the same number of Accomodators and Assimilators. Learning styles by class site are presented in Table 11.

Table 11

Learning Styles by Class Site

	Broadcast	Remote	Traditional
Accommodator	3	7	7
Diverger	4	8	3
Converger	5	4	12
Assimilator	3	15	15

Research Question Two

Do these learning styles vary by gender, ethnicity, or age in the traditional classroom, broadcast classroom or remote classroom?

Based on the results of the data analysis from null hypothesis 1, null hypothesis 2, null hypothesis 3, null hypothesis 4, and null hypothesis 5; the learning styles of participants in this study do not vary by gender, ethnicity, or age in the different class settings.

Data analysis for all null hypothesis can be found in Appendix E.

Research Question Three

Among gender, ethnicity and age groups, which classroom setting and learning style has the best student performance based on mid-semester grades?

Among gender, the female students in the remote classrooms have the highest mid-semester grades. The highest mid-semester grades among learning styles for females students occurs within those female students who are Accommodators. In the male category, the remote class site again hosts the highest mid-semester grades. Within learning styles, among male students, those who are Divergers have the highest mid-semester grades. None of these differences was significant at the .05 alpha level.

Ethnicity will be excluded due to the sample containing all Caucasian students with the exception of three.

Among age, students in the broadcast classroom, in the age group 18 to 21 have the highest mid-semester grades. Like the male gender variable, the Divergers again have the highest mid-semester grades.

The data presented in this chapter collaborates to the findings from the studies of Dexter (1995), Freeman (1995), and Dillon et al. (1992) showing no significant differences in performance among broadcast and traditional classrooms as compared to the remote site classrooms.

Chapter 5 presents an interpretation of the finding of this study. Conclusions, implications, and recommendations for additional research are also included.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the learning styles of students within the traditional classroom, remote site classroom, and broadcast classroom and to determine if there is a relationship among learning styles and performance in these distinct settings.

To gather the data, a two-part survey was distributed by the instructor to undergraduate students over the age of 18. The first part was designed by the researcher to gather demographic data and information about why each student selected the instructional format in which he or she was enrolled as well as students' preferences for classroom format. The second part of the survey was made up entirely of Kolb's Learning Style Inventory (LSI) which was used to assess the student's learning style. The return rate from the classrooms was 62%.

Findings

No statistically significant difference were found in and of the five null hypotheses. Therefore, the null hypotheses were not rejected. Through analysis of the data, using the Kruskal-Wallis Test, Chi-Square, Cross Tabulation, and Regression, I found that for my sample: no difference existed in academic performance among students in the remote classroom, the broadcast classroom, and the traditional classroom. There was no difference in academic performance among students with different learning styles. No difference was found in learning styles among students of different genders and age groups. Ethnicity was not tested due to an overwhelming majority of students in the sample being Caucasian.

My research in this study is consistent with the study of Freeman (1995). Freeman's study focused on learning styles and outcomes for medical students enrolled in distance education courses. Her research found when examining delivery methods and learning styles, no significant difference was found. Likewise, the results of Dexter (1995) agreed with Freeman's research. His study included 286 campus-based students and 138 distance education students at Pikes Peak Community College. Dexter's research also concluded that there was no significant difference in the performance outcomes between the on-campus and off-campus students. Like Dexter's research, I also found that females scored higher in the remote classrooms than did their male counterparts.

Dillon et al. (1992) also found that among lower-level college students enrolled in televised courses, no significant differences in overall GPAs were found between the on-campus and off-campus students.

However, in the study by Burkman (1994), who studied 54 students enrolled in two psychology classes, he concluded there were significant differences in achievement between the host class and the remote classes. Burkman's study used the learning style inventory by Dunn and Dunn.

Interestingly, I found that Class Standing was the only significant value in this study. Results of this study indicated that members of the Senior class scored higher on their mid-semester exam. This result was significant at the .0095 level, when compared to scores obtained by students of other class standings.

Conclusions

Distance education is not a new concept in higher education. It continues to flourish in popularity among students of different age groups, genders, and ethnicities. Distance education is well-liked because it is practical for students who have time constraints due to family and/or work obligations, to those who live long distances from colleges and universities, and students with disabilities.

There have been questions regarding whether or not students achieve academically the same performance if classroom delivery methods vary. The findings of this study concluded that while students in the remote classroom did score higher mid-semester grades, those differences were not statistically significant and therefore may have occurred by chance. There are no statistically significant differences in these findings that would indicate that students in remote class sites academically achieve any better or worse than those in broadcast class sites or traditional class sites.

Researchers such as Schmeck (1983) argue that identifying a student's learning style in the distance education setting should be beneficial to both the instructor and the student. While I agree that it may be beneficial, the research in this study does not validate Schmeck's statement.

The research as compiled by Freeman (1995), Dexter (1995), and Dillon et al. (1992) indicate the delivery system of instruction is not significant in the academic performance of the students they studied. The data analysis in this research study has concluded the same outcome. However, researchers such as Kelly (1997) have a valid argument that there are benefits to understanding one's learning style. Learning styles can help students and instructors find areas of strength and weakness. This information can allow the instructor to cover materials in a way that best fits the diversity of the classroom.

In agreement with other researchers who have found there is no significant differences in academic performance among students in the remote classrooms, broadcast classroom, and traditional classroom sites; these findings suggest that ITV courses and other distance education options are cost effective ways to deliver high quality instruction to students at a variety of locations.

In addition, instructors who participate in distance education courses should be commended for the additional effort they provide to meet the many and varied needs of students in all the learning environments. Though the data in this study fail to show that a positive difference results from ITV broadcast or remote classroom participation, it does demonstrate again that there is also no reduction in quality of instruction as indicated by the lack of statistically significant differences between groups of students in all three settings.

Recommendations

As a result of this study, these recommendations may prove useful:

1. Research should be conducted on a larger sample of undergraduate students enrolled in ITV courses at ETSU and other universities to further research learning styles and academic performance.
2. Similar comparative studies should be conducted on graduate students enrolled in ITV courses at ETSU and other universities to further research learning styles and academic performance.
3. Research should be conducted to study the use of learning style inventories in undergraduate and graduate ITV courses at ETSU and other universities.

4. Research using more diverse populations should be conducted to investigate the variable of ethnicity that could not be done due to the nature of the sample used in this study.
5. Research using a full semester of grading should be conducted.
6. Research should be conducted using more instructors with focus on the teacher's learning styles.
7. The continuation of ITV and other distance education delivery formats should not only continue but be encouraged at East Tennessee State University. This research and other studies have shown that there is no difference in achievement levels which illustrates that these courses are as good as traditional classrooms for many students.
8. The continuation of ITV and other distance education delivery formats offer large cost savings to the universities by using one instructor for a course. This research and other studies have shown that there is no difference in achievement levels in class sites that do have an instructor present as opposed to class sites that do not.

REFERENCES

- Amundsen, C. & Bernard, R. (1989). Institutional support for peer contact in distance education: An empirical investigation. *Distance Education*, 10 (1), 7-27.
- Alford, B. & Engelland, B. (2001). Delivering distance education via interactive television: Considerations in faculty preparation, course administration and student evaluation. [Online]. Retrieved April 12, 2002 from <http://www.mmaglobal.org/alford.htm>
- Anderson, M. (1994). *Success in distance education courses versus traditional classroom education courses*. (Doctoral Dissertation, Oregon State University, 1994).
- Baker, M. (1995). *Distance teaching with interactive television: Strategies that promote interaction with remote-site students*. (Doctoral dissertation, The University of Iowa, 1994).
- Beard & Wilson. (2002). The concept of experiential learning and John Dewey's theory of reflective thought and action. *International Journal of Lifelong Education*. 19(1), January/February, pp. 54-72.
- Becker, G. (1999). How the web is revolutionizing learning. *Business Week*, 12/27/99.
- Blackmore, J. (1996). Learning Styles: Preferences. Retrieved April 19, 2002 from <http://www.cyg.net/~jblackmo/diglib/styl-d.html>

- Burkman, T. (1994). *An Analysis of the relationship, achievement, attitude, and sociological element of individual learning styles of students in an interactive television course.* (Doctoral dissertation, Western Michigan University, 1994).
- Cambre, M. (1991). The state of the art of instruction television. *Instructional technology: Past, present, and future.* Englewood, CO: Libraries Unlimited.
- Charp, S. (1999, September). Distance education. *The Journal*, 27(2), 1-3.
- Claxton, C. & Murell, P. (1987). *Learning styles: Implications for improving education practices.* ASHE-ERIC Higher Education Report No. 4. Washington, D.C.: Association for the Study of Higher Education.
- Curran, C. (1997). ODL and traditional universities: dichotomy or convergence? *European Journal of Education*, 32, 335-346.
- DeBello, T. (1985). A Critical analysis of the achievement and attitude effects of administrative assignments to social studies writing instruction based on identified, eighth grade student's learning style preferences for learning alone, with peers, or with teachers. (Doctoral dissertation, St. John's University, 1985). *Disseration Abstracts International*, 46, 1606A.
- Dewey, J. (1938). *Experience and education.* New York: Macmillan.
- Dexter, D. (1995). *Student performance based outcomes of televised interactive community college distance education.* (Doctoral Dissertation, Colorado State University, 1995).
- Dillon, C., Gunawardena, C., & Parker, R. (1992). Learner support: The Critical link in distance education. *Distance Education*, 13(1), 29-45.

- Distance Learning. (2001). *Issues and controversies on file*, Vol. 6, Facts on File News Services, March 16, 2001.
- Felder, M. (1996). *Matters of style*. ASEE Prism, 6(4), 18-23. Retrieved April 12, 2002 from <http://www.ncsu.edu/felder-public/Papers/LS-Prism.htm>
- Freeman, V. (1995). *Delivery methods, learning styles and outcomes for distance medical technology students*. (Doctoral Dissertation, The University of Nebraska, 1995).
- Gagne, R. & Driscoll, M. (1988). *Essentials of learning for instruction, 2nd Edition*. Englewood Cliffs, New Jersey: Prentice Hall.
- Giannitti, M.C. (1988). An experimental investigation of the relationships among the learning style sociological preferences of middle school students, their attitudes and achievement in social studies, and selected instructional strategies (Doctoral dissertation, St. John's University, 1988). *Dissertations Abstracts International*, 49, 2911A.
- Gibson, E., Hsleh, P., Miller, T., & Walsh, W. (1996). Factors affecting achievements in a satellite delivered Japanese language program. *The American Journal of Distance Education*, 9(1), 11-25.
- Heron, J. (1992). *Feelings and personhood: Psychology in another key*. London: Sage.
- Holmberg, B. (1977). *Distance education: A survey and bibliography*. New York: Nichols.
- Holmberg, B. (1986a). *Growth and structure of distance education*. London: Routledge.
- Holmberg, B. (1986b). *Theory and practice of distance education*. London: Routledge.
- Innovations in Distance Education*. (n.d.). Retrieved from http://www.outreach.psu.edu/de/ide/guiding_principles

Jeffries, M. (2001). The history of distance education. *IPSE – Research in distance education*.

Retrieved December 3, 2001 from

<http://www.ihets.com/consortium/ipse/fdhandbook/resrch.html>

Jonassen, D.H. (1992). Applications and limitations of hypertext technology for distance learning. *Paper presented at the Distance Learning Workshop, Armstrong Laboratory, San Antonio, Texas.*

Keefe, J. (1988). *Learning style profile handbook*. Reston, VA: National Association of Secondary School Principals.

Keegan, D. (1986). *Foundations of distance education*. London: CroomHelm.

Kelly, C. (1997). David Kolb, the Theory of Experiential Learning and ESL. *The Internet TESL Journal*, Vol. III, No. 9, September, 1997.

Knox, A. (1986). *Helping adults learn*. San Francisco: Jossey Bass.

Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Kolb, D. (1993). *Learning style inventory*. Boston: McBer.

Liu, Y., & Ginther, D. (1999). Cognitive styles and distance education. *Online Journal of Distance Learning Administration*, volume II, number III, Fall.

Litzinger, M., & Osif, B. (1992). Accommodating diverse learning styles: Designing instruction for electronic information sources. *What is good instruction now? Library instruction for the 90s*. Ann Arbor, MI: Pierian Press.

- Matthews, D. (1999). The origins of distance education and its use in the United States. *The Journal*, 27(2), 54-56.
- McIsaac, M., & Gunawardena, C. (2001). *The handbook of research for educational communications and technology*. Retrieved December 3, 2001 from <http://www.aect.org/Intranet/Publications/edtech/13/index.html>
- Miles, B. (1987). An investigation of the relationships among the learning style sociological preferences of fifth and sixth grade students, selected interactive classroom patterns, and achievement in career awareness and career decision-making concepts (Doctoral dissertation, St. John's University, 1987). *Dissertation Abstracts International*, 48, 2527A.
- Petrides, L. (2000). *Case Studies on Information Technology in Higher Education: Implications for Policy and Practice*. Hershey, PA: Idea Group.
- Piaget, J. (1952). *The origins of intelligence in children*. New York: International University Press.
- Phillips, D., & Soltis, J. (1985). *Perspectives on learning*. New York: Teachers College Press.
- Pickles, T. (n.d.) *Experiential learning articles and critiques of David Kolb's Theory*. Retrieved August 12, 2002 from <http://reviewing.co.uk/research/experiential.learning.htm#2>
- Plato, *Meno*. (1981). Translation Benjamin Jowett. Indianapolis, IN: Bobbs-Merrill.
- Rogers, C.R. & Freiberg, H.J. (1994). *Freedom to learn (3rd Edition)*. Columbus, OH: Merrill/Macmillan.

- Ruttan, J. (1998). *Cognitive learning theory terms*. Retrieved September 3, 2002 from http://mse.byu.edu/ipt/ipt301/jordan/learnterm_c.html
- Rumble, Greville & Harry, K. (1982). *The distance teaching universities*. New York: St. Marin's Press.
- Salomon, G. (1981). *Communication and education: Social and psychological interactions*. London: Sage.
- Schmeck, R.R. (1983). Learning styles of College Students. In R.F. Dillon and R.R. Schmeck (Eds.), *Individual differences in cognition*. (pp 233-279). London: Academic Press.
- Sherry, L. (1996). Issues in distance learning. *International Journal of Educational Telecommunication*. 1, 337-265.
- Skinner, B.F. (n.d.) *Operant conditioning*. Retrieved from <http://tip.psychology.org/skinner.html>.
- Smith, M. (2001). David A. Kolb on experiential learning. *The Encyclopedia of Informal Education*. Retrieved from <http://www.infed.org/bibliob-explrn.htm>.
- Steiner, V. (1995, October 10). *What is distance education?"* Retrieved from <http://www.dlrn.org/text/library/dl/whatis.html>
- Tharp, G. (1992). Relationship between personality type and achievement in an undergraduate physiology course. *American Journal of Physiology*, 262, S1-S3.
- Tennent, M. (1988). *Psychology and adult learning*. London: Routledge.
- Vogt, W. (1993). *Dictionary of statistics and methodology*. Newberry Park, CA: Sage.

Webb, N.M. (1983). Predicting learning from student interaction: Defining the interaction variables. *Education Psychologist*. 18(1), 33-41.

Wedemeyer, C.(n.d.) *Learning at the back door: Reflections on non-traditional learning in the lifespan*. Madison, WI: The University of Wisconsin Press.

Wiggins, S.M. (n.d.) *Design and illustration*. Retrieved from www.kaskal.net/smw/creativity.html.

Willis, B. (1995). Guide #1 Distance education: An overview. *Engineering Outreach at the University of Idaho* [On-line]. Available: <http://www.uidaho.edu/evo/dist1.html>

APPENDICES

APPENDIX A

Letter from McBer & Company received 6/10/02 giving the researcher permission to use the Learning Style Inventory by David A. Kolb.

Dear Colleague,

Thank you for your interest in the Learning Style Inventory (LSI). In cooperation with David A. Kolb you have been approved to do research using the LSI, provided you mail us a copy of your findings, and your research contribution is greatly appreciated.

We look forward to hearing about your results. Please mail us a copy of your research paper or publication when completed to the following address:

LSI Research Contracts
c/o Keith Cornella
HayGroup
116 Huntington Avenue, 4th floor
Boston, MA 02116

Attached you will find two documents (.pdf files--Adobe Acrobat 4.05):

* LSItest.pdf - This is a copy of the LSI test. You may print or copy this document as needed for your research.

* LSIprofile.pdf - The profile sheet contains the answer key for the test as well as the profiling graphs for plotting scores. This document may also be reproduced as necessary for your research. The AC-CE score on the Learning Style Type Grid is obtained by subtracting the CE score from the AC score. Similarly, the AE-RO score = AE minus RO.

If you have any further questions, you can call me at 617.927.5024.

Sincerely yours,
Keith Cornella
Permissions Editor

(See attached file: LSItest.pdf)

(See attached file: LSIprofile.pdf)

APPENDIX B

Kolb's Learning Style Inventory and Profile

Due to the request of McBer & Company, I will not be able to publish the LSI or the ranking profile in the appendix.

McBer & Company can be contacted for information regarding use and distribution of Kolb's Learning Style Inventory at:

LSI Research Contracts
c/o Keith Cornella
HayGroup
116 Huntington Avenue, 4th floor
Boston, MA 02116

APPENDIX C

Demographic Survey

DO NOT COMPLETE THIS SURVEY IF YOU ARE UNDER THE AGE OF 18

Please check the appropriate box:

- 1. Class Site Broadcast Classroom
 Remote Classroom
 Traditional Classroom

- 2. Gender Female
 Male

- 3. Age 18 to 21
 22 to 26
 27 to 31
 32 to 36
 37 to 41
 42 to 46
 Over 47

- 4. Ethnicity American Indian
 Black
 Caucasian
 Hispanic
 Other: (please specify) _____

- 5. Class Standing Freshman
 Sophomore
 Junior
 Senior

- 6. Number of ITV courses taken: _____

- 7. Reason for selecting a particular instructional format (ie. remote classroom, broadcast classroom, traditional classroom).
 - Location of class
 - Time of class
 - Instructor
 - Required class
 - Other: _____

- 8. Would you prefer to be in another classroom other than the one you are in?

APPENDIX D

Data Interpretation Key

Learning Styles	1	Accommodator	Class Site	1	Broadcast
	2	Diverger		2	Remote
	3	Converger		3	Traditional
	4	Assimilator			
Gender	0	Female	Ethnicity	1	American Indian
	1	Male		2	Black
		3		Caucasian	
		4		Hispanic	
		5		Other	
Age	1	18 to 21	Class Standing	1	Freshman
	2	22 to 26		2	Sophomore
	3	27+		3	Junior
		4		Senior	
Reason	1	Location	Preference	1	Yes
	2	Time		2	No
	3	Instructor			
	4	Required			
	5	Other			

APPENDIX E

WINSTAT Data Analysis Hypothesis 1 to 5

Midterm vs. Class site

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Class site</i>	1	14	43
	2	36	47.36111111
	3	36	39.83333333

H	Degrees of Freedom	P
1.642978991	2	0.439776123

Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Learning Style</i>	1	17	35.47058824
	2	15	48.43333333
	3	21	42.07142857
	4	33	46.3030303

H	Degrees of Freedom	P
2.828497548	3	0.418830185

Cross tabulation Gender vs. Learning Style

Crosstabulation

Column variable: Gender
Learning
Row variable: *Style*

	0	1	Sums
1			
Frequency	1	16	17
Expected frequency	1.779069767	15.22093023	
Row percent	5.882352941	94.11764706	
Column percent	11.11111111	20.77922078	
Total percent	1.162790698	18.60465116	
Cell chi-square	0.341161271	0.039875993	
2			
Frequency	0	15	15
Expected frequency	1.569767442	13.43023256	
Row percent	0	100	
Column percent	0	19.48051948	
Total percent	0	17.44186047	
Cell chi-square	1.569767442	0.183479311	
3			
Frequency	3	18	21
Expected frequency	2.197674419	18.80232558	
Row percent	14.28571429	85.71428571	
Column percent	33.33333333	23.37662338	
Total percent	3.488372093	20.93023256	
Cell chi-square	0.292912514	0.034236528	

Cross tabulation Gender vs. Learning Style cont'd

	4				
Frequency	5	28			33
Expected frequency	3.453488372	29.54651163			
Row percent	15.15151515	84.84848485			
Column percent	55.55555556	36.36363636			
Total percent	5.813953488	32.55813953			
Cell chi-square	0.692545611	0.08094689			
Sums	9	77			86
% Cells with E.F. < 5			Degrees of Freedom	P	Contingency Coefficient
					Cramer's V
50	3.234925559	3	0.356802977	0.190399022	0.193946935

Cross tabulation Ethnicity vs. Learning Style

Crosstabulation

Column variable: Ethnicity
Learning
Row variable: *Style*

	1	2	3	Sums
1				
Frequency	0	1	16	17
Expected frequency	0.395348837	0.197674419	16.40697674	
Row percent	0	5.882352941	94.11764706	
Column percent	0	100	19.27710843	
Total percent	0	1.162790698	18.60465116	
Cell chi-square	0.395348837	3.256497948	0.0100951	
2				
Frequency	0	0	15	15
Expected frequency	0.348837209	0.174418605	14.47674419	
Row percent	0	0	100	
Column percent	0	0	18.07228916	
Total percent	0	0	17.44186047	
Cell chi-square	0.348837209	0.174418605	0.018912861	
3				
Frequency	2	0	19	21
Expected frequency	0.488372093	0.244186047	20.26744186	
Row percent	9.523809524	0	90.47619048	
Column percent	100	0	22.89156627	
Total percent	2.325581395	0	22.09302326	
Cell chi-square	4.678848283	0.244186047	0.079260564	

Cross Tabulation Ethnicity vs. Learning Style cont'd

	4					
Frequency	0	0	33			33
Expected frequency	0.76744186	0.38372093	31.84883721			
Row percent	0	0	100			
Column percent	0	0	39.75903614			
Total percent	0	0	38.37209302			
Cell chi-square	0.76744186	0.38372093	0.041608294			
Sums	2	1	83			86
% Cells with E.F. < 5		Chi-square	Degrees of Freedom	P	Contingency Coefficient	Cramer's V
67	10.39917654	6	0.108817363	0.32844512	0.245886821	

Cross Tabulation Age vs. Learning Style

Crosstabulation

Column variable: Age
Learning
Row variable: *Style*

	1	2	3	Sums
1				
Frequency	12	3	2	17
Expected frequency	10.87209302	2.174418605	3.953488372	
Row percent	70.58823529	17.64705882	11.76470588	
Column percent	21.81818182	27.27272727	10	
Total percent	13.95348837	3.488372093	2.325581395	
Cell chi-square	0.117012809	0.313456038	0.965253078	
2				
Frequency	10	1	4	15
Expected frequency	9.593023256	1.918604651	3.488372093	
Row percent	66.66666667	6.666666667	26.66666667	
Column percent	18.18181818	9.090909091	20	
Total percent	11.62790698	1.162790698	4.651162791	
Cell chi-square	0.01726568	0.439816772	0.07503876	
3				
Frequency	13	4	4	21
Expected frequency	13.43023256	2.686046512	4.88372093	
Row percent	61.9047619	19.04761905	19.04761905	
Column percent	23.63636364	36.36363636	20	
Total percent	15.11627907	4.651162791	4.651162791	
Cell chi-square	0.013782342	0.642756468	0.159911406	

Cross Tabulation Age vs. Learning Style cont'd

	4					
Frequency	20	3	10			33
Expected frequency	21.10465116	4.220930233	7.674418605			
Row percent	60.60606061	9.090909091	30.3030303			
Column percent	36.36363636	27.27272727	50			
Total percent	23.25581395	3.488372093	11.62790698			
Cell chi-square	0.057819207	0.353161638	0.704721635			
Sums	55	11	20			86
% Cells with E.F. < 5		Chi-square	Degrees of Freedom	P	Contingency Coefficient	Cramer's V
58	3.859995833	6	0.695616049	0.207257484	0.149805995	

APPENDIX F

WINSTAT Data Analysis Research Question #3

Midterm vs. Gender

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Gender</i>	0	9	45.61111111
	1	77	43.25324675

H	Degrees of Freedom	P
0.071865758	1	0.78863936

Midterm vs. Ethnicity

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Ethnicity</i>	1	2	8.5
	2	1	3
	3	83	44.8313253

H	Degrees of Freedom	P
6.797435652	2	0.033416088

Midterm vs. Age

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Age</i>	1	55	42.14545455
	2	11	36.63636364
	3	20	51

H	Degrees of Freedom	P
2.797856936	2	0.246861346

Female Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Learning Style</i>	1	16	31.5
	2	15	43.9
	3	18	39.22222222
	4	28	40.51785714

H	Degrees of Freedom	P
2.649143634	3	0.448939101

Female Midterm vs. Class Site

H-Test (Kruskal-Wallis)

<i>Class site</i>	Mid-term grade	
	N	Mean Rank
1	14	38.85714286
2	34	41.85294118
3	29	35.72413793

H	Degrees of Freedom	P
1.175589586	2	0.555551041

Male Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

<i>Learning Style</i>	Mid-term grade	
	N	Mean Rank
1	12	24.79166667
2	10	33.9
3	13	30.96153846
4	20	25.05

H	Degrees of Freedom	P
2.960792715	3	0.397709775

Male midterm vs. Class site

H-Test (Kruskal-Wallis)

<i>Class site</i>	N	Mid-term grade Mean Rank
1	0	----
2	1	8
3	8	4.625

H	Degrees of Freedom	P
1.35	1	0.245278128

Age Group 1 Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

<i>Learning Style</i>	N	Mid-term grade Mean Rank
1	12	24.79166667
2	10	33.9
3	13	30.96153846
4	20	25.05

H	Degrees of Freedom	P
2.960792715	3	0.397709775

Age Group 1 Midterm vs. Class site

H-Test (Kruskal-Wallis)

<i>Class site</i>	N	Mid-term grade Mean Rank
1	12	30.125
2	20	30.925
3	23	24.34782609

H	Degrees of Freedom	P
2.073722411	2	0.354565861

Age Group 2 Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

<i>Learning Style</i>	N	Mid-term grade Mean Rank
1	3	4.333333333
2	1	5
3	4	5.25
4	3	9

H	Degrees of Freedom	P
3.507575758	3	0.319780916

Age Group 2 Midterm vs. Class Site

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Class site</i>	2	4	5
	3	7	6.571428571

H	Degrees of Freedom	P
0.571428571	1	0.449691803

Age Group 3 Midterm vs. Learning Style

H-Test (Kruskal-Wallis)

		N	Mid-term grade Mean Rank
<i>Learning Style</i>	1	2	7.5
	2	4	9.875
	3	4	7.25
	4	10	12.65

H	Degrees of Freedom	P
3.089108352	3	0.378089433

Age Group 3 Midterm vs. Class Site

H-Test (Kruskal-Wallis)

<i>Class site</i>	N	Mid-term grade Mean Rank
1	2	5.5
2	12	11.83333333
3	6	9.5

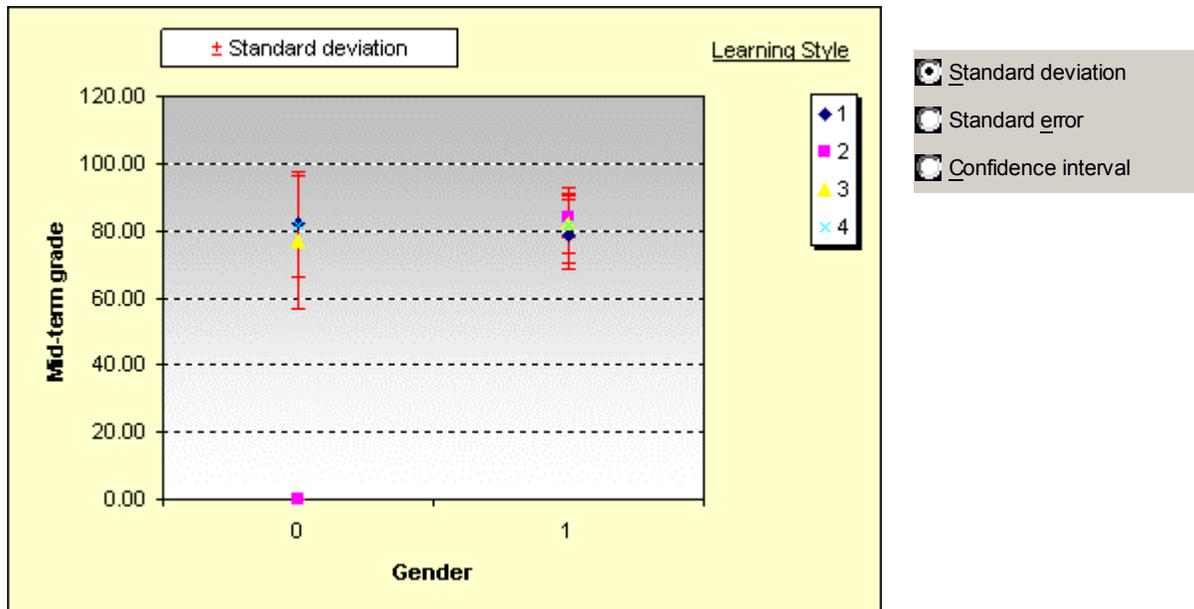
H	Degrees of Freedom	P
2.211186356	2	0.331014476

Means Midterm (Gender x Learning Style)

Means

Variable: Mid-term grade
 grouped by: Gender
Learning
 and by: *Style*

		95%				
		N	Mean	95% Conf. (±)	Std.Error	Std.Dev.
1		17	78.94	5.18	2.443028178	10.07286322
	0	1	82.00	----	----	----
	1	16	78.75	5.53	2.592826643	10.37130657
2		15	84.14	3.40	1.586874736	6.145939426
	0	0	----	----	----	----
	1	15	84.14	3.40	1.586874736	6.145939426
3		21	81.48	4.78	2.292564635	10.50585098
	0	3	76.63	48.83	11.34847028	19.65612712
	1	18	82.28	4.44	2.102476753	8.920053416
4		33	81.75	4.20	2.059935831	11.83343043
	0	5	81.86	19.76	7.11636143	15.91266791
	1	28	81.73	4.39	2.141811363	11.33340044
Entire sample		86	81.54534884	2.213341992	1.113185072	10.32325367

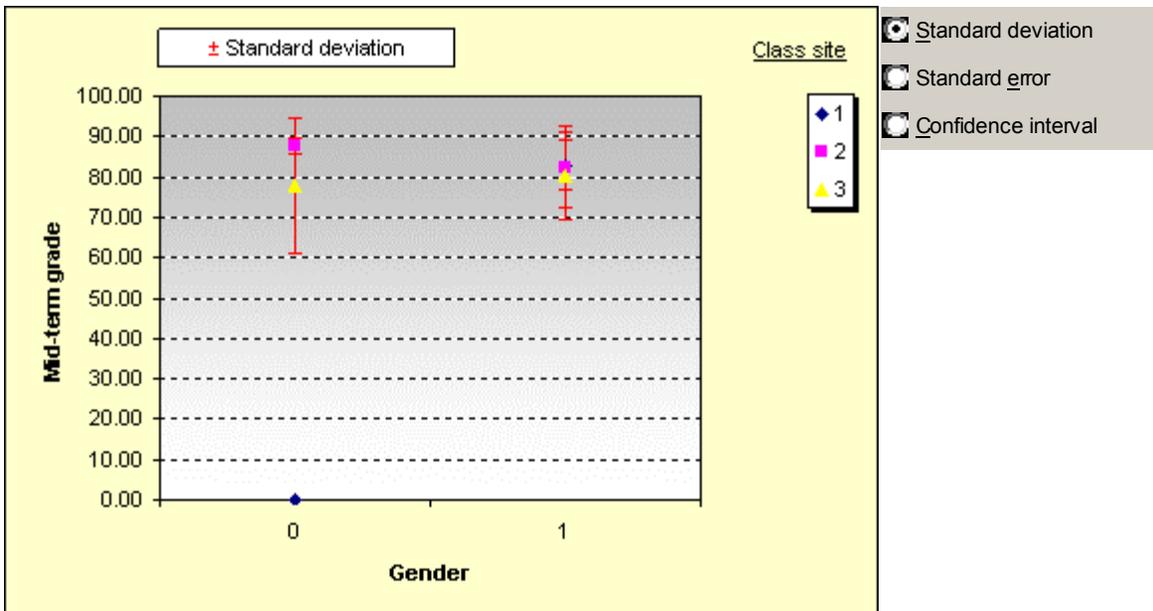


Means Midterm (Gender x Class Site)

Means

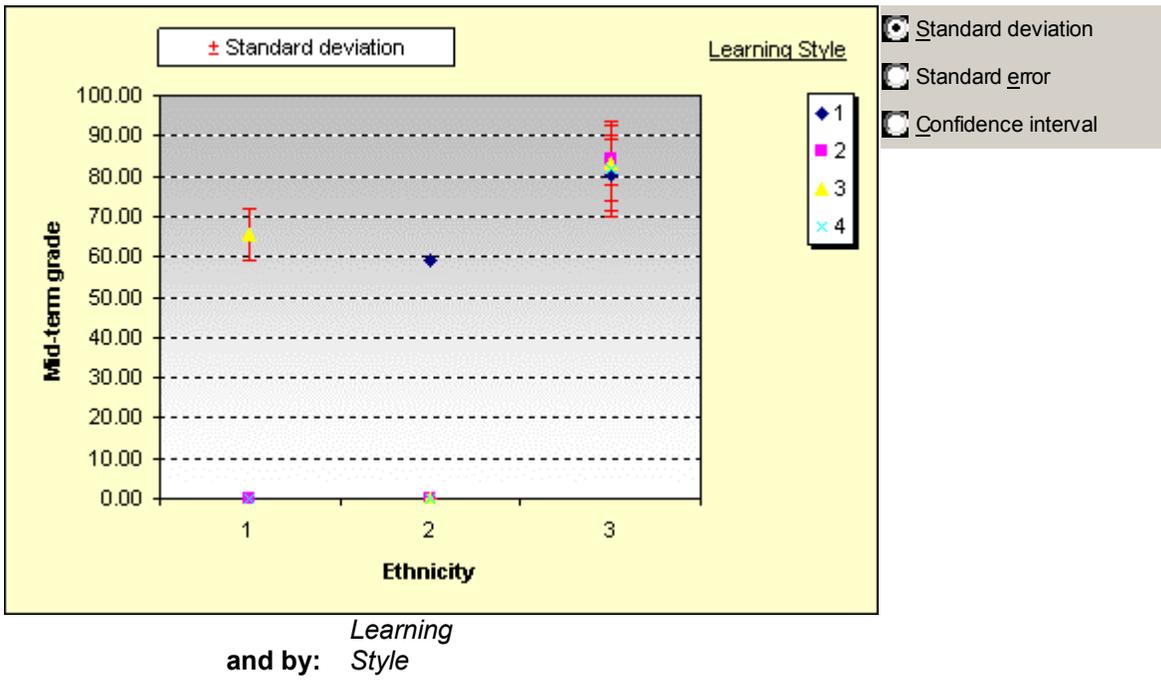
Variable: Mid-term grade
 grouped by: Gender
 and by: Class site

		95%				
		N	Mean	95% Conf. (±)	Std.Error	Std.Dev.
1		14	82.88	3.58	1.658517098	6.20560275
	0	0	----	----	----	----
	1	14	82.88	3.58	1.658517098	6.20560275
2		36	82.64	3.33	1.641477643	9.84886586
	0	2	87.55	14.50	1.45	2.050609665
	1	34	82.35	3.51	1.725277368	10.06000934
3		36	79.93	4.04	1.992306632	11.95383979
	0	7	78.01	15.55	6.352855697	16.80807629
	1	29	80.40	4.11	2.008059394	10.81373078
Entire sample		86	81.54534884	2.213341992	1.113185072	10.32325367

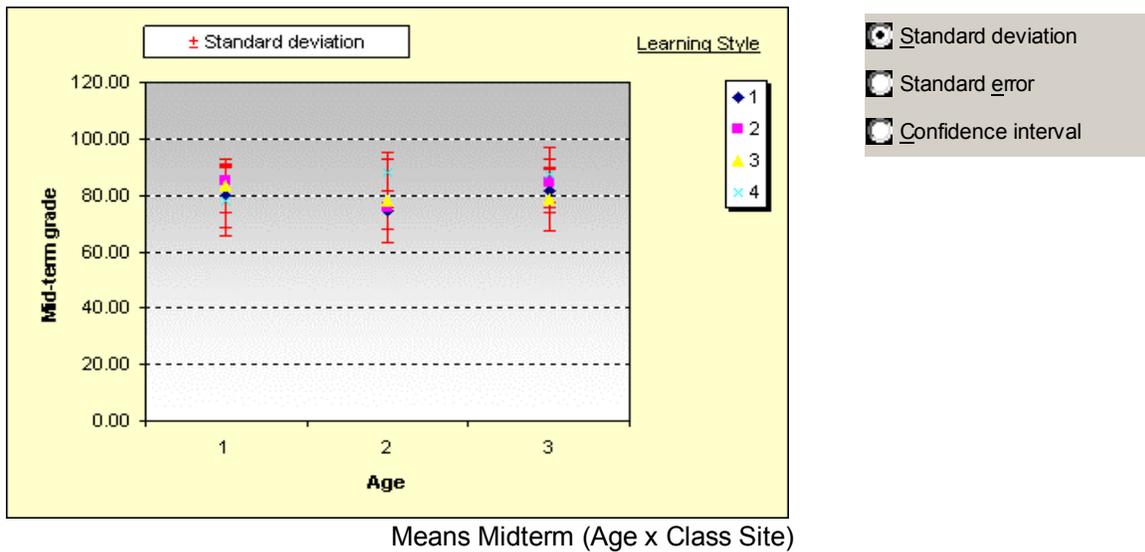


Variable: Mid-term grade
 grouped by: Ethnicity
 Learning
 and by: Style

		95%				
		N	Mean	95% Conf. (±)	Std.Error	Std.Dev.
1		17	78.94	5.18	2.443028178	10.07286322
	1	0	----	----	----	----
	2	1	59.00	----	----	----
	3	16	80.19	4.77	2.236904017	8.94761607
2		15	84.14	3.40	1.586874736	6.145939426
	1	0	----	----	----	----
	2	0	----	----	----	----
	3	15	84.14	3.40	1.586874736	6.145939426
3		21	81.48	4.78	2.292564635	10.50585098
	1	2	65.60	46.00	4.6	6.505382387
	2	0	----	----	----	----
	3	19	83.15	4.56	2.168330918	9.45153535
4		33	81.75	4.20	2.059935831	11.83343043
	1	0	----	----	----	----
	2	0	----	----	----	----
	3	33	81.75	4.20	2.059935831	11.83343043
Entire sample		86	81.54534884	2.213341992	1.113185072	10.32325367



		N	Mean	95% Conf. (±)	Std.Error	Std.Dev.
1		17	78.94	5.18	2.443028178	10.07286322
	1	12	79.59	7.16	3.254797353	11.27494877
	2	3	74.63	16.73	3.887729986	6.733745862
	3	2	81.50	55.00	5.5	7.778174593
2		15	84.14	3.40	1.586874736	6.145939426
	1	10	84.93	3.64	1.609282104	5.088996845
	2	1	75.40	----	----	----
	3	4	84.35	13.41	4.21238254	8.424765081
3		21	81.48	4.78	2.292564635	10.50585098
	1	13	83.36	5.67	2.603561133	9.387273163
	2	4	78.15	23.48	7.378629051	14.7572581
	3	4	78.68	17.79	5.588884057	11.17776811
4		33	81.75	4.20	2.059935831	11.83343043
	1	20	77.99	5.71	2.726394139	12.19280526
	2	3	88.23	17.20	3.99847193	6.925556536
	3	10	87.34	6.90	3.052001165	9.651275103
Entire sample		86	81.54534884	2.213341992	1.113185072	10.32325367



Means

Variable: Mid-term grade
grouped by: Age
and by: Class site

		95%				
		95%				
		N	Mean	Conf. (±)	Std.Error	Std.Dev.
1		14	82.88	3.58	1.658517098	6.20560275
	1	12	83.58	4.10	1.861618919	6.448837104
	2	0	----	----	----	----
	3	2	78.70	11.00	1.1	1.555634919
2		36	82.64	3.33	1.641477643	9.84886586
	1	20	81.90	4.72	2.257362224	10.09523077
	2	4	75.63	13.39	4.206814908	8.413629815
	3	12	86.21	5.70	2.590321682	8.973137521
3		36	79.93	4.04	1.992306632	11.95383979
	1	23	78.56	5.31	2.561363421	12.28386744
	2	7	82.01	10.99	4.491337089	11.88296099
	3	6	82.77	12.53	4.873784749	11.93828575
	Entire sample	86	81.54534884	2.213341992	1.113185072	10.32325367

APPENDIX G

WINSTAT Data Analysis Regression

Multiple Regression

X-variable: Learning
 Style
 Class site
 LS * CS
 Gender
 Age
 Ethnicity
 Class Standing
 # of ITV
 Reason
 Prefer

Y-Variable: Mid-term grade

Method: Maximum R-square

Steps	P	R-Square	Corrected
Class Standing(+)	----	0.084102693	0.072653976
Ethnicity(+)	----	0.153001986	0.131558999
Class site(+)	----	0.170886869	0.138997902
Reason(+)	----	0.183161081	0.140727891
Prefer(+)	----	0.195153521	0.142203094
Class site(-)	----	----	----
LS * CS(+)	----	0.196622956	0.143769203
# of ITV(+)	----	0.202075367	0.138241396
Class site(+)	----	0.20651492	0.131455521
Age(+)	----	0.206562082	0.119609981
Gender(+)	----	0.206595566	0.107420012
Learning Style(+)	----	0.206604602	0.094858771

Summary

	N	R	R-Square	Std.Error
normal	82	0.45453779	0.206604602	9.498801884
corrected		0.307991512	0.094858771	

Equation

	95%				
	95%				
	Coefficient	Conf. (±)	Std.Error	T	P
Constant	62.88513843	30.70100895	15.39655129	4.08436521	0.00011455
Learning Style	0.091246099	6.398330184	3.208761608	0.028436547	0.977393756
Class site	1.345830789	8.050708308	4.037428984	0.333338566	0.739861135
LS * CS	0.288897659	2.737235183	1.372723025	-0.2104559	0.833914682
Gender	0.226880501	8.328488971	4.176735944	0.054320049	0.956832736
Age	0.091462208	2.806866832	1.407643287	0.064975416	0.948376175
Ethnicity	6.129820294	8.063909492	4.044049376	1.51576297	0.134019032
Class Standing	3.932445035	2.94079745	1.474809471	2.666408857	0.009487348
# of ITV	0.937905817	2.817737421	1.413094885	0.663724585	0.509016145
Reason	1.266274075	1.746190162	0.875714099	-1.44599028	0.152579955
Prefer	2.773674023	5.393703412	2.704941436	1.02541001	0.308650739

Analysis of variance

	Sum of Squares	Degrees of Freedom	Mean Square	F	P
Regression	1668.193107	10	166.8193107	1.848879738	0.067427721
Residue	6406.133844	71	90.22723724		
Total	8074.326951	81	99.68304878		

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