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# The effect of multimedia instruction on achievement of college history students

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

THE EFFECT OF MULTIMEDIA INSTRUCTION ON ACHIEVEMENT OF

COLLEGE HISTORY STUDENTS

A dissertation submitted in partial fulfillment of the  
requirements for the degree of

DOCTOR OF EDUCATION

in

HIGHER EDUCATION

by

Rosalie (Roe) Billera

1999

To: Acting Dean Robert Vos  
College of Education

This dissertation written by Rosalie (Roe) Billera, and entitled The Effect of Multimedia Instruction on the Achievement of College History Students, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Joyce Peterson

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Paul A. Rendulic

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Janice R. Sandiford, Major Professor

Date of Defense: May 17, 1999

This dissertation of Rosalie (Roe) Billera is approved.

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Acting Dean Robert Vos  
College of Education

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Dean Richard L. Campbell  
Division of Graduate Studies

Florida International University 1999

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## DEDICATION

I dedicate this dissertation to my husband. Without his patience, understanding, support, and most of all love, the completion of this work would not have been possible.

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I wish to thank the members of my committee for their helpful comments and patience. I also want to thank Dr. Paulette Johnson from Statistical Consulting, and all of my family and friends for listening to and encouraging me along the way.

I particularly want to thank my major professor, Dr. Janice Sandiford, for her support and encouragement, and for all the help and assistance she provided with this project.

ABSTRACT OF THE DISSERTATION

THE EFFECT OF MULTIMEDIA INSTRUCTION ON ACHIEVEMENT OF  
COLLEGE HISTORY STUDENTS

by

Rosalie (Roe) Billera

Florida International University, 1999

Miami, Florida

Professor Janice R. Sandiford, Major Professor

The purpose of this study was to investigate the effect of multimedia instruction on achievement of college students in AMH 2010 from exploration and discovery to 1865. A non-equivalent control group design was used. The dependent variable was achievement. The independent variables were learning styles, method of instruction, and visual clarifiers (notes). The study was conducted using two history sections from Palm Beach Community College, in Boca Raton, Florida, between August and December, 1998. Data were obtained by means of placement scores, posttests, the Productivity Environmental Preference Survey (PEPS), and a researcher-developed student survey. Statistical analysis of the data was done using SPSS statistical software. Demographic variables were compared using Chi square. *T* tests were run on the posttests to determine the equality of variances. The posttest scores of the groups were compared using the analysis of covariance (ANCOVA) at the .05

level of significance. The first hypothesis there is a significant difference in students' learning of U.S. History when students receive multimedia instruction was supported,  $F = (1, 52) = 16.88$ ,  $p < .0005$ , and  $F = (1, 53) = 8.52$ ,  $p < .005$  for Tests 2 and 3, respectively. The second hypothesis there is a significant difference on the effectiveness of multimedia instruction based on students' various learning preferences was not supported. The last hypotheses there is a significant difference on students' learning of U.S. History when students whose first language is other than English and students who need remediation receive visual clarifiers were not supported. Analysis of covariance (ANCOVA) indicated no difference between the groups on Test 1, Test 2, or Test 3:  $F(1, 45) = .01$ ,  $p < .940$ ,  $F(1, 52) = .77$ ,  $p < .385$ , and  $F(1, 53) = .17$ ,  $p < .678$ , respectively, for language. Analysis of covariance (ANCOVA) indicated no significant difference on Test 1, Test 2, or Test 3, between the groups on the variable remediation:  $F(1, 45) = .31$ ,  $p < .580$ ,  $F(1, 52) = 1.44$ ,  $p < .236$ , and  $F(1, 53) = .21$ ,  $p < .645$ , respectively.

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# CHAPTER I

## Introduction

A definition of multimedia is the use of “a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate” (Hofstetter, 1995, p. 3). Teachers and instructors use multimedia instruction across the spectrum of education. It was the aim of this research to examine what effect multimedia instruction had on college students in a history course. This chapter will discuss the researcher’s problem statement, the background that resulted in this research on multimedia instruction, the purpose of the study, the researcher’s questions and hypotheses that guided this study, and the format for the rest of the chapters.

## The Problem

### Background

Recent research has shown that the use of computer technology can have a great impact on an institution. Administrators of community colleges that integrate technology and teaching have found that there is the perception at each institution that it is a leader in bringing about changes in traditional practices. They have found that the impact on the institution is prestige, recognition, and an improved self-image. In addition, there is an increase in enrollment, the improved employability of the students, and the overall better feeling by the students about the college, curriculum and faculty. The students also see the college as up-to-date and believe they are getting a good education. There is a positive impact on faculty, as well. Boredom, frustration, and burnout are addressed through new and innovative use of computer technology. New approaches to teaching

and learning and new enthusiasm by veteran faculty for their disciplines are other results (Anandam, 1989).

Because of findings such as these and others, Palm Beach Community College in Boca Raton, Florida offered a unique opportunity to adjunct faculty. To encourage the integration of computer technology and teaching, those faculty members who were both interested in and selected by division chairpersons were trained in Podium, a hypermedia product developed at the University of Delaware in 1988 (Hofstetter, 1995). The administration had hoped to start some adjuncts on the way to using multimedia instruction in their classroom. This researcher was one of the adjuncts selected to learn this type of instruction. The ultimate goal of administration was to foster learning through technology, and turn the campus into a technological learning center.

Although computer technology in general, and multimedia instruction specifically, will be used more and more in classrooms in the future, it is precisely that “potential” that presents the problem to educators (Butler & Clouse, 1994). There is no doubt that the roles of instructors and students are changing. Instructors are changing from information transmitters to orchestrators of learning (Butler & Clouse, 1994). The new type of technology “provides a whole new conception of knowledge and of ways of attaining it in educational settings” (Oser, Dick, & Patry, 1992, p. 40). If educators are to take advantage of the opportunities afforded by computer technology, they must develop a whole new idea of education and instruction, and they must become familiar with the new technological capabilities. “For education to realize any of technology’s potentials, classroom practices, curricula, instructors’ roles and behaviors, social structures, and the



nature of classroom activities all need to be orchestrated into a well-integrated learning environment” (p. 41).

However, there is reluctance of the faculty and students to use computer technology in the classroom. “The traditional lecture continues to be the dominant vehicle to convey information to students” (Armstrong, 1996, p. 69). Armstrong noted that students expect that they will be taught in this manner. Also, students still see their role in school as note takers who listen to lectures, read the assignments and remember enough to pass the midterm and final (Butler & Clouse, 1994). Furthermore, faculties fail to integrate multimedia instruction into their classroom presentations. Even though the movement to multimedia instruction is a positive change, the fear of embarrassment or ridicule from students and colleagues makes instructors reluctant to try something new (Armstrong, 1996; Gerard, Sleeth, & Pearce, 1996; McDaniel & Klonoski, 1995). They would rather stay with what is “tried and true” (Armstrong, 1996, p. 69). Partee (1996) said it this way, “instructors through fear, lethargy or ignorance retain the teaching methods of yesteryear” (p. 79). In addition, certain subjects have traditionally been taught by the lecture method. Social studies are an example. “The social studies may be among the last of the disciplines to recognize the potential of technology” (Janger, 1988, p. 463).

### Statement

The perspective taken in this research study is that students’ learning may be enhanced by multimedia instruction, and that this enhancement should be the same for students of different learning preferences. Furthermore, the learning of students whose first language is other than English, and students who have difficulty in reading and

writing skills may be enhanced, as well. The problem to be investigated in this study is the effect of multimedia instruction on achievement of college history students. The theoretical framework for this study comes from a number of studies recently made in this area, most particularly Luna and McKenzie (1997), Moore and Miller (1996) and Pearson, Folske, Paulson, and Burggraf (1994). Luna and McKenzie's study tested whether or not multimedia enhances aggregate student performance. In addition, they investigated how multimedia impacted the performance of students with differing learning styles. Moore and Miller tried to determine how the use of multimedia affected students' learning, class attendance, and retention of information. Pearson, Folske, Paulson and Burggraf measured students' reactions on the environment, note taking, learning information overload, interest, real life, and teaching quality. This research directed this study. Some of the variables used in this research were also used in this study.

### Significance

Futurists such as Hirschbuhl (1992), Pinheiro (1993), and Oblinger (1992), as cited in Armstrong (1996), predict that computer technology and multimedia presentations will be major instruments of instruction. Perelman (1992) said education will be abandoned in the future and in its place will be "hyperlearning." Hyperlearning is "a universe of new technologies that both possess and enhance intelligence" (p. 23). Hyper refers to the extraordinary speed and scope of new information technology and the unprecedented degree of connectedness of knowledge, experience, media, and brains both human and non-human. Learning refers most literally to the transformation of knowledge and behavior through experience and goes far beyond anything we have

known before. While interaction is going on between humans and machines, learning is taking place.

Since social science classes have not been traditionally taught in this integrated manner, an investigation into the potential benefits may have a positive impact on the way these classes are taught in the future. Furthermore, it will be significant to determine if different learning preferences modify this type of instruction, and if students whose language is other than English, and students who have difficulties in reading and writing skills will benefit from this type of instruction. With the diverse population of the U.S., more and more students are entering college whose first language is other than English. In addition, Roueche and Roueche (1995) maintained that many students who attend community colleges are unprepared and have real difficulty. Perhaps the use of visual presentations and the notes generated from the presentations that multimedia instruction provides will give students the materials needed to learn better.

### Purpose of Study

#### Statement

The purpose of this study was to investigate the benefits to students that could be achieved through the use of multimedia instruction. This study investigated the use of multimedia instruction on students enrolled in a U.S. History class at a community college in the fall semester of 1998. The study investigated how this type of instruction affected the achievement of the students. Since students have various learning preferences, the study also explored whether or not these learning preferences had an impact on the effect of the multimedia instruction. Finally, since the use of a multimedia presentation allows an instructor to generate notes that can be distributed to the students,

this study investigated the effect of notes on students whose first language is other than English, and on students who, because of poor verbal skills, needed remediation. (For the purpose of this study, the notes generated from the multimedia presentation were called visual clarifiers.)

### Research questions

The basic questions for this study were the following:

1. Does the use of multimedia instruction have an effect on students' learning of U.S. History?
2. Does a student's learning preference moderate the effectiveness of multimedia instruction on their learning of U.S. History?
3. Does the use of visual clarifiers have an effect on students' learning of U.S. History on students whose first language is other than English? (Students who do not speak English as their first language may have trouble understanding and keeping up with the instructor.)
4. Does the use of visual clarifiers have an effect on students' learning of U.S. History on students who need remediation in verbal skills? (Students who need remediation in verbal skills may have difficulty in writing notes that would be helpful to the achievement in history or any other subject.)

### Hypotheses

The research hypotheses for this study were:

- H<sub>1</sub>. There is a significant difference in students' learning of U.S. History when students receive multimedia instruction compared with students who receive instruction in the traditional lecture method.

H2. There is a significant difference on the effectiveness of multimedia instruction on students' learning of U.S. History based on students' various learning preferences.

H3. There is a significant difference on students' learning of U.S. History when students whose first language is other than English receive visual clarifiers compared with students who do not receive visual clarifiers.

H4. There is a significant difference on students' learning of U.S. History when students who need remediation in verbal skills receive visual clarifiers compared with students who do not receive visual clarifiers.

### Definition of Terms

For the purpose of this study, the following definitions will apply:

**Achievement** - The successful attainment of a higher score in a course as measured by exams given by the researcher during this study.

**American College Testing Program Examination (ACT)** - Administered to grade 12 and junior college students preparing to transfer to 4-year colleges. It measures such subjects as English usage, mathematics usage, social studies, reading, natural sciences reading, and composition.

**Computer technology** - Computers used in education to convey ideas. In this paper the term instructional technology or educational technology may be substituted for computer technology.

Florida College Entry Level Placement Test - FCELPT (Formerly CPT) is administered at Palm Beach Community College to those students who have not taken any other standardized placement test. It is used to identify the appropriate level of study for each entering student in each of several subjects (reading, writing and mathematics). The FCELPT is for PBCC purposes only and may not transfer to other colleges.

Learning - Achievement, as defined above, of knowledge or skill in a subject area. For this paper learning will be used in place of achievement.

Learning Preference - The preference an individual has for acquiring knowledge and skills in a subject area as measured by the learning preference inventory administered at the beginning of the course.

Microsoft® Power Point© - Power Point is the copyrighted program for presentations associated with Microsoft. The copyright is 1987. This program was used to present the classroom notes as a slide-show presentation.

Multimedia instruction - The use of a computer to combine text, sound and motion that is then viewed on a screen by an overhead projector.

Productivity Environmental Preference Survey (PEPS) - A self-report instrument designed to identify productivity and learning styles of adults.

Scholastic Aptitude Test (SAT) - A college entrance test, which provides two, scores: verbal and mathematical.

Visual clarifiers - The written notes in outline form that are generated from the presentation used in the multimedia instruction.

WebCT - A web based tool developed at the University of British Columbia. It features instructor created sample courses, course templates, search tools, and student home pages. It has the following collaboration tools: discussion options, asynchronous/threaded, synchronous (chat), chat session logs, bulletin board, E-mail, file sharing and workgroups. The content-centered tracking indicates the number and duration of hits on each course page. This information can be used to make inferences about the interest and difficulty of the content.

### Assumptions of this Study

The following assumptions are made:

1. Researcher as instructor will not bias the outcome of the study.
2. Ability will be randomly distributed within the treatment and control groups.
3. Learning preferences will be randomly distributed within the groups.
4. Students will read the text and attend class prepared to learn.
5. Students will access the notes available to them.

### Limitations of this study

The following limitations should be considered when interpreting the results of this study:

1. The treatment and control groups will meet on different days.
2. The treatment and control groups will meet at different times of the day.

### Delimitations of this Study

The following delimitations should be considered when interpreting the results of this study:

1. The sample of students is a convenience sample of two intact classes.

Participants were derived from classes of students who selected a course section by their scheduling preference.

2. The study was limited to the fall term.
3. The study was limited to students of AMH 2010, U.S. History to 1865.

### Summary

Students must prepare themselves to make well-reasoned forward thinking and healthy lifelong decisions. They must learn to locate, comprehend, interpret, evaluate, manage and apply information from a variety of sources and media. They must learn to communicate effectively, use math skills to analyze information, solve problems and create products to meet new needs (Bouchillon, 1996). All students must be able to do all these things and instructors must teach these things effectively.

There is a need to investigate how to effect change in both students and instructors. There is no doubt that anything that can be done to improve the learning process should be tried. The benefit of multimedia instruction on the learning process is



inconclusive. This study will focus on the use of multimedia instruction in U.S. History at Palm Beach Community College. This research must take place to determine the benefits of multimedia instruction.

### Organization of Chapters

Chapter I presented the statement of the problem, the background of the study, the purpose and significance of the study, followed by the hypotheses, definition of terms, assumptions and limitations. Chapter II reviewed the relevant literature. In addition, it provided the conceptual framework through which this study was conceived. Chapter III contained the method used in conducting this study. Included in this chapter were the population and sample, instrumentation, and the analytical and statistical treatments. Chapter IV presented and analyzed the data, and the final chapter of the study (Chapter V) provided a discussion with conclusions and recommendations for practice and research.

## CHAPTER II

### Review of the Literature

This chapter reviews and summarizes relevant literature in the areas related to this study. Because this study investigated the effect of multimedia instruction on adult learners of different learning preferences, this review focused on learning and the learning processes. This review also summarized the literature on learning styles and learning preferences. In addition, this review summarized the literature on instructional technology. Finally, the remainder of the summary was on multimedia and studies in multimedia. The literature was taken from books and journal articles written on these topics. With the help of a computerized system of search engines at the library, every effort was made to obtain the most current and relevant information possible.

#### Learning

Man alone can acquire knowledge, preserve it and pass it on to others, thereby building a body of knowledge. Humans accumulate a vocabulary of more than 50,000 words. They learn at least one language, can talk, read and write, measure and calculate, express abstract thoughts and master mechanical and physical skills (Edson, 1975). Theorists have studied learning since ancient times. Aristotle theorized that there must be a power inherent in the mind that sorts impressions into concepts. More recent theorists have offered two major theories about learning: conditioned learning and concept learning. Psychologists such as Pavlov, Watson, Thorndike and Skinner were proponents of conditioned learning. Conditioned learning promotes the idea that people learn from outside themselves. Other psychologists such as Piaget were proponents of conceptual

learning. Concepts are ideas of normality. Things like chair and person are concepts. Concept learning is essential to the organization, flexibility and progress of thought. Concept learning and conditioned learning go together. Concept learning teaches people how to think about the world around them. The sense organs cannot perceive universal ideas or categories, but merely pick up impressions of the things they touch, see, hear, smell, and feel. This, therefore, is why Aristotle came to his conclusion, and why Piaget postulated that the human mind possesses an innate order generalizing capacity, a built-in drive to learn (Edson, 1975).

In Winn's (1997) article about learning theory, he contends that there is much data in the world. Humans only detect a small amount, but it forms the basis for everything we know and learn about the world. Our senses, which have detected this data, impose structure on them. Data received form information and this information becomes our knowledge of how the world works. A cognitive process by means of which new information is assimilated to existing knowledge accommodates to it in turn. The judicious application of all this knowledge is wisdom. Because, the acquisition of wisdom takes a long time we associate it with old age. "Learning theory, therefore, describes how data are transformed into information, information into knowledge, and knowledge into wisdom. Physiological (perceptual) processes perform the first transformation. The second is performed by cognitive processes and the third by environmental and cultural processes" (p. 38).

However, others (Edson, 1975; Holt, 1967) postulated learning cannot occur without two other components, retention and recall of experience. The aspect of the human mind that allows the average person to store billions of items such as words,

pictures, faces, scenes, and objects in a lifetime is memory. Memory and learning are inseparable (Edson). Holt said, “vivid, vital and pleasurable experiences are the easiest to remember,” and “memory works best when unforced” (p. x). Today, modern psychologists divide memory into three systems: sensory memory, motor skills, and verbal skills. Sensory memory falls in the area of perception that Gregorc (1982) called concrete perception. He defined perception as the way humans take in information and view the world. Abstract perception is the way that humans visualize, conceive ideas and understand or believe what they cannot see. Intuition, intellect and imagination are other words for this. Concrete perception is how humans register information through the five senses: sight, smell, touch, taste, and hearing. Also, according to Gregorc, ordering is the way humans use information they perceive. Two ways humans do this are sequentially, in a linear, step by step manner and randomly, ordering information by chunks with no particular sequence (Tobias, 1994).

Barbe and Swassing (1979) as cited in Tobias (1994) defined three models of sensory perception or ways of remembering that all humans use in varying degrees: auditory, visual, and kinesthetic. Also called modalities by the authors, these models refer to learning by listening to verbal instructions, remembering by forming the sounds of words, (auditory) learning by seeing and watching, using strong visual associations, (visual) and learning by becoming physically involved, and actually doing something with what is being learned. Although Gardner (1983) put it slightly different, he was agreeing with Barbe and Swassing.

Gardner called his theory of intelligences frames of mind. He claimed that his idea was just that; an idea. He was positive in his claim that he was not the first to think

of multiple intelligences. While he argued that the nature and breadth of each intellectual frame has not been established, nevertheless, there are a number of intelligences independent of one another. Furthermore, individuals and cultures can combine these intelligences in a multiplicity of ways. Gardner based his evidence on the observation of a large group of sources. He looked at studies of prodigies, gifted individuals, brain-damaged patients, idiot savants, normal children and normal adults. He also consulted experts in different lines of work, and individuals from diverse cultures to make the case for his theory of multiple intelligences. He identified some intelligences such as linguistic, musical, logical-mathematical, spatial, bodily kinesthetic, and personal.

Gardner also explored actual ways of learning. He contends there are two ways of learning. First, there is direct learning where the learner observes an activity. Second, there is imitation where the learner observes and then imitates an activity either immediately or later on. In these ways of learning spatial, bodily, interpersonal, and, possibly, linguistic forms of knowledge are involved. However, “instruction in a specific skill may also occur outside the context in which that skill is customarily practiced” (p. 335). Furthermore, various means and media are used to transmit knowledge. For example, the transmission of knowledge can be accomplished through the use of books, pamphlets, charts, maps, television, computers, and various combinations of them all. Also, the site of location where knowledge is transmitted varies. Learning can take place at home, in schools, in shops, or in laboratories. Other variables in the transmission of knowledge are the particular agents who do the transmitting. Finally, the cultural context in which learning takes place is an important factor. For example, “in a traditional nonliterate society, most learning is considered a requirement for survival” (p. 336).

Writing a little later than Gardner, Sternberg (1988) postulated that in his context, intelligence could be understood as mental self-management. He, too, argued that there is no single set of behaviors that is intelligent for everyone. Also, intelligence is more than what conventional tests measure. The way that Sternberg formed his theory was by looking back at major theories of intelligence that have been proposed during the twentieth century. He determined that to understand the relationship of intelligence, one must examine three things. These three things are the internal world of the individual, the external world of the individual, and the experience with the world that mediates between the internal and the external worlds. He called his theory the “triarchic” theory of human intelligence. Sternberg argued that his theory is different from other psychologists, and contends that others such as Gardner tried to prove their theories but “fail to disprove the views of others” (p. 58). Sternberg reasoned that this is because other theories are incomplete. He argued Gardner’s notion that multiple intelligences are independent is simply wrong. He said, “in solving a mathematical word problem, for example, verbal and quantitative abilities need to work together” (p. 73). Gardner’s point of view did not make sense to Sternberg either statistically or psychologically. Rather than compete with other theories, Sternberg’s goal is to subsume them or view them as subdivisions of a more general theory.

The discussion on learning has been general so far. However, when knowledge and skills are acquired by persons considered by society to have adult responsibilities, then the discussion becomes one of adult learning (Stewart, 1987).

## The adult learner

Earlier in this century, studies about learning focused only on children. In 1926 things began to change. The American Association for Adult Education was founded then, and an influential book, by Lindeman (1926), The Meaning of Adult Education, laid the foundation for a systematic theory about adult learning. Lindeman was influenced by his friend and colleague, John Dewey to examine this issue (Knowles, 1973, Stewart, 1987). One of Lindeman's key assumptions about adult learners was that adults are motivated to learn as they experience needs and interests that learning will satisfy. In addition, adults' orientation to learning is life centered. Finally, experience is the richest resource for adult learners, and adults have a deep need to be self-directing. By 1940 most of the elements required for a comprehensive theory of adult learning had been discovered, but remained isolated insights, ideas, and principles (Stewart, 1987).

By 1949 an actual name for the theory came from Europe. It was called andragogy to differentiate it from the theory of child learning; pedagogy. The andragogical model for teaching is a process model. It is not a content model where the teacher decides the content and how it is to be presented. Rather, the andragogical teacher prepares in advance a set of procedures for involving learners in the process (Knowles, 1973, 1984). For example, the andragogical teacher would involve the learner in mutual planning, in diagnosing their own needs for learning, in formatting objectives, in designing and carrying out learning plans, in evaluating their learning and providing contracts for structure (Knowles, 1984). This method takes into consideration the various learning styles and preferences among students.

## Learning Styles and Preferences

A number of researchers have studied learning and learning styles in an attempt to understand how people learn. Some of these researchers were Kolb (1971) and Jung (1976) as cited in McCarthy (1987). Kolb (1971) took the cognitive approach and identified concrete experience, the sensing/feeling dimension, active experimentation, the doing dimension, reflective observation, the watching dimension, and abstract conceptualization, the thinking dimension. Combining these, he came up with four different learning styles: diverger, (CE and RO) assimilator, (AC and RO) converger, (AC and AE) and accomodator (CE and AE). Similarly, Jung (1976) in Psychological Types identified four categories: feelers, thinkers, sensors, and intuitors.

Kenneth and Rita Dunn (1979) looked more at physiological traits and identified 18 elements of learning styles. The first element is environmental. Students of all ages respond to sound, light, temperature and design. Examples are that some students require absolute silence when they are concentrating, while others can ignore sounds around them. Some students require a cool environment, while others prefer to feel comfortably warm. For some students the amount of light available determines how they think. There are also, according to Dunn and Dunn, emotional elements such as motivation, persistence, responsibility, and a need for structure. The sociological elements are working alone, with peers, with an adult, or some combination of the aforementioned. Finally, there are physical elements such as perceptual strengths, intake, time of day, and need for mobility. The authors argued that motivated students are not the problem. The need to eat or drink, nibble or chew or smoke when studying is as important to how



people learn as the time of day when one's energy is highest (Dunn & Dunn, 1979 & Ingham & Dunn, 1993).

Unlike Dunn and Dunn (1979), but similar to Kolb, Gregorc (1982) determined that an individual's style consists of four combinations: concrete sequential, abstract sequential, abstract random, and concrete random. Also similar to Kolb, Lawrence (1982), as cited in McCarthy (1987), called learners feeling types, thinking types, sensing types, and intuitive types.

McCarthy (1987) who researched this topic a little later than the others devised a complicated model for learning styles. She divided learning styles into two major categories; perceive and process. She broke down perceive into concrete and abstract, sensor feeler or thinker, and process into active and reflective. She further identified learners as type one learners who seek personal meaning, type two learners who seek intellectual competence, type three learners who seek solutions to problems and type four learners who seek hidden possibilities. McCarthy used Kolb's Learning Style Inventory to test her theory of learning styles. She administered the inventory to 2,367 teachers and administrators in 1986 and 1987. She found that there were more type one and type four females than males, (25% of the women were type one and 32.7% were type four, 57% sensing feeling, 42.2% prefer the abstract dimension of perceiving). She also found that there were more type two and type three males, (61% of the men were either type two or type three learners and the number of males who prefer the abstract dimension of perceiving, the thinkers, were considerably higher than the men who prefer the concrete dimension, the feelers-39%).

Knowing the learning style of individuals can help teachers structure their own teaching styles. It has been commonly noted that teachers teach as they were taught. Dunn and Dunn (1979) argued that teachers do not teach the way they were taught, but, rather, the way they learn. This leads to the premise that matching teaching styles with students' learning styles may be a good suggestion. In 1979 Dunn and Dunn did not fully agree that this was possible. They pointed out that students and teachers are not consistently one way or another, and that even if schools were able to match teachers' teaching styles to students' learning styles, it might not be effective. However, after a decade of research on the topic, Sternberg (1988) postulated that styles are independent of abilities in general. "People do not simply have one style or another, but, rather, have preferences among the various possible styles" (p. 294). According to Sternberg, styles represent a link between intelligence and personality, and are probably partially socialized. He also noted the effectiveness of the styles will depend on how well they are integrated. Within that same decade Cafferty (1980) found that the closer the styles between teacher and student the higher the grade point average, and the reverse (Davidson, 1990). However, Dunn, Beaudry and Klavas (1989) said, "those who suggest that children learn to adapt to their teachers' styles disregard the biological nature of style" (p. 154). While all these findings are enticing, Cohen, Hyman, Ashcroft and Loveless (1989) as cited in Davidson (1990) warn that more research on learning styles is necessary. They found that when they poured through 1800 ERIC searches on learning styles, only 30 were researched based and these 30 did not support matching styles with instruction (Davidson).

Some researchers suggest that while teaching and learning styles cannot always be matched, certain things can be done to modify the differences. Teachers can adapt to different learning styles. Teachers, who use whole class lectures and discussion, for example, can use selected small group techniques for those students who like working with other classmates and who strain in their seats when required to sit and listen. This technique is also beneficial to student who cannot remember what has been taught or has difficulty paying attention at the time of day the lesson is scheduled (Dunn & Dunn, 1979).

### Learning and Technology

Richlin and Cox (1994) edited the Journal on Excellence in College Teaching. They postulated that the teaching-learning connection involves a number of important elements. The first element is the subject, and depending on the content and the relevance to life situations, “the professor needs to answer the following subject-based questions: What are the learning objectives? What is the place of this class within the curriculum? Is the knowledge at the level of facts, application, or synthesis? In what ways does this class build an understanding of and interest in the discipline?” (p. 2)

The second element is the student. Because students differ greatly by gender, culture, intellectual development and family academic background, student based questions must be answered. Examples of questions to be answered are “what is their cognitive level, and what is their prior knowledge of the subject?”(Richlin & Cox, 1994, p. 3) A third element in the teaching learning connection is the environment. However, unlike Dunn and Dunn (1979), Richlin and Cox’s environment referred to equipment available in the classroom. They argued that if the environment is hampered, it might

inhibit learning. For example, classrooms with computers and video equipment can facilitate learning, while classrooms without computers and video equipment can inhibit it. Computers and video equipment in the classroom is instructional technology.

In the journal edited by Richlin and Cox (1994) a number of studies dealt with the issue of instructional technology. One of the studies was by Silliker (1994) who determined that learning from student presentations was much more active than from the traditional lecture. Silliker's study asked 40 graduate students in a career-counseling course at St. Bonaventure's University to work on a term research project in groups of two to five. He instructed the students to present their findings both orally and in writing. The students videotaped their oral presentations outside of class. At the end of the semester the class viewed the videotapes. A survey was administered to evaluate the experiment. Students were asked to rate their experience with the videotaped presentations. The mean rating for the videotaped project was 7 on a Likert scale of 10. The mean rating of the oral presentation was five. When asked if they would enjoy a similar course project in the future, the response was 68% yes and 10% no. (18% were undecided.) Thirty-four percent of the students responded they had fun and enjoyed socializing with other students. Other responses pertained to positive learning experiences (24%), anxiety reduction (12%), and improvement in class time management (7%) (Silliker, 1994). While this study was not the most scientific with more statistical data, it proved useful to the researchers. This is evident in their discussion and conclusion. One serendipitous effect according to the researcher was that students who entered the class not knowing how to use a video camera mastered video camera operation during the course. The conclusion was that while everyday use of video

technology is growing in our society, the educational application of this technology lags behind.

While video technology has been around for some time, computers are the latest in a long line of technologies that educators have at their disposal. Eble (1988) described several revolutions in education. The first revolution was the shift from parent to teacher. The second revolution was the shift from the spoken word to the written, and the third revolution was the invention of printing. The fourth revolution is now in electronic technology or computers used both inside and outside the classroom. Past generations of educators used whatever technology was available at the time. In the 40s educators used radio, in the 50s it was television (Butler & Clouse, 1994). Since the 1980s computers have been in use. The use of this latest technology in the college classroom has had an impact on how courses are taught. (Bosworth, 1993). Bosworth argued that the results of his research could help understand how faculties are using multimedia in the classroom and how their teaching styles are changing.

The study was done on the main campus of St. John's University in New York City. Six classrooms had been remodeled to provide environments for faculty to try new ways of teaching with computers. In the Fall of 1991 and the Spring of 1992 Bosworth distributed questionnaires to the faculty who taught in the remodeled classrooms. Thirty-one instructors in five divisions, instructing 39 different courses used the classrooms. A scale from zero to five was used with five representing the highest score. A weighted average was computed for each survey question. With between 16 and 19 responses for each question, the averages were quite high (4.63, 4.30, 4.37, 4.12, 4.63, 3.06). Only one question received a 1.16. That question asked if the faculty found it difficult learning

how to lecture and use the projection system. Bosworth concluded that the faculty of St. John's University was excited over the use of technology for instruction. Seventy-eight percent of the respondents wanted to be scheduled in the new facilities every semester. The perception was that technology helped them teach better. It would strengthen his argument if Bosworth had followed up his previous study by going back and questioning these same professors after subsequent semesters have been completed.

While he did not do a formal study Noblitt (1993) also argued on behalf of new ways of teaching with new technologies. Based on literature by McClintock, 1993, McLuhan, 1964, Olson & Torrance, 1991, and Postman, 1991, he identified different learning processes (sequential, relational, and creative learning mode). He evaluated how information technology can contribute to the enhancement of educational methods. He found that "students benefit from instructional sequences based on the mentor's knowledge of learning development" (p. 158). He found that computer based reference materials provide the learner with access to related information. Furthermore, computer based learning gave students the tools for integrating ideas, creating new knowledge, and aiding in self-expression. These tools may be combined with the sequential and relational instructional materials to create learning environments, such as writing labs and simulations for exploring the sciences (Noblitt, 1993).

Northrup, Barth, and Kranze (1991) maintained that technology can be used to promote visual and tactile learning as opposed to traditional instruction that is language oriented. The authors cited recent research that has demonstrated that computer-assisted instruction can be more effective and can teach the same amount of material in less time (Rooze and Northrup, 1989). They cited Perelman (1990) who concluded that 30 percent

more learning in 40 percent less time could be achieved at 30 percent less cost. They cited Gardner (1983) and Sternberg (1988) who believe there are several modes of intelligence that would benefit from the new technology. Barth (1990) as cited in Northrup, Barth, & Kranze, (1991), himself, noted that students retain 10 percent of what they hear in a lecture. This is increased by 10 percent if a visual is used and if a discussion is added, it increases by 40 percent. With the use of technology to present an interactive multimedia computer lesson which provides experience and practice students' retention is raised by 80 percent. . In general, computers can enhance learning by requiring students to make use of more of their senses.

Azarmsa (1997) agreed that computers could enhance learning. Azarmsa cited a study by Dr. Albert Mehrabian, a specialist in interpersonal communications at the University of California. He found spoken words alone account for seven percent of the impact of face-to-face communications. Vocal communication accounts for 38 percent, and visual elements make up the majority of communication, with 55 percent of the total impact (in Lindstrom, 1994 as cited in Azarmsa). The more senses that are used in the learning process the better.

Not only does learning improve when more senses are used, but the research of Friedlander and McDougall (1992) indicated that students progress more when they are involved in their own learning. The amount of time that students are engaged in the learning process is better if it is increased. The use of technology should increase the time students are engaged in the learning process. A study done by Ullom in 1989 at Santa Barbara City College as cited in Friedlander and McDougall indicated that community college students in programs for music appreciation and history did better

when they answered question that were embedded in a video disc. The extra time it took to answer the questions as opposed to just viewing the disc improved the students short term and long term learning.

Others who have indicated that computer technology is working to improve education are Sethi (1998), Shrawder (1998), and Facciola (1997). Sethi said, “college campuses are experiencing a transformation involving the increasing integration of technology into mainstream curricula” (p. 16). Educators can communicate concepts in a manner that includes a variety of delivery methods, and this could help a greater number of students comprehend and retain information better. Sethi used the example of a female student who was majoring in geology at Radford University. She was able to examine minerals through the use of a computer. This preparation for a field trip she was about to make was extremely helpful. A later example was an assignment in groundwater hydrology. By entering data from a site where the soil was contaminated at an industrial location, the students were able to call up a 3D image showing an aerial view of the site. The unforgettable image showing disastrous results from the contamination is something the students cannot forget.

Shrawder (1998) argued that if used properly, technology could help teachers teach for success in a way nothing else can. Therefore, it is critical for educators to do what they can to maximize the payback that an investment in computer technology offers learners (Facciola, 1997). Facciola cited Salomon, Perkins & Globeron, 1991 who contend that there are two effects with regard to learners, the effect with computers and the effects of computers. The effect of computers occurs when students grow as a consequence of working with computers. For example, students who write better essays



because they used spell and grammar check on a word processor have felt the effect with computer, while students who write better essays with pen and pencil later on have experienced the effect of computer.

Davis (1989) noted that computers are learning machines rather than teaching machines. The computer has the unique ability to imitate the mental process of connecting pieces of information to form a thought. “Any student who moves from only listening to classroom lectures to doing personal research has crossed into learning rather than being taught” (p. 412). However, language is an important component. Davis cited Project Athena created in 1983 at MIT. It was a five-year program established to explore new, innovated uses of computing in the MIT curriculum. Digital Equipment Corporation and International Business Machines gave fifty million dollars of hardware, software, technical support, maintenance and networking to MIT. Davis indicated a concern about who should control the process and decide content and structure. He concluded that the educator is an important component in the use of technology.

Rubin (1996) agreed that technology is not the only thing to consider. His ideas stem from the experience of being asked to write a brief commentary for the Panel on Educational Technology of President Clinton’s Committee of Advisors on Science and Technology. Rubin is a scientist who has developed educational software in math and language arts. He is now working with American military schools in Germany to integrate educational technology. Rubin contends computer use can provide “a multitude of powerful possibilities for education” (p. 20). However, the powerful possibilities need more than just hardware to accomplish significant learning goals. Software, curriculum, professional development and community involvement are needed. Software

development is difficult and time consuming according to Galloway (1989) and there are few rewards for doing it. However, Rubin argued educational technology or the use of computers can reawaken students' curiosity and provide what is necessary to make sense of the world. Computers will not replace teachers, but used well can add productive activity to classrooms. Rubin has concerns, and offers several ideas particularly on the use of the Internet and the World Wide Web. Students may or may not be making use of these resources. However, even when students do use them, they are only browsing as in a bookstore.

According to Rubin, in order to be literate, one has to read books in depth, not just browse the bookstore. Therefore, if the Internet and the World Wide Web are to be used for education, the government must fund projects that connect technology, software, teacher development, and community development. It must support experiments with an emphasis on long-term integration. It must alleviate the 'assessment time-lag,' and stabilize the school computer market (Rubin, 1996, p.20).

In addition to Rubin's (1996) concerns, there are other concerns about the use of computers. According to Pesanelli (1993) the high tech environment can be harmful and unnatural. He suggested that classrooms should embrace natural surroundings. For instance, there might be "large windows to give students views of trees, meadows and lakes," which would provide "a serene visual respite for kids spending many hours with computer screens and electronic devices of one type or another" (p. 272). Another concern involves training instructors in the use of technology to allay their fears and educate them to use technology more effectively (Gerard, Sleeth, & Pearce, 1996; Chauncey & Perry, 1994).

A survey by Chauncey and Perry (1994) in Pinellas county asked Library Media Specialists, who the authors contend know better than anyone else in a school, about the users of technology. The data indicated that teachers use computers less than overheads, VCRs and tape recorders. It also indicated that teachers would use computers more if they had more training. McDaniel and Klonoski (1995) described a successful 1993 to 1994 faculty development initiative at the University of Hartford. It engaged a number of faculty members in information technology training. It was the authors' belief that hardware and software are purchased, but under utilized on too many college campuses. They also found that group computer instruction was unpopular because the faculty at the university had different computers, keyboards, and software. Therefore, it was decided that the faculty would be trained in their own workspaces and on their own machines. Although this was a more expensive way to go, the other way (group computer instruction) had been a failure.

The trainers were chosen from the faculty, computer services and the library. Calls for training came first from those who already had some expertise, but it was decided entry level training would be conducted first and advanced training last. It was also determined that not everyone would be able to be trained, especially some senior faculty members who were not agreeable to the change. The deans were asked first to offer the names of those they thought were most interested. The deans wanted to be trained first, then some faculty and staff was trained. With a pool of institutional money, new connections to computers were made. Finally, whole departments began to ask for training.

McDaniel and Klonoski (1995) devised several principles from their experience with this endeavor. They contend that to be successful, training programs should train users on their own equipment. Users should be taught what they needed to know when they needed to know it. This meant allowing the learner to interrupt the lesson and obtain specific information. Taking away the suspicions of technology and showing the users that they can make good use of it is also a good idea. Trainers should adjust the training to the learner and remember that the human element matters. In conclusion, McDaniel and Klonoski postulated that this model of a training program offered instruction on demand, it was individualized, it was peer supported, and it was delivered on site. They believed that this project provided a cultural shift for the University. However, this was only one study. There is no evidence, however, that the researchers researched any other ways to train faculty. So while this method seems to have worked well there is a need for more successful faculty training programs.

Winn (1997) took another position. He claimed that support for his position came from references to research and theory, to current practices, and to personal experience. He warned that less emphasis should be placed on how to use the technology and more on why to use it unlike what some others contend. Winn cited examples such as Galbraith, 1971, Heinrich, 1984, Glaser, 1976, and Simon, 1981 that emphasized how to use technology. Winn argued that there should be a theory developed in regards to instructional technology. Curricula in university programs emphasize practice at the expense of understanding or put another way, theory is played down in favor of being practical. Winn said “instructional design procedures often don’t work” (p. 36).

According to Winn understanding of theory can help compensate for the fallibility of instructional design procedures.

Also according to Winn individual differences in learning have been the object of much research (Snow, 1992, 1994; Sternberg, 1994; Tobias, 1989). The factors that mediate between the perceived stimulus or method and student performance or outcome vary greatly in their nature and effect from individual to individual. Therefore, it cannot be determined which methods should be used for which individuals. Other researchers (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991) argue that environment determines which learning takes place rather than what the student brings to the learning. Since instructional designers cannot know exactly what the learning situation will be, they cannot predict what the outcome will be. This is why Winn recommended that instructional designers have a knowledge of perceptual and cognitive theory, “of how people acquire wisdom as cognitive processes interact with the contexts in which people find themselves, and human factors” (p. 38).

Seels (1997) took the position that Winn took a little further. Her premise was that conceptual frameworks and taxonomies produce a body of interrelated concepts called a theoretical system. In her article she reported on traditional concepts of theory development and their applicability to instructional technology. Seels discussed the different theories such as Trenholm’s (1991) categories of theories which are the positivist theories, the interpretive theories, and the critical theories, and Richey’s (1986) procedural and conceptual theories. She then discussed the different taxonomic classification principles, such as cognitive, affective, and psychomotor. In her discussions on taxonomic classification principles Seels cited people like Bloom, 1956,

Gagne, 1985 and Krathwohl, 1994. Seels maintained that using a conceptual framework, taxonomies, and theoretical systems, together, can help one both explain and predict. She discussed three conceptual frameworks for instructional technology, Riegeluth's Elaboration Theory, Hannafin's ROPES Model, Kaufman and English's Organizational Elements Model, and four theoretical systems, Merrill's Component Display Theory (CDT)/Instructional Transactional Theory, Keller's Motivation Theory, Rogers' Diffusion of Innovations Theory, and Gagne's Conditions-Based Instruction.

Seels argued there are not many theoretical systems in instructional technology and the few that exist vary greatly. However, she concluded that theory building needs all three components, conceptual frameworks, taxonomies, and theoretical systems to create a theory of instructional technology that is so important. To sum up, there are benefits and obstacles revolving around the use of computers in the classroom. Up until now the discussion has been about computers in general. The use of the Web, e-mail and newsgroups are some ways to enhance traditional classroom instruction (Partee, 1996). Multimedia is another.

### Multimedia

Multimedia (or hyper media) has been described as the presentation of sound, image, and text combined with computers (Martorella, 1991; Noblitt, 1993). It is audio, still imaging, animation, and full motion video presented on a computer (Azarmsa, 1997). Put another way, it is high quality voice, music, sound, color, motion video, still images, and graphics all accessible through a computer (Marrison & Frick, 1994; Waterhouse, 1991). The presence of a computer is what makes multimedia something different from books and video because it allows the user to interact and control the information

(Beerman, 1996; Lynch, 1998). Multimedia allows teachers to use the tools helpful to learning. Fontana (1991) said, “Photographs, video, film, primary source documents, graphs, charts, maps, and statistics are the tools of skillful teachers who know how to capture and keep their students’ attention” (p. 221). Multimedia is the marriage of computers and video and this marriage will revolutionize education. Many authors agree that multimedia “enhances” communication between teachers and students ( Davis, 1993; Lynch, 1998; Noblitt, 1993).

Noblitt (1993) contends that the use of multimedia presentations is more important today. When he took a look at the various educational media and methods starting with the oral and direct methods, he found that in those methods the classroom is the domain of instruction and the students are within sight and hearing of the teacher. In the print medium and analytic methods, the text and the library provide an extension of the learning environment beyond the classroom. In information and audio-visual methods there is a provision for critical thinking skills and this must be coupled with a value system that includes responsible empowerment of the student. The digital medium and interactive method allows both the instructors and the students to control the presentation and analysis without very elaborate computer skill. Students are engaged actively in learning and instructors can introduce students to primary data. Media allows students to see real-world images that make instruction more concrete and comprehensible (Timpson, 1996). Teachers then become facilitators of knowledge and guide students in learning.

Christel (1994) took the discussion a little further when he argued that the presentation of material as motion video rather than a slide show suggests there is better

recall with motion video. He contends that the objective in an educational course is to give the learner a better understanding of what is being taught so that the learner can apply what they have learned long after the course is over. He tested five hypotheses to see if his theory was correct. The null hypotheses he tested was there is no difference in scores, recall or perceived meaning of a subject with regard to the presence or absence of motion video in the course.

He reviewed literature that indicated that multimedia instruction is effective. However, the literature never indicated whether or not motion video influenced recall test scores and perceived meaning of the subject matter. For his own investigation, Christel studied 72 students from two senior level software engineering classes, two master's level software engineering classes, and one master's level human computer interface class. The institutions were the University of Pittsburgh Graduate School of Business and Carnegie Mellon University's School of Computer Science. The subjects were randomly assigned to one of four experimental groups with 16 students per group. When an analysis of the background data was done, it revealed that there was no pretreatment factor that would bias the results of the experiment. The design consisted of recall tests to test each hypothesis. The results were on only 64 subjects because eight subjects had incomplete data. A number of tests were given to the subjects each time they concluded a particular topic. The results for each recall test in regard to frame rate interface variable and navigation effects were given. In the test to determine if motion video affects recall, there was a significant difference on at least one test. The other tests, however, found no significant differences. In the test to determine if the navigation effects impact recall, there was no significant difference on all tests. Christel concluded that the results



suggested that there is better recall with motion video. The research was inconclusive since the results only suggested better recall with motion video. More testing on this subject is needed.

Regardless of these or other results “today’s teachers should organize a presentation environment that includes a wide variety of media” according to Azarmsa (1997, p. 10). Davis (1993) warned, however, that multimedia technology as an instructional method should be investigated, but it should not be used as fancy overheads or chalkboards. This is why teachers and students who focus on areas that involve communication should have some formal introduction to multimedia. Things like the uses, limitations, tools and methods that go into creating it should be presented to teachers (Cavalier, 1998). In addition, teachers should be given options on how to organize multimedia presentations. Storyboarding in multimedia production is one way. Storyboarding is the mapping of ideas through frames and actions (Wadley, 1997). Teachers should know that multimedia is interdisciplinary and can be used across disciplines (Karrer & Hauer, 1998). According to Bergeron, McClure, Dichter and Rouse (1991) a cost effective way to use all the data available is by using data originally intended for one purpose for another. They call this “repurposing” (p. 123). Martorella (1991) believed that instructors could make their own software or could “repurpose” already existing information (p.56). The literature indicates a variety of thoughts on the subject of multimedia, and Christel did a study. However, it is important to look at other studies on multimedia to see how it is doing “in the field.”

## Studies on Multimedia in the classroom

In the evolution of the literature on the topic of multimedia the 1980s literature focused on the reluctance of instructors to use it (Berg, 1983). The next wave of writing included recommendations for how to get faculty to use multimedia (Janger, 1988). Even as late as the mid-1990s articles were being written about motivating faculty (McDaniel & Klonoski, 1995, Armstrong, 1996). More recently, however, researchers have been conducting studies to determine the benefits of multimedia in the classroom (Beerman, 1996; Luna & McKenzie, 1997; Marrison, 1994; Moore & Miller, 1996; Pearson, Folske, Paulson, & Burggraf, 1994). They contend that research suggests that the appropriate use of relevant visuals can enhance recall and understanding of material (Moore & Miller, 1996). The use of computers, these studies indicate, results in higher test scores compared to conventional methods, as well as greater long-term retention (Beerman, 1996). Furthermore, multimedia can increase interest and motivation, and promote critical thinking (Moore & Miller, 1996). The research described in this section is in different disciplines such as agriculture (Marrison & Frick, 1994), biology (Moore & Miller, 1996), nutrition (Beerman, 1996), and political science (Luna & McKenzie, 1997). However, according to Beerman multimedia textbooks that contain audio, animations, and search capabilities are available in many disciplines such as medicine, geology, chemistry, anatomy, physiology, mathematics, and political science.

Beerman (1996) contends it is inevitable that students would prefer and learn better with the use of multimedia since they have grown up with television, VCRs, Nintendo and personal computers in their home and school. While others agree with this contention, it is debatable. Nevertheless, this contention is what prompted her study. She

observed exam scores and final grade distributions in an introductory nutrition course at Washington State University in Pullman, Washington during the 1992 and 1993 semester. This class was taught using conventional lecture methods, a 50-minute lecture using overhead projection. During the following semester 1994 and 1995 she taught the entire course with computer based multimedia, a 50-minute lecture using computer presentation software. Her findings after tests which she said were only slightly different from one semester to the other, were that the overall means differed significantly between semesters taught with and without multimedia. Students taught with multimedia had significantly higher test scores than students taught without multimedia. The fact that she used overhead projection indicates that there was some kind of visuals used in class. The only difference between the two courses were the type of machine used. Each course seemed to be quite similar. In addition, the tests should have been exactly alike and not just slightly different.

While Beerman stated that good students do well regardless of how the course is taught, she maintained that multimedia instruction helped average and below-average students to learn material more effectively. She also concluded that multimedia helped keep students interested in class, and indicated that may keep them attending. While no one would dispute this, it is questionable how she came to these conclusions based on her study.

Another study by Pearson, Folske, Paulson, and Burggraf (1994) tried “to explore the extent to which students’ learning is facilitated by the use of computerized multimedia presentations in a large lecture course” (p. 4). Over a two-year period the researchers used a computer assisted multimedia presentation to teach a 200-level course

called Introduction to Mass Communication. The sample they used consisted of 168 students. The researchers described their setting as a midsize eastern university. The students were asked to fill out questionnaires about their learning experiences. The demographics indicated that the largest group of students was communication majors (63 or 37.5%). The authors devised a questionnaire that they called the “Perceptions of Multimedia Classroom Environment Survey.” They also used the revised Kolb Learning Styles Inventory to identify students’ learning styles. They described the “Perceptions of Multimedia Classroom Environment Survey” as a 36-item questionnaire that measures students’ perceptions of their learning experiences with multimedia lectures on six dimensions. The questions assessed students’ general reactions to the classroom environment, presentation of notes, perception of learning, feeling of information overload, interest in the content present in the media segments, recall of the course content, extent to which the information related to their real life experiences, and teaching quality. The Kolb Learning Style Inventory divided the students into four learning types, divergers, assimilators, convergers and accomodators. This measured the students’ learning styles along two continua (abstract-concrete and reflection-activity).

After the researchers obtained the relevant statistics for the learning styles, they performed a multivariate analysis of variance on the above variables. The results of their study within each learning style indicated that students’ liking of and perceived ability to learn from multimedia in the classroom are independent of learning styles. The researchers concluded that there was no evidence to suggest that learning styles and multimedia presentations were in any way related. “Hence, the pedagogical benefits that can be obtained from the use of computerized multimedia classroom presentations are

equally available to students of all learning styles” (p. 9). While the number of participants for this study may seem adequate, even the researchers indicated that this study should be done with more students in order to make generalizations. The researchers did make every attempt to report findings as accurate as possible. They maintained that in order to explore the possibility that their findings resulted from a lack of statistical power, they decided to further examine two questions. They discovered that the students (over nine out of ten) enjoyed the class more as a result of multimedia, and the students believed that they learned more as well. The researchers concluded that they can say with some degree of confidence that their results are representative of those that will be found in future studies.

One further word they did have about the learning style inventory was that their study presented the possibility that learning style inventories created for use in the classroom may be inadequate for assessing student reactions to multimedia classroom environments. This contention came from the expectation that at least one learning style preference would differ in regard to perceptions of multimedia in the classroom and yet no differences were found. A recommendation that this study could make is that more and better inventories are needed to further assess the new technology known as multimedia.

Another study by Moore and Miller (1996) looked at how the use of multimedia affects students’ learning, class attendance, and retention of information. Their study conducted on introductory biology students at a university in Ohio indicated that the type of instruction did affect attendance and student retention. To the best of their knowledge, there were no significant differences in the various sections of the courses they taught.

They calculated attendance and drop rate in their classes where they used only lecture method. They compared these statistics with other professors teaching the same course. They then taught sections based on computer integrated multimedia. To determine how the various types of instruction affected students' retention of information, they asked the students three kinds of questions. The questions were chosen from the assigned reading, lecture material, and multimedia presentations shown in class. Student responses to questions derived from assigned readings and lectures produced significantly fewer correct responses. However, most students provided correct answers to questions derived from multimedia presentations.

On the variable attendance, the results were that in their standard lecture sections about 60% of the students attended regularly. In other instructors' classes only about 35% attended. However, in the multimedia classes about 90% of the students attended and on some days more students attended their class than were enrolled. The results of the drop rate indicated 16 percent of their students dropped the lecture course. When they converted the course to multimedia the drop rate decreased by an 11 to 14-fold drop. There are too many variables in this study that the authors addressed, but not adequately enough. For example, the students may have been coming to class because they liked the professors teaching the class more than they liked the manner in which the professors were teaching. It is difficult to say what keeps students attending class. The time of day may have made all the difference. However, this is an important issue and further studies like this would be very interesting and informative.

While the aforementioned studies were in a variety of subjects, the study for this paper was in the area of the social sciences or, more precisely, history. There is very

little written about the use of multimedia in history. As was reported before, history is one of the last disciplines to incorporate computer technology into the curriculum. A study that was in the social sciences was Luna and McKenzie's (1997). The study grew out of an earlier study under a grant sponsored by a consortium of San Diego area community colleges and IBM Corporation. Under that grant the researchers developed a PC assisted multimedia application entitled *The Vietnam Experience* for an American Government course.

In the new study that grew out of the old one the researchers tested the effectiveness of multimedia technology as an instructional method. They did this by developing a multimedia curriculum for two political science courses based on a survey of instructors who used multimedia. Two groups were made with the control group receiving traditional lecture and the experimental group receiving multimedia-enhanced instruction. Over 200 students made up the test population. Student learning styles were identified. Luna and McKenzie used the Cognitive Styles Learning Inventory, the Teaching Style Inventory, and the Productivity Environmental Preference Survey.

The hypothesis that was tested was that multimedia education enhances aggregate student performance. In addition, multimedia might impact the performance of students with differing learning styles. The results of this research were mixed. The hypothesis that there was a "link between multimedia and student exam performance was not strongly substantiated. The data did substantiate a correlation between learning style and test performance" (Luna & McKenzie, 1997, p.80). Students who learn better through visual stimulation actually had higher test scores in both traditional and multimedia instruction. Qualitative results were obtained from attitudinal surveys. Two were

administered. The percent of students who felt that multimedia improved understanding was 40%. The percent of students who did not feel that multimedia improved understanding was 25%. The percent of students who preferred multimedia to traditional lecture methods was 64%. Other results showed that most students preferred this method of instruction and wanted more classes taught that way. However, one area that seemed to show dissatisfaction, was note taking. The students (41%) did not believe that multimedia facilitated more note taking on their part. Whether or not this study can be generalized is not certain. However, the findings are encouraging. Furthermore, this action research can result in improvements for the future of multimedia. Findings such as “greater practice and patience is required to avoid scrolling through an instructional presentation like so many slides from last year’s vacation” can assist others in their attempts to integrate microcomputers and multimedia into their classroom presentation (p. 79). In other words, any research in the field can only help by adding to the body of knowledge regarding multimedia use in educational settings.

In conclusion, other studies can be found on the use of computer in educational settings. Ramos and Wheeler (1989) did a study on integrating microcomputers in the history curriculum. However, they did not use multimedia per se. Likewise, Stevens (1993) used computers to teach world history, but this study mostly dealt with using the computer as a word processor. However, while studies in the discipline of history are in short supply, Butler & Clouse (1994) contend historians must look at the new possibilities computers provide with respect to their discipline. Furthermore, some social sciences may benefit even more from multimedia presentations. In a recent article Berdan, Stark, and Van Loon (1998) argued that the use of multimedia simulations may



help anthropology students to assume the identity of an ethnologist and undertake anthropological fieldwork. They maintained that interactive multimedia simulations may be very useful in other areas such as international business, teacher training, public administration, critical thinking, and language learning as well.

According to Friedlander, (1989) in addition to new ways of teaching, new subject matter will be brought into the classroom. For example, in theater courses, the complexity of performances can be brought to the classroom. Likewise, in foreign language courses, the everyday reality of watching how and when people talk can be brought into the classroom to better help students communicate. One final word on the use of multimedia in the classroom. While much is argued about the potential and benefit of multimedia use, there is a population of students who may need to be considered. Lee, Groom and Groom (1996) did a case study of a visually impaired student's progress through a Graduate program in Information and Communication Sciences. The study took place at Ball State University in Muncie, Indiana. The authors asserted that multimedia should be used to make visual information more understandable for an entire class. This requires in-depth voice explanation for even sighted students. According to the authors, when a visually impaired student participates in a multimedia classroom, the professor must do more. Some suggestions are to break the visual segment into small pieces, and explain the whole and each part. Audio tape recorders could be used to create a copy of the professor's spoken presentation to serve as lecture notes. The lack of the one sense, sight, makes the processing of the information different from that of sighted students. However, it can be done. Building in redundancy and more pauses into lectures is another solution (Lee, et al.)

## Summary

People register information through the five senses: sight, smell, touch, taste, and hearing. There are three models of sensory perception, auditory, visual and kinesthetic. While the use of more senses may increase the learning process, people have preferences for which of the senses they use most. Although all learners have some things in common, adults constitute a separate category of learners who have their own needs. In their attempt to teach, teachers use various means and media to transmit knowledge. Computer technology is the newest is a line of technologies that have been available to teachers.

The literature is full of studies that promote computer-assisted instruction. Authors argue that more information can be taught in less time through the use of computers. However, the literature is mixed on the beneficial results of computer technology and more specifically multimedia instruction. Some researchers have concerns about using only computers in the learning process. Furthermore, while multimedia is being used more and more, authors warn that it should not be used as fancy overheads. In addition, studies have indicated that multimedia instruction is not affected by students' learning preferences. Students of all learning preferences could benefit equally from the use of multimedia instruction.

Therefore, it is evident to some researchers that regardless of learning styles, multimedia instruction may improve grades, and it definitely improves enjoyment. Attendance, which is an important element in helping students' learning, definitely seems to improve when multimedia instruction is used over lecture instruction according to other researchers. Multimedia can be used in a variety of settings with a variety of

subjects, and can be “repurposed” for other subjects. It can even be used with the visually impaired, if used carefully and thoughtfully. The evidence obtained on the potential benefit of multimedia has encouraged this researcher to conduct a study of her own. Many of the studies taking place today are inconclusive. Furthermore, the social studies are lacking in studies on the potential benefit of multimedia instruction. The fact, however, that some people are taking such an interest in this subject is encouraging.

This chapter has reviewed the literature relevant to this study in the main areas of learning, instruction, and multimedia. In the next chapter the methodology used in this study is discussed.

## CHAPTER III

### Method

The purpose of this study was to investigate the benefits that could be achieved through the use of multimedia instruction. The basic methodology that was used in this study is described in this chapter. The design, population, instruments, treatments, data collection procedures and statistical analysis are discussed.

### Design

The design was a non-equivalent control design. There was no random assignment of subjects to groups. Two existing groups were given a treatment that was dependent on the room assignments. The group assigned to the multimedia room received the treatment multimedia instruction. The group that served as the control group was taught in the traditional lecture method of instruction which has been the method of this instructor in the past. According to Gay (1996) each group in this type of design serves as a control for the other. “The purpose of the control group is to indicate what the performance of the treatment group would have been if it had not received the treatment” (p. 363). Because random assignment of the subjects to groups was not possible, and the treatment was assigned to the groups based on the room assignment of the two classes, every effort was made to identify as many variables on which the two groups were similar. The identification of these variables was to determine the extent to which the groups were equivalent at the start of the study.

### Research Setting and Population

This study was conducted on the South Campus of Palm Beach Community College in Boca Raton, Florida. Since the researcher was an adjunct instructor at this

college, it was the college used in the study. Palm Beach Community College is a public, two-year, post-secondary educational institution. South Campus provides students with state of the art classrooms and laboratory facilities, and is considered the technological leader among the four campuses. This study was limited to the social sciences in general and to U. S. History in particular. The overall population of Palm Beach Community College was 15,538 for 1998-1999. The enrollment of South Campus in Boca Raton consisted of 1,204 full time students and 2, 683 part time students. Of the 3, 887 full time and part time students, about 67% were White, non-Hispanic, 12% were African American, 11% were Hispanic, 3% were Asian or Pacific Islander, less than 1% was American Indian or Alaskan Native, and 5% were non resident-alien. Fifty-six percent of the population was female, while 44% were male (Institutional Research, 1999).

The sample of students came from the total population of 19 sections (day and evening) offered in AMH 2010, U.S. History to 1865. Classes are generally capped at about 40 students. Two class sections taught by the researcher were used in this study. The sample was derived by those students who selected the class hours. The total number of students in the two sections at the start of the semester was 76. There were 39 students enrolled in the treatment group and 37 in the control group. The number of students at the end of the study was 26 for the treatment group and 32 for the control group.

The classes met two times a week for 1 1/4 hours each. The control group met on Tuesday and Thursday at 10:30 to 11:45, and the treatment group met on Monday and Wednesday at 1:30 to 2:45. Since the Monday/Wednesday class was assigned to a classroom with multimedia capacity, this became the class that received the treatment.

Finally, permission to use the subjects for this study was obtained from the administration of Palm Beach Community College. These subjects signed a consent form (Appendix A) with the understanding they could withdraw at any time and all information would be kept confidential. This informed consent form was administered at the beginning of the term to all the students involved in the study. The researcher offered a copy to anyone who wanted it, and kept the originals throughout the study.

### College Placement Tests

The researcher obtained the college placement test scores where they were available for as many students in the study as possible. These test scores were obtained from school records and were used as a covariate because “how students score before a treatment is generally correlated with how they score after treatments”(Stevens, 1996, p. 314). In addition, the verbal sub-test scores from each college placement test obtained were used for analysis of the effect of visual clarification on students whose note-taking skills may be less than adequate. The researcher accessed the files of each student and recorded the scores that were on record. The information most relevant to this study was the verbal section of the college placement test taken by the student. The college placement tests that were analyzed for the students of this study were the Florida College Entry-Level Placement Test (FCELPT) formerly called CPT, the Scholastic Achievement Test (SAT), and the American College Testing Program Examination (ACT).

At Palm Beach Community College all first time in college, degree seeking freshmen are required to take the Florida College Entry-Level Placement Test (FCELPT) if their ACT or SAT results are not within the past two years prior to admission. Students are also required to take the FCELPT if the scores on the current ACT or SAT placed

them in preparatory classes (Palm Beach Community College, 1998-1999, p. 18). Being placed in a preparatory class does not preclude a student from enrolling in U.S. History. The formula for placing students in preparatory classes is as follows: if a student scored under 16 on the English sub-test of the ACT, or under 420 on the verbal sub-test of the SAT, he or she must take the FCELPT. Any student scoring 0-60 on the reading comprehension portion of the FCELPT must enroll in College Prep Reading I. Any student scoring 61-82 on reading comprehension must enroll in College Prep Reading II. A student scoring 0-60 on sentence structure must enroll in College Prep English I, and a student scoring 61-82 on sentence structure must enroll in College Prep English II. Students should have completed placement testing prior to enrolling in classes and are to register in courses as indicated by the results. This researcher discovered, however, that not all students had placement test scores on their record. Transfer students did not always have scores recorded. Also, some foreign students did not have scores recorded. A total of nine students, four in the experimental group and five in the control group, did not have scores available. Analysis of these students results on the first test revealed that they were very similar in performance, i.e., experimental group mean of 50.7 compared with a mean of 54.4 for the control group.

To determine how reliable the FCELPT is in identifying students that need to take preparatory courses, this researcher looked in the literature for information about the tests. The FCELPT was developed by the College Board with the help of committees of college professors to provide information about reading, English, and mathematics skills that are required for success in college. According to Gay (1996) reliability is expressed numerically, usually as a coefficient. A high coefficient indicates high reliability. "If a

test were perfectly reliable, the coefficient would be 1.00; this would mean that a student's score perfectly reflected her or his true status with respect to the variable being measured" (p. 145). The technical data supplement to the Computerized Placement Tests has a reliability index that provides an indication of the consistency of test scores. The reliability coefficients for the FCELPT are reported as .87 in Reading Comprehension, .91 in Sentence Skills, .92 in Arithmetic, .92 in Elementary Algebra, .86 in College Level Math, .88 in Levels of English Proficiency Test-Reading Skills, .92 in Levels of English Proficiency-Sentence Meaning, and .87 in Level of English Proficiency-Language Use (College Board, 1993, p. 32). These coefficients are quite high. Test-retest reliability is the degree to which scores are consistent over time. "All of the reliability of classification indices are at or above .90, indicating substantial agreement between the classifications based on CPTs (currently called FCELPT) scores and classifications that would be based on true scores, were they known" (p. 42).

"Validity is the most important quality of any test. Validity is concerned with what a test measures and for whom it is appropriate" (Gay, 1996, p. 138). "For a placement test, evidence of content validity and predictive validity is crucial" (College Board, p. 51). The College Board provided positive evidence for the content and predictive validity of the test. The content of the Reading Comprehension, Sentence Skills, Arithmetic, and Elementary Algebra had their basis in the specifications of the New Jersey College Basic Skills Placement Test (NJCBSPT). Advisory committees of subject specialists from both two-year and four-year institutions assisted in the development of the test. The College Board includes a table that provides relevant specifications for the CPTs. The table includes lower and upper bounds of the range of



percentages indicating the typical percentage of questions administered to students. In some instances, there are two sets of numbers that indicate the percentage of questions administered to students at the low end of the ability scale and the percentage of questions administered to students at the high end. For example, in the area of Reading Comprehension, identifying main ideas, the approximate percentage of the test was 12-24. In sentence skills only one percentage was reported and that was 33. The other subjects varied with the highest percentage in the area Elementary Algebra, Algebraic Expressions that reported percentages of 42-58. The College Board technical data supplement notes that the “specifications are designed to give each test good measurement throughout the range of possible scores” (College Board, p. 51).

A large-scale study of the predictive validity of the CPTs began in January 1990 and continued through early 1992. Fifty colleges and universities took part in this study. Each student had a score on at least one module of the CPTs and a placement and grade in one course. About one third of the records included the student’s self reported gender and ethnic group membership. Descriptive statistics indicated that the gender group results showed very similar mean test scores for males and females with the largest difference much less than .1 standard deviation. Although the differences were small, females obtained higher grades in each course level for which a comparison could be made. ESL students obtained mean test scores close to the middle of the 20 to 120 point scale. This indicated that there was a good match between the proficiencies of the students and the difficulty of the tests. The English Best Language students in this sample scored much higher on average. This indicated that a more difficult test would be appropriate as the basis for placement decisions (College Board, p. 53).

The correlational results indicated that the correlation across institutions of Reading Comprehension test scores with grades in Developmental Reading is .18. The median correlation within institutions of Reading Comprehension test scores with grades in Developmental Reading is .19. The highest correlation between the test scores and course grades in Developmental Reading at a particular institution was .38. The correlation of Sentence Skills test scores with grades in Developmental English across institutions was .15. The median correlation within colleges of Sentence Skills test scores with grades in Developmental English was .20. The highest correlation at an institution with final course grades in Developmental English was .34. Higher ranges of scores were noted in scores for Arithmetic where the range was .25 to .39. Overall correlations in Elementary Algebra was .19 to .38, and overall correlations in College Level Mathematics was .25 to .53. The College Board noted that the “coefficients are based on situations in which the test scores were used in placing students into courses. Thus, there is generally some restriction in the range of scores-sometimes rather severe restriction-as compared to that for all students who took one of the tests, and the coefficients underestimate the magnitude of the relations that would be found if the scores were not used in placement” (College Board, p. 58-59).

Those students whose scores on the American College Testing Program Examination (ACT) or the Scholastic Achievement Test (SAT) were above 16 for ACT and above 420 for SAT did not need to be tested further. To determine the reliability and the validity of these other tests, this researcher consulted The Thirteenth Mental Measurement Yearbook (Impara & Plake, 1998). This edition referred the reader back over thirty years to the sixth edition of the book. In that edition a significant review by

Engelhart (1965) of the ACT noted that the overall reliability of the four subtests of Form 4-AC was .90, .89, .86, and .83 for English, mathematics, social studies, and natural sciences, respectively. Engelhart said that the reliability of the composite standard score is .95. The intercorrelations of the four tests are English and mathematics, .53, English and social studies, .63 and English and natural sciences, .58.

He suggested that these substantial intercorrelations indicate the need for caution in offering advice in counseling or making differential predictions. Findley (1965) also reviewed the tests and found using the Spearman-Brown split-half technique that reliabilities for the four ACT tests vary from .83 to .88. The lowest reliabilities tended to be found for the two reading tests (.83 to .86) but the highest intercorrelations for the four tests were between the reading tests (.70 to .77). Findley summed up his review by saying that the test content is excellent and the composite score is predictive of college achievement.

Fricke (1965) reported in the Sixth Mental Measurements Yearbook that a significant validity study of the SAT obtained validity coefficients of .54 and .41 for SAT-Verbal and SAT-Mathematical. Gay (1996) indicated in her book that while it is difficult to say how high a coefficient must be to be good, a coefficient of .50 might be acceptable under certain circumstances. The validity of the total score was .54. Because the correlation between the two tests is important to determine reliability, it was reported that the median correlation between V and M was .54. While Fricke was unable to find test-retest reliability coefficients, he referred to a study by Levine in which the verbal and mathematical aptitude scores were correlated with the Scholarship Qualifying Test (SQT). The correlations between the two parts of the SQT and the SAT proved to be

very high showing a correlation of .85 on the verbal section and .81 on the mathematical section (Buros, 1965).

## Instrumentation

### Environmental Preference Survey

As this study looked at learning preferences to determine their effect on multimedia instruction, a learning preference inventory called the Productivity Environmental Preference Survey (PEPS) was administered about a month and a half into the term (October 14 for the treatment group and October 15 for the control group). Kenneth and Rita Dunn, and Gary E. Price devised this inventory in 1979. The PEPS Inventory is described as a comprehensive approach to the identification of how adults prefer to function, learn, concentrate and perform in their occupational or educational activities. The inventory examines preferences in the following areas: immediate environment (sound, temperature, light and design), emotionality (motivation, responsibility, persistence, and structure), sociological needs (self oriented, peer oriented, authority oriented, and combined ways), and physical needs (perceptual preference(s), time of day, intake and mobility). Since this study investigated multimedia instruction in the classroom, preferences of sound and light were relevant to the study. Also, since the subjects were adults, this inventory was preferable. (Many of the inventories measure learning styles in children.) Furthermore, since the control group and the treatment group met at different times of the day, the information about the students' preference in time of day was also relevant to this study.

A comparison of learning style research (Dunn & DeBello, 1981) listed a number of researchers and their definitions of learning styles. It gave a brief description of the

instruments and their applications/implications. This comparison helped this researcher make a determination about the instrument for this research. The researchers that were compared were Canfield and Lafferty, Dunn, Dunn and Price, Anthony F. Gregorc, Joseph E. Hill, David E. Hunt, David Kolb, Ramirez and Castaneda, and Ronald R. Schmeck. One of these inventories (Gregorc's) was seriously considered for this study. However, further research indicated there were questions regarding the reliability and validity of the Gregorc Style Delineator. Another question concerned the time frame for this inventory. The time frame of the inventories was one consideration. Some inventories (Hill's) were as long as 50 minutes, while others (Gregorc's) were as short as five minutes. Some (Canfield and Lafferty's) were for ages ranging from junior high to adult and others (Hill's, Hunt's) were for elementary to adult.

The PEPS inventory is strictly an adult version. Dunn, Dunn, and Price have another version for use with grades 3-12. This and other criteria about the test made this researcher believe this was the right test for this study. First of all, the inventory primarily permitted individuals to identify how they prefer to learn or work. Secondly, the PEPS provided a computerized profile of each individual's preferred style. It provided a basis for the instructor to identify the way(s) that permit each person to concentrate best. Finally, the PEPS could be completed in 20 to 30 minutes which was an acceptable time to this researcher. This researcher took into consideration the time period of each class and the students' ability to stay focused. For these reasons, this researcher believed that this inventory was the right one for this study. There were, however, limitations to the use of this inventory.

In the Thirteenth Mental Measurements Yearbook (Impara & Plake, 1998), the most current one this researcher could find, Kaiser reported that the reliability of the inventory on the 20 scales measured overall range from .39 to .87. Individual areas such as learning in several ways, tactile, and kinesthetic have reliabilities of less than .60. Kaiser noted that the authors did not provide any information about content, construct, or predictive validity. The authors did, however, list a number of studies that used the instrument. Kaiser could not find support in those studies for the validity of the PEPS and ended his review with the warning that this instrument is not recommended for use until more evidence about its validity and reliability is obtained. In another review in the same edition of the Mental Measurements Yearbook Rozecki reviewed the PEPS. According to Rozecki the authors of the inventory stress the correct use of this inventory is “to classify specific environmental, emotional, sociological, and physical factors that could then be used to identify environments that would be most conducive in meeting the preference of individuals within various organizational environments”(p. 788). After describing the inventory and repeating the same reliability coefficients that Kaiser noted, Rozecki advises the reader that the manual of the inventory lists 16 abstracts of studies in which the PEPS was used. The types of studies include cognitive style, college undergraduates, ethnic differences, gender differences, instructional style, life span changes, personnel and management, structure, and study skills. Rozecki said, “the PEPS appears to be an assessment tool that can offer a clearer assessment strategy than more simplistic methods that are often utilized by teachers, administrators, and personell managers. It highlights specific environmental conditions and preferences that often impact work or learning performance and can serve as a guide for structuring groups that

might increase their performance by being clustered together” (p. 790). He ended by advising that the inventory not be used as a diagnostic assessment of an individual’s ability to succeed in a particular work or academic environment, and that a personal interview accompanied by the administration of the instrument is wise because of the reliability and validity issues.

Luna and McKenzie (1997) did a study to determine how students with different learning styles integrated multimedia instruction over traditional lecture instruction. The researchers of this study developed a multimedia curriculum for two political science courses based on a survey of instructors who used multimedia. Over 200 students made up the test population. For the study, the researchers used three different learning inventories and one attitudinal survey. One of the learning style inventories was the Productivity Environmental Preference Survey. The hypothesis that was tested was that multimedia education enhances aggregate student performance. Although the results of the research were mixed, the data did substantiate a correlation between learning style and test performance. However, the correlation did not prove that multimedia instruction was better. Rather, it found that identified visual learners had higher test scores in both traditional and multimedia instruction. However, nowhere in the discussion or recommendation was there an indication that the instrument was inadequate. Therefore, in this instance, it may be presumed that the instrument measured adequately what the researchers wanted to measure.

#### Researcher Developed Tests and Surveys

For this study two midterms and one final examination were administered to the students. Due to copyright issues, copies of the tests are not included in the appendix of

this manuscript. However, they are available to anyone who wants to see them. These examinations were generated through the test bank that accompanied the textbook. The computer randomly selected the questions on the examinations. Two versions of the same test were generated to avoid compromising the integrity of the tests. Each exam was a 50 item multiple-choice exam. The first exam was administered after five chapters had been covered both in class and outside the class through the textbook. The first exam for the control group was administered on October 1. The first exam for the treatment group was administered on October 5. After the next five chapters had been covered in class, another midterm exam was administered. The date of the second exam was November 10 for the control group and November 16 for the treatment group. At the end of the semester the final exam was administered. The dates of the final exam were December 17 for the control group and December 16 for the treatment group. The College prescheduled the dates for the final exam. The researcher had no control over these dates. The final exam covered the last five chapters. None of the exams were cumulative. The exams only covered those chapters assigned in that period of time. Therefore, each exam was used as a posttest for the material covered in that time period. The students recorded their answers on a scantron sheet and a scantron machine scored these sheets.

A colleague who teaches history gave a cursory review of at least two of these exams. Although it was not possible for him to determine reliability, he deemed the tests valid for content. A memo concerning his review can be found in Appendix A. To determine reliability a Cronbach's alpha reliability test was run on SPSS for the final test



only. There were 55 cases recorded and the number of items was 50. The reliability coefficient was .79 which is considered to be moderate.

In addition to the researcher-developed tests, demographic information about language, credits taken and attendance was collected from students on a student survey form. A copy of this survey can be found in the Appendix B. This survey was administered to determine whether or not English was the primary language of the students involved in the study. The question about how many credits the students had completed was to determine the level of experience of the students in regard to how many different classes the students were exposed to before and what the expectations of the students were for a college level course. Attendance was considered a factor because if one class overall had good attendance but the other did not, the classes would not be considered equivalent. All of this information provided the researcher with valuable information to be used in conjunction with the data.

#### Procedures and Materials

The study was conducted using two intact groups; one control and one treatment. The control group was taught in a straight lecture didactic format. This group did not view any videos or laser disks in class. (Of course, there was no guarantee that the students did not view them on their own outside of class, however.) There were no visual enhancements to the lecture such as slides used on the overhead projector in class. The only use of visuals was the instructor's notations on the board and the textbook that the group was required to read. This method has been the method of instruction used by this instructor in the past.

The treatment group was taught with multimedia. A computer was used to project the instructor's notes onto a screen. This instructor used Microsoft PowerPoint as the presentation manager. Interspersed with the text on the computer were laser disk and CD-ROM presentations made available from publishers and companies. Some of the frames were still pictures while others were brief thematic essays with sound and motion. This group was also required to read the textbook to supplement what they had heard and seen in class.

All procedures took place at Palm Beach Community College, South Campus in Boca Raton, Florida and began on August 24, 1998 and ended on December 17, 1998. Each group met 31 times during the semester. The treatment group met in a multimedia room set up with a computer and projector. The control group met in a module on campus that contained only the basics: desks, green board and chalk. To insure that the researcher/instructor was consistent in the lecture material, the same notes were used for each class.

### Textbook

A textbook was ordered by the college to be used in conjunction with this course. The subjects in the study were required to buy and use the textbook. The textbook that was used by the subjects in this study was Out of Many-A History of the American People by John Mack Faragher, Mari Jo Buhle, Daniel Czitrom and Susan H. Armitage. This 1997 version is the second edition and was published by Prentice Hall in Upper Saddle River, New Jersey. The representative of the publisher informed this researcher that determining the reading level of the text is not done routinely for college level books. Therefore, the researcher obtained information for determining the reading level of a

textbook. According to Fry (as cited in Zakaluk and Samuels, eds., 1988) the goal of most authors is true readability. His formula with a graph was in Zakaluk and Samuels' book, Readability: its past, present and future. Fry's article was entitled, Writeability: The principles of writing for increased comprehension. This researcher followed his formula and determined that the reading level of the text was grade 14.

### Notes

Both groups took notes on the lectures for the first five chapters. In other words, while the instructor lectured in the control group and presented the material in multimedia form to the treatment group, the students were required to take their own notes. This went on each day that the classes met from approximately August 24 to the date of the first exam (October 1 and October 5). When the last 11 chapters were presented, (beginning on October 6 for the control group and October 7 for the treatment group) the students were advised that they could access the notes that had been generated from the multimedia presentation. The instructor had a computer technician place the notes on the web page prior to the start of Chapter 6. These notes could be accessed from the College or from the students' home if they had access to the Internet. The instructor's web page contained all the notes from Chapter 6 to Chapter 16. The address was \_\_HYPERLINK <http://www.pbcc.cc.fl.us> \_\_<http://www.pbcc.cc.fl.us>\_. The students were advised they would get on Palm Beach Community College's website. They then could access South Campus. Next they scrolled down to "Faculty," "B," for "Billera," and then U.S. History to 1865. The notes were broken into two units with a table of contents listing each chapter.

If the students wanted to access the notes from the College, they could do so by going to the Center for Personalized Instruction (CPI) on the second floor of Building B of Palm Beach Community College, South Campus where they could access and print out the notes. All students from both classes were able to access these notes. Since all the notes were available at this time, the students could access all or part of the notes. For example, they might have wanted to obtain each day's notes at the time they were needed or they might have obtained all the notes for the remainder of the course at the same time. These uniform notes would ensure that everyone had a complete set without relying on students' ability to take their own. With everything being equal, the only difference would be the method of instruction.

#### Data analysis

The computer software program, Statistical Package for the Social Sciences (SPSS) Graduate Pack, was used to analyze the data. This student edition of SPSS was run on a personal computer.

Means of the demographic data were depicted in tabular form in order to compare the subgroups of the population sample. The test scores for the subgroups were summarized with descriptive statistics: mean, and standard deviation for each. The two groups were compared to detect any significant differences on the demographic data using chi square statistics at the .05 level of significance. The chi square was used because it is the best test to compare group frequencies. That is, this test determines if an event occurs more frequently in one group than another. The chi square test is appropriate when the data represent a nominal scale. The categories may be true categories such as

male and female as in this study, or they may be artificial categories such as tall and short.

The posttests were correlated with the pretest scores and then compared using analysis of covariance (ANCOVA) at the .05 level of significance. ANCOVA is a statistical method that adjusts scores on a dependent variable for initial differences on some other variable. Covariance can be helpful in reducing bias when random assignment of groups is not possible (Stevens, 1996) as was the case in this study. It can also be used when intact groups are involved which again was the case in this study. However, results must be interpreted with due caution. Pretest scores in the form of placement test scores were used as a covariate. According to Stevens one should use only pretest or other material gathered before the treatment as covariates (p. 321). (Since the pretests were of different kinds and on an ordinal scale, a linear regression was done and the scores were standardized first so that analysis could be done.) Cross-tabulations was used to analyze the groups by the categorical data for learning preferences. A chi square test was run for each variable and group. The two groups were compared on learning preferences using ANCOVA and an interaction was looked for between group and learning preference.

The same procedure was followed for the investigation of visual clarifiers (notes). The researcher used cross-tabulations to analyze the groups by remediation and then by language. A chi square test was run for each variable and group. The two groups were then compared separately on these two variables using ANCOVA.

Results of all analyses are reported in Chapter IV and discussed in Chapter V.

## Summary

This study investigated the use of multimedia instruction on the achievement of students of U.S. History at Palm Beach Community College in the fall 1998. The two classes used for this study were intact groups taught by the researcher. The methods of instruction for the control and treatment groups were lecture and multimedia instruction, respectively. The dependent variable was achievement as measured by posttests and College Placement Tests. The study also explored whether or not learning preferences had an impact on the effects of multimedia instruction. Finally, this study investigated the potential benefit of visual clarifiers (notes) generated from multimedia presentations on student achievement. In this chapter the study methodology was described.

For a table summary of the research methodology, see Table 1.

Table 1.

Summary of Research Methodology

Research Question	Data to be collected	Instrumentation	Analysis
1. Does the use of multimedia instruction have an effect on students' learning of U.S. History?	Scores of pre and posttests.	Researcher developed tests and standardized placement test scores	Computing means, and standard deviations, <i>t</i> tests, and an analysis of covariance (ANCOVA)
2. Does a student's learning preference moderate the effectiveness of multimedia instruction on their learning of U.S. History?	Scores on a learning preference inventory	Productivity Environmental Preference Inventory (PEPS)	Chi square, and analysis of covariance (ANCOVA)
3. Does the use of visual clarifiers have an effect on the learning of U.S. History on students whose first language is not English?	Test scores and student surveys	Researcher developed tests and researcher developed surveys	Chi square, and analysis of covariance (ANCOVA)
4. Does the use of visual clarifiers have an effect on the learning of U.S. History on students who need remediation?	Test scores and placement test scores	Researcher developed tests and FCELPT, SAT, or ACT test scores	Chi square, and analysis of covariance (ANCOVA)

## CHAPTER IV

### Results

In this chapter the results of the analysis of the study data are presented according to the purposes described in Chapter I, and the procedures outlined in Chapter III. Results of all analytic procedures related to the hypotheses are presented. Both descriptive and inferential statistics were used and included analysis of covariance (ANCOVA), chi square, and *t* tests. The .05 level of significance was selected for analysis of data related to the hypotheses.

#### Description of the Population Sample

The sample was drawn from the population of Palm Beach Community College. More specifically, the sample came from the 19 sections of history, two of which were assigned to this researcher. At end of the session there was 26 students in the treatment group and 32 students in the control group.

The statistics for the year 1998-99 indicated that the overall population for the south campus of Palm Beach Community College was 3, 887. The total of males both full time and part time was 1, 702 and the total of females was 2, 185. The percentage of males and females for the College was 44% males and 56% females. At the end of the study, there were 12 males and 14 females in the treatment group. The percentage of males and females for this group was 46% and 54%, respectively. At the end of the study, the control group had 11 males and 21 females. The percentage of males and females for this group was 34% and 66% respectively. The treatment group more closely mirrored the general population of Palm Beach Community College for males and



females. Overall, however, the males constituted 40% and the females constituted 60% of the sample.

The treatment group had 39% of students who took 15 credits or less, and 54% of students who took 16 credits or more. (Information on two students or 8% was not available.) The control group had 9% of students who took 15 credits or less, and 91% who took 16 credits or more with the maximum number of credits at 59.

The groups were close in the number of students (23 and 24) who spoke English as a first language. However, the percentages were considerably different between the groups due to the sizes of the two groups. Of the students who spoke English as a first language, the treatment group had 88%, and the control group had 75%. Of the students who spoke a language other than English, the treatment group had 12%, and the control group had 25%. Overall, 81% of the entire sample spoke English as their first language, while 19% spoke a language other than English first.

Attendance was also used to establish the equivalency of the groups. The number of students (19) who missed between one and three times was the same for the two groups. However, once again due to group sizes, the percentages were very different. In the treatment group 73% missed between one and three times, while in the control group 59% missed between one and three times. The number of students who never missed class was very small for both groups (1 and 4). The percentages were 4% and 13% for the treatment and control groups, respectively. The numbers were only slightly higher for the students who missed four or more. The numbers were 2 and 6, and the percentages were 8% and 19% for the treatment and control groups, respectively. The demographic

variables of gender, number of credits taken, number of days attended, and the languages of the students are summarized for the two groups in Table 2.

Chi square tests were performed on the descriptive variables. Analysis indicated that there were no significant differences in regard to gender, and language between the two groups. The chi square test for attendance was not valid because cell sizes were too small. There was, however, a significant difference between the groups on the number of credits taken. More students in the control group (91%) had taken 16 or more credits as compared to the treatment group. The chi square test results were:  $1, N = 58 = 10.493, p < .005$ .

Therefore, the sample was considered to be equivalent for gender and language, but not so for number of credits taken. Because there was a significant difference between the groups based on the amount of credits taken, it may be inferred that the outcome of the study might have been the result of the students' experience rather than the treatment. The level of experience of the control group might somehow have impacted the results of this study.

Table 2.

Frequencies and percentages for Gender, Credits, Language, and Attendance

Descriptor	Treatment	Control	Total
	N (%)	N (%)	N (%)
Gender:			
Males	12 (46)	11 (34)	23 (40)
Females	14 (54)	21 (66)	35 (60)
Total	26 (100)	32 (100)	58 (100)
Credits:			
0-15	10 (42)	3 (9)	13 (23)
16+	14 (58)	29 (91)	43 (77)
Total	24 (100)	32 (100)	56 (100)*
Language:			
English	23 (89)	24 (75)	47 (81)
Other	3 (11)	8 (25)	11 (19)
Total	26 (100)	32 (100)	58 (100)
Attendance:			
Never missed	1 (5)	4 (14)	5 (10)
1-3 misses	19 (86)	19 (65)	38 (74)
4+ misses	2 (9)	6 (21)	8 (16)
Total	22 (100)	29 (100)	51 (100)*

Note. Because of missing data, all row totals do not accumulate to 58.

## Study Hypotheses

### Tests scores

*T* tests were run on the three exams, but only to obtain the means and standard deviations. The means for test 1 indicated the two groups were somewhat similar (49.83 for the treatment group and 47.61 for the control group). However, there is a larger difference between the two means for test 2 and test 3 (50.56 for the treatment group and 37.00 for the control group, 51.38 for the treatment group and 41.75 for the control group, respectively). The range of scores is different between the groups and also between the exams. On Test 1 the range for the treatment group is 26-72 and 20-68 for the control group. The range for Test 2 is 30-80 for the treatment group while the control group range is 16-66. The range of scores for Test 3 is 24-78 for the treatment group and 25-68 for the control group. The greatest difference is between the groups in Test 2. The descriptive statistics on these test scores is presented in Table 3.

Table 3.

Descriptive Statistics on Test Scores for Students by Group

Test Scores	Treatment	Control	Total
Test 1			
N	23	31	54
Mean	49.83	47.61	48.56
SD	14.04	12.30	12.99
Test 2			
N	25	32	57
Mean	50.56	37.00	42.95
SD	14.96	11.77	14.79
Test 3			
N	26	32	58
Mean	51.38	41.75	46.07
SD	15.59	11.31	14.13

Note. One student from the treatment group and one student from the control did not take test 1. One student from the treatment group did not take test 2.

To determine if the tests correlated significantly with each other, a correlation was run with the Pearson  $r$ . The placement scores from the FCELPT, ACT and SAT were called pretest and were used as a covariate. The correlations are summarized in Table 4.

Table 4.

Correlation of pretest and posttest scores

Variable	Pretest	Test 1	Test 2	Test3
Pretest	1.000			
Test 1	.575 **	1.000		
Test 2	.375 **	.409 **	1.000	
Test3	.421 **	.511 **	.499 **	1.000

\*\*Correlation is significant at the 0.01 level.

The findings were that the three tests all positively correlated significantly with each other and with the placement scores that were used as a pretest.

Analysis of covariance (ANCOVA) was run on the three tests. Because the pretest was correlated with all three tests, it was only used as a covariate for Test 1 to control for individual differences. The pretest was a significant covariate,  $F(1, 45) = 20.22$ ,  $p < .0005$ . After adjusting for pretest scores, there was still no significant difference between the two groups on test 1,  $F(1, 45) = 0.00$ ,  $p < .990$ . For Tests 2 and 3, the Test 1 score was used as a covariate. For Test 2 and Test 3 there was a significant difference in test scores between the groups:  $F(1, 52) = 16.88$ ,  $p < .0005$ ,  $F(1, 53) = 8.52$ ,  $p < .005$ , respectively. These results suggest that the method of instruction does positively effect students' learning. Therefore, the research hypothesis:  $H_1$ . There is a

significant difference in learning between students who receive multimedia instruction and those who receive traditional lecture is supported.

A comparison of adjusted means is summarized in Table 5.

Table 5.

Means for Test 1, Test 2, and Test 3 by Groups

Tests	Means	
	Treatment	Control
1	47.76	47.80
2	51.38	37.22
3	51.59	42.36

Learning preferences

An inventory called the Productivity Environmental Preference Survey (PEPS) to determine students' preferences for learning was administered to see if these learning preferences moderate the effectiveness of multimedia instruction on the learning of U.S. History. The variables, which were most relevant to the study, were auditory and visual.

The survey indicated preference by placing students' responses on a continuum. When an area descriptor such as noise level represented itself between 40 and 60 it meant there was no preference. When the score for that particular descriptor was over 60, the student was identified as having a preference for sound. When the score for that particular descriptor was under 40, the student was identified as having a preference for quiet. Most of the students' scores in all twenty descriptors fell in the mid-range, which indicated no preference. Using crosstabs to analyze only the areas of auditory and visual

learning, an observed difference between the groups could be seen in the category auditory learning. Thirteen students or 43% in the control group preferred auditory learning. The frequencies by group are summarized in Table 6.

Table 6.

Frequencies by group for learning preferences

Learning Preference	Treatment	Control	Total
	N (%)	N (%)	N (%)
Auditory			
Does not prefer	3 (12)	3 (10)	6 (11)
No preference	17 (68)	14 (47)	31 (56)
Prefers	5 (20)	13 (43)	18 (33)
Total	25 (100)	30 (100)	55 (100)
Visual			
Does not prefer	1 (4)	6 (20)	7 (13)
No preference	20 (80)	21 (70)	41 (74)
Prefers	4 (16)	3 (10)	7 (13)
Total	25 (100)	30 (100)	55 (100)

Note. One student from the treatment group and two students from the control group did not fill out the Productivity Environmental Preference Survey.

The results of the chi square analysis on these descriptors, however, indicated that the preference for either auditory learning or visual learning was not significant. The chi square test results were: (2, N = 55) = 3.42,  $p < .18$  for auditory learning and (2, N =



55) = 3.31,  $p < .19$  for visual learning. Because of the high percentage of students in the control group who preferred auditory learning, a two way analysis of covariance (ANCOVA) was done on the variable auditory learning. The results indicated there was no significant difference on Test 1, Test 2, or Test 3 between the groups based on the learning preference for auditory learning:  $F(2, 43) = .66$ ,  $p < .52$ ,  $F(2, 49) = .81$ ,  $p < .45$ ,  $F(2, 50) = 1.92$ ,  $p < .16$ , respectively. These results suggest that learning preferences do not moderate the effectiveness of multimedia instruction on the learning of students. Therefore, the research hypothesis: H<sub>2</sub>. There is a significant difference on the effectiveness of multimedia instruction based on students' various learning preferences is not supported. The analysis of covariance for auditory learning is summarized in Table 7.

Table 7.

Analysis of Covariance for Auditory Learning

		<u>F</u>		
Source	df	Test 1	Test 2	Test 3
Between Subjects				
Group (G)	1	.96	11.85	14.40
Auditory Learning (AL)	2	2.90	.71	2.32
G x AL	2	.66	.81	1.92
Error	124	(118.78)	(159.51)	(124.03)

$p > .05$

## Visual Clarifiers

First, the variable language was investigated to determine if visual clarifiers would positively affect students' learning of U.S. History on students whose first language was other than English. The hypothesis H<sub>3</sub>. There is a significant difference on students' learning of U.S. History when students whose first language is other than English receive visual clarifiers was not supported. Frequencies for this variable indicated three students or 11% in the treatment group, and eight students or 25% in the control group spoke a language other than English. The overall number of students who spoke English was 81% while the speakers of other languages was 19%. The factorial analysis of covariance (ANCOVA) indicated no difference between the groups on Test 1, Test 2, or Test 3:  $F(1, 45) = .01, p < .94$   $F(1, 52) = .77, p < .38$  and  $F(1, 53) = .17, p < .68$  on the variable language. Analysis of covariance for language is summarized in Table 8.

Table 8.

### Analysis of covariance for English as a Second Language (ESOL)

Source	df	<u>F</u>		
		Test 1	Test 2	Test 3
Group (G)	1	.00	5.69	.02
ESOL	1	4.38	.63	.46
ESOL x G	1	.01	.77	.17
Error	150	(176.9)	(232.1)	(199.0)

ps > .05

Next, students were identified as remedial or non-remedial based on the results of their verbal pretest scores. Students who took the ACT must have received a grade 16 or above in English. Students who took the SAT must have received a grade of 420 or above in Verbal. Those students who did not receive this minimum grade must take the FCELPT. After taking the FCELPT, if a student receives 0-60 they must take College Preparatory Reading I. Other scores up to 83 have particular designations of preparatory courses. Students who took the FCELPT and received a grade of 83 or above can then enroll in ENC 1101 or College Composition I. It was based on these requirements that this researcher designated the students remedial or non-remedial.

The control group had more students who, based on the scores of their pretests, were required to take remedial courses (25% as compared to 11.5% in the treatment group). The non-remedial students were more evenly distributed in the two classes (23 and 24), but because of the differences in class size the percentages were quite different (88.5% for the treatment group and 75.0% for the control group). The results of the chi square:  $(1, N = 58) = 1.69, p < .19$ , however, indicated there was no significant difference between the classes on this variable remediation.

A factorial analysis of covariance (ANCOVA) indicated no significant difference on Test 1, Test 2, or Test 3, between the groups on the variable remediation:  $F(1, 45) = .31, p < .58$ ,  $F(1, 52) = 1.44, p < .24$ , and  $F(1, 53) = 28.78, p < .64$ , respectively. Therefore, the hypothesis there is a significant difference on students learning of U.S. History when students who need remediation receive visual clarifiers is not supported. A summary of the analysis of variance for remediation can be found in Table 9.

Table 9.

Analysis of covariance for Remediation

Source	df	<u>F</u>		
		Test 1	Test 2	Test 3
Group (G)	1	.07	3.31	4.50
Remediation (R)	1	.85	.41	.15
G x R	1	.31	1.44	.21
Error	150	(176.93)	(232.09)	(199.00)

ps > .05

In this chapter the study data were analyzed and results were presented.

These results are discussed further in Chapter V, along with their relationship to current literature. In Chapter V, conclusions are drawn regarding the implications of the results for each hypothesis, and recommendations for further research are made.

## CHAPTER V

### Discussion, Conclusions and Recommendations

In this chapter, the results of the research study are discussed. Conclusions regarding the results of the data analyses for the various hypotheses are presented, and recommendations for further research in the area of multimedia instruction are made.

#### Discussion

When this researcher was offered an opportunity to learn how to teach with multimedia, the topic for this study was conceived. The literature affirmed that multimedia instruction enhances communication between teachers and students (Davis, 1993; Lynch, 1998; Noblitt, 1993). Studies indicated that with the appropriate use of relevant visuals, better recall, a better understanding of the material, increased interest and motivation, and the promotion of critical thinking could be achieved (Moore & Miller, 1996). In addition, test scores for multimedia instruction were higher when compared to conventional methods of instruction (Beerman, 1996). Furthermore, there was no difference between the students based on their learning style or preference. Multimedia could benefit students of any learning style (Pearson, Folske, Paulson, & Burggraf, 1994). However, while contributors to journals were writing about the good things that multimedia instruction could bring to a classroom, there were many that were reluctant to try this new instructional method. Davis (1993) warned that using multimedia as fancy overheads or chalkboards would not be the proper way to use it. Clearly, there was a need for solid research in the area of multimedia instruction. The

purpose of this study, then, was to investigate the effect of multimedia instruction on students' learning. More specifically, this study investigated the effect of multimedia instruction on community college students' learning of U.S. History.

As some time passed, this researcher began to ask more questions such as could the notes generated from a multimedia presentation benefit students whose first language is other than English? Could the use of notes have an effect on students' learning of U.S. History on students who need remediation? What should be noted here is that there is a tremendous difference between these notes and notations written on the chalkboard. The notations on the chalkboard are in the form of key words or hard to spell words, but are not complete notes of everything the instructor said.

The questions noted above developed into hypotheses that there is a significant difference in students learning of U.S. History when students received multimedia instruction. There is a significant difference on the effectiveness of multimedia instruction on students' learning of U.S. History based on students' various learning preferences. There is a significant difference on students' learning of U.S. History when students whose first language is other than English receive visual clarifiers, and there is a significant difference on students learning of U.S. History when students who need remediation receive visual clarifiers are the other hypotheses.

To test these hypotheses this researcher used two intact classes selected from 19 total sections. One group selected a class time that was assigned to a multimedia room at the community college, and this became the treatment group. The other class became the control group. Using a convenience sample such as this has limitations that might negatively affect the results. Attrition was a problem as this study started out with a total

of 76 students in the two sections combined, but ended with only 58 students. In the treatment group two students never came to class even though they had signed up, four students withdrew after the first test, and seven students just stopped coming to class after the first test. In the control group one student stopped coming after the first test, two students stopped coming after the second test, one student never came and withdrew, and one student never came but did not withdraw from class officially. The number of students at the end of the study was 26 for the treatment group and 32 for the control group. This loss of students resulted in a smaller sample than was expected.

Furthermore, while the difference between the groups at the beginning of the study was small (only two students), at the end of the study there was a difference of six students.

The researcher taught the same material to both classes. However, the group that received the treatment was taught with a Microsoft Power Point presentation of each chapter. When the presentation was being shown, the instructor was saying what the students were seeing on the screen and elaborating on the material as well. At the beginning or end of each period a CD Rom summary of the chapter was presented. This was a resource provided by the textbook publisher and came with the book if the book was purchased new. That meant that any student in both groups could have had access to it, however, this researcher only showed it in the class receiving the treatment. The control group was taught in the same way that this researcher has taught in the past. That is, the researcher used the same notes, but no visuals were used except for handwritten notations on the chalkboard. As was stated before, these notations are not in the form of formal notes or even complete sentences. Rather, they are just key words, or hard to spell words. This class met in a portable classroom that had no maps or anything visual.

The classes met on different days and at different times of the day. The treatment group met later in the day (1:30 to 2:45) than the control group (who met 10:30 to 11:45), but for the same amount of time. It is a common belief that students who take early classes are often students who have jobs, while students who take later classes do not. Furthermore, students tend to prefer early classes and those students who have later classes may have procrastinated too long and have those classes because they were the only ones left. In addition, students in earlier classes (not too early) are more alert and attend more classes, while students who take classes after lunch are sluggish and miss more classes. While these “facts” are more observation and speculation than scientific fact, there might be enough truth in this to indicate that the groups were different in some important way. Statistical analysis, however, indicated that the groups were equivalent on two of the variables measured to determine the equivalency of the groups. That is, the groups were equivalent on gender and language. Unfortunately, the variable attendance could not be analyzed because the cell sizes were too small. On the variable the number of credits taken there was a significant difference between the groups. There were more students in the control group that had taken 16 or more credits. This was the group that met earlier in the day than the treatment group. This may or may not have been a coincidence based on what was stated before. If nothing else, this group was more experienced in the community college setting.

Next, the hypotheses were tested. The test scores used for this study consisted of the college placement tests and three researcher-developed tests. Some students were transfer students who did not have a placement score recorded. Foreign students also did not always have a score. Where scores were available, they were recorded. Because there



was concern that unavailable pretest scores might impact the results of the analysis, a *t* test for equality of means was run. It indicated that the students whose pretest scores were not recorded did not impact the results of the analysis.

While the pretest scores did not present a problem the researcher-developed posttests had some problems. To ensure that the tests were not biased in any way, the researcher made totally random selection of the test item questions through a computer-generated test bank. Since the researcher devised the multimedia presentation, and the tests were computer generated, it was believed by the researcher that there was no way the test could be biased towards the multimedia presentation. However, the method used to generate the tests resulted in one version that was linear, and another version that was not. Therefore, of the two classes taking the tests, one had questions that were in chronological order, the other was not. When the researcher chose the method of generating the tests, it was not evident that this might be a problem. To compensate for this unexpected occurrence, the versions were reversed when the second test was administered. The group that received the nonlinear test the first time received the linear test and vice-versa for the other group. For the third test, both classes were administered the exact same test, the linear version.

In addition to the way in which the computer generated the tests, there were some errors in the questions that were found by the researcher and the students. One test item listed one answer in the answer key of the test bank, but another answer in the answer key of the student guide. (This student guide was not required by the researcher, however some students did have and use it.) Another test item was proven to be wrong by one student who carefully read the book and picked up the discrepancy in the answer listed in

the test bank. Nevertheless, in spite of the problems with some answers, the four tests (one pretest and three posttests) all positively correlated significantly with each other. Furthermore, a reliability test done on the final only gave a moderate reliability coefficient.

Note taking presented some problems as well. Both groups were expected to take notes for the first five chapters discussed in class. The treatment group had a harder time with this. When the text was projected on the screen, the treatment group thought it necessary to copy every word. They sought to create very elaborate notes. However, some students write quicker than others, some abbreviate, and some just write down key words. Everyone's pace was different. Therefore, it was a challenge for the researcher to keep the presentation flowing. One interesting event did occur, however. On the only one occasion when the computer was not working, this researcher proceeded to lecture to the class. Everyone seemed to settle in to taking notes without the previous problem of going too fast or too slow. This indicated that students are accustomed to taking notes when they need to, and are perfectly capable. However, when they are presented with something new they have some difficulty.

Further evidence of this is that the control group did not have the same problem with note taking that the treatment group had. Everyone wrote notes, presumably to the best of their ability. The researcher collected the notes at the end of the first five-chapter sequence. The notes taken by the treatment group were, as would be expected, the exact words from the presentation. However, the notes taken by the control group from straight lecture instruction were very similar from student to student. In other words, whether it was the writing on the chalkboard or oral clues, the students thought the same things were

important enough to write down. The level of sophistication of this group as was indicated previously also could account for the difference in their ability to take notes.

Another part of the research involved the learning preferences of the students. This researcher investigated several learning preference inventories for adults. One in particular was Gregorc Style Delineator (Gregorc Associates, Inc., 1997), however the one chosen was the Productivity Environmental Preference Survey or PEPS (Price Systems, Inc., 1993). The developers of this inventory were Rita Dunn, Kenneth Dunn and Gary E. Price. This researcher spoke directly to Dr. Price about this study, and he indicated that a special research rate would be given with his approval if he saw a copy of the proposal. After reviewing this, he stated that, to the best of his knowledge, no one had investigated learning preferences and multimedia instruction. He said he hoped to see the final manuscript after it was completed. The instrument was purchased and administered to the students in October 1998, and sent back for scoring immediately. When the scores came back, there were individual profiles for each student. The students reviewed these. Most of the comments were that they knew this information about themselves. Interesting findings about the group summary and the sub-scale summary were that the students, for the most part, preferred structure, and afternoon was the best time of the day for learning preference. One other interesting note was that the control group, that did not receive the treatment multimedia instruction but only heard the lecture, preferred auditory learning as a group. Neither group preferred evening or morning as was indicated by the higher percentages in that category for "does not prefer." For the statistical analysis, however, only those items relevant to the study were analyzed. That is, auditory and visual learning were analyzed.

Two of the hypotheses investigated in this study dealt with language and remediation. The information on the first language of each student was determined by students indicating this on a survey at the end of the course. Early in the semester, there had been a discussion in the control group about what constituted a second language. The debate was over whether or not someone had to be from another country to consider English a second language. Also, whether or not someone learned to read and write the language first was a consideration. When the students filled out the survey, nothing was said about what constituted a second language, and each student interpreted that according to their own belief. Almost everyone in the two groups completed the statement, “my first language is \_\_\_\_\_.” However, one student who was clearly of Asian origin, did not answer the question. Of course, because he was clearly of Asian origin, this did not necessarily mean he was not born somewhere where English was his first language. However, this researcher found out through placement test information that this student was from another country where he probably did not speak English first.

The frequencies and percentages by group for language indicated there were more students in the control group whose first language was other than English. When the frequencies and percentages by group for remediation was done, the control group also had more students who were required to take remedial courses. This is the group, however, that also had more students who had taken 16 or more credits. Another consideration is that the control group had more total students.

Because this researcher wanted to keep the groups constant while trying out other variables, the analysis for learning preferences were thrown out and language and remediation were substituted. While the results indicated there was a significant

difference in test score when student received visual clarifiers, this did not truly indicate anything significant as a difference in test scores based on treatment had already been established.

Finally, this study did have the students do an outside assignment. The college obtained, for use in this study, a computerized bulletin system called WebCT. The purpose of the assignment was to give the students exposure to interactive computer use. WebCT's content centered tracking indicated the number and duration of hits on each course page, information that could be used to make inferences about the interest and difficulty of the content (Gray, 1998). The idea for this assignment came from an article by Watson (1992). The two classes were divided into three forums. Each forum had semiprivate access to a "folder" on a computerized bulletin system. Any user accessing the system could read the messages, but only the members of the forum were granted writing privileges. The assignment was divided into four parts with completion deadlines for each part. The first part assigned each member of the forum to write a brief introduction about him or herself and recommend a topic to discuss. The second part was to vote and rank three choices from the topics suggested by the forum. When the forums had tallied the votes, the third part of the assignment had them write a message relating to the agreed on topic. If there was a tie in voting, the students had to resolve the issue by electronic message. They could not get together in person.

This assignment was very useful in getting students to use a computer in a different way as was indicated by the students' responses to oral questions and discussion of this assignment. Many of the students had not used a computer before, or had not used

it as a communication tool. This introduction to the use of a bulletin board was very helpful to them.

### Conclusions

The analysis to determine the equivalency for this study indicated the sample was considered to be equivalent for gender and language, but not so for number of credits taken. Multimedia instruction may have made a difference in the learning of the students as is indicated by the treatment group receiving significantly higher scores on Test 2 and Test 3. While this result should be interpreted with caution, this may have an implication for multimedia instruction and future research. Since this result supports the use of multimedia instruction, it is consistent with Beerman's (1996) study. She maintained that multimedia instruction helped average and below average students to learn material more effectively. In another study, Pearson, Folske, Paulson, and Burggraf (1994) found that learning styles and multimedia presentations were not related in any way. This study was consistent with that finding as well. While this study was based on another study done by Luna and McKenzie (1997) the results should be compared to their results. However, like this research, the results were mixed. Luna and McKenzie found that the relationship between multimedia instruction and student exam performance could not be strongly substantiated. Therefore, while researchers believe that students are positively affected when multimedia instruction is integrated in classrooms (Davis, 1993; Lynch, 1998; Noblitt, 1993), further research is needed on the subject. This researcher, however, was encouraged by the findings.

The second hypothesis: There is a significant difference on the effectiveness of multimedia instruction based on students' various learning preferences, was not

supported. The data did not reveal any significant relationship between learning preferences and achievement. Luna & McKenzie (1997) found that students who learn better through visual stimulation actually had higher test scores in both traditional and multimedia instruction. However, as was stated before that study failed to definitely substantiate a distinct relationship between learning preferences and one type of instruction, namely multimedia.

The last hypotheses concerning visual clarifiers did not provide any indication that the use of notes improved the learning of students. Although the literature indicated that some students can be helped by having formal notes, this was not supported in this study. Nothing in this study indicated that students, whose first language is other than English, benefited from having notes in front of them either. This researcher was unable to find actual studies that looked at notes and note taking and the effect on students who learned English as a second language. However, this researcher theorized, because of her experience with learning a language that students may read and write the second language but have a hard time following the spoken word. The combination of written notes and text projected on a screen would benefit those students, it was believed. However, based on the statistical tests, it made no difference. Of course, there was a very small population of students tested. Furthermore, although the notes were available, and the students may have accessed them, there is no sure way to determine if they truly used them.

Similarly, there was also a small group of students who required some remediation in the sample population. Based on the statistical tests, there was no significant difference in the scores of these students as compared to the rest of the group.

The same thing could be true of these students in regard to accessing and using the notes provided. The literature indicated that note taking is dependent upon one's ability to understand what is being said and hold it in working memory long enough to write it down. Note taking involves elaboration and transformation of ideas, and involves students' ability to process and integrate information (McKeachie, 1986). Further studies on this topic, this researcher believes, would be very beneficial.

In conclusion, of the four variables studied, only multimedia instruction was significant. Learning styles, second language and notes, and remediation and notes were not significant. While teaching and learning is a complex phenomenon, there is some evidence that multimedia has some potential to be positive in the learning process.

#### Recommendations

Experts in the area of learning would have us believe that the more senses utilized in the learning process, the more learning takes place. This is why it is important to do studies such as this one. While learning preferences did not statistically impact the learning as measured by the posttests, something did allow the students in the multimedia class to perform better. While students may not recognize a preference for visual enhancement, it may still impact the way they learn. This study and others should be replicated. However, some recommendations are necessary. One recommendation concerns the technology. It is advised that in the future another researcher make certain that the technology is consistently available. He or she should be prepared for the unexpected because the computer can break down. Other visuals such as videos should be available as a backup. Also, for consistency in lecturing, it might be a good idea for



the researcher to tape the lectures to insure that what is being said in one class is also being said in the other.

Another recommendation concerns the tests. This researcher recommends that anyone trying to replicate this or another study, not use test bank tests, or if so, chooses the questions very carefully. The researcher should not let the computer perform this function. Furthermore, the tests should be linear and all exactly the same. In addition, it is better if the researcher not deviate from what he or she has done before. Also, the reliability of the exams should be tested before they are administered.

A third recommendation this researcher could make is that more studies be reviewed. In particular, studies on note taking, studies on note taking and first language, and studies on note taking and remediation should be reviewed if the part of this study on language or remediation is to be replicated. If the multimedia instruction component of this study is replicated, more studies done on this topic should be reviewed. While it is difficult to find many studies in a particular discipline, there may be more in various fields that can be reviewed.

Fourth, and this is only from the perspective of the researcher, is that the notes generated from the multimedia presentation may be too extensive. While this is generally the way notes are given in conjunction with a presentation, it might be better to give just a general outline and have the students fill in other facts. This would require an entirely different set of notes be generated. The reason why this recommendation is made, however, is because it was the experience of this researcher that the students relied entirely on the notes in the last two thirds of the class when they were provided. While consistency is necessary for the sake of the study, the fact that the students access these

notes restricted the researcher as instructor from interjecting other things. Furthermore, when students have notes in front of them, it is not necessary for the instructor to write on the board (in the case of the control group). Not writing on the board first of all makes the class go faster. The instructor gets through the material quicker. Also, there is a tendency to want to read the notes rather than discuss them. This researcher found that using the notes as a guide when no one else had them made the discussion more lively with more interesting interjections. However, when the students were following along with the notes, there was the tendency to not want to deviate too much.

A fifth recommendation is to have another instructor teach the classes while the researcher observes. This would alleviate any bias the instructor might have and also free up the researcher to better observe what is taking place.

Finally, the most important recommendation is for this study to be replicated with a larger sample. A larger sample could provide the information necessary for generalizations to be made.

This chapter has thoroughly discussed this study and made some conclusions regarding the results of the statistical analyses. This section has also indicated recommendations for further research.

## REFERENCES

- Anandam, K. (Ed.). (1989). Transforming teaching with technology: perspectives from two year colleges. Educom Strategies Series on Information Technology. Academic Computing Publications, Inc.
- Armstrong, G. (1996, May). One approach to motivating faculty to use multimedia. T. H. E. Journal, 23(10), 69-71.
- Azarmsa, R. (1997, January). Technology-mediated presentation in the classroom. Syllabus, 10 (5), 10-11, 16.
- Beerman, K. (1996). Computer-based multimedia: new directions in teaching and learning. Journal of Nutrition Education, 28(1), 15-18.
- Berdan, F., Stark, E., Van Loon, C. (1998, October). Multimedia development for cultural anthropology: Fieldwork simulation. Syllabus, 12(3), 54-57.
- Bergeron, B., McClure, R., Dichter, M., & Rouse, R. (1991, May). Repurposing: A fundamental factor in the development of multimedia applications. Collegiate Microcomputer, IX(2), 123-128.
- Berg, R. (1983, May). Resisting change: What the literature says about computers in the social studies classroom. Social Education. 314-316.
- Bosworth, B. (1993). Changing teaching styles when technology becomes part of the classroom. In Chambers, Jack A. (Ed.) The Center for the Advancement of Teaching and Learning. Selected papers from the 4th Conference on College Teaching and Learning. Florida Community College at Jacksonville. 1-8.
- Bouchillon, W. (1996). Preparing all learners for tomorrow's work force. Florida's Applied Technology-Curriculum Planing Companion for the Sunshine State Standards.
- Buros, O. (Ed.) (1965). The Sixth Mental Measurements Yearbook. Highland Park, NJ: The Gryphon Press.
- Butler, J. D., & Clouse, R. (1994, May). Educational technology and the teaching of history. promise, practice and possibilities. (Report No. SO024273). Tennessee: Social Studies/Social Science Education. (ERIC Document Reproduction Service No. ED 373 005).

- Cavalier, R. (1998, May). The art of multimedia production-A new curriculum. Syllabus, 11(9), 14-16.
- Chancey, M., & Perry, J. (1994). Technology and teacher training: A Pinellas County survey. Florida Technology in Education Quarterly, 6(3), 6-19.
- Christel, M. G. (1994). The role of visual fidelity in computer-based instruction. Human-Computer Interaction, 9, 183-223.
- College Board (1993). Technical Data Supplement for Computerized Placement Tests developed jointly by the College Board and Educational Testing Service. Princeton, NJ:Author.
- Columbia, CT: Gregorc Associates, Inc.
- Davidson, G. (1990, April). Matching learning styles with teaching styles: Is it a useful concept in instruction? Performance and Instruction, 36-38.
- Davis, B. (1989). Image Learning Higher Education and Interactive Videodisc. In Hans Oosthoek and Ton Vroeyenstijn (Eds.), Higher Education and New Technologies (pp.409-414) Oxford: Pergamin Press.
- Davis, B. G. (1993). Computers and multimedia. Tools for Teaching. San Fransisco: Jossey Bass.
- Dunn, R., Beaudry, J. & Klavas, A. (1989, March). Survey of research on learning styles. Educational Leadership, 46(6), 50-56.
- Dunn, R. & DeBello, T. (1981, February). "Learning style researchers define differences differently." Educational Leadership, 372-380.
- Dunn, R. & Dunn, K. (1979, January). Learning styles/teaching styles: Should they ... can they ... be matched? Educational Leadership.
- Eble, K. E. (1988). The Craft of Teaching. San Francisco: Jossey Bass Publishers.
- Edson, L. (1975). How We Learn. Alexandria: Time-Life Books.
- Engelhart, M. (1965). Review of ACT. In O. K. Buros (Ed.) The Sixth Mental Measurement Yearbook. Highland Park, NJ.: Gryphon Press.
- Facciola, P. (1997, September). Building an effective computer learning environment in the dynamic learning classroom. Syllabus, 11(2), 12, 14, 51.

- Faragher, J., Buhle, M., Czitrom., & Armitage, S. (1997). Out of Many-A History of the American People. Upper Saddle River, NJ:Prentice Hall, Inc.
- Findley, W. (1965). Review of ACT. In O. K. Buros (Ed.) The Sixth Mental Measurement Yearbook. Highland Park, NJ: Gryphon Press.
- Fontana, L. (1991). GTV: A Geographic perspective on American history. Social Education, 52(4), 221-222.
- Friedlander, J., & MacDougall, P. (1992). Achieving student success through student involvement. Community College Review, 20(1), 20-28.
- Friedlander, L. (1989 July). Moving images into the classroom: Multimedia in higher education. Laserdisk Professional. 33-39.
- Galloway, G. L. (1989). Cornell University: An institutional perspective on using information technologies to add value to teaching and learning. In William H.Graves (Ed.), Computing Across the Curriculum: Academic Perspectives (pp. 213-233). McKinney, TX: Academic Computing Publications, Inc.
- Gardner, H. (1983). Frames of Mind-The Theory of Multiple Intelligences. New York: Basic Books, Inc., Publishers.
- Gay, L. (1996). Educational Research-Competencies for Analysis and Application. Englewood Cliffs, NJ: Prentice-Hall.
- Gerard, G., Sleeth, R. & Pearce, G. (1996, Summer). Technology-assisted instruction and instructor cyberphobia: Recognizing the ways to effect change. Education, 116 (4), 604-608.
- Gray, S. (1998, September). Web-based Instructional Tools. Syllabus, 12(2), 18, 20, 22, 57.
- Gregorc, A. (1982). An Adult's Guide to Style. Columbia, Connecticut: Gregorc Associates, Inc.
- Hofstetter, F. (1995). Multimedia Literacy. New York: McGraw-Hall.
- Holt, D., Holt L., & Corsano, J. (1994). Empowering Student Learning with instructional technology. Florida Technology in Education Quarterly, 6(3), 42-51.
- Holt, J. (1967). How Children Learn. New York: Delacorte Press/Seymour Lawrence.
- Impara, J., & Plake, B. (Eds.). (1998). The Thirteenth Mental Measurements Yearbook. Lincoln: University of Nebraska Press.

- Ingham, J. & Dunn, R. (1993). The Dunn and Dunn model of learning styles: Addressing learner diversity. Pfeiffer and Company The 1993 Annual: Developing Human Resources.
- Institutional Research. (1999, April). Palm Beach Community College Opening Winter Enrollment Headcount-South Campus. (No. 4518) Lake Worth, FL: Author.
- Janger, S. (1988, October). A Call for innovation. Social Educaion, 52(6), 463.
- Kaiser, J. (1998). Review of the Productivity Environmental Preference Survey. In Impara & Plake (Eds.) The Thirteenth Mental Measurements Yearbook. Lincoln: University of Nebraska Press.
- Karrer, A. & Hauer, B.(1998 March). The interdisciplinary multimedia project course: Preparing students for the 'real world' of multimedia development. Syllabus, 11(7). 48, 50-51.
- Knowles, M. (1973). The Adult Learner: A Neglected Species. Houston: Gulf Publishing Company.
- Knowles, M. (1984). Andragogy in Action: Applying Modern Principles of Adult Learning. San Francisco: Jossey-Bass Publishers.
- Kozma, R. (1991, Summer). Learning with media. Review of Educational Research, 61 (2), 179-211.
- Lawrence, KS: Price Systems, Inc.
- Lee, G., Groom, C., & Groom F. (1996, February). Teaching visually impaired students in a multimedia-enriched environment. T. H. E. Journal. 88-9
- Luna, C., & McKenzie, J. (1997). Testing multimedia in the community college classroom. T. H. E. Journal, 24(7), 78-81.
- Luskin, B. J. (1996, February). Toward an understanding of media psychology. T. H. E. Journal. 82-84.
- Lynch, P. (1998, May). Stacking Books: Adapting print projects to multimedia Syllabus, 11, 9, 50-51.
- Marrison, D. & Frick, M. (1994). The effect of agricultural students' learning styles on academic achievement and their perceptions of two methods of instruction. Journal of Agricultural Education, 35(1), 26-30.

- Martorella, P. (1991, January). Harnessing new technologies to the social studies curriculum. Social Education. 55-57.
- McCarthy, B. (1987). The 4Mat System-Teaching to Learning Styles with Right/Left Mode Techniques. Barrington: EXCEL, Inc.
- McDaniel, E. & Klonoski, E. (1995). Engaging the faculty in information technologies training. Journal of Staff, Program and Organizational Development, 13(2), 61-65.
- McKeachie, W. (1986). Teaching Tips. Lexington, MA: D. C. Heath and Company.
- Moore, R. & Miller, I. (1996, February). How the use of multimedia affects student retention and learning. Journal of College Science Teaching, 25(4), 289-293.
- Noblitt, J. (1993). Enhancing instruction with multimedia. In J. A. Chambers (Ed.), Selected paper from the 4th National Conference on College Teaching and Learning. 153-162.
- Northrup, T., Barth, J. & Kranze, H. (1991, April/May). Technology standards for social studies: A proposal. Social Education. 218-220.
- Oser, F., Dick, A., & Patry, J. (Eds.). (1992). Effective and Responsible Teaching-The New Synthesis. San Francisco: Jossey-Bass Publishers.
- Partee, M. (1996). Using E Mail, Web sites and newspapers to enhance traditional classroom instruction. T. H. E. Journal, 23(11), 79-82.
- Pearson, M., Folske, J., Paulson, D., & Burggraf, C. (1994). The Relationship between Student Perceptions of the Multimedia Classroom and Student Learning Styles. Presented at the Eastern Communication Association Conference, Washington, D. C. 5/1/1994.
- Perelman, L. (1992). School's Out. New York: Avon Books.
- Pesanelli, D. (1993, September/October). Plug-In school: A learning environment for the 21st Century. The Futurist. 29-32.
- Ramos, D. & Wheeler, R. (1989, February). Integrating microcomputers into the history curriculum. The History Teacher, 22(2), 177-188.
- Richlin, L. & Cox, M. (1994). Improving the teaching learning connection. Journal on Excellence in College Teaching, 5(1), 1-5.

- Roueche, S. & Roueche, J. (1995 April/May). Making good on the promise. American Association of Community Colleges Journal, 18, 20-22.
- Rubin, A. (1996, Spring). Educational technology challenges ahead. Hands On, 19,(1), 2, 20.
- Seels, B. (1997, January-February). Taxonomic issues and the development of theory in instructional technology. Educational Technology, 12-20.
- Sethi, P. (1998, April). Computer-Aided graphics and visualization: Power tools for teaching and learning. Syllabus, 11, (8), 16, 18.
- Shrawder, J. (1998, February). Technology-demands and benefits. Teaching for Success, 10, (2), 1.
- Sternberg, R. (1988). The Triarchic Mind-A New Theory of Human Intelligence. New York: Viking Penguin, Inc.
- Stevens, J. (1996). Applied Multivariate Statistics for the Social Sciences. 3rd Ed. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Stevens, L. (1993, January). A social studies computer lab. Social Education. 8-10.
- Stewart, D. (1987). Adult Learning in America: Eduard Lindeman and His Agenda for Lifelong Education. Malabar, FL: Robert E. Krieger Publishing Company.
- Timpson, W. (1996). Other issues for learning. Concepts and Choices for Teaching. Madison, WI: Magna Publications, Inc. (pp. 20-22).
- Tobias, C. (1994). The Way They Learn. Colorado Springs: Focus on the Family Publishing.
- Wadley, E. (1997, October). Storyboarding your educational multimedia project. Syllabus, 11(3), 22-23.
- Waterhouse, L. (1991, Spring). A vision of technology for higher education. Library Administration and Management, 2(2)
- Watson, C. (1992). Interactive Classroom Management/Extension Through the Use of Computers. (Report No. JC 920 535). Lansing, MI: Lansing Community College. (ERIC Document Reproduction Service No. ED 351 058).
- Winn, W. (1997, January-February). Advantages of a theory-based curriculum in instructional technology. Educational Technology, 34-40.



Zakaluk, B., & Samuels, S. (Eds.). (1988). Readability: its past, present and future.  
Newark, DE: International Reading Association.

## APPENDICES

## Appendix 1 – Informed Consent

Informed Consent  
The Effect of Multimedia Instruction on Achievement of College History Students

I freely and voluntarily consent to be a participant in the research project entitled The Effect of Multimedia Instruction on Achievement of College History Students to be conducted at Palm Beach Community College during the Fall Semester, 1998 with Rosalie Billera as Principal Investigator.

I understand that the purpose of this research is to determine the effectiveness of instruction on the achievement of students of various learning styles.

I understand that the research procedures will be as follows. I will be given an inventory to determine my learning style. Then I will continue to take class as usual. I will attend class, and do the outside reading and assignments. I will take three exams during the semester, two midterms and a final. They will be graded and my final grade will be based on these three exams and an outside assignment. In addition, I understand that the researcher will attempt to secure my College Placement Test to be used as a pretest in this study.

I understand that there are no known risks or benefits involved in my participation in this experiment. I have been told that my inventory and test results will be kept strictly confidential. All scores will be identified only by a code number and my individual performance will not be revealed to anyone without my express permission. All results will be anonymous and there will be approximately sixty subjects in the total sample for this study.

I understand that I may withdraw my consent and discontinue participation in this research project at any time with no negative consequences. I have been given the right to ask questions concerning the procedure, and any questions will be answered to my satisfaction.

I understand that if I desire further information about this research, I should contact Rosalie Billera at Palm Beach Community College (561) 367-4525. I have been offered a copy of this informed consent form.

I have read and I understand the above.

---

Participant's signature

---

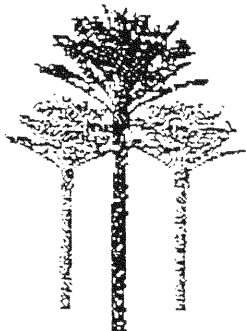
Date

I have explained and defined in detail the research procedure in which the participant has agreed to participate, and have offered him/her a copy of this informed consent form.

\_\_\_\_\_  
Principal Investigator's signature


\_\_\_\_\_  
Date

## Appendix 2 – Colleague’s Review of Tests 1 and 2



PALM BEACH COMMUNITY COLLEGE  
SOUTH CAMPUS

ASSOCIATE ACADEMIC DEAN  
STAFFORD MOONEY

TO: Roe Billera  
FROM: Stafford Mooney   
DATE: September 11, 1998  
RE: Your American History Tests

---

I have thoroughly reviewed both versions of the American History tests, Number 1 and 2. They are clearly and carefully worded. I consider these questions to be valid and reliable.

## Appendix 3 – Student Survey



## STUDENT SURVEY

Participation in this survey is voluntary, but your rating is important because it will provide me with information relevant to the study.

Place a check mark next to the correct choice:

I have completed between 0 and 15 credit hours \_\_\_\_\_

I have completed between 16 and 30 credit hours \_\_\_\_\_

Place a check mark next to your gender:

Male \_\_\_\_\_

Female \_\_\_\_\_

Please answer the following:

My first language is \_\_\_\_\_

My major is (if undecided, please indicate) \_\_\_\_\_

Finally, place a check mark next to the correct answer:

I have attended every session of this course this semester (no absences). Yes \_\_\_ No \_\_\_

I have missed between 1 and 3 sessions of this course this semester. Yes \_\_\_ No \_\_\_

I have missed more than 3 sessions of this course this semester. Yes \_\_\_ No \_\_\_

## VITA

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