AN EXPLORATORY INVESTIGATION TO DETERMINE THE EFFECTS OF A MULTIMEDIA COMPUTER-BASED SCIENCE LEARNING ENVIRONMENT AND GENDER DIFFERENCES, ON ACHIEVEMENT, AND ATTITUDES AND INTERESTS OF STUDENTS IN AN EIGHTH GRADE SCIENCE CLASSROOM

by

Alan Koki Nishino

A Dissertation Presented to the

FACULTY OF THE SCHOOL OF EDUCATION

UNIVERSITY OF SOUTHERN CALIFORNIA

In Partial Fulfillment of the

Requirements for the Degree

DOCTOR OF EDUCATION

May 1993

This dissertation, written by

ALAN KOKI NISHINO

under the direction of the Chairperson of the candidate's Guidance Committee and approved by all members of the Committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education.

2/24/93

Date

Dean

Guidance Committee

Chairperson

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation and gratitude to my chairman, Dr. Patrick O. Rooney, for his guidance, encouragement, support and understanding during my journey as a doctoral candidate. His words of wisdom and commitment to assist all whom he encounters will be a model for me as I continue my educational career. Appreciation is also extended to Dr. Robert Ferris and Dr. William Millington for their support and advisement as committee members.

Appreciation is also extended to my parents, Mr. and Mrs. Ken Nishino and Mr. and Mrs. Masaji Kanda, for their unwavering support during my tenure as a doctoral student.

Special appreciation, recognition, and thanks are given to my wife, Akiko and my children, Krystina and Garrett, for their patience and words of encouragement. They endured many sacrifices during my graduate career and their understanding and support enabled me to complete doctoral my studies at the University of Southern California.

TABLE OF CONTENTS

DISSERTATION ABSTRACT

This study employed an exploratory investigative approach which utilized a quantitative two-by-two experimental factorial design. An analysis of covariance was utilized to adjust for any initial differences. The purposes on the study were to determine the relationships of a multimedia computer-based science learning environment and gender differences on achievement and attitudes and interests of students in an eighth grade science classroom. The control group received instruction based upon traditional science teaching methodologies while the experimental group received instruction using a multimedia computer-based science learning environment.

The population for this particular study were randomly selected from a student enrollment alpha listing and consisted of 160 eighth grade students from two schools located within the same school district. Although efforts were made to ameliorate all possible variables, the variable of one teacher versus another teacher cannot be discounted.

The Soares and Soares Affective Perception Inventory was used to assess the differences in student's attitude and perceptions toward self, science,

and school. The Hueneme Computerized Interactive Test on Science was used to assess achievement in science.

The following relationships were found:

1. Students in the experimental classroom had a significantly higher posttest mean score in "self-concept" than the students in the traditional science classroom.

2. Female students in the experimental classroom had a significantly higher posttest mean score on "self perception as a student" than both the males and females of the traditional science classroom and the males of the experimental classroom.

3. Students in the experimental classroom had a significantly higher posttest mean score on the Hueneme Computerized Interactive Test on Science than the students in the traditional science classroom.

Because this was a newly designed prototype classroom which was endemic to a single school district, it is recommended that this study be replicated. It is also recommended that other curricular areas, ethnicity and social economic status be included in future studies. This study contributed information on the relationships of self-concept, gender, student achievement and a multimedia computer-based science learning environment and could have a positive impact on the planning and utilization of technology in future curricular and classroom development.

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

The Problem

Introduction

> "Over the past century, the methods used in agriculture and manufacturing have changed dramatically in this country. Means of transportation and communication have been developed that could hardly be imagined a century ago. Medicine has been revolutionized, as have the means of waging war. Educational methods have changed very little. Although it would be rash to attribute this difference to the relative lack of application of technology to education, there can be no doubt that the degree to which technology has impacted education pales by comparison with its use in these other areas" (Nickerson, 1988, p. 9).

Changes in educational practices over the past thirty years have been through a myriad of educational movements including but not limited to: non-graded school systems, programmed instruction, career education, individualized instruction, back-to-basics, and open education. Each of these movements centered around the improvement of the educational system and the perceived needs of that specific era in time (Cohen, 1988). According to Ely (1988, p. 5), "Over the past fifty years educational technology has evolved from its early emphasis on the production and use of the media and instruments of communication to its current concern with the systematic approach to solving educational problems based on theories of learning and instruction." During the past two decades the use of computers, laser disk players and other forms of audio-visual media have been investigated and researched and as Cohen (1988, p. 231) stated: "New technology, after all, is an old educational enchantment." As we enter the twenty-first century and the "information age", the potential benefits in the use of technology in education have arrived and "... offers potential solutions to some of the most pressing problems in all areas of the world" (Ely, 1988 p.10).

The business and educational communities during the past decade have produced an increasing demand for schools to find and utilize computer-based technology in the educational environment (Commons, D. 1985 p. 30; Berman et al., 1985, p. 22; White, 1989). Pat Ordovensky of the Gannet News Service, exemplified the dissatisfaction concerning the utilization of technology. In his article, "Educators Fall Down on Jobs, Schools Failing To Teach Skills Needed in Today's High Technology Society," he remarked about how the nation's business leaders were:

> ... horrified to find the schools are teaching skills for a society that is becoming obsolete. The problem, well-documented by

> social researchers and even educators themselves, is that the new skills needed for the high-technology, information based society of the 80's aren't being taught...(Ordovensky, 1983, p. 126)

In addition, the National Science Foundation stated the importance of science and technology in their 1982 report, Today's Problems Tomorrow's Crises, A Report of the National Science Board Commission on Precollege Education in Mathematics, Science, and Technology:

> Improved preparation of all citizens in the fields of mathematic, science, and technology is essential to the development and maintenance of our nation's economic strength, military security, commitment to the democratic ideal of an informed and participating citizenry, and leadership in mathematics, science, and technology (p. 1).

The effort to introduce new technologies into the learning environment has been a part of the educational arena since Thomas Edison in 1913 predicted that:

> Books will soon be obsolete in the schools. Scholars will soon be instructed through the eye. It is possible to touch every branch of human knowledge with the motion picture (Cuban, 1985, p. 11).

Educational technological innovations have evolved from an emphasis on media production and as an instrument of communication, to a systematic approach to educational problems which have focused upon learning and instruction. The expectations of each new technological innovation to replace older instructional methodologies did not meet the expectations of the educational community and have produced mixed reviews and limited evidence of any significant or revolutionary use (Saettler, 1968; Cuban 1985; Botkin, Elmandjra, and Mailitza, 1979). Most of the computer-based studies, computer assisted instruction (CAI) and computer managed instruction (CMI), computer-based instruction (CBI), as well as research concerning the use of video laser disk players, have produced mixed reviews as to the effects on student motivation, self-concept and achievement. As we enter the twenty-first century, new technological innovations should be investigated, researched and developed in an effort to meet the needs of students in an ever increasing high technological and multisensory informational based society.

Statement of the Problem

The educational reform movements nationally and statewide have stressed the importance and potential power of technology in the classroom, both as a tool for learning and as a disseminator of information (Commons, 1985; Berman, et al., 1985). This changing role of American education, from an industrial labor intensive model, to an informational knowledge-based service oriented network, has influenced the business community, federal, and state governments to investigate and expand on the use of technology in the schools (California Commission on Educational Quality, 1988; White, 1989). Although education, in comparison to other large organizations, continues to be a follower in the use of technology; educational studies have been done to assess the value, success, and pitfalls of electronically-based technology (White, 1989). Isolated studies (e.g. film strips, television, motion picture projectors, video tape recorders, computers and interactive laser disc players) have demonstrated questionable success and sometimes meaningless results in the educational arena (Clark, 1985; Cohen, 1988; Cuban, 1985; Liberman, 1988).

The potential power and use of technology to improve the delivery of curriculum and instruction in science and mathematics must continue to be investigated. The National Science Foundation (1982) report indicated that:

> There is evidence that many students who have an interest in mathematics, science, and technology are not being reached through instructional approaches currently used in the classroom. Whereas many students do not like school science and form this opinion by the end of third grade many do like the science and technology that they see on television. They also like what they encounter at science and technology museums, planetariums, nature centers, and national parks (p. 7).

In addition, the report recommended that new and innovative instructional approaches used in exhibits and television programs should be examined and where possible, applied to the classroom setting.

Perhaps Tetenabum and Mulkeen (Thomas, 1987: p. 102) best described the importance of technology as a catalyst in educational improvement during a period of societal change by providing:

> ... an occasion to explore educational issues, to release new energies, to rethink what we do, to reconceptualize schools, and to create a basis for change. Schools remain largely unchanged since the turn of the century. They are not only out of step with the present, they are not anticipating the future ... Computers have triggered educators' awareness. Now thoughtful, well-developed pro-active strategies are necessary so education can productively and meaningfully enter the twenty-first century.

Purposes of the Study

The purposes of this exploratory investigation were to determine the relationships of a multimedia computer-based science learning environment and gender differences on achievement and student's perception, attitude and interest toward science and school. This investigation also evaluated whether there was an interaction effect between gender and treatment.

Questions to be Answered

1. What significant relationships, if any, were present in mean student self-concept scores on the

Soares and Soares Self-Perception Inventory on Self-Concept (Appendix A), between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

2. What significant relationships, if any, were present in mean scores on student self-perceptions as a student, on the Soares and Soares Student Self-Perception Inventory (Appendix B), between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

3. What significant relationships, if any, were present in mean scores on student's attitude and interest toward science, on the Soares and Soares Attitude and Interest Toward Science Perception Inventory (Appendix C), between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be

attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

4. What significant relationships, if any, were present in mean scores on student's attitude toward school, on the Soares and Soares Attitude Toward School Perception Inventory (Appendix D), between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can to be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

5. What significant relationships, if any, were present in mean science achievement scores as measured by the Hueneme Computer Interactive Test on Science (HCITS), between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

Importance of the Study

While adding to the body of knowledge in the area of a multimedia computer-based learning environment in the field of science, if evidence could be found that there is a positive relationship between student achievement, gender differences and student perceptions about themselves and their abilities in science; there could be implications to further the use of a multimedia computer-based learning environment in other curricular areas.

This study is important for the following three reasons:

1. It will provide information about the perceptions and attitudes of students in a multimedia computer-based science learning environment.

2. It will provide synopses about the changes of computer-based educational technology in general.

3. It will provide information about the relationship among attitude, achievement, and gender using a multimedia computer-based science learning environment.

Assumptions

The following assumptions were made:

1. The research design, data analysis procedures,

and control methods selected for this study were appropriate.

2. The data were accurately recorded and analyzed.

3. The perceptions of the two teachers on the value of multimedia computer-based learning environment and the values of a traditional mode of instruction in science were similar.

4. The findings of this study could be applied to future multimedia computer-based learning environments subject to the limitations set forth in the study.

5. The survey used in the study would provide true responses.

6. The students' self-reports were honest and accurate on all four of the Soares and Soares API.

Delimitations

Delimitations of the study were limited to:

1. Two junior high schools in a single school district.

2. One hundred and sixty eighth grade science students.

3. Two science teachers in the Hueneme School District. One teacher from one junior high school instructed the experimental group and one teacher from

the another junior high school instructed the control group.

4. An experimental multimedia computer-based science learning environment classroom which is unique and endemic to the Hueneme School District.

5. The time frame between February and June, 1990.

Limitations

This study was limited in the following ways:

1. The degree of cooperation from the teachers and students involved in the study affected the outcome.

2. To the degree that the methodological assumptions set forth were not met, the internal and external validity of the study would be limited.

3. The degree to which the multimedia computer-based science learning environment classroom operated as designed, could affect the outcome of the study.

4. The experimental classroom teacher was chosen for this experiment because at the time of the study, she was the only instructor involved in this type of multimedia computer-based science learning environment. The control group classroom teacher was a former student teacher of the experimental classroom teacher and therefore had experienced the view-points, curriculum,

teaching methodologies, and instructional strategies of the experimental teacher.

5. Although the subjects came from the same school district and had similar socio-economic backgrounds, ethnic makeup and comparable science achievement test scores; caution should be exercised in generalizing the results of this study due to the uncontrollable variable of one teacher versus another teacher.

Multimedia Computer-Base Science Learning Environment

The multimedia computer-based learning environment classroom included 36 individual computer learning work stations which were networked by an interactive computer which delivered curriculum to the students in a highly individualized fashion. Each student work station received visual, aural, verbal, and numeric information from a computer linked network of central data bases. In addition to interconnected and individual stand-alone computers, the hardware included a microwave satellite dish, two video cassette recorders, color video camera, 2 interactive laser disks, compact disk read only memory (CD ROM), a telephone modem, publicational scanners, graphics printers, and a robotics station. A Data Video Audio System (DVAS) allowed for instant electronic switching to the appropriate learning resource which enabled the students to continuously progress through subject content and skill mastery.

The system offered opportunities for non-linear exercises through simulations in interactive full motion video and other electronic learning resources.

Dissimilar technologies (television, laser disk player, computer software, video tape recorder and CD ROM) were integrated electronically into a common delivery system. The switching capabilities of the DAVS allowed for 36 different events to be going on simultaneously under program control. The teacher was able to view each student station on the teacher monitor and could also display individual student work over a large video projector screen. The curriculum delivery system (CDS) and the monitor control unit MCU allowed for automatic vertical and horizontal branching within the unified curriculum software and then out to the co-curriculum learning resources (laser disks, video tapes, cable television programs, programs brought in by satellite, CD ROM). The personal computer stored at the student and teacher desks was comprised of a central processing unit (CPU), a keyboard, a special color video monitor and a MCU. There was also a microphone and earphone headset connected to each MCU. The MCU was controlled by the corresponding CPU.

The multimedia classroom increased the electronic learning resources by stacking 2 interactive disk programs and 2 VCR players. The VCR players were computer controllable. The system also networked one CD-ROM player to eight separate learning stations. A "trackstar" board, allowed for the integration of Apple hardware and networkable software into the common DOS-based delivery system creating a seamless interface with the curriculum delivery system and the monitor control unit.

The classroom design utilized the advantages of a computer as a medium for presenting and evaluating scientific contents and skills. The system not only enabled appropriate placement and/or grouping of students along the curriculum scope and sequence, it also assisted the teacher in diagnosing student's instructional activities (remedial, corrective or enrichment). Student performance and progress were evaluated by grading, by mastery records, with a reporting facility for student learning profiles.

Traditional Learning Environment

The traditional learning environment consisted of large group instruction with group cooperation in the scientific experiment section of the curriculum. The classroom configuration was a standard six rows with six desks in each row. Traditional lecture, question answer periods and wet lab experiments dominated the instructional phases of the classes. Teacher made and generic textbook quizzes and tests were the assessment tools. The curriculum objectives and materials which were covered matched the objectives of the experimental science classroom. The California Science Frameworks and Hueneme School District Frameworks and Curriculum Guides on science were followed by both instructors involved in the study.

Procedures

Design

This was an exploratory investigation study, which utilized a quantitative two-by-two experimental factorial design. The mode of instruction afforded by the multimedia computer-based science learning environment classroom and gender were the independent (treatment) variables, and the HCITS and the Soares and Soares Affective Perception Inventory (which measures student's perception, attitude and interest) were the dependent variables. HCITS was equated and normed with a standardized-norm reference test in the spring of 1988 by the Directory of Testing and Evaluation for World Institute Computer Assisted Teaching (WICAT). The Soares and Soares Affective Perception Inventory Questionnaire is a norm-referenced semantic differential instrument containing four categories maintained along a continuum between two terms opposite in meaning (dichotomous traits) which are separated by the four spaces of distance in a Likert-type forced choice format.

Sample

The sample was derived from a single school district which had two junior high schools approximately one and one-half miles apart. The population of both schools was similar in science academic achievement, ethnic makeup, and socio-economic factors.

At the end of the fall semester, each school had forty boys and forty girls randomly picked out of a box containing all eligible eighth graders who were enrolled in a science class for the spring of 1990. Ten additional names were drawn as alternates for students who would not be attending school in the spring. Principals were notified and time lines were established (Appendix E). Permission slips were then sent home to parents (Appendix F). A total of three students at each school had parents who requested that their children not participate in the research experiment. The next available student who was a backup became a part of the research. A total of eighty students (40 boys and 40 girls) were picked from each school.

Instrumentation

The HCITS test (standardized in the fall of 1988 by WICAT) and the Soares and Soares API were given to each of the students in January of 1990 as a pretest and the same instruments were used as a posttest in May of 1990.

Method of Data Treatment

Pretests and posttests were collected and data were analyzed using a two-by-two factorial analyses of covariance test.

Definition of Terms

The following terms are defined to prevent misinterpretation and to assist the reader in understanding special usage of terms.

Achievement: Performance on a standardized test in a given subject.

Affective Perception: Self-conceptualization, self-perception, or feelings about the self. The learner develops different perceptions as he/she accumulates experiences in different settings. These perceptions are derived from attitudes toward subjects or disciplines and feelings about one's abilities.

Computer-Assisted Instruction (CAI): The use of instructional programs to perform instructional tasks, such as drill and practice, tutorials, and tests.

Interactive Videodisc: An interactive computer-assisted instructional technology that uses a computer to provide access to up to two hours of video information stored on a videodisc. Like CD-ROM, videodiscs are read-only optical storage media and are designed specifically for the storage and random-access retrieval of images, including stills and continuous video. An interactive videodisc application includes a computer program that serves as a front end to the information stored on the videodisc, a cable that links the computer to the videodisc player, and a videodisc that contains the appropriate images.

Multimedia: Interactive computer integration of sound, video, text and graphics.

Self-Concept: For purposes of this study, self-concept is the system of perceptions which an individual formulates of himself or herself in awareness of his/her existence and reality (Soares and Soares, 1980). Combs

(1971) states that self-concept may be the most important single factor determining what a person is able to do under any given circumstances.

Student Self-Concept of Academic Achievement: Refers to the degree to which a student views himself/herself capable of achievement in school.

Videodisc: An optical disk used for the storage and retrieval of still pictures or television pictures and sound. A videodisc player is required to play back the videodisc on a standard television monitor.

Organization of Remainder of the Study

In Chapter II there is a review of literature that includes the following areas:

1. A synopses of educational technology in general.
2. Pertinent aspects of Affective Perceptions.
3. Synopses relating to gender and achievement.

Chapter III explains the instrumentation used, in the selection of participants, analyses of data, and methodological assumptions.

Chapter IV presents the procedures used for analyzing the data, statistical findings, and a summary of the findings of this study based on analysis of the data.

Chapter V summarizes the purposes of the study, literature review, methodology, instrumentation, limitations, and data analysis. In addition, selected findings, other findings, conclusions, recommendations for further study, and implications for practice based on the results of the study are included in this chapter.

References and Appendixes are located at the conclusion of the dissertation.

CHAPTER II

Review of Related Literature

Introduction

The focus of this review was limited to integrating specific research areas which included:

1. Literature related to educational technology in general.
2. Literature related to affective perceptions.
3. Literature related to gender and student achievement.

Due to the fact that at the time of this research there had not been a study or information involving the use of a computer-based multimedia learning environment in science; the intent of the literature review was to provide adequate coverage of each topic for a balanced perspective and to clarify the necessity of a study involving the use of multimedia technology in the educational arena.

Literature Related to the Field of Educational Technology

To date, a consistent definition of educational technology has not yet reached consensus among professionals. In fact, even those who specialize in this field have failed to concur about a common definition for this term (Gerlach, 1984; Meirhenry, 1984). The broadest and one of the most widely accepted definitions is the one adopted by the United States Association for Educational Communications and Technology (Ely, 1988, p. 7): this definition integrated virtually all possible educational applications:

> Educational technology is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of learning (AECT 1977).

The relationships among management functions, educational development functions, and learning resources comprise the Domain of Educational Technology Model. Silber (1981) identified four types of technology that have evolved with the broadest impact in the field of educational technology. They were: print materials, radio, television, and computers.

For the purposes of this study, the evolution of radio, television, computer and laser disc technology and their integration into the classroom have been researched.

Educational Print Material

The invention of the printing press brought about the ability to mass produce information in a relatively inexpensive fashion. Educational print material, such as books and allied print materials, continued to serve as the primary technological produced aids in education, for both administrative and instructional activities. A great majority of the world's classrooms is still dominated by text (Cohen, 1988; Thomas, 1987). Printed materials have survived because they have been abundant, transportable, inexpensive and readily publishable (Thomas, 1987). Educational print materials have also been a "highly effective way of teaching basic facts, principles, and applications" (Percival, 1988, p. 91).

Despite the advantages associated with print materials, Percival (1988) stated that "conventional textbooks ... by themselves, may not necessarily be suitable for enabling mastery of desired materials to be achieved. This was due to the fact that most textbooks were designed to simply present information, not to provide users with a systematic learning program" (p. 90). Other disadvantages associated with the use of educational print materials were:

(a) that instruction using textual materials required careful planning and structuring on the part of the supervising teacher,

(b) that the method of learning was totally dependent on suitable texts being available,

(c) that the method was not really suitable for achieving many higher cognitive and non-cognitive objectives and,

(d) that unless a deliberate attempt was made to build in participative student activities through a study guide, the study of material in textbooks was a passive form of study, with little or no interaction taking place between the learner and the learning materials (Percival, 1988, p. 91).

In addition, Alfred Bork, (1987, p. 201) stated additional disadvantages ... "the two primary learning modes provided, the textbook and the lecture, do not create active learning possibilities for most students and offer the same learning experience to all students regardless of background, learning style, learning speed, or goals in life."

Radio and Television

Radio's widespread use in the classroom began as early as the 1920's, with television gaining acceptance beginning in the 1950's. Despite this acceptance, "learning via television is yet in a primarily experimental stage ... with an absence of theories capable of organizing much of the experience for use in new applications" (Armsey and Dahl, 1973, p. 39). As broadcast technologies, both types of media had the capability of enhancing the repertoire of learning resources available in the classroom. An additional advantage of broadcast technologies was the ability to be implemented in non-traditional educational settings, and to provide both formal and informal learning experiences. Percival (1988) contributed to this list of benefits ... "Radio and television constitute a high-quality material that can be used as an effective substitute for, or supplement to, a conventional taught lesson as and when appropriate, thus enabling a teacher, lecturer or trainer to introduce variety into a course" (p. 69). In reviewing the usage of annual international broadcast hours, Thomas (1987) found that the small amount of radio and television programming available was educational in terms of formal and direct instruction.

However these media were primarily informational, where the learner was the passive recipient of information (Cohen, 1988; Thomas, 1987). Thus interaction in the learning environment was not provided. A second disadvantage, according to Armsey and Dahl (1973) after examining research and experience with television usage in the classroom, was that:

> ... television will not be effective in carrying the entire weight of teaching .... Television will be efficient in promoting some kinds of learning and poor for others ... it often will be not effective when it is used in conjunction with other media. Another implication is that a great deal of attention must be given to what happens at the receiving end, in the classroom, to what the learner does in interaction with the televised media (p. 39).

A review of the literature on broadcast technologies indicated that instructional broadcast media such as radio and television were extensively implemented, under many diverse conditions, with large investments undertaken for equipment installation (Campeau, 1974). These programs were designed to be received by individuals, rather than by mass audiences.

Schramm (1977) and Cohen (1988) suggested that implementation of instructional broadcast technologies was based upon administrative and organizational requirements, considerations of cost, availability and user preference, and not upon evidence of instructional effectiveness. Rather, widespread adoption of instructional radio and television has been marketed as a solution to economic and social problems such as overcrowded classrooms, teacher shortage, keeping classes quiet or filling slots in timetables, and for control but has not made any long lasting or significant impact in the instructional arena (Thomas, 1987; Percival, 1988). One of the reasons video has not been effective is that it becomes a passive delivery system and the learners do not interact or actively participate in the learning process (Gendele and Gendele, 1984). The lack of impact by broadcast technologies in education has been due to limited usage and research (Armsey and Dahl, 1973).

Computer Technology

The computer has served much the same purpose as the textbook as a tool for instruction. The dictionary defines the tool as "an instrument or apparatus used in performing an operation necessary in the practice of a vocation or profession" (Webster, 1977, p. 1230). This definition was used in the research to define the use of computers as one of the many instructional resources used to convey information about a subject.

Although Programmed Instruction can be considered the harbinger of CAI starting in mid-1950's, the use of computers in education (i.e., computer-assisted instruction, or CAI), can be traced to late 1950's and early 1960's. Widespread use of computers in education began in the 1970's, paralleling the success of the microcomputer. According to Becker (1987), the average time an elementary student spent on computers doubled from 1983 to 1985.

What is known about effective instruction can clearly be used to guide and structure methods for the use of computers in the classroom. The conceptual underpinnings for using computers in instruction have been illustrated in the myriad and extensive literature on mastery learning developed by Benjamin Bloom (1971, 1974, 1976) and others. According to Caldwell (1981) computers have the ability to " ... structure repetitive tasks into carefully planned sequences which adapt to the individual learner's responses .... This is done automatically and efficiently in a way that would not only be impossible for a teacher to do but efficient" (p. 260). In addition Bork (1987) stated that with mastery learning:

> A student is kept with a given topic until mastery is demonstrated. Demonstration is typically some type of exam with the student being required to perform almost perfectly on the exam ... Several approaches to learning the topic may be required, perhaps reflecting different pedagogical approaches and different media. Students are thus encouraged to learn at their own rate and ability ... Experience suggests that mastery learning is possible with the use of modern technology (p. 2020-3).

Computer Assisted Instruction, Motivation, and Cognition

The evidence available on the effectiveness of CAI supported a focus on knowledge and comprehension outcomes. Kulik, Bangert, and Williams (1983) conducted one of the best known meta-analyses of studies on CAI effectiveness. They analyzed fifty-one studies on the effects of CAI on performance in final examinations and retention tests; both of these variables traditionally emphasized knowledge and comprehension. The study also indicated that increases in both effectiveness and efficiency were evident from the use of CAI. These benefits included:

> (a) students learn faster and more comfortably in CAI, (b) students can be presented with richer materials and more complex problems and, (c) CAI provides a better measurement of student progress.

The analysis showed that the use of CAI raised final examination scores by approximately .32 standard deviations (a rise from the fiftieth to the sixty-third percentile). Very few studies examined by Kulik and Kulik (1987) had results that favored traditional instruction over CAI. Most importantly, Kulik and Kulik (1987) suggested that the effects of CAI seemed especially clear in studies promoting the development of basic academic skills with pupils who have traditionally been classified as "disadvantaged"; the CAI curriculum role of remediation was clearly supported by Kulik's findings.

Supporting Kulik and Kulik's (1987) findings on the benefits of CAI was a field experiment study by Krendl and Fredin (1984) which applied the medium theory to a computer-based encyclopedia informational seeking study. They predicted that eighth grade students using an electronic encyclopedia would have greater breadth of information but that the print encyclopedia group would score higher on depth of knowledge. The results indicated that the computer-based information strategy scored significantly higher in both the broad (horizontal) knowledge and in depth (vertical) knowledge. Therefore the medium did affect the information and presentation and determined its effect irrespective of the content which was delivered.

The Group for the Study of Effective Teaching (1983) reviewed over 650 studies of effective instruction and developed a matrix of sixteen research-based instructional principles related to the design and development of effective instruction. Of the sixteen principles, the three which supported the use of CAI over traditional instruction were:

(a) use of relevant examples and demonstrations from kindergarten through college level indicated a consistent and relatively strong relationship between the number of relevant examples and demonstrations used and student achievement. Supporting this were studies by; Armento (1976); Emmer, Sanford, Evertson, Clements, and Martin (1981); Evans and Guyman (1978); Gage et al., 1968; and Smith, 1977.

(b) ensuring high rates of success were associated with higher levels of student on-task behavior and more appropriate student social behavior. Supporting this was research by Kozma, 1982; Emmer, Sanford, Evertson, Clements, and Martin (1981); Emmer, Sanford, Clements, and Martin, 1982; and Fisher et al., 1978.

(c) presentation of materials on an individualized basis were too slow in a typical classroom and by necessity the teacher paced instruction to the pace of the group. Research conducted at all grade levels had consistently demonstrated that students learned more when instruction proceeded at a reactively fast pace on an individual basis. Supporting this was research by Becker, 1977; Becker and Gersten, 1982; Cooley and Leinhardt, 1978; Good and Grouws, 1979; and McDonald, 1976.

The International Communications Industries Association (ICIA, 1985) reported and published fifteen major studies on CAI and concluded that results of the evaluations were positive and were confirmed in an updated report by the ICIA in 1987.

A 1985 survey of teachers and principals on the uses of computers was conducted by the Center for Social Organization of Schools, located at Johns Hopkins University. The results indicated that computers had a significant impact in:

(a) increased student cooperation and independence,

(b) increased learning opportunities for high-achieving students,

(c) increased student motivation and,

(d) increased opportunities for low-ability students to master basic skills.

Empirical research has also suggested that there is a positive relationship between prompt, individualized feedback and student achievement (Good and Grouws, 1979; Evertson, Anderson, and Brophy, 1978; Hughes, 1973; Stallings, 1978).

Rubin and Weisgerber (1985) stated that one of the most powerful characteristics of this (CAI) technology was its flexibility. CAI adjusted to suit the needs of individual learners, such as the level of task difficulty, the extent of remediation, the pacing of instruction, the frequency of reinforcement, and the use of motivational elements. In addition, Charp (1981), indicated that CAI has been an effective tool with various groups of learners and under a multitude of instructional settings.

CAI has also had a positive effect on learner interests, attitudes, motivation and self-esteem (Clement, 1981; Dalton & Hannafin, 1984, 1985; Kulik and Kulik, 1984; Perez and White, 1985; Riel, 1985; Ybarrondo, 1984). Studies by Ford, Hess, McGarvey, and Bergin, (1986), and Turkle (1984) supported the above findings that using computers was interesting and motivating to students.

A study by Fetler (1985), which surveyed California sixth and twelfth grade students in computer science and literacy in 1982-83, concluded that boys:

(a) had a higher level of achievement than girls,

(b) were exposed more than girls to computers at home and at school and,

(c) were basically more positive in attitudes towards the role of computers in the workplace than girls.

Pea and Kurland (1984) suggested that problem-solving and planning skills learned from computer instruction do not consistently transfer to other contexts. A study by Mandinach (1984) and Mandinach and Corno (1985) which included seventh and eighth grade students supported the concept that high-ability students benefit from playing problem-solving games on a computer and are most likely to transfer these skills.

Bozeman (1988) in his article Microcomputers in Education: The Second Decade, questioned methods of research. In addition, Clark (1986) and Driscoll (1984), questioned the procedures used in some meta-analysis studies and suggested that learning gains come from good instructional design and practice and from novelty, not from the medium used to deliver instruction and that there were profound limitations when comparing research which compared knowledge gain from CAI versus traditional classroom instruction. Research studies by Pea and Kurland (1984) and Hess et al. (1986) concluded that computers neither inhibit nor accelerate cognitive development. In addition, Martorella (1983) concluded that there are many instructional situations for which CAI is not satisfactory.

Laser Disk Interactive Videodisc Technology

Although multimedia technology has traditionally been defined as all audio visual presentation materials, it is the use of the computer as the control center for a variety of media that is new. Interactive videodisc-based learning consists of using computer-assisted instructional modules that combine audio, video, graphics, and text in a single delivery vehicle to provide individualized, self-paced learning experiences. "Interactive video systems are still very much in their infancy, but basically attempt to utilize two relatively well-established teaching media ... in an integrated teaching resource. In marrying the two, the aim is to combine a flexible, interactive, and accessible teaching program with good visual and sound development characteristics" (Percival, 1988, p. 98).

Although most of the research and development on interactive videodisc technology in training and education has been conducted by product developers or in military settings, academic research is available for review. Studies have demonstrated that interactive video has been effective in improving performance over a wide variety of learning context (Ferrier, 1982; Harless, 1985; Wooley, 1982). The multimedia experience provides the learner with sensory cues and has the ability to simulate realistic situations. In a study by Leonard (1985) students had a high level of satisfaction with computer/videodisc technology as compared to wet lab experiences, especially in the area of instruction time efficiency.

Fleming & Levie (1978) suggested that visuals can trigger recall of prior knowledge which can be used in the cognitive process. Schaffer & Hannafin (1984) indicated that interactive delivery of video improved short-range recall and aided in retention of information and dramatically improved the efficiency of instruction presented. "Interactive videodisc packages can offer the user an enriched, highly stimulating instructional environment" (Matta and Kern, 1989, p. 78). "With the increasing experience in instructional uses of computers, there has come growing recognition that there are many learning situations where on-line use of the computer is most effective when combined with the use of projected photographic images and recorded audio messages" (Armsey and Dahl, 1973, p. 64). These systems are particularly interesting for the study of science (i.e., simulation of lab experiments, hypothesis testing, etc.).

A research group at WICAT Systems in Orem, Utah conducted a project that was the first of its scope to investigate the feasibility of instruction via computer-controlled videodisc systems (Bunderson, Olsen, Baillio, Lipson, and Fisher, 1981). In this study, researchers used an interactive videodisc system to teach a semester long introductory course in biology which included laboratory practice. Results indicated that students who had received the videodisc instruction scored significantly higher on posttests than students who had received instruction from a traditional classroom lecture/textbook/lab approach. The videodisc group scored 8-16 percent better on objective test items, 24-75 percent better on short answer items, and 15-27 percent better on achievement tests. Moreover, the average total study time of the videodisc-based group was 30 percent less than the regular classroom experience.

A comprehensive report to Congress evaluating the Potential of Interactive Videodisc Technology for Defense Training and Education (Bunderson, Olson, and Greenberg, 1990) reported the following conclusions:

(1) Interactive videodiscs can be used to teach. Nine evaluations of interactive videodisc instruction were compared to a "placebo" environment in which nothing was taught, and resulted in an average effect size of 2.19 (a rise for the 50th percentile student to the 98th percentile) for immediate tests of achievement and

an average effect size of .87 (a rise for the 50th percentile student to the 80th percentile) for retention achievement tests given after some time interval. Evaluation studies (Bosco, 1986; De Bloois, Maki and Hall, 1984; De Bloois, 1988), found that interactive videodisc instruction is more effective than conventional/traditional approaches to instruction.

(2) The more the interactive features of interactive videodisc technology are used, the more effective the resulting instruction.

(3) Interactive videodisc instruction is equally effective in imparting knowledge and improving task performance skills.

(4) Directed tutorial approaches are more effective than free play simulations of interactive videodisc instruction. The study found that guided discovery with extensive, positive feedback is worth more than simple discovery in instruction.

An exploratory study by Dalton and Hannafin (1985) on the effects of interactive video instruction on learner performance and attitude with the effects of conventional computer assisted instruction and stand-alone video on junior high industrial arts students resulted in:

(1) Interactive video instruction produced significant improvements in the attitudes of low ability learners when compared with video and CAI.

(2) The attitude effects were not consistent across prior achievement level.

(3) Interactive video was not the most effective in producing high levels of performance.

(4) CAI and interactive video were more effective in producing high levels of performance than video.

On the other hand, Russell (1984) reported that the increased benefit of CAI are lost when video based instruction is brought into the arena. Clark indicated that media does not influence student achievement but is "just the delivery system" (Clark, 1983 p. 455). He further stated that, "Generally, it appears that media do not affect learning in and of themselves. Rather, some particular qualities of media may affect particular cognitive processes that are relevant for students with specific aptitude levels to learn particular knowledge or skills" (Clark, 1988, p. 445).

Summary

Although much of the research described above supports the concept that technology can improve student achievement and attitudes, the reviews are mixed ranging from positive to negative to questionable, and no significant difference.

A meta analysis "box score" tally of studies, evaluations, and reviews of research by Jamison, Suppes and Wells (1974) compared traditional instruction with radio, television, and computers, concluded that most of the studies indicated no significant difference (p. 38). According to Ely (1988, p. 13) "Most of the research conducted on the effectiveness of different modes of presentation has not yielded unequivocal results: a no significant difference was almost always reported." O'Neill (1989) in a study comparing attitudes, achievement, and interactive videodisc instruction concluded that there was no significant difference in achievement, attitudes toward interactive videodisc or in the relationship between achievement and attitudes. In addition, studies by Dubin & Taveggia (1968), Chadwick (1979), and Schramm (1977), demonstrate that even when there was a significant result, it was insufficient to make any type of conclusion. Studies by Levie and Dickie (1973), Schramm (1977), Clark (1986) and Ross and Morrison (1989) suggested that media delivery systems were not as important in positive outcomes (e.g. attitudes and achievement) as the instructional method or content which was delivered.

Clark (1983, 1986, 1988) suggested that poorly designed studies and confounding effects account for advantages of newer media over traditional. Clark (1988) further stated that "...the most common sources of confounding in media research seem to be the uncontrolled effects of (a) instructional method or content differences between treatments that are compared, and (b) novelty effect for newer media, which tends to disappear over time" (p. 24).

Literature Related to Affective Perception, Self-Concept, Achievement and Gender

This section is divided into four subsections which will succinctly address:

a. Theoretical Framework on Affective Perceptions.

b. Impact of Classroom Environment on Self-Concept.

c. Relationship of Self-Concept to Achievement.

d. Relationship of Gender to Self-Concept and Achievement.

Theoretical Frameworks on Affective Perceptions

Social Learning Theory and Cognitive Development

Piaget's theory of cognitive development and studies from social learning theory have influenced and been a part of the framework underlying affective perception. Social learning theory, developed by Bandura and Walters in 1963, stressed the importance of such concepts as modeling, imitation and social reinforcement in the analysis of behavioral and attitudinal change. In addition, social learning theory suggests that visuals can play a role in influencing behavior as a segment of the interactive process involving cognition, environmental factors and behavior (Bandura, 1969, 1977, 1986; Bandura & Walters, 1963). Martin and Briggs (1986) and Gephart and Ingle (1976), contend that it is difficult to separate the cognitive component from the emotional affective component.

Self-Concept

William James' (1890) theory about self-concept in the late 1900's was based primarily upon his personal insights and observations of others and was significant because it was the first detailed descriptions of what is presently called self-concept. He also believed that people are comprised of three selves:

(a) a material self, which consists of one's body and personal possessions,

(b) a social self, which is established by social status and interpersonal skills and,

(c) a spiritual self, which is determined by emotions and desires.

Cooley's (1902, p. 84) "looking glass self" described his idea of self-concept and was based on the belief that self-perceptions are largely the result of feedback received from other people who influence an individual's life. In the 1930's and 40's, the study of self-concept focused on social-psychological factors (Mead and Lewis, 1934; Lecky, 1945; Murphy, 1947).

The two most influential theoreticians in the 1950's and 1960's were Abraham Maslow and Carl Rogers. Maslow (1954) was the founder of "A Theory of Human Motivation," and his ideas about basic needs and self-actualization have contributed significantly to present day thinking about self-concept. The contributions of Rogers (1951, 1959, 1969) in many ways have brought self-concept to the center of all psychological discussions and thinking regarding human behavior and motivation. Rogers' non-directive counseling techniques were structured around the importance of the development of "self" in all human behavior. In every person there is a tendency toward self-actualization; positive regard from others and towards oneself are of the utmost importance in attaining psychological health.

Rosenberg (1965, 1979) had written extensively about self-esteem, and believed that a positive or negative attitude toward the self influenced the way an individual reacted to others and determined the way he or she dealt with problems and stress. Wyle (1974) believed that self-esteem developed in early childhood changed depending upon daily successes and failures that the individual experienced. Thus, the role of the school, the classroom environment, and the teacher may significantly impact a learner's self-image.

Brookover (1967) contributed much to the research about self-concept and laid the groundwork for further research in the area of self-concept and academic ability. James Beane and Richard Lipka (1984) and William Purkey (1970, 1978) have also contributed to contemporary understanding of the relationship of self-esteem and self-concept to academic success. In 1966, a study by Loevinger suggested that the ability to form a self-concept increases with education and age. As the student matures, he or she moves from a stereotyped and socially acceptable concept of himself or herself to one which is diverse and realistic. Combs (1962) stated that self-concept may be the single most important factor in determining what an individual is capable of doing under any given circumstance.

Three important studies have been identified to show that self-concept is influenced more strongly by psychological factors than economic factors. Soares and Soares (1969), Kerensky (1967), and Carter (1968) compared the self-perceptions of advantaged and disadvantaged elementary school children. All three studies yielded surprising findings that disadvantaged children do not have lower self-concepts than their advantaged counterparts. These findings suggested that economic status is only one of many aspects of self-perception. Disadvantaged children can have positive self-concepts of school achievement if educators structure instruction to promote success and positive reinforcement of efforts.

Soares and Soares (1980) reported in their research that different abilities loosely grouped under the term "self-concept" should be more systematically identified, sorted and categorized in an effort to minimize intra-individual variation.

The Impact of Classroom Environment on Self-Concept

"Various learners are persuaded to assume various behavior patterns in various ways, and in response to various stimuli sources" (Sleeman, 1979, p. 285). Among the certain general sources which influence the behavior of most learners is "one's school-by way of the learning experiences" (Sleeman, 1979, p. 286). Sleeman further stated that:

> ... the mass media and one's peer group are ordinarily the most powerful of all influences on attitude behavior. Depending on the scope, depth, and intensity of their interactions with the learner, the school and the family are the next most powerful influences (p. 286).

There was evidence in the research to support the theory that a student-centered environment works well in building self-concept (Kalunian, 1975; Purkey, 1978). Several studies have found that such environments contain identifiable characteristics which have an apparent relationship to improving student self-concept, and in turn, overall perceptions and academic achievement. These include: (a) a positive teacher attitude; (b) activities that promote positive feedback; and (c) a democratic classroom atmosphere (Quick, 1973; Wallace and Reizenstein, 1978; Schubert, 1978; Berg, 1987).

Robert Bills (1981) concluded that other similar characteristics help to encourage the growth of a positive self-concept. He maintained that schools should create an environment which encourages: (a) discovery learning; (b) open communication; (c) facilitating, rather that controlling teaching roles;

(d) positive reinforcement; and (f) student locus-of-control.

Research by Beane, Lipka, and Ludewig (1980) supports Bills' findings. Specifically, they identified several important factors supporting a student-centered curriculum, such as a high degree of individualization, interaction, and a flexible learning environment, as opposed to a custodial climate.

Studies regarding student attitudes and classroom atmosphere revealed a significant relationship between the learner and his/her environment and that learning environments should respect individual differences (Diebert and Hoy ,1977; Bradford, 1973; Purkey 1970, 1978; Russell, Purkey and Seigal, 1982; Purkey and Nowak, 1984).

<u>The Relationship of Self-Concept to Academic Achievement</u>

Purkey (1970) concluded that difficulties in one's life are connected with how people perceive themselves and the world in which they live. Purkey further suggested that deficiencies in achievement development can be attributed to trying to avoid experience of anxiety brought about by threat to the self. The most important aspect of this research strongly supported the notion that negative self-concept is strongly correlated with under achievement.

Specific research on the relationship between self-concept and student achievement suggests that a positive correlation does exist. In reviewing the literature, studies on which comes first, academic success or positive self-concept are mixed. Attitudes in general influence the recall of ideas, lead to logical thinking, affect the interpretation of ideas, and affect the tendency to read about a topic (Betts, 1955; Shepard, 1982). A study by Quick (1973) suggested that each variable might lead to changes in the other and that as self-concept improves, so does achievement, and visa versa.

Anderson (1965), Combs (1964), Fink (1962) found that students who view themselves as unsuccessful tend to score low in academics. In addition, a study by Bauer (1981) regarding gifted students concluded that there was a significant relationship between reading achievement and self-concept.

Studies by Newman (1984) in mathematics across grades 2, 5, and 10 and Batterson (1987) in reading and mathematics in grades 4 and 5 indicated a positive correlations between achievement and self-perceptions and self-concept. A study by Nails (1970) concluded that there was a positive correlation between the development of a positive self-concept of black intercity elementary-junior high school students and improvement of academic performance. In studies by Brookover, LePere, Hamachek, Thomas, and Erickson (1965), Williams and Cole (1968), Combs (1962), Purkey (1970), Quandt (1979), Smith and Elliot (1979), Willis (1985) and Farquhar (1968) concluded that there was a relationship between academic achievement and self-concept. Researchers, such as Schubert (1978), supported the notion that self-concept may be a better predictor of reading success than intelligence. Kemp (1983) concluded that there was: (a) a positive relationship between regression of reading and math achievement scores and student's change in self-concept, and (b) self-concept can be a useful predictor of student achievement in math and reading.

Tamir, Welch, and Rakow (1985) assessed the relationship between science, affective attitudes, and achievement for 1,955 seventeen year-old students, concluding that interest in science, self-concept of science ability, and achievement were related and found a positive correlation between attitudes toward science and achievement.

A six year study by Brookover (1967), conducted at Michigan State University, supports the relationship between school environment and academic ability. Results from an analysis of the data support these hypotheses:

(1) Self-concept of academic achievement is associated with academic achievement at each grade level.

(2) Change in self-concept of academic achievement is associated with parallel changes in academic achievement.

(3) Self-concept of academic achievement is a necessary, but not a sufficient condition for the occurrence of academic achievement.

(4) Student perceptions of the evaluations of their academic ability by others (parents, friends, and teachers) are associated with self-concept of ability at each grade level.

(5) Changes in student perceptions of the evaluations of their academic ability by others (parents, friends, and teachers) are associated with parallel changes in self-concepts of ability.

There is additional research data which substantiates the opinion that academic success predicts self-concept more so than self-concept predicting achievement (Gage and Berliner, 1984). A study by Caplin (1969) comparing the relationship between self-concept and general academic achievement concluded that despite the fact that a significant relationship between self-concept and achievement is apparent, a cause and effect relationship cannot be theorized as existing. Brookover, Erickson, and Joiner (1967) have made some valid arguments about why self-concept does not always correlate with school achievement. They point out that loose definitions of self-concept and instruments which are multi-factor by definition have led some researchers to discard self-concept as a relevant variable in understanding behaviors such as achievement. They contend that due to poor methodology and/or unclear study conceptualization, it is difficult to accurately replicate studies on the self-concept and achievement.

Hankoos and Penick (1987) have found that students are more likely to experience gains in achievement if exposed to a classroom environment which allows them to establish their own locus of control and to voice individual opinions.

Although many studies seem to indicate a correlation between self-concept and achievement, other studies have failed to show a correlation or report "no significant relationship" (Bridgeman and Shipman, 1978; Kifer, 1975; Michaud, 1979; Alexander, 1980; Doenholter, 1981; Pirtle, 1982). The literature supports, at the very least, the hypothesis that students' affective attitudes and achievement are interrelated.

The Relationship of Gender to Student Achievement and Attitudes

Studies have been conducted which examine the relationship between gender, academic achievement, and attitudes. Steinkamp and Maehr (1984) in analyzing published findings concluded that sex-related differences in school achievement and motivation favoring males do exist. Sex-related differences in educational achievement have been explained on the assumption of biologically or socially acquired differences in abilities, cognitive style, possession of knowledge or identification with stereotyped sex roles (Shrock, 1979). The socially acquired differences, in part, may be explained by the suggestions of Smail and Kelly (1984) who stated that

" ... it is possible that this sort of incidental knowledge (science and technology) is made available more readily to boys than to girls - through hobbies and household tasks in which interested in and encouraged to do. Such informal knowledge provides the basis for later learning in school" (p. 61).

In a study by Willey (1988) on the writing process and gender differences, self-perception, and achievement on eighth grade social study students and tenth grade science students concluded that there were gender differences favoring females in positive self-concept, attitudes toward science and attitudes toward school. There were no significant relationships between gender and achievement.

Gender gap in relationship to computer utilization between males and females is most apparent during adolescence and is most pronounced in areas such as home use of computers, elective time spent in computer activities and enrollments in computer literacy, and programming classes (Elmer-DeWitt, 1986; Horn,, 1985; Sealfon, 1986; Lockheed, 1985; Moursund, 1984). Additional studies have shown sex-related differences in motivational attitudes toward computers. Specifically, girls tend to be less desirous of learning to use computers than boys and less adept, at least initially (Corno and Mandinach, 1983; Lepper, 1982; Williams and Williams, 1984). In a study by Rezabek (1988), the results showed no significant differences of eighth grade students perceptions of media presentations in relationship to gender or attitudes toward computers.

The learning of computer programming or using the computer for math drill leads to the association that learning computer skills is stereotypical of male inclination toward science and math (Deboer, 1984; Handley and Morse, 1984; Levin and Fowler, 1984; Scott, 1984; Steinkamp and Maehr, 1984). The use of computers tends to be associated with a solitary or individual activity and therefore comes under the male dominated activity. Traditional sex role stereotypes tend to associate the female with the characteristics of affective concern, relationship-orientation, nurturance, cooperation and expressiveness, while the male is traditionally associated with independence, competitiveness, self-sufficiency, autonomy, self-reliance and individualism (Sealfon, 1986; Johnson, Johnson and Stanne, 1985; Lueptow, 1984).

In a study examining the relationship between computers and gender, Eastman and Krendl (1984) discovered that the pretest showed a consistency with other studies that boys hold more stereotypical views than girls. The pretest also indicated that girls are less likely to expect that their abilities would differ from boys, and girls are less likely to think that math skills are related to learning the use of computers. In examination of the posttest, the results showed that the computer group was significantly different in attitude after using a computer and differences in computer performance failed to appear; boys and girls showed equivalent operational skills.

Other studies have revealed that girls express more negative attitudes toward science and math than boys (Fox, 1977), and toward computers in general (Williams and Williams, 1984; Winkle and Mathews, 1982). This argument is supported by the results obtained from the Girls Into Science and Technology (GIST) Project. "The results on children's attitudes to science indicated that boys in the cohort (of the GIST project) were much keener than girls to learn about physical science" (Smail, 1985, p. 351). Smail also stated that:

> ... the girls saw physics and technical subjects as less useful for a career, less enjoyable and interesting, and they underestimated how well they performed .... Throughout the project the boys were much more sex-stereotyped than the girls and drew clearer distinctions between activities which they thought suitable for one sex or the other .... These attitudes were reflected in their behavior in the laboratory and workshop, where boys tended to monopolize the equipment and taunt girls who made mistakes (p. 351).

Summary

Self-concept does not influence all behavior but is a differentiating paradigm of self-perceptions, varying and developing independently according to experiences, capabilities, treatment from others, and individualized patterns detecting mechanisms in long term memory

(Soares and Soares, 1980).

In a synthesis of over 54 studies involving almost 15,000 students from elementary school through college, Lysakowski and Walberg (1981) found a strong relationship between participation, corrective feedback, and achievement. In a landmark study of observational studies in classrooms, Fisher et al. (1980) reported that student engagement, active participation, student-teacher interaction, and instructional monitoring by the teacher consistently related to improvements in achievement.

In analyzing the evolution of a variety of technologies, we find that learning in its traditional form has remained unchanged in the last century, while the use of broadcast, radio, and computer technology has advanced in areas such as entertainment and industrial training. Despite a long history of technological change (e.g. camera, 1826; phonograph record, 1877; radio broadcasting, 1920; commercial television, 1945; microcomputers, 1980), the basic assumption of many schools is that new technologies will be absorbed into the existing curriculum. If this trend continues, the danger exists that technologies will just become additional items on the "media librarian's shelf - another category of educational technology ancillary to education" (Brophy and Hannon, 1985, p. 52). In short, the potential of technology is not being met. Simply put, " ... our schools are being swept up in a tidal wave of technology without any idea of how to make wise use of it" (Bonner, 1984, p. 64). Meirhenry (1983) surveyed thirty United States research centers and higher institutions of learning and found that " ... the majority of (research) studies underway involves (technological) trendiness that belies the idea that researchers of technology have really moved away from doing research on the impact of a medium of technology and toward a total set of factors that influence human learning" (p. 101-2).

The strong evidence that the classroom environment contributes positively to affective perception and self-concept provides justification of the need for further observational research and subsequent redesign of educational settings. The assumption behind this research is that learning in general needs to be redesigned to reflect the needs of a modern, competitive and increasingly international work force. The literature tends to deal with technology as an isolated variable that can be categorized around traditional curriculum and measured independently from a variety of complex variables. There is value in research that deals with the total learning environment and will ultimately impact the ways in which schools are designed, new learning paradigms, and new literacies (i.e., the ability to evaluate quality of information, the ability to analyze visual imagery, and the ability to acquire critical thinking skills, etc.). Finally, the literature suggests that science is a curricular area with the greatest number of available videodisc and broadcast materials to study the relationship of new technologies to affective perception and self-esteem.

CHAPTER III

Methodology

Introduction

In this chapter, the methodology is presented. The research design of this study is followed by information pertaining to: (a) research design, (b) selection sample for the study, (c) instrumentation, (d) method of data treatment, (d) methodological assumptions and (e) summary.

Research Design

This study employed an exploratory investigative approach, which utilized a quantitative two-by-two experimental factorial design (Campbell and Stanley, 1966). The major strengths of this design are: (a) several hypotheses can be tested simultaneously which can address several complex questions at once, (b) where the interaction between two or more variables simultaneously makes a difference, it reveals this difference (Isaac and Michael, 1989). The potential of an interaction between the pretest and the treatment could be considered a design weakness. To minimize the effects of sample error, the following precautions were

taken: (a) participants were randomly selected from within their own school; (b) the schools were within a 1.5 mile radius of each other;
(c) there were similarities in ethnic population, social economic status (Borg and Gall, 1989) and achievement levels; (d) and the district curriculum alignment of objectives were standardized.

The mode of instruction afforded by the multimedia computer-based science learning environment classroom and gender were the independent (treatment) variables. The dependent variables were: (a) overall self-concept, (b) perceptions of self as a student, (c) student's attitude and interest toward science, (d) student's perception of school, (e) achievement in science.

Although the variable of one teacher versus another teacher may influence the outcome of the research experiment, it was deemed impossible to avoid, due to the fact that the Hueneme Elementary School District's multimedia computer-based science learning environment was the only classroom of this nature available at the time of the study. In an effort to minimize variables which could affect the study the following conditions were considered:

(a) The control school was chosen from within the same demographic area.

(b) The ethnic, socio-economic, and student achievement levels between the control and experimental schools were similar.

(c) The teacher at the control school (E.O. Green) was a former student teacher of the instructor at the experimental school (Blackstock) and although he did not teach in the multimedia classroom, he had some familiarity with the instructional style, curriculum and objective expectations of the teacher of the multimedia classroom.

Sample Selection

Participants in the study were from two junior high schools in the Hueneme Elementary School District in Port Hueneme, California. The demographic makeup of the two schools was similar in ethnic and socio-economic factors and in science achievement levels. Students from E.O. Green Junior High School (control group) and Blackstock Junior High School (experimental group) were randomly selected from students who were scheduled to take eighth grade science classes during the Spring of 1990. Two groups were established for each school. One group was comprised of boys (40) and the other group was made up of girls (40). This accounted for a total of four groups of 40 students each. All male students who were enrolled in any of the eighth grade science classes in the control group had a number assigned and all of the numbers were placed in a box. Fifty (50) names were randomly selected from the box and the names were listed as subjects for the study in order of drawing. Although the study would only involve forty (40) participants, the last ten (10) names were selected as backup participants in case all students were not able to participate. The same procedure was then used for the two groups of girls. The final total sample was 160: (a) eighty (40 boys and 40 girls) from E.O. Green Junior High School, and (b) eighty (40 boys and 40 girls) from Blackstock Junior High School.

Instrumentation

The principals at each school site and the two teachers involved in the research experiment were contacted by the researcher in November of 1989 to explain the research study. They were encouraged to give input in regard to the administration of the study and the procedures which would cause the least amount of classroom distractions. Timelines and procedures were then established. The researcher obtained a current "alpha" enrollment listing of all eighth grade students at each junior high school. Those students who moved were removed from the list. A random sample of the remaining names was then selected for participation. At the end of the first semester (January, 1990), the randomly selected students (100 although only 80 would eventually participate in the study) from the control group were summonsed to the cafeteria during the last period of the school day to meet with the researcher. An explanation and reason for the survey were given to the students. A letter to the parents explaining the process and reasons for the research and requesting permission for their child to participate in the research was given to each student to take home. The ten extra students were also asked to take the permission slips home and were advised that they would be backups in case someone moved and/or could not participate. This same procedure was replicated for the experimental group.

Of the 160 students who were randomly selected, three girls and two boys from the control group and one boy and two girls from the experimental group did not have parental permission to participate. Therefore, the next names that were randomly drawn (numbers 41, 42 etc.) were used in the study.

Hueneme Computerized Interactive Test On Science

The Hueneme Computerized Interactive Test on Science was administered to one hundred and sixty (160) students by the computer lab managers during their regular WICAT computer lab session. The HCITS objectives were matched (Appendix G) and individual test items equated with a standardized norm referenced test in October of 1988 by WICAT Systems in Orem, Utah. The research study ... "demonstrated significantly high reliability and validity correlation coefficients for the HCITS test when compared to the nationally standardized ... test" (Maynes, M.S. and Olsen, 1988, p.19).

Although this was a computer generated test, both the control and the experimental groups had previous experiences and access to the WICAT computer labs and computer-based testing and therefore were equally exposed to keyboarding and computer commands. The test had a total of 76 questions and was scored automatically by the main frame computer. The results of the test were given to the researcher at the end of the day. Makeups were not allowed.

Soares and Soares Affective Perception Inventory

The Soares and Soares Affective Perception

Inventory (API) Questionnaires were administered period by period (six periods per day) with one full day allocated for each site. The participating students were given a second overview of the experiment and were reassured that both the HCITS and the Soares and Soares API questionnaire were not going to be graded or be a part of the grading system.

The API (1975, 1980, 1985) questionnaire, developed by Dr. Louise M. Soares and Dr. Anthony T. Soares is a grade norm-referenced semantic differential instrument containing four categories maintained along a continuum between two terms opposite in meaning (dichotomous traits) which are separated by the four spaces of distance in a Likert type forced-choice format. This instrument was used to measure the students' affective perceptions (defined as feelings about self, and their attitudes and interests toward a specific discipline or subject).

There are four levels of this instrument ranging from primary (grades 1-3) and intermediate (grades 4-8) to advanced (grades 9-12) and college (post-secondary schools students). Each of the levels contains nine scales for measuring feelings about the self relative interest and ability in a specific subject area (i.e. science), self as a person, self in the role of a student, and self in the environment of school and in interaction with people who are a part of an educational setting (Soares and Soares; 1985).

The Intermediate survey (grades 4-8) for the Affective Perception Inventory Survey Form I was used and consisted of four sections and had the following subtest reliability of students:

1. Self-Concept Inventory - 20 questions. This inventory assesses general self-concept. The construct validity was $\underline{r}$ = .57. Eight week test - retest reliability was .82.

2. Student-Self Inventory - 20 questions. This inventory assesses the individual student's feelings about how they see themselves as a student. The construct validity was $\underline{r}$ = .62. Eight week test - retest reliability was .77.

3. Science Perceptions had 10 questions. This inventory assesses how the child sees the self in ability and interest in the subject (science). The construct validity was $\underline{r}$ = .54. Eight week test - retest reliability was .68.

4. School Perceptions - 30 questions. This inventory assesses how the child sees the self in the school environment, including peers, administrators and teachers. The construct validity was $\underline{r}$ = .49. Eight

week test - retest realizability .61.

The researcher handed out the materials and explained the process and reviewed the reasons for the experiment to the participants. The test and questionnaire were administered one day apart (a total of three days) due to the fact that the researcher attended and spent one and a half days at each school site. One day for the API questionnaire and one half day for the HCITS.

Both the control and experimental posttests were given during the last week in May. The attrition of students between January 1990 and May 1990 was the result of students: (a) who had moved, (b) who did not correctly fill out the answer sheets, or (c) who were absent on the last day of the survey and or HCITS test. As with the HCITS, makeups were not allowed.

The final matched scores were identified: (a) Blackstock experimental boys 32, (b) Blackstock experimental girls 26, (c) E.O. Green control boys 28, (d) E.O. Green control girls 26.

The SAS Statistical Computer Program was used to analyze the data. Due to chance and/or because true randomization was not employed, an analysis of covariance was used to adjust for any initial group differences (Borg and Gall, 1989; Mc Millan and

Schumacher, 1984; Isaac and Michael, 1989). A series of two-by-two factorial statistical analysis were then conducted. The .05 level of significance was used.

Method of Data Treatment

The data from the Soares and Soares API Questionnaire and the HCITS were collected and prepared for computerized data processing. The data were processed utilizing the SAS statistical program package. A two-by-two factorial design was utilized. The strengths of this design are: (a) several hypotheses can be tested simultaneously which can address several complex questions at once, (b) where the interaction between two or more variables simultaneously makes a difference, it reveals this difference. (Isaac and Michael, 1989). Although the students were randomly selected from an "alpha" listing of eighth grade students from the two junior high schools involved in the study, an analysis of covariance was used to adjust for any initial differences between the groups. The .05 level of significance was used.

Methodological Assumptions

The following methodological assumptions were made:

1. The research design, data analysis procedures,

and control methods selected for this study were appropriate.

2. The data were accurately recorded and analyzed.

3. The perceptions of the two teachers on the value of a multimedia computer-based science learning environment and the values of a traditional mode of instruction in science were similar.

4. The findings of this study could be applied to future multimedia computer-based learning environments subject to the limitations set forth in this study.

5. The survey used in the study would provide true responses.

6. The students' self-reports were honest and accurate on all four of the Soares and Soares Affective Perception Inventories.

Summary

Eighty girls and eighty boys from two junior high schools located within the same school district were randomly selected to ascertain if there were any significant relationships of treatment and gender, and the interaction between treatment and gender as they relate to: self-concept; attitudes toward self in science; attitudes and interests toward science;

attitudes toward school; and achievement in science as measured by the HCITS. This was an exploratory investigation study which utilized a quantitative two-by-two experimental factorial design. Five two-by-two factorial statistical analysis and analysis of covariance were used to determine the significance of the relationships. The .05 level of significance was used. The pretest was administered in January of 1990 and the posttest was administered in May of 1990.

CHAPTER IV

Findings

Introduction

In this chapter the results of the data analyses, summary and tables are reported. Five two-by-two factorial analyses of covariance were administered. Each pretest score acted as a covariate to its corresponding posttest score to control for any initial differences which may have existed between the groups studied. The .05 level of significance was used.

The purposes of this exploratory investigation were to determine the relationships of a multimedia computer-based science learning environment and gender differences, on achievement and student's perception, attitude and interest toward science and school. This investigation also evaluated whether there was an interaction effect between gender and treatment. More specifically, the study focused on the following questions:

1. What significant relationships, if any, were present in mean student self-concept scores on the Soares and Soares Self-Perception Inventory on Self-Concept, between students in a multimedia computer-based

science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender?

2. What significant relationships, if any, were present in mean scores on student self-perceptions as a student, on the Soares and Soares Student Self-Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender?

3. What significant relationships, if any, were present in mean scores on student's attitude and interest toward science, on the Soares and Soares Attitude and Interest Toward Science Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender?

4. What significant relationships, if any, were present in mean scores on student's attitude toward school, on the Soares and Soares Attitude Toward School Perception Inventory, between students in a multimedia

computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender?

5. What significant relationships, if any, were present in mean science achievement scores, as measured by the Hueneme Computer Interactive Test on Science, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender?

Analysis of Findings

Question One asked what significant relationships, if any, were present in mean student self-concept scores on the Soares and Soares Self-Perception Inventory on Self-Concept, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender? The results of this analysis are presented in Table 1.

Research Question 1 (a)

An analysis of the Affective Perception Inventory on student self-concept posttest mean scores for question 1 (a), where an F (1,4) = 12.57, $p > = .0006$, found that there was a significant relationship in the experimental versus the control group posttest mean scores. The experimental group had a significantly higher self-concept overall mean score in comparison to the control group.

Research Question 1 (b)

An analysis of the Affective Perception Inventory on student self-concept posttest mean scores for question 1 (b), where F (1,4) = .03, $p < .8652$, found that there was no significant relationship in posttest means scores in self-concept which could be attributed to gender.

Research Question 1 (c)

An analysis of the Affective Perception Inventory on student self-concept posttest mean scores for question 1 (c), where F (1,4) = .02, $p < .9010$, found that there was no significant interaction effect in self-concept scores between treatment and gender.

Table 1

<u>A Comparison of the Adjusted Posttest Measures of the Science Experimental and Control Groups' Differences on the Soares and Soares Self-Perception Inventory on Self-Concept with Treatment and Gender Interactions Derived from a two-by-two Factorial Analysis of Covariance</u>

Variables	Adjusted Posttest Mean	F	Pr >F
Treatment (T)		12.570	0.0006*
Experimental	24.88		
Control	21.23		
Gender		0.03	0.8652
Male	23.14		
Female	22.96		
Interaction (T x G)		0.02	0.9010
Exp. x Male	24.91		
Exp. x Female	24.87		
Con x Male	21.38		
Con. x Female	21.07		

* significant at the .05 level

Question Two asked what significant relationships, if any, were present in mean scores on student self-perceptions as a student, on the Soares and Soares Student Self-Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender? The results of this analysis are presented in Table 2.

Research Question 2 (a)

An analysis of the Affective Perception Inventory on self-perception as a student posttest mean scores for question 2 (a), where an F (1,4) = .076, p < .3857, found that there was no significant relationship in posttest mean scores due to treatment in student perceptions about themselves as students.

Research Question 2 (b)

An analysis of the Affective Perception Inventory on self-perception as a student posttest mean scores for question 2 (b), where F (1,4) = .04, p < .8350, found that there was no significant relationship in posttest mean scores which could be attributed to gender in student perceptions about themselves as students.

Research Question 2 (c)

An analysis of the Affective Perception Inventory on self-perception as a student posttest mean scores for question 2 (c), where $\underline{F}$ (1,4) = 4.28, $\underline{p} > .0411$, found that there was a significant interaction effect between treatment and gender in student perceptions about themselves as students. The girls in the experimental group had a significant higher posttest mean score than the girls and boys of the control group and the boys of the experimental group.

Table 2

A Comparison of the Adjusted Posttest Measures of the Experimental and Control Groups' Differences on the Soares and Soares Student Self-Perception Inventory with Treatment and Gender Interactions Derived from a two-by-two Factorial Analysis of Covariance

Variables	Adjusted Posttest Mean	F	Pr >F
Treatment (T)		0.76	0.3857
Experimental	18.40		
Control	16.90		
Gender		0.04	0.8350
Male	17.82		
Female	17.50		
Interaction (T x G)		4.28	0.0411*
Exp. x Male	16.80		
Exp. x Female	19.99		
Con. x Male	18.86		
Con. x Female	14.95		

* significant at the .05 level

Question Three asked what significant relationships, if any, were present in mean scores on student's attitude and interest toward science, on the Soares and Soares Attitude and Interest Toward Science Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? (c) interaction of treatment and gender? The results of this analysis are presented in Table 3.

Research Question 3 (a)

An analysis of the Affective Perception Inventory on student's attitude and interest toward science posttest mean scores for question 3 (a), where an F (1,4) = 2.70, p < .1030, found that there was no significant relationship in the experimental versus the control groups posttest mean scores on attitude and interest toward science which could be attributed to treatment.

Research Question 3 (b)

An analysis of the Affective Perception Inventory on student's attitude and interest toward science posttest mean scores for question 3 b), where F (1,4) =

.62, $p < .4310$, found that there was no significant relationship in posttest mean scores on attitude and interest toward science which could be attributed to gender.

Research Question 3 (c)

An analysis of the Affective Perception Inventory on student's attitude and interest toward science posttest mean scores for question 3 (c), where $F(1,4) = 2.28$, $p < .1342$, found that there was no significant interaction effect on attitude and interest toward science between treatment and gender.

Table 3

A Comparison of the Adjusted Posttest Measures of the Experimental and Control Groups' Differences on the Soares and Soares Attitude and Interest Toward Science Perception Inventory with Treatment and Gender Interactions Derived from a two-by-two Factorial Analysis of Covariance.

Variables	Adjusted Posttest Mean	F	Pr >F
Treatment (T)		2.70	0.1030
Experimental	11.87		
Control	9.63		
Gender		0.62	0.4310
Male	10.21		
Female	11.29		
Interaction (T x G)		2.28	0.1342
Exp. x Male	10.31		
Exp. x Female	13.42		
Con. x Male	10.11		
Con. x Female	9.15		

Question Four asked what significant relationships, if any, were present in mean scores on student's attitude toward school, on the Soares and Soares Attitude Toward School Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? and (c) interaction of treatment and gender? The results of this analysis are presented in Table 4.

Research Question 4 (a)

An analysis of the Affective Perception Inventory on student's attitude toward school posttest mean scores for question 4 (a), where an F (1,4) = 2.56, p < .1122, found that there was no significant relationship in posttest mean scores on attitude toward school which could be attributed to treatment.

Research Question 4 (b)

An analysis of the Affective Perception Inventory on student's attitude toward school posttest mean scores for question 4 (b), where F (1,4) = .09, p < 7710, found that there was no significant relationship in posttest mean scores on attitude toward school which could be attributed to gender.

Research Question 4 (c)

An analysis of the Affective Perception Inventory on student's attitude toward school posttest mean scores for question 4 (c), where $\underline{F}$ (1,4) = 1.52, $\underline{p} < .2202$, found that there was no significant interaction effect on attitude toward school between treatment and gender.

Table 4

A Comparison of the Adjusted Posttest Measures of the Science Experimental and Control Groups' Differences on the Soares and Soares Attitude Toward School-Perception Inventory with Treatment and Gender Interactions Derived from a two-by-two Factorial Analysis of Covariance

Variables	Adjusted Posttest Mean	F	Pr >F
Treatment (T)		2.56	0.1122
Experimental	29.89		
Control	26.79		
Gender		0.09	0.7710
Male	28.05		
Female	28.62		
Interaction (T x G)		1.52	0.2202
Exp. x Male	28.41		
Exp. x Female	31.36		
Con. x Male	27.70		
Con. x Female	25.88		

Question Five asked what significant relationships, if any, were present in mean science achievement scores as measured by the Hueneme Computerized Interactive Science Test on Science between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment? (b) gender? (c) interaction of treatment and gender? The results of the analysis are presented in Table 5.

Research Question 5 (a)

An analysis of the Hueneme Computerized Interactive Test on Science posttest mean scores for question 5 (a), where an F (1,4) = 8.40, p > .0046, found that there was a significant relationship in the experimental versus the control group posttest mean scores. The experimental group scored significantly higher on posttest mean scores than the control group on the Hueneme Computerized Interactive Test on Science.

Research Question 5 (b)

An analysis of the Hueneme Computerized Interactive Test On Science posttest mean scores for question 5 (b), where F (1,4) = .62, p < .4336, found that there was no significant relationship in posttest mean scores on the

Hueneme Computerized Interactive Test on Science which could be attributed to gender.

Research Question 5 (c)

An analysis of the Hueneme Computerized Interactive Test on Science posttest mean scores for question 5 (c), where F (1,4) = 1.68, $p < .1981$, found that there was no significant interaction effect between treatment and gender on the Hueneme Computerized Interactive Test on Science.

Table 5

<u>A Comparison of the Adjusted Posttest Measures of the Science Experimental and Control Groups' Differences on the Hueneme Computerized Interactive Test on Science with Treatment and Gender Interactions Derived from a two-by-two Factorial Analysis of Covariance</u>

Variables	Adjusted Posttest Mean	F	Pr >F
Treatment (T)		8.40	0.0046*
Experimental	45.27		
Control	42.44		
Gender		0.62	0.4336
Male	44.24		
Female	43.50		
Interaction (T x G)		1.68	0.1981
Exp. x Male	45.02		
Exp. x Female	45.53		
Con. x Male	43.46		
Con. x Female	41.41		

* significant at the .05 level

Summary of Findings

A series of two-by-two factorial statistical analysis and analysis of covariance were employed to investigate the relationships of a multimedia computer-based science learning environment and gender differences on achievement and student's perception, attitude and interest toward science and school. This investigation also evaluated whether there was an interaction effect between gender and treatment. At the .05 level, there were significant relationships in three areas.

On research question:

1 (a) the experimental group had a significantly higher posttest mean score in self-concept (how the individual sees the self as a person) than the control group (traditional science classroom).

2 (c) the experimental female group had an interaction affect between treatment and gender on self- perception as a student posttest mean scores. The experimental female group had a higher overall posttest mean score than both the males and females of the control group and of the males in the experimental group.

5 (a) the experimental group had a significantly higher posttest mean score than the control group on the

Hueneme Interactive Computer Test on Science. There were no significant relationships regarding the remaining questions.

CHAPTER V

Introduction, Summary, Conclusions, Recommendations, and Implications

Introductions

This chapter summarizes the purposes of the study, literature review, methodology, instrumentation, limitation, data analysis, selected findings, other related findings, conclusions, recommendations and implications for practice.

Summary

Purposes of the Study

The purposes of this exploratory investigation were to determine the relationships of a multimedia computer-based science learning environment and gender differences on achievement and student's perception, attitude and interest toward themselves, science and school. This investigation also evaluated whether there was an interaction effect between gender and treatment. The study specifically focused on the following questions:

1. What significant relationships, if any, were present in mean student self-concept scores on the Soares and Soares Self-Perception Inventory on Self-Concept, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

2. What significant relationships, if any, were present in mean scores on student self-perceptions as a student, on the Soares and Soares Student Self-Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

3. What significant relationships, if any, were present in mean scores on student's attitude and interest toward science, on the Soares and Soares Attitude and Interest Toward Science Perception Inventory, between students in a multimedia computer-

based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

4. What significant relationships, if any, were present in mean scores on student's attitude toward school, on the Soares and Soares Attitude Toward School Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

5. What significant relationship, if any, were present in mean science achievement scores as measured by the Hueneme Computer Interactive Test on Science between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to:

a. treatment?

b. gender?

c. interaction of treatment and gender?

Summary of Literature

At the time of this study, research was very limited in respect to a multimedia computer-based learning environment in science. Therefore, the review of the literature focused upon and was a synopsis of past research and information with respect to affective perceptions and educational technology in general.

Over the past thirty years, there has been a myriad of studies pertaining to educational technology (Cohen, 1988). These studies have ranged from programmed instruction, radio, television, computer assisted instruction, and laser disk technology. The literature review in this study focused upon three aspects:

1. A synopsis of educational technology in general.
2. Pertinent aspects pertaining to Affective Perceptions.
3. Synopses relating to gender and achievement.

Much of the review of literature suggests that there is a relationship between educational technology and:

(a) student achievement (Kulik, Bangert, and Williams, 1983; Krendl and Fredin, 1984, 1985; Armento, 1976; Emmer, Sanford, Evertson, Clements, and Martin, 1981; Evans and Guyman, 1978, Gage et al., 1968).

(b) the affective domain (Clement, 1981; Dalton and Hannafin, 1984, 1985; Kulik, 1984; Perez and White, 1985).

(c) in gender differences (Eastman and Krendl, 1984; Williams and Williams, 1984; Winkle and Mathews, 1982; Smail, 1985).

Other research studies suggest that research design in technology studies are flawed (Clark, 1986; Driscoll, 1984), that using computers neither inhibit nor accelerate cognitive development (Pea and Kurland, 1984; Hess et al., 1986), and that there are many instructional situations for which computer-based technology is not satisfactory (Martorella, 1983).

In general, research in the field of computer-based multimedia educational technology, self-concept, and affective perception has not been examined. Yet, despite conflicting research findings (e.g., CAI and laser disc video), evidence of a relationship between self-concept and performance in the academic arena seems to be documented in the literature. In addition, there is support for the claim that the classroom environment may contribute to achievement and that there is a gender gap between boys and girls with regard to their perceptions of computers and other forms of electronic delivery systems e.g., laser disc systems.

Methodology

The sample was derived from an alpha listing of all eighth grade students who were to enroll in science for the spring of 1990. Two groups were established for each school. One group was comprised of boys and the other group was made up of girls. All male students who were enrolled in any of the eighth grade science classes in the control group had a number assigned and all of the numbers were placed in a box. Fifty names were randomly selected from the box and the names were listed as subjects for the study in order of drawing. The same procedure was used for the girls at each school. Although the study would only involve forty boys and forty girls from each school, the last ten names were selected from each group as backups in case all students were not able to participate in the study. The total number matched scores were: (a) Blackstock Junior High School experimental boys thirty-two (32), (b) Blackstock Junior High School experimental girls twenty-six (26), (c) E.O. Green Junior High School control boys twenty-eight (28), (d) E.O. Green Junior High School control girls twenty-six (26).

Pretests and posttests were administered utilizing the SAS Statistical Computer Program.

Instrumentation

Principals and participating teachers at each school site were given an overview of the study and a timeline for completion. Suggestions and input were solicited by the researcher. Students who were randomly selected to participate in the study were given participation letters to take home which explained the process and reasons for the research. Students were given the Hueneme Computerized Interactive Test on Science and the Soares and Soares Affective Perception Inventory Questionnaires in January of 1990. A posttest was administered in May of 1990. Makeup tests were not allowed. Matched scores were then statistically analyzed utilizing a quantitative two-by-two experimental factorial design and an analysis of covariance to adjust for initial group differences. The .05 level of significance was used.

Limitation of the Study

This exploratory investigation involved a multimedia computer-based science learning environment which is endemic to the Hueneme School District and was limited to eighth grade students of the Hueneme School

District and should not be generalized for all students and/or school districts. Although the teachers involved in the study were familiar with the curriculum and instructional strategies of the district and each other, the issue of one teacher versus another and the cooperation from the teachers and students could have affected the study. Although precautions were taken to neutralize the "Hawthorne", "novelty", and/or "John Henry" effect, (discussions with participating students, teachers, and principals with respect to not affecting the grade of the students or the evaluation of the teacher), the perception of being in a novel and/or different environment could have influenced the study.

Data Analysis

Students from the experimental and control group were administered the Hueneme Computerized Interactive Test on Science and the Soares and Soares Affective Perception Inventory as a pretest in January of 1990. A posttest was administered in May of 1990. The data were collected and appropriate statistical tests were used from the SAS Statistical Computer Program for analysis: (a) two-by-two factorial tests, (b) analysis of covariance.

Selected Findings

The selected findings relative to the testing of the research questions were as follows:

1. Research question One investigated the relationship in mean scores on student self-concept, on the Soares and Soares Self-Perception Inventory on Self-Concept, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which could be attributed to: (a) treatment, (b) gender, or (c) interaction of treatment and gender.

There was a significant relationship in mean scores on self-concept which could be attributed to treatment. The students in the multimedia computer-based science learning environment scored significantly higher in mean self-concept scores than the control group. There were no significant relationships in mean scores on self-concept which could be attributed to: (b) gender, or (c) the interaction of treatment and gender.

2. Research question Two investigated the relationship in mean scores on student self-perceptions as a student, on the Soares and Soares Student Self-Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be

attributed to: (a) treatment, (b) gender, or (c) interaction of treatment and gender. There was a significant relationship on mean scores on the interaction between treatment and gender in attitudes toward self as a student. Girls in the experimental group scored significantly higher on mean posttest scores than the girls and boys of the control group and the boys of the experimental group. There were no significant relationships in mean scores on attitudes toward self as a student which could be attributed to: (a) treatment, or (b) gender.

3. Research question Three investigated the relationship in mean scores on student's attitude and interest toward science, on the Soares and Soares Attitude Toward Science Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment, (b) gender, or (c) interaction of treatment and gender. There were no significant relationships between treatment, gender, or the interaction of treatment and gender on attitudes toward science.

4. Research question Four investigated the relationship in mean scores on student's attitude toward school, on the Soares and Soares Attitude Toward School

Perception Inventory, between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment, (b) gender, or (c) interaction of treatment and gender. There were no significant relationships between treatment, gender, or the interaction of treatment and gender on attitudes toward school.

5. Research question Five investigated the relationship in mean science achievement scores as measured by the Hueneme Computerized Interactive Test on Science between students in a multimedia computer-based science learning environment and students in a traditional science classroom which can be attributed to: (a) treatment, (b) gender, or (c) interaction of treatment and gender. There was a significant relationship in experimental versus the control group posttest mean achievement scores. The experimental group scored significantly higher on posttest mean scores than the control group on the Hueneme Computerized Interactive Test on Science. There were no significant relationships in posttest mean scores on the Hueneme Computerized Interactive Test on Science which could be attributed to: (b) gender, or (c) interaction of treatment and gender.

Other Findings

The following findings, although not significant could be of interest:

1. The mean scores on self-concept for both boys (25.86 to 23.07) and girls (19.19 to 18.69) in the control group decreased while the mean scores for both boys (23.75 to 25.31) and girls (23.19 to 24.92) in the experimental group increased. Although not significant, it appears that the boys and girls in the control group actually had a lower self-concept of themselves after their experiences with a traditional science classroom. It would be interesting to compare traditional eighth grade science classes from both junior high schools and determine if there would be a decrease in attitudes toward science for both schools.

2. Girls in the traditional classroom were the only participants which decreased (15.88 to 14.73) in overall posttest mean scores on perceptions of themselves as students. Although not significant, this could suggest that girls enrolled in a traditional science classroom had a lower perception of themselves as students.

3. Girls in the experimental classroom had the highest posttest mean score (12.35) on their attitude toward science survey and the greatest difference

between pretest and posttest mean scores (5.04 to 12.35). The control group girls had the lowest (8.84) overall posttest mean scores. Although not significant, this could suggest that the girls in the experimental multimedia computer-based science learning environment classroom had experiences which had a more positive influence on their attitude toward science than both the boys and girls in the traditional classroom and boys in the experimental classroom. It would be of interest to compare four eighth grade junior high school classes (one experimental and one traditional from each school) and determine if attitudes toward science would elicit similar results.

4. Girls in the control classroom had a decrease in their posttest mean scores (29.30 to 26.79) on their school perception scores. Although not significant, this could imply that attitudes toward school could be affected by how female students are doing in a specific class and/or subject area.

5. Although not significant, it is interesting to note that the girls overall scored higher than the overall boys on the science achievement pretest and posttest.

Conclusions

The following conclusions evolved from an analysis of the selected findings and data:

1. Students who were enrolled in the experimental multimedia computer-based science learning environment had a higher overall mean self-concept score (how they perceive themselves as persons) than the students from the traditional science classroom. This supports the studies by Clement (1981), Dalton and Hannafin (1984 and 1985), Kulik (1984), Perez and White (1985), Riel (1985), Turkle (1984), Ford, Hess, Mc Garvey, and Bergin, (1986), Turkle (1984), Dalton and Hannafin (1987), that technology (e.g., CAI and interactive video) has a positive effect on learner self-esteem.

2. Girls enrolled in the experimental multimedia computer-based science learning environment had a higher overall mean self-perception score (how they perceived themselves as students) than both boys and girls in the traditional science classroom and boys in the experimental classroom. This contradicts studies by Steinkamp and Maehr (1984), Corno and Mandinach (1983), Lepper (1982), Williams and Williams (1984), Winkle and Mathews (1982), that there are sex-related differences in attitudes and/or feelings toward computers (specifically, girls tend to be less desirous of

learning to use computers than boys and initially less adept). The results appear to implicate that girls who are in an environment similar to the experimental classroom would have a higher perception of themselves as students in general.

3. Students who were enrolled in the experimental multimedia computer-based science learning environment had a higher overall mean achievement score on the HCITS than the students from the traditional science classroom. This would support the studies by Kulik, Bangert, and Williams (1983), Krendl and Fredin (1984; 1985), Bunderson, Olsen, Baillio (1981), Bunderson, Olsen, and Greenberg, (1990) that instruction using technology (e.g. computers and/or laser disc video) can increase achievement. In addition, when combined with the finding of the first question pertaining to self-concept, it would appear that self-concept and achievement are interrelated. These findings would support Betts (1955), Shepard (1982), Quick (1973), Anderson (1965), Brookover, LePere, Hamachek, Thomas, and Erickson (1965), Brookover (1967), Gage and Berliner (1984), Willis (1985), that there is at least a relationship between academic success and self-concept but would not support the studies by Bridgeman and Shipman (1978), Doenholter (1981), Pirtle (1982), that

there is no significant relationship between self-concept and achievement. The results would imply that the use of a multimedia computer-based learning environment increases achievement in science.

Recommendations

Based on the research and results of this study, the need for further research in several areas seems to be indicated:

1. This was an exploratory investigation which focused upon a newly designed multimedia computer-based delivery format. Because the experimental classroom was a newly designed prototype and the instructor had less than a year to operate in this environment, it is highly recommended that this study be replicated.

2. The use of computer-based multimedia presentations as a delivery of instruction is relatively new to the educational arena and demonstrated positive relationships in self-concept, positive attitudes of girls with respect to how they perceive themselves as students and in academic achievement in science. It is therefore recommended that this instructional platform be researched in other curricular areas when other multimedia computer-based classrooms become available.

3. Due to the fact that there was only one multimedia computer-based science environment, which is endemic to the Hueneme School District, this study was limited to one teacher versus another teacher. Although every effort was made to neutralize and ameliorate this possible uncontrollable variable, its influence on the results cannot be discounted. It is therefore recommended that as technology advances and the availability of similar types of multimedia computer-based learning environments become more accessible, the research be expanded to involve more teachers and students.

4. Gender was used in this study and resulted in a positive relationship for girls in attitudes toward themselves as students. It is recommended that other variables such as; ethnicity and/or social economic status be utilized in future research.

5. The long term impact and influence that technology plays on the development of attitudes' of students (especially girls) toward science should be addressed. It is therefore recommended that a longitudinal study be done, to determine if students who were involved in this exploratory investigation, maintained their attitudes toward science in high school and how many enrolled in elective science classes.

Implications for Practice

The conclusion of this research offers implications for practical application for school districts, curriculum leaders, technology coordinators, environmental design specialists, teachers, and other educators. School districts should be investigating and planning the use of technology as a tool to not only meet the challenges of the twenty-first century, but as an instructional delivery system. If this is accomplished, it could enhance academic achievement and positively impact the affective perceptions of students in general and girls in particular.

Curriculum leaders, technology coordinators, and environmental and instructional design specialists should be investigating and designing classrooms which have the capability and potential power of merging visual images, auditory reception, and written data into a seamless integration of information to students. This type of educationally conducive environment could enhance student's self-concept and academic success.

Although the review of literature and research indicates that girls are making progress in terms of access and availability to all subject areas; principals, teachers and other educators should continue to encourage girls to pursue all academic endeavors including, but not limited to, those which they historically have not pursued (e.g., science, math, and computers).

REFERENCES

Alexander, Delores, "A Study of the Effects of a Remedial Reading Program Upon Reading Attitude, Reading Achievement, Self-Concept, and Intellectual Achievement Responsibility of Selected Students of the Fourth and Fifth Grades," Dissertation Abstracts, 27, 1567, 1980 Order No. 8028311.

Anderson, C. (1965). The Self-image: A theory of the dynamics of behavior. In Don E. Hamcheck (Ed.), The Self in Growth, Teaching, and Learning. (pp. 1-13) Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Armento, B.J. (1976, April). Teacher behaviors related to student achievement on a social science concept test. Paper presented at the annual meeting of the American Educational Research Association. San Francisco. (ERIC Document Reproduction Service No. ED 126 145).

Armsey, James W. and Dahl, Norman C. (1973). An Inquiry into the uses of Instructional Technology. The Ford Foundation, New York, NY.

Association for Educational Communications and Technology (1977). The definition of educational technology. Washington, DC: Author.

Bandura, A. (1977). Social Learning Theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, Albert and Walters, Richard H. (1963). Social Learning and Personality Development. New York: Holt, Rinehart and Winston, Inc.

Bandura, A. (1969). Social-learning theory of identificatory process. In D.A. Goslin (Ed.). Handbook of Socialization Theory and Research (pp. 213-262). Chicago, IL: Rand McNally.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.56

Batterson, George W. (1987). Self-concept, Self-Esteem and Academic Achievement. (Doctoral dissertation, State University of New York at Buffalo, 1987). University Microfilms International, 1990.

Bauer, Jane A., (1981 October). " A Study of Third and Fourth Grade Gifted Students Reading Achievement and its Relationship to their Self-Concept," Dissertation Abstracts, Vol 42 No. 4.

Beane, James A. and Lipka, Richard P. (1984). Self-Concept, Self-Esteem and the Curriculum. Boston, London, Sydney, Toronto: Allyn and Bacon, Inc.

Beane, J., Lipka, R., and Ludewig, J. (1980). Synthesis of Research on Self-Concept. Educational Leadership, 38, 84-89.

Becker, W.C., & Gersten, R. (1982). A follow-up of follow - through: The latter effects of the direct instructional model on children in 5th and 6th grades.

Becker, H.J. (1987). The Impact of Computer Use on Children's Learning: What Research Has Shown and What it Has not, Paper presented at the annual meeting of the American Educational Research Association, Washington, D.C.

Becker, W.C. (1977). Teaching reading and language to the disadvantaged-what have we learned from the field research. Harvard Educational Review, 47, 518-543.

Berg, John A. (1987). Teacher Self-Concept of Teaching Ability: Does it Make A difference? (Doctoral Dissertation, Ohio State University (1987)). University Microfilms International, 1990.

Berman-Weiler Associates, (1990). Restructuring California Education: A Design for Public Education in the Twenty-First Century. Recommendations to the California Business Roundtable.

Betts, E. (1955-September). Reading as a thinking process. The National Elementary Principal, 35, 90-95.

Bills, R.E., (1981). Self-concept and schooling. West Lafayette, IN: Kappa Delta Pi Publications.

Bloom, B. (1971). Learning for Mastery. In B. Bloom, J. Hasings, & G. Madaus (Eds.), Handbook of Formative and Sumative Evaluation of Student Learning. New York: McGraw-Hill.

Bloom, B.S. (1976). Human characteristics and school learning. New York: McGraw-Hill.

Bloom, B.S., (1974). Time and learning. American Psychologist, (pp. 682-688).

Bonner, P. (1984). Toward a more thoughtful use of computers in education. Personal Computing, 8, 153.

Borg, Walter R. and Gall, Meredith D. (1989). Educational Research, An Introduction.

Bork, Alfred (1987). The potential for interactive technology, educational computing. BYTE, pp. 201-204.

Bosco, J.J. (1984). Educational Technology. Vol 24, p. 13.

Botkin, J.W., Elmandjra, M., and Mailitza, M. (1979). No limits to learning: Bridging the human gap. The Club of Rome report. Oxford: Pergamen Press.

Bozeman, W.C., (1988, February). Microcomputers in education: The second decade. T.H.E. Journal, pp. 82-86.

Bradford, E. (1973). A Comparison of two methods of teaching in the elementary school as related to achievement in reading, math and self-concept of children (Doctoral dissertation, University of Michigan, 1972). Dissertation Abstracts International, 33, 4786A.

Bridgeman, B., and Shipman, S. (1978). Preschool measure of self-esteem and achievement motivation as predictors of third-grade achievement. Journal of Education Psychology, 709, 17-28.

Brookover, W.B., LePere, J.M., Hamachek, D.E., Thomas, S., & Erickson, E.L. (1965). Self concept of ability and school achievement, II (Educational Research Series No. 31.) East Lansing, MI: Educational Publication Series.

Brophy, J. & Hannon, P. (1985). On the future of microcomputers in the classroom. The Journal of Mathematical Behavior, 4, pp. 47-6

Bunderson, C.V., Olson, James V., Baillio, Bruce (1981). Proof of concept demonstration and comparative evaluation of a prototype intelligent videodisc system. Final Report NSF Grant #SED-790000794. Orem, UT, Learning Design Laboratories, WICAT, Inc.

Bunderson, C.V., Olson, James B., Greenberg, Arana, (1990). Computers in Educational Assessment: An Opportunity to Restructure Educational Practice. Paper prepared for the US Congress Office of Technology Assessment. Pennington, NJ, Institute for Computer Users in Education.

Caldwell, Robert M. (1981). Computers and Curriculum Promises and Problems.Technology and Education: Policy, Implementation, Evaluation. Proceedings of the National Conference on Technology and Education, January 1981.

California Commission on Educational Quality (June 1988). A Report to the Governor.

Campbell, Donald T. and Stanley, J. C. (1966). Experimental and Quasi-experimental Designs for Research. Chicago: Rand McNally and Company.

Campeau, P.L. (1974). Selective review of the results of research on the use of audio-visual media to teach adults. AV Communication Review, 22 (1) Spring, pp. 5-40.

Caplin, M.D. (1969). The relationship between self-concept and academic achievement. The Journal of Experimental Education, 37, (3), 13-16.

Carrier, S. (1982). Computer-aided interactive video instruction: Closing the gaps between needs and outcomes in competency-based leadership, management, and organizational development training. Programmed Learning and Educational Technology, 19, 311-316.

Carter, T.P., "The Negative Self-Concept of Mexican-American students," School and Society, Fall 1968, Vol. 96, 217-219.

Center for Social Organization of Schools (1985). National survey on use of computers in education. Baltimore: Johns Hopkins University.

Chadwick, C. B. (1979) Why educational technology is failing (and what should be done to create success). Educational Technology, 7-19.

Charp, S. (1981). Effectiveness of computers in instruction, Viewpoints in Teaching and Learning, 57(2), 28-32.

Clark, R.E. (1985). Confounding in educational computing research. Journal of Educational Computing Research, 1, 129-130.

Clark, R. E. (1988). Research on Instructional Media, 1978-1988, in Elwood E. Miller (Ed.), Educational Media and Technology Yearbook, 1988, Littleton, CO: Libraries Unlimited pp. 19-36.

Clark, R.E., (1986). Evidence for confounding in computer-based instruction studies: Analyzing the meta-analysis. Educational Communication and Technology Journal, 33(4), 249-262.

Clark, R.E., (1983). Reconsidering research on learning from media. Review of Educational Research, 53(4), 455-459.

Clement, F. (1981). Affective considerations in computer-based education. Educational Technology, 21(4), 28-32

Cohen, David K. (1988). Technology in Education: Looking Toward 2020. Educational Technology and School Organization, pp. 231-264.

Combs, A. (1962). Perceiving, behaving, becoming: A new focus in education. Washington D.C.: Associationfor Supervision and Curriculum Development.

Combs, C., (1964). "Perception of Self and Scholastic Under-achievement in the Academically Capable." Personnel and Guidance Journal, September 1964, Vol. 43 no. 1, 47-51.

Commons, Dorman L. (1985). Who will teach our children? A strategy for improving California's Schools. Report of the California Commission on the teaching profession.

Cooley, W.W., & Leinhardt, G. (1978). The instructional dimensions study: The search for effective classroom processes (final report). Pittsburgh: University of Pittsburgh, Learning Research and Development Center. (ERIC Document No. ED 167 580).

Cooley, C.H. Human Nature and the Social Order, New York: Charles Scribner's, 1902.

Corno, L., & Mandinach, E.B. Using existing classroom data to explore relationships in a theoretical model of academic motivation. Journal of Educational Research , 1983, 77, 33-42.

Cuban, L. (1985), Teachers and Machines: The Classroom use of Technology. New York: Teachers College Press.

Dalton, D.W. & Hannafin, M.J. (1987). The effects of individual versus cooperative computer assisted instruction on student performance and attitudes. Manuscript submitted for publication.

Dalton, D. & Hannafin, M. (1985). The effects of computer-assisted instruction on the self-esteem and achievement of remedial junior high school students: An exploratory study. Association for Educational Data Systems Journal, 18(3), 172-182.

Dalton, D.W. and M. Hannafin, (1984), The Role of Computer-assisted Instruction in Affecting Learner Self-esteem: A Case Study, Educational Technology, 25:12, pp. 42-44.

DeBloois, M. L. (1988, February). Use and effectiveness of videodisc training: A status report. Falls Church, VA: Future Systems Inc.

DeBloois, M., Maki, K.C., & Hall, A.F (1984). Effectiveness of interactive videodisc training: A comprehensive review. Falls Church, VA: Future Systems, Inc., The Videodisc Monitor.

Deboer, G.E. (1984). A study of gender effects in the science and mathematics course-taking behavior of a group of students who graduated from college in the late 1970's. Journal of Research in Science Teaching. 1984, 21, 95-103.

Department of Education, State of California, California Education Summit (February 1990). Meeting the Challenge, The Schools Respond, Background Papers.

Diebert, J.P., & Hoy, W. (1977). Custodial high schools and self-actualization of students. Educational Research Quarterly, 2, 24-31.

Driscoll, M.P. (1984). Alternative paradigms for research in instructional systems. Journal of Instructional Development, 7(4).

Dubin, R., and Taveggia, T.C. (1968). The Teaching Learning Paradox. Eugene, OR: University of Oregon Press.

Eastman, Susan-Tyler and Krendl, Kathy A. (1984) Differential Effects of Elecrtronic Search on Students' Achievement and Attitudes. Paper presented at the annual meeting of the Communication, Language and Gender Conference (Oxford, OH).

Elmer-DeWitt, P. (1986, November 3). From Programs to Pajama Parties. Time, P. 88.

Ely, Donald P. & Plomp, Tjeard. "The Promises of Educational Technology: A Reassessment," in Elwood E. Miller (Ed.), Educational Media and Technology Yearbook, 1988, Littleton, CO: Libraries Unlimited, 1988, pp. 5-18.

Emmer, E.T., Sanford, J.P., Evertson, C.M., Clements, B.S., & Martin, J. (1981). The classroom management improvement study: An experiment in elementary schools, Austin, TX. University of Texas, Research and Development Center for Teacher Education. (R & D Report No. 6050).

Emmer, E.T., Sanford, J.P., Clements, B.S., & Martin, J. (1982). Improving classroom management and organization in junior high schools: An experimental investigation, Austin, TX. University of Texas Research and Development Center for Teacher Education. (Eric Document Reproduction Service No. ED 151 321).

Evans, W., & Guyman, R.E. (1978, March). Clarity of explanation: A powerful indicator of teacher effectiveness. Paper presented at the annual meeting of the American Education Research Association, Toronto, (ERIC Document Reproduction Service No. ED 151 321).

Evertson, C.M., Anderson, L.M., & Brophy, J.E. (1978). Process-outcome relationships in the Texas junior high school study compendium. Washington: National Institute of Education. (ERIC Document Reproduction Service No. ED 166 192).

Farquhar, W. V., "A Comprehensive Study of the Motivational Factors Underlying Achievement of Eleventh Grade High School Students," U.S. Office of Education Cooperation Research Report No. 846., East Lansing: Office of Research and Publications, Michigan State University.

Fetler, M. (1985). Sex differences on the California statewide assessment of computer literacy, Sex Roles, 13, 181-191.

Fink, M. B., "Self-Concept as it Relates to Academic Under-achievement," California Journal of Educational Research, March 1962, Vol 13 No. 2, 57-62.

Fisher, C.W., Filby, N.M., Marliave, R., Cahen, L.S., Dishaw, N.M., Moore, J.E., & Berliner, D.C. (1980). Teaching behaviors, academic learning time, and student achievement: An overview. In C. Denham, & A. Liebman (Eds.), Time to Learn. Washington, DC: U.S. Government Printing Office.

Fleming, M.L., & Levie, W.H. (1978). Instructional message design: Principles from the behavioral sciences. Englewood Cliffs, NJ: Educational Technology Publications.

Ford, M.E., Hess, R.D., McGarvey, L. and Bergin, D. (1986) What Makes the Difference: Contributions of Social Behavior, Software, Home Use and Teacher Strategies to Students' Academic Gains. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Fox, L.H. (1977). The effects of sex-role socialization in mathematics participation and achievement. In L.H. Fox et, al. Women and Mathematics: Research Perspectives for Change. NIE papers in Education and Work, No. 8, Washington, D.C.: National Institute of Education, November 1977.

Gage, N.L., Belgard, M., Dell, D., Hiller, J.E., Rosenshine, B., & Unruh, W.P. (1968). Explorations of the teacher's effectiveness in explaining (Technical report No. 4). Stanford, CA: Stanford University, Center for Educational Research. (ERIC Document Reproduction Service No. ED 028 147).

Gendele, J.F. & Gendele, J.G. (1984). Interactive videodisc and its implications in education. Technological Horizons in Education, 12(1), 93-97.

Gephart, W.J., & Ingle, R.B. (1976). Evaluation and the affective domain. In W.J. Gephart, R.B. Ingle, & F.J. Marshall (Eds.), Evaluation in the Affective Domain (pp. 165-193). Bloomington, IN: Phi Delta Kappa.

Good, T.L., & Grouws, D.A. (1979). The Missouri mathematics effectiveness project: An experimental study in fourth grade classrooms. Journal of Educational Psychology, 71, 355-362.

Group for the Study of Effective Teaching (1983). Teaching Effectiveness Evaluation Project: Final Report. Quality Assurance Program, State of North Carolina.

Handley, H.M. and L.W. Morse (1984) "Two-Year Study Relating Adolescents' Self-Concept and Gender Role Perceptions to Achievement and Attitudes Toward Science." Journal of Research in Science Teaching, 21(6): 599-607.

Hankoos, G.D., & Penick, J.E. (1987). Interaction effect of personality characteristics classroom climate and science achievement. Science Education, 71, 735-743.

Harless, W. (1985). The TIME project. Paper presented at the annual meeting of the Association for the Development of Computer Based Instructional Systems, Philadelphia.

Hess, R.D., Ford, M.E., McGarvey, L., Bergin, D., Brawer, J., Okamoto, Y., Meyer-Gaub, G. and McDevitt, T. (1986). Effects of Microcomputer Use in Kindergarten on Students' Social Behavior and Academic Performance. Summary of a symposium presented at the annual meeting of the American Educational Research Association, San Francisco.

Horn, J. C. (1985 July). Man, woman and computer: Interest matters. Psychology Today, p. 13.

Hughes, D.C. (1973). An experimental investigation of the effects of pupil responding and teacher reacting on pupil achievement. American Educational Research Journal, 10, 21-37.

International Communications Industries Association. (1985). Computer-assisted instruction (CAI): The bottom line. Falls Church, VA: Education Turnkey Systems.

International Communications Industries Association, (1987). Computer-assisted instruction (CAI): The bottom line: An update. Falls Church, VA: Education Turnkey Systems.

Isaac, Stephen, and Michael, William B. (1989). Handbook in Research and Evaluation for Education and the Behavioral Sciences.

James, W., (1890) Principles of Psychology, New York: Dover Publications, Inc.

Jamison, D., Suppes, P. & Wells, S. (1974). Effectiveness of alternative instructional media. Review of Educational Research,44, 1-67.

Johnson, R.T., Johnson, D.W. & Stanne, M.B. (1985). Effects of cooperative, competitive, and individualistic goal structures on computer-assisted instruction. Journal of Educational Psychology, 77(6), 668-677.

Kalunian, J. (1975). The effects of a humanistic education curriculum on attitudes, self-concept, anxiety and achievement level of primary school children and teachers (Doctoral Dissertation, Boston University, 1974). Dissertation Abstracts International, 35, 5817A.

Kemp, Martin M., "The Relationship of Student Self-Concept to Achievement in Reading and Mathematics and Time off Task," Dissertation Abstracts, Vol. 43 No. 7, January 1983.

Kifer, E. (1975). Relationships between academic achievement and personality characteristics: A quasi-longitudinal study. American Educational Research Journal, 12, 191-210.

Kozma, R. (1982). Instructional design in a chemistry laboratory course: The impacts of structure and aptitudes on performance and attitudes. Journal of Research in Science Teaching, 19, 261-270.

Krendl, K.A. and E.S. Fredin, (1984), Biases of Communication Systems: Approach to Studying New Communication Technologies. Indiana University, Bloomington, IN.

Krensky, V.M., (1967). "Reported Self-Concept in Relation to Academic Achievement in an Inner-City Setting." Dissertation Abstracts International, 27, 2325.

Kulik, James E., Kulik, Chen Lin C. (1987) Computer Based Instruction: What 200 Evaluations Say. Paper presented at the Annual Convention of the Association for Educational Communications and Technology (Atlanta, GA, February 26-March 1, 1987).

Kulik, J., Bangert, R., and Williams, G. (1983). Effects of computer-based teaching on secondary school students. Journal of Educational Psychology, 75, pp. 19-23.

Kulik, J.A., & Kulik, C.C. (1984). Synthesis of research on effects of accelerated instruction. Educational Leadership, 42, 84-89.

Lecky, Prescott (1945). Self-Consistency: A Theory of Personality, New York: Island Press.

Leonard, William H. (1985) Biology Instruction by Interactive Videodisc or Conventional Laboratory: A Qualitative Comparison. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (58th, French Lick Springs, IN, April 15-18, 1985).

Lepper, M.R. (1982). Microcomputers in Education: Motivational and Social Issues. Stanford University: Department of Psychology.

Levie, W.H. & Dickie, K. (1973). The analysis and application of media. In R.M.W. Travers (Ed.) Second Handbook of Research on Teaching. Chicago: Rand McNally.

Levin, J. and H.S. Fowler (1984). "Sex, Grade and Course Differences in Attitudes that are Related to Cognitive Performance in Secondary Science." Journal of Research in Science Teaching, 21(2): 151-166.

Lockheed, M. E. (Ed.) (1985a). Women, girls, and computers: A first look at the evidence. Sex Roles, 133/4, 115-121.

Loevinger, J. (1966). "The Meaning and Measurement of Ego Development." American Psychologist, 21, pp. 195-206.

Lueptow, L.B. (1984). Adolescent sex roles and social change, New York: Columbia University Press.

Lysakowski, Richard S. & Walberg, Herbert J. (1981). Classroom reinforcement and learning: A quantitative synthesis. Journal of Educational Research: 1981 Nov-Dec Vol. 75(2), pp. 69-77.

Mandanich, E.B. and Corno L. (1985). Cognitive Engagement Variations Among Students of Different Ability Level and Sex in a Computer Problem Solving Game, Sex Roles, 133/4, pp. 241-251.

Mandinach, E. B. (1984). Clarifying the "A" in CAI for Learners of Different Abilities, paper presented at the annual meeting of the American Educational Research Association, New Orleans.

Martin, B.L., & Briggs, L.J. (1986). The affective and cognitive domains: Integration for instruction and research. Englewood Cliffs, NJ: Educational Technology Publications.

Martorella, P. (1983). Interactive video systems in the classroom. Social Education, 47(5), pp. 325-7.

Maslow, Abraham, Motivation and Personality, New York: Harper and Brothers, 1954.

Matta, Khalil F. and Kern, Gary M. (1989). A Framework for Research in Computer-Aided Instruction: Challenges and Opportunities. Computer Education, pp. 77-84.

Maynes, Dennis D., and Olsen, James B., (PH.D.) (1988). An Equating Study Between the Hueneme Computerized Interactive Test and the California Achievement Test. Hueneme School District: 1988 Equating.

McDonald, F.J. (1976). Report on phase II of the Beginning Teacher Evaluation Study. Journal of Teacher Education, 27(1), pp. 39-42.

McMillan, J.H., and Schumacher, S. (1984). Research in Education. Canada: Little, Brown and Company.

Mead, H. G., Lewis, A. (1934). Mind, Self and Society. Chicago: University of Chicago Press.

Meierhenry, W.C. (1983). Current research in educational media and technology: A survey in J.W. Brown & S.N. Brown, Educational Media Yearbook 1983. Littleton, CO: Libraries Unlimited.

Meierhenry. W.C. (1984). A brief history of educational technology. In J.W. Brown and S.N. Brown, Educational Media Yearbook 1984. Littleton, Colorado: Libraries Unlimited.

Michaud, David, (1979). "The Effects of a Group Enhancement Program on Self-Concept, Behavior and Academic Achievement of Fourth and Fifth Grade Students," Dissertation Abstracts, 27, 3886A, Order No. 8105434.

Moursund, D. (Ed.). (1984). Computer equity (Special Issue). The Computing Teacher, 11, (8).

Murphy, G. (1947). Personality, New York: Harper and Row.

Nails, Odell (1970). "Positive Self-Concept as an Influence for Academic Achievement in Inner City Schools Jefferson Jr. High School/Whittier", Jefferson Jr. High School/Whittier," Dissertation-University Microfilms International, Ann Arbor, MI.

National Science Board, National Science Foundation. Today's Problems, Tomorrow's Crises, A Report of the National Science Board Commission on Precollege Education in Mathematics, Science and Technology, Washington, D.C., 1982, P.1.

Newman, Richard S. (1984). "Children's Achievement and Self-evaluations in Mathematics: A Longitudinal Study," Journal of Educational Psychology, Vol. 76 No. 5, pp. 857-873.

Nickerson, Raymond S. (1988). Technology in Education in 2020: Thinking About the Not-Distant Future, Technology in Education: Looking Toward 2020. 1, 1-9.

O'Neill, Paula Newport, (Ed.D), (1989). A comparison of student achievement and attitude between instruction via interactive videodisc instruction and classroom lecture. University of Huston.

Ordovensky, Pat. "Educators Fall Down on Jobs, Schools Failing To Teach Skills Needed in Today's High Technology Society," in James W. Brown (Ed.), Educational Media Yearbook, 1983, Littleton, Colorado: Libraries Unlimited, Inc., p. 126.

Pea, R. D. (1984), The Aims of Software Criticism: Reply to Professor Papert, Educational Researcher, 16:5, pp. 4-8.

Pea, R.D., and Kurland, D.M. (1984). On the cognitive effects of learning computer-programming. New Ideas, 2(2). 137-168.

Percival, Fred (1988). A Handbook of Educational Technology: a Practical Guide for Teachers, Second Edition, Nichols Publishing, New York, NY.

Perez, E.C. and M.A. White, (1985), Student Evaluation of Motivational and Learning Attributes of Microcomputer Software, Journal of Computer-Based Instruction, 12:2. pp. 39-43.

Pirtle, Klaire B. (1982). Cross-Age Tutoring by High School Students and the Affective Perception of Fourth Graders. (Doctoral Dissertation, University of Arizona, 1982). University Microfilms International.

Purkey, W. and Nowak, J. (1984). Inviting School Success. (2nd ed.). Belmont, CA: Wadsworth.

Purkey, W. (1978). Inviting School Success: A Self-Concept Approach to Teaching and Learning. Belmont, California: Wadsworth Publishing Company.

Purkey, W. (1970). Self-Concept and School Achievement. Englewood Cliffs, N.J.: Prentice Hall.

Quandt, I. (1979). He just thinks he can't read. Childhood Education, 49, 438-440.

Quick, D. (1973). Toward positive self-concept. The Reading Teacher, 49, 438-440.

Recommendations from the Commission on Public School Administration and Leadership (Oct.-1988). Return to Greatness: Strategies for Powerful Improvements in Our Schools.

Rezabek, Landra L. (1988). Perceived Credibility of Female Peer Talent in the Context of Computer Instruction. Proceedings of Selected Research Papers presented at the annual meeting of the Association for Educational Communications and Technology (New Orleans, LA. January 14-19, 1988).

Riel, M. M., (1985). The Computer Chronicles Newswire: A Functional Learning Environment for Acquiring Literacy Skills. Journal of Educational Computing Research, 1:3, pp. 317-337.

Rogers, C.R. (1959). Counseling and Psychotherapy: Theory and Practice. New York: Harper Row Publishers.

Rogers, C.R. (1969) Freedom to Learn. Columbus, OH: Merrill Publishing Co.

Rogers, C.R. (1951) Client-Centered Therapy. Boston: Houghton Mifflin Co.

Rosenberg, M., (1979). Conceiving the Self. New York: Basic Books.

Rosenberg, M., (1965). Society and the Adolescent Self-Image. Princeton, N.J.: Princeton University Press.

Ross, S.M., and Morrison, G.R. (1989). In search of a happy medium in instructional technology research: Issues concerning external validity, media replications, and learner control, Educational Technology Research and Development, 37, 19-33.

Rubin, D.P. and Weisgerber, R.A. (1985). The center for research and evaluation in the application of technology to education. The Journal 12(6), 83-87.

Russell, A. (1984). From videotape to videodisc: From passive to active instruction. Journal of Chemical Education, 61(10).

Russell, D., Purkey, W., & Siegel, B. (1982). The artfully inviting teacher: A hierarchy of strategies. Education, 103, 35-38.

Schaffer, L. & Hannafin, M. (1984). The effects of progressive interactivity on learning from interactive video. Educational Communication and Technology Journal, 33(2).

Schramm, W. (1977) Big Media, Little Media. Beverly Hills, CA: Sage.

Schrock, S.A. (1979). Sex differences in problem-solving performance: The roles of ability, cognitive style, and attitude. Unpublished doctoral dissertation, Indiana University, 1979.

Schubert, D.G. (1978). Reading improvement through self-concept development. Reading Improvement, 15, 157-159.

Scott, K.P. (1984). Effects of an intervention on middle school pupils' decision making, achievement and sex role flexibility. Journal of Educational Research, 1984, 77, 369-375.

Sealfon, P. (1986, December 15). Fighting the computer gender gap. American Way, pp. 54-57.

Seattler, Paul (1968). A History of Instructional Technology, New York: McGraw Hill, 1968, p. 52.

Shepard, D. (1982). Comprehensive High School Reading Methods, (3rd ed.). Columbus, OH: Charles E. Merrill Publishing Company.

Silber, Kenneth (1981). "Some Implications of the History of Educational Technology, We're All in This Together," in James Brown (Ed.), Educational Media Yearbook, 1981, Littleton, CO: Libraries Unlimited, pp. 18-26.

Sleeman, Phillip J. (1979). Instructional Media and Technology, Longman, Inc., New York, NY.

Smail, Barbara (1985). The Girls into Science and Technology. Journal of Curriculum Studies, 351-354.

Smail, B and A. Kelly. "Sex Differences in Science and Technology Among 11-Year-Old School Children: I - Cognitive." Research in Science and Technological Education, 2(1): 61-76, 1984.

Smith, C.B., & Elliott, P.G. (1979). Reading activities for middle and secondary schools: A handbook for teachers. New York: Holt, Rinehart, & Winston.

Smith, L.R. (1977). Aspects of teacher discourse and student achievement in mathematics. Journal for Research in Mathematics Education, 8, 195-204.

Soares, A.T. & Soares, L.M. (1969). "Self-Perceptions of Culturally Disadvantaged Children," American Educational Research Journal, Vol.6, No. 1.

Soares, Anthony T. and Soares, L.M. (1980). The Affective Perception Inventory, Test Manual/Intermediate Level.

Soares, A. T. and Soares, L. M. (1985). Composite Test manual, rev. ed., The Self-Perception Inventory, Trumbull, Ct.: Soares Associates.

Stallings, J.A. (1978, March). Teaching basic reading skills in secondary schools. Paper presented at the annual meeting of the American Educational Research Association, Toronto, (ERIC Document Reproduction Service No. ED 166 634).

Steinkamp, M.W., & Maehr, M.L. (1984). Gender differences in motivational orientations toward achievement in school science: A quantitative synthesis. American Educational Research Journal, 1984, 21, 39-59.

Tamir, P., Welch, W., & Rakow, S. (1985). The influence of science class attitudes and teacher image on student outcomes. Journal of Research and Development in Education, 18, pp. 26-32.

Thomas, R. Murray and Kobayashi, Victor N. (1987). Educational Technology - Its Creation, Development and Cross-Cultural Transfer.

Turkle, S. (1984). The Second Self: Computers and the Human Spirit. Simon and Schuster, New York, 1984.

Urrows, H. and Urrows E. (1984). Videotext in British and French Education, Videodisc and Optical Disk, 4:3, pp. 190-198.

Wallace, J.G., & Reizenstein, D.C. (1978). Self-realization: A case study. Academic Therapy, 13, 305-312.

Websters New Collegiate Dictionary (1977). G&C Merriam Company, Springfield, Massachusetts.

White, Mary-Alice (1989). Current Trends in Education and Technology as Signs to the Future. Education and Computing, International Journal, vol. 5, pp. 3-10.

Willey, Liane Holliday (1988). The effects of selected Writing-to-Learn Approaches on High School Students' Attitudes and Achievement (Doctoral dissertation, Mississippi State University, 1988). University Microfilms International, 1990.

Williams, R.L. and Cole, S., "Self-Concept and School Adjustment," Personnel and Guidance Journal, 1968, Vol. 46, pp. 478-481.

Williams, F. and Williams, V.(1984). Gender Differences in Motivational Orientations toward Achievement in School Science: A quantative synthesis. American Educational Research Journal, Vol. 21, pp. 39-59.

Willis, J.. (1985). Student affective characteristics and academic achievement. (Doctoral dissertation, University of Georgia, 1985). Dissertations Abstracts International, 47, 25.

Winkle, L., and Mathews, W. (1982, January). Computer equity comes of age. Phi Delta Kappa, pp. 314-315.

Wolfe, P. (1984). Instructional skills trainers' manual. Napa, CA: Napa County Office of Education.

Wooley, R. (1982). Training applications: Making interactive video technology work effectively. In M. DeBloois (Ed.) Videodisc/Microcomputer Courseware Design. Englewood Cliffs, NJ: Educational Technology Publications.

Wyle, Ruth C., (1974) The Self-Concept, Lincoln, Nebraska: University of Nebraska Press.

Ybarrondo, A. (1984) A Study of the Effectiveness of Computer-assisted Instruction in the High School Biology Classroom. ERIC Document #ED265015, SE046309.

APPENDIX A

SOARES AND SOARES AFFECTIVE PERCEPTION INVENTORY QUESTIONNAIRES

STUDENT SELF

People are different in the ways they think about themselves partly because of the different roles they take. A boy can be a son, a hockey player, and a student; or a girl can be a daughter, a sister, a baseball player, and a student -- all at the same time. What kind of <u>student</u> do you think you are right now? Give a picture of yourself as a student by placing a check in one of the four spaces on the line between the sentences. Each space tells how well the words agree with how you look at yourself as a student.

<u>Example:</u>

I am happy in school. _____ : _____ : _____ : _____ I am unhappy in school.

very happy	more happy than unhappy	more unhappy than happy	very unhappy

---

(1)	I do well in school.	_____	_____	_____	_____	I do poorly in school.	(1)
(2)	I get things done on time in school.	_____	_____	_____	_____	I do not get things done on time in school.	(2)
(3)	I am creative.	_____	_____	_____	_____	I am not creative.	(3)
(4)	I like to learn.	_____	_____	_____	_____	I do not like to learn.	(4)
(5)	I work hard in school.	_____	_____	_____	_____	I am lazy in school.	(5)
(6)	I like to work with others in school.	_____	_____	_____	_____	I like to work by myself in school.	(6)
(7)	I am curious about things in school.	_____	_____	_____	_____	I am not curious about things in school.	(7)
(8)	I keep things in order.	_____	_____	_____	_____	I do not keep things in order.	(8)

(9)	I learn quickly.	____ : ____ : ____ : ____	I learn slowly.	(9)
(10)	I care about school work.	____ : ____ : ____ : ____	I do not care about school work.	(10)
(11)	I do neat work in school.	____ : ____ : ____ : ____	I do sloppy work in school.	(11)
(12)	I do not worry about grades in school.	____ : ____ : ____ : ____	I worry about grades in school.	(12)
(13)	I am not afraid of failing in school.	____ : ____ : ____ : ____	I am afraid of failing in school.	(13)
(14)	I do things on my my own in school.	____ : ____ : ____ : ____	I do not do things on my own in school.	(14)
(15)	I am smart in school.	____ : ____ : ____ : ____	I am not smart in school.	(15)
(16)	I can express myself in school.	____ : ____ : ____ : ____	I cannot express myself in school.	(16)
(17)	I am willing to try things in school.	____ : ____ : ____ : ____	I am not willing to try things in school.	(17)
(18)	I am a leader in school.	____ : ____ : ____ : ____	I am a follower in school.	(18)
(19)	I am sure of myself in school.	____ : ____ : ____ : ____	I am not sure of myself in school.	(19)
(20)	I feel good when I am in school.	____ : ____ : ____ : ____	I do not feel good when I'm in school.	(20)

SCIENCE PERCEPTIONS

How do you feel about science? How do you see yourself as a student in science? Give a picture of how you feel by placing a check in one of the four spaces on the line between the sentences. Each space tells how you look at science or at yourself as a science student.

<u>Example:</u>

	very good	more good than poor	more poor than good	very poor	
I am good at remembering the names of trees.	____	____	____	____	I'm poor at remembering the names of trees.

---

(1)	I like science.	____	____	____	____	I do not like science.	(1)
(2)	Science is easy for me.	____	____	____	____	Science is hard for me.	(2)
(3)	I think science is interesting.	____	____	____	____	I do not think science is interesting.	(3)
(4)	I learn a lot from science class.	____	____	____	____	I do not learn a lot from science class.	(4)
(5)	I think science is a waste of time.	____	____	____	____	I think science is a waste of time.	(5)
(6)	I like to do experiments.	____	____	____	____	I do not like to do experiments.	(6)
(7)	I am good at working out science problems.	____	____	____	____	I am not good at working out science problems.	(7)
(8)	I am good at thinking up new ideas in science.	____	____	____	____	I am not good at thinking up new ideas in science.	(8)
(9)	I like to discover things in science.	____	____	____	____	I do not like to discover things in science.	(9)
(10)	I am good in science.	____	____	____	____	I am not good in science.	(10)

SELF CONCEPT

What kind of person do you think you are right now? Give a picture of yourself by placing a check in one of the four spaces on the line between the sentences. Each space tells how well the words agree with how you see yourself as a person.

Example:

I am a tall person.	____ :	____ :	____ :	____	I am a short person.	(1)
	:very :tall	:more :tall :than :short	:more :short :than :tall	:very :short		

---

(1)	I am masculine.	____ :	____ :	____ :	____	I am feminine.	(1)
(2)	I do not mind changes.	____ :	____ :	____ :	____	I do not like things to change.	(2)
(3)	I think of others.	____ :	____ :	____ :	____	I think only of myself.	(3)
(4)	I am a relaxed person.	____ :	____ :	____ :	____	I am a nervous person.	(4)
(5)	I think before doing anything.	____ :	____ :	____ :	____	I do things without thinking.	(5)
(6)	I stand on my own two feet.	____ :	____ :	____ :	____	I go along with the gang.	(6)
(7)	I am a happy person.	____ :	____ :	____ :	____	I am not a happy person.	(7)
(8)	I can wait for things.	____ :	____ :	____ :	____	I want things right away.	(8)
(9)	I make friends easily.	____ :	____ :	____ :	____	I do not make friends easily.	(9)
(10)	I like people as they are.	____ :	____ :	____ :	____	I find fault with people.	(10)
(11)	I am kind to people.	____ :	____ :	____ :	____	I often hurt people.	(11)
(12)	I like to be with people.	____ :	____ :	____ :	____	I would rather be alone.	(12)
(13)	I am not afraid of things.	____ :	____ :	____ :	____	I am afraid of many things.	(13)
(14)	I am not easily hurt.	____ :	____ :	____ :	____	I am easily hurt.	(14)

(15)	I can control my temper.	_____:_____:_____:_____	I lose my temper easily.	(15)
(16)	I do most things well.	_____:_____:_____:_____	I do not do most things well.	(16)
(17)	I trust people.	_____:_____:_____:_____	I do not trust people.	(17)
(18)	I am sure of myself.	_____:_____:_____:_____	I am not sure of myself.	(18)
(19)	I'm glad I am me.	_____:_____:_____:_____	I would like to be someone else.	(19)
(20)	I am somebody.	_____:_____:_____:_____	I am nothing	(20)

SCHOOL PERCEPTIONS

How do you look at school and the people in it? Give a picture of the school would as you see it by placing a check in one of the four spaces on the line between the sentences. Each space tells how you feel about your school and the people in it.

Example:

People are friendly at school.	very friendly	:more friendly	:more unfriendly	:very unfriendly	People are unfriendly at school.

(1)	Teachers like students	____	____	____	____	Teachers do not like students.	(1)
(2)	Teachers take me as I am.	____	____	____	____	Teachers pick on me.	(2)
(3)	Teachers are good at their job.	____	____	____	____	Teachers are not good at their job.	(3)
(4)	Teachers are pleasant.	____	____	____	____	Teachers are unpleasant.	(4)
(5)	Teachers try to help students.	____	____	____	____	Teachers are not interested in student problems.	(5)
(6)	Teachers treat everyone fairly.	____	____	____	____	Teachers have favorites.	(6)
(7)	Teachers are patient.	____	____	____	____	Teachers are not patient.	(7)
(8)	Teachers are well prepared.	____	____	____	____	Teachers do not know what they are doing.	(8)
(9)	Teachers work hard.	____	____	____	____	Teachers do not work hard.	(9)
(10)	Teachers are happy people.	____	____	____	____	Teachers are unhappy people.	(10)
(11)	Teachers are interesting.	____	____	____	____	Teachers are boring.	(11)
(12)	Teachers want me to do well.	____	____	____	____	Teachers do not want me to do well.	(12)
(13)	Teachers seem to care about me.	____	____	____	____	Teachers do not care about me.	(13)
(14)	I like most of my my teachers.	____	____	____	____	I do not like most of my teachers.	(14)

(15)	The principal works well with teachers.	____:____:____:____	The principal does not work well with teachers.	(15)
(16)	The principal cares for students.	____:____:____:____	The principal does not care for students.	(16)
(17)	The principal is helpful.	____:____:____:____	The principal is not helpful.	(17)
(18)	Kids try to do the right thing in school	____:____:____:____	Kids pay little attention to rules in school.	(18)
(19)	Kids let you do what you want.	____:____:____:____	Kids make you do what they want to do.	(19)
(20)	Kids at school get along with others.	____:____:____:____	Kids at school are snobs.	(20)
(21)	Kids work hard in school.	____:____:____:____	Kids don't work hard in school.	(21)
(22)	Kids at school seem to like me.	____:____:____:____	Kids at school do not seem to like me.	(22)
(23)	I enjoy myself at school.	____:____:____:____	I do not enjoy myself at school.	(23)
(24)	School lets me do things I want to do.	____:____:____:____	School is a jail.	(24)
(25)	School is a friendly place.	____:____:____:____	School is an unfriendly place.	(25)
(26)	School is a pleasant place.	____:____:____:____	School is an unpleasant place.	(26)
(27)	There are many things at school to do.	____:____:____:____	There are few things at school to do.	(27)
(28)	I like the subjects we study at school.	____:____:____:____	I do not like the subjects we study at school.	(28)
(29)	The school equipment and materials are o.k.	____:____:____:____	The school equipment and materials are not o.k.	(29)
(30)	I like school.	____:____:____:____	I do not like school.	(30)

APPENDIX E

LETTER TO THE PRINCIPALS

Hueneme School District
205 North Ventura Road
Port Hueneme, California 93041
488-3588
November 20, 1989

Dear Principals,

As per our discussion last week, I will be doing a research project at your schools during the spring semester. I would like to meet with you and your eighth grade science teacher on November 27th at 3:00 p.m. at the district office to discuss the project and timelines. I have listed a tentative schedule for the testing dates and times below. If you have any questions, please feel free to bring them up at our meeting.

November 30, 1989	-	Meet with students and hand out parent permission slips.
December 14, 1989	-	Permission slips due back to me from the participating students.
January 17, 1990		Have a final listing students who have permission slips back and who will participate in the study.
January 29, 1990	-	Administer Soares and Soares API at Blackstock Junior High
January 30, 1990	-	Administer Soares and Soares API at E.O. Green Junior High
January 31, 1990	-	Administer the HCIST at E.O. Green Junior High and Blackstock Junior High
May 29, 1990		Administer Soares and Soares API at Blackstock Junior High
May 30, 1990	-	Administer Soares and Soares API at E.O. Green Junior High
May 31, 1990	-	Administer HCIST at E.O. Green Junior High and Blackstock Junior High

Sincerely,

Alan K. Nishino

APPENDIX C

LETTER TO THE PARENTS

Hueneme School District
205 North Ventura Road
Port Hueneme, California 93041
488-3588
November 30, 1989

Dear Parent,

Your child has been randomly selected to participate in a research study conducted by me, a doctoral student at the University of Southern California. This study is strictly voluntary and is not connected with any academic testing or grading which your child will be given during the regular school year. The results of this study will address group responses not individual responses and therefore will be highly confidential in regard to your child.

The first part of the study will be administered in January of 1990. There will be a follow-up in May of 1990. This study will not only assist me in the doctoral program but will also provide important information in regard to the science programs at both junior high schools.

I would again like to emphasize that this study is voluntary and will not affect your child's status at school. If you have any questions, please do not hesitate to contact me at Parkview School, 486-2669. I thank you in advance for your consideration in assisting me.

Sincerely,

Alan K. Nishino

IF YOU DO NOT WANT YOUR CHILD TO PARTICIPATE IN THIS STUDY, PLEASE SIGN AND RETURN THE BOTTOM PORTION OF THIS LETTER BY DECEMBER 14, 1989.

I do not want my child to participate in the USC doctoral study.

Child's Name____

Parent Signature____________________________________

APPENDIX D

HUENEME COMPUTERIZED INTERACTIVE TEST ON SCIENCE

Listing of Objectives
Science, Grade 8

Objective Short Form	Items	Objective Text
scientific method	(4)	The student will demonstrate an understanding of the scientific method.
ID direct observation	(4)	The student will be able to identify a direct observation
grph/chrt,compar	(4)	The student will demonstrate proficiency in reading graphs and charts, showing comparisons and identifying patterns.
ordr by meas, seq,etc.	(4)	The student will order objects or events by measurement, developmental sequence or other characteristics.
arrang by charistic	(4)	the student will arrange objects or events in categories, such as by using characteristics or relationships.
ID graphs	(4)	The student will identify graphs or parts of graphs that represent given data.
ID hypothesis	(4)	The student will identify a hypothesis for given information.

ID controls/variable	(4)	The student will identify controls and variables in a given experiment.
draw conclusions	(4)	The student will draw conclusions from data or information given in a text, table or graph.
ID life processes	(4)	The student will identify life processes of all living things, i.e., response to stimuli, reproduction, growth and use of energy.
ID kingdoms	(4)	The student will identify three major kingdoms of living things, i.e., protists, plants, animals.
cell theory	(4)	The student will understand the basic concept of the cell and cell theory.
hydro-atmosphere	(4)	The student will understand the basic interrelationship between the hydrosphere and atmosphere of our planet.
solar system	(4)	The student will have a knowledge of the solar system
types of rocks	(4)	The student will identify the three basic types of rocks

states of matter	(4)	The student will identify the three basic states of matter.
structure of atom	(4)	The student will identify the basic structure of the atom.
safety principle	(4)	The student will identify basic safety principles in the laboratory situation.
science careers	(4)	The student will have a knowledge of careers in science.

APPENDIX E

PRETEST AND POSTTEST
TABLES 6-10

Table 6

Pretest and Posttest Statistics for Student Self-Concept Scores

Group		Pretest		Posttest	
		M	SD	M	SD
Experimental	(n = 58)	23.50	7.59	25.18	6.60
Control	(n = 54)	22.65	9.06	20.96	8.22
Female	(n = 52)	21.19	9.42	21.80	8.75
Male	(n = 60)	24.73	6.86	24.27	6.44
Exp. Male	(n = 32)	23.75	6.66	25.31	5.23
Exp. Female	(n = 26)	23.19	8.77	24.92	8.00
Con. Male	(n = 28)	25.86	7.02	23.07	7.51
Con. Female	(n = 26)	19.19	9.84	18.69	8.49

Table 7

Pretest and Posttest Statistics for Student Self-Perception Scores

Group		Pretest M	Pretest SD	Posttest M	Posttest SD
Experimental	(n = 58)	16.95	13.62	18.48	10.99
Control	(n = 54)	15.76	11.01	16.70	10.29
Female	(n = 52)	17.37	13.23	17.90	10.51
Male	(n = 60)	15.52	11.67	17.38	10.84
Exp. Male	(n = 32)	15.41	11.63	16.38	12.44
Exp. Female	(n = 26)	18.85	15.76	21.08	8.40
Con. Male	(n = 28)	15.64	11.94	18.54	8.76
Con. Female	(n = 26)	15.88	10.17	14.73	11.56

Table 8

Pretest and Posttest Statistics for Student Attitudes and Interest Toward Science Scores

		Pretest		Posttest	
Group		M	SD	M	M
Experimental	(n = 58)	5.65	11.41	10.97	9.11
Control	(n = 54)	8.48	9.21	10.44	9.05
Female	(n = 52)	5.75	9.68	10.60	7.60
Male	(n = 60)	8.12	11.05	10.82	10.19
Exp. Male	(n = 32)	6.15	12.60	9.84	10.95
Exp. Female	(n = 26)	5.04	9.96	12.35	6.07
Con. Male	(n = 28)	10.36	8.65	11.93	9.33
Con. Female	(n = 26)	6.46	9.53	8.84	8.64

Table 9

Pretest and Posttest Statistics for Student School-Perception Scores

Group		Pretest		Posttest	
		M	SD	M	SD
Experimental	(n = 58)	27.43	19.25	29.67	16.62
Control	(n = 54)	27.63	22.75	26.89	17.22
Female	(n = 52)	29.73	16.35	30.04	13.83
Male	(n = 60)	25.62	24.17	26.85	19.19
Exp. Male	(n = 32)	25.19	21.85	26.90	18.50
Exp. Female	(n = 26)	30.19	15.45	33.08	13.66
Con. Male	(n = 28)	26.10	26.97	26.79	20.29
Con. Female	(n = 26)	29.30	17.50	26.79	20.29

Table 10

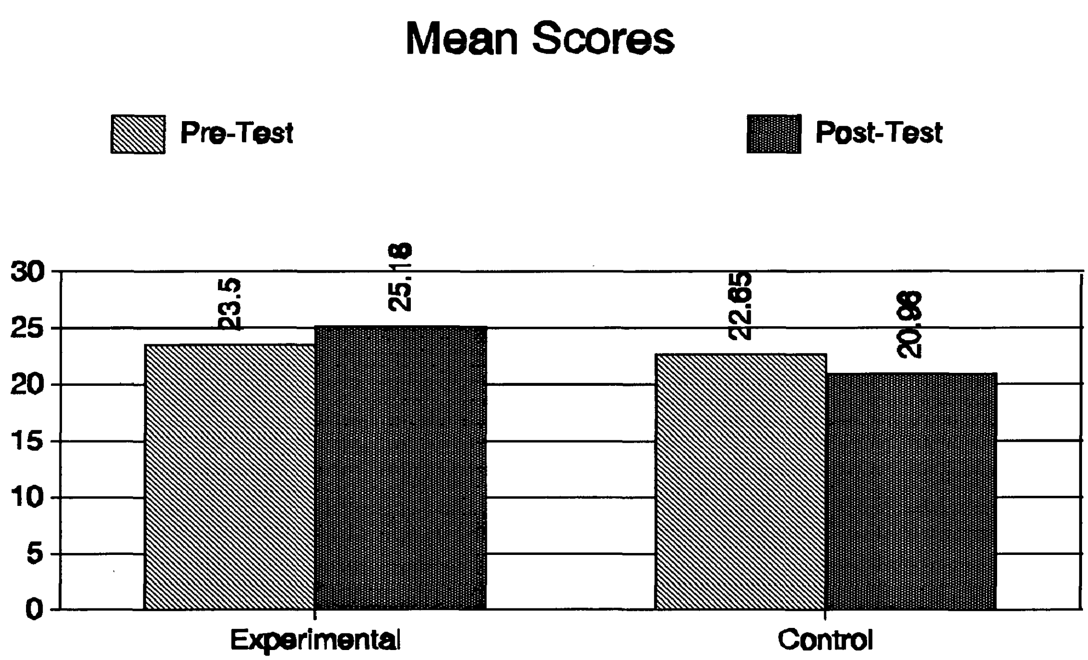
Pretest and Posttest HCITS on Achievement

Group		Pretest		Posttest	
		M	SD	M	SD
Experimental	(n = 58)	39.67	10.23	45.47	8.87
Control	(n = 54)	39.07	8.96	42.24	9.13
Female	(n = 52)	40.46	8.74	44.29	9.31
Male	(n = 60)	38.45	10.27	43.58	8.98
Exp. Male	(n = 32)	37.47	11.03	43.56	9.28
Exp. Female	(n = 26)	42.38	8.58	47.80	7.88
Con. Male	(n = 28)	39.57	9.39	43.60	8.78
Con. Female	(n = 26)	38.54	8.62	40.80	9.44

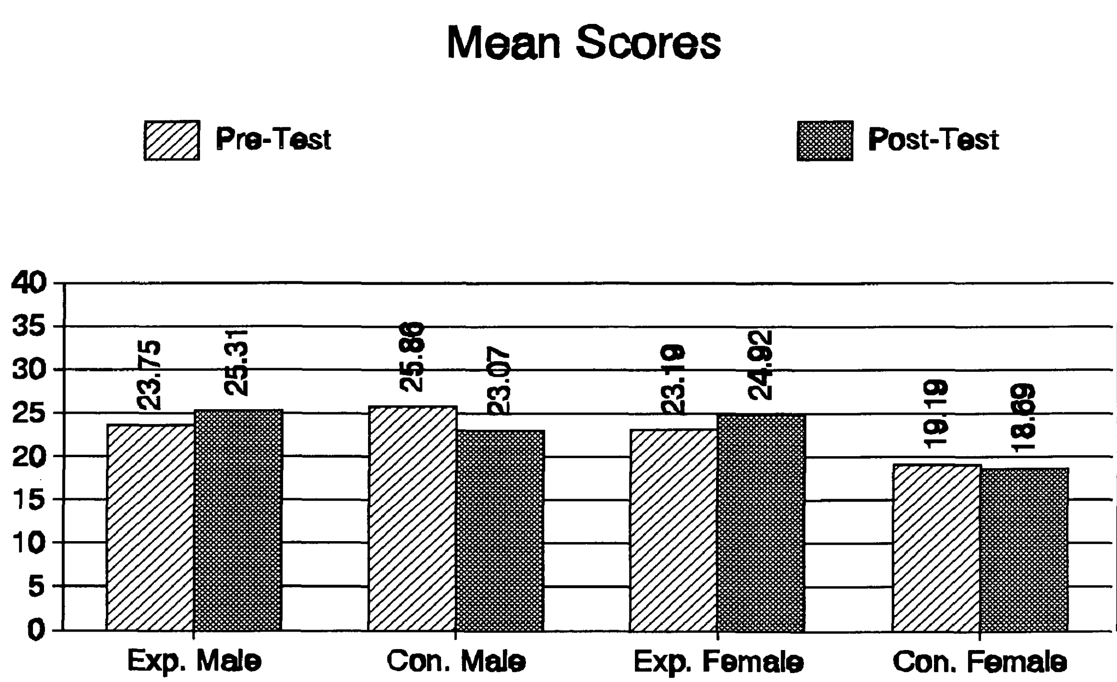
APPENDIX F

FIGURES 1-10

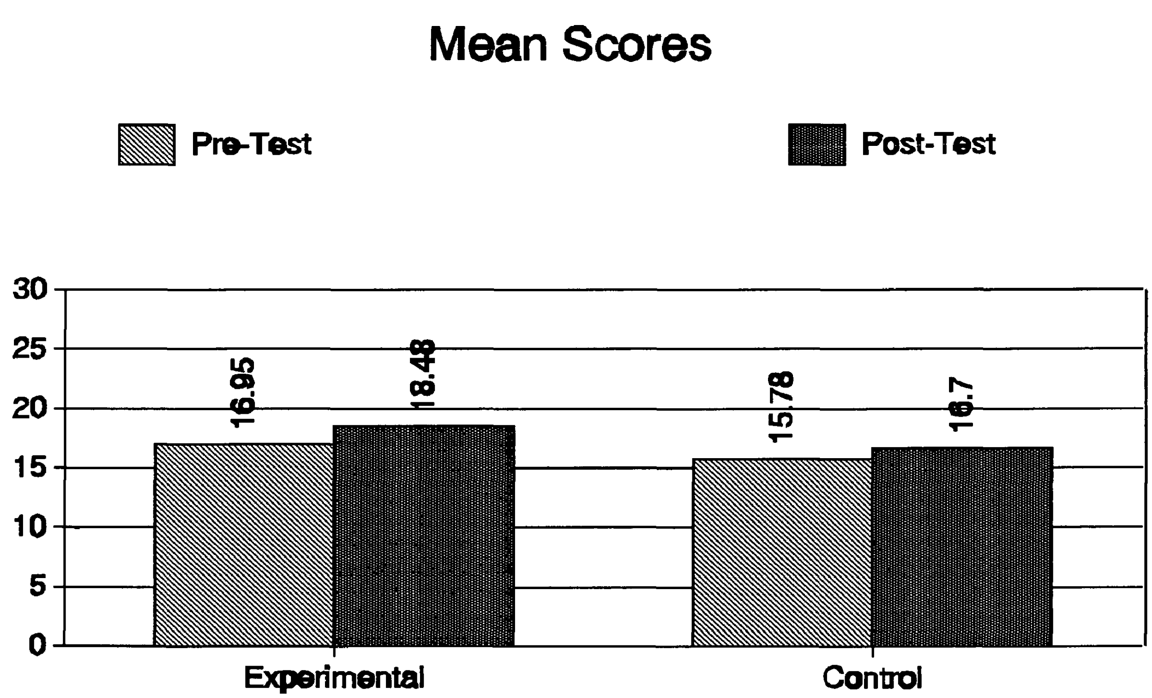
Student Self-Concept Experimental and Control Group Bar Graph



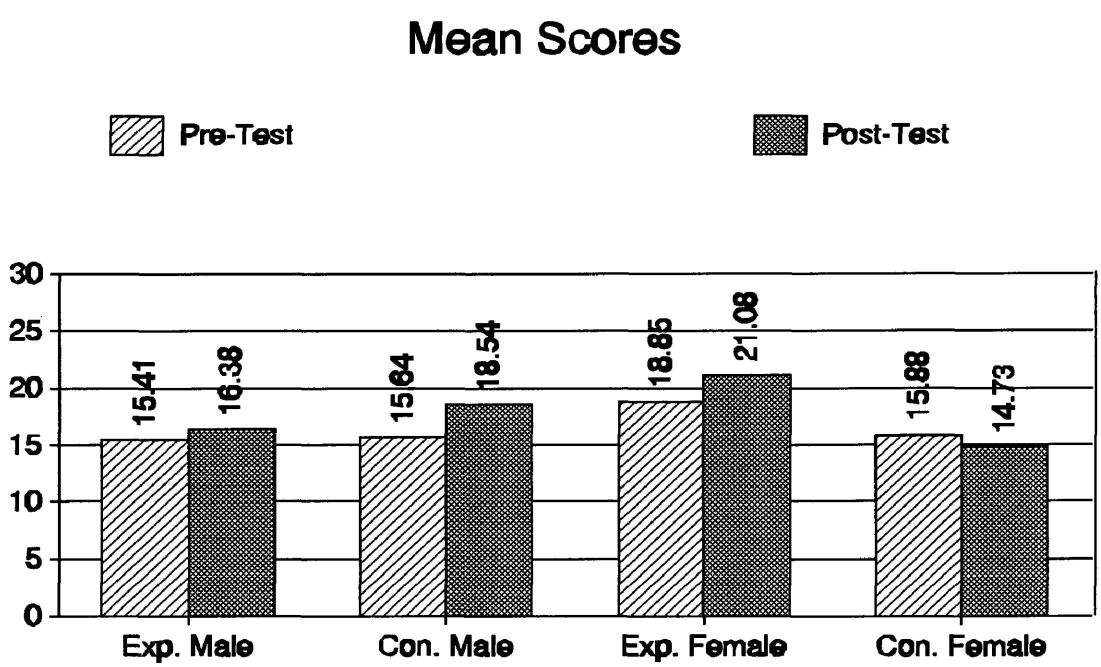
Student Self-Concept Experimental Male/Female and Control Male/Female Bar Graph



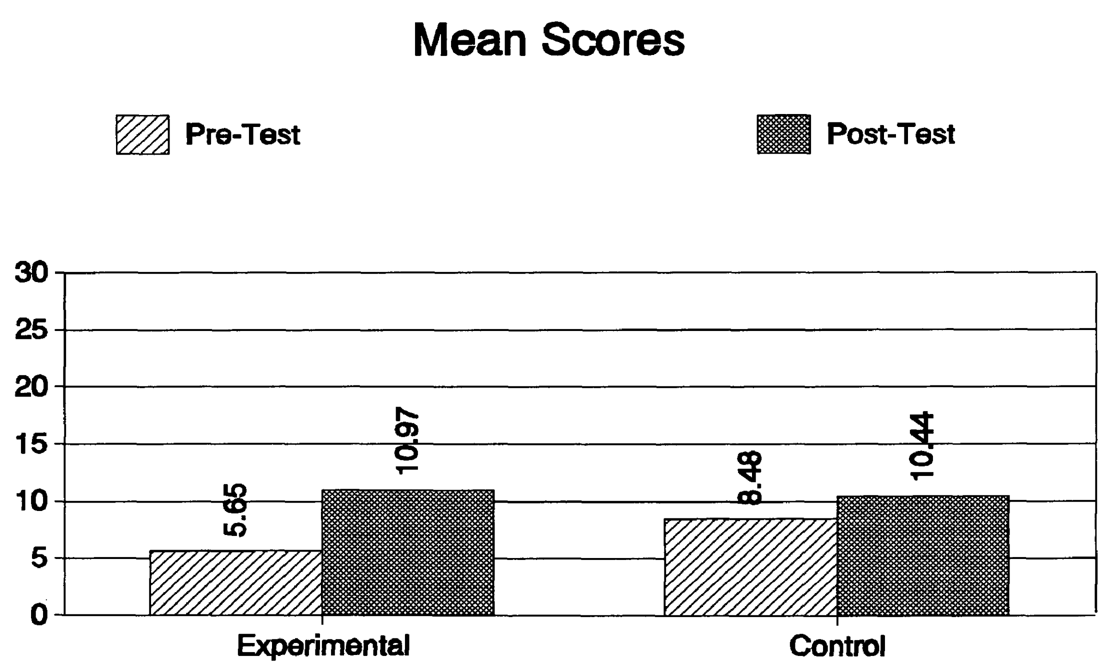
Student-Self Perception Experimental and Control Group Bar Graph



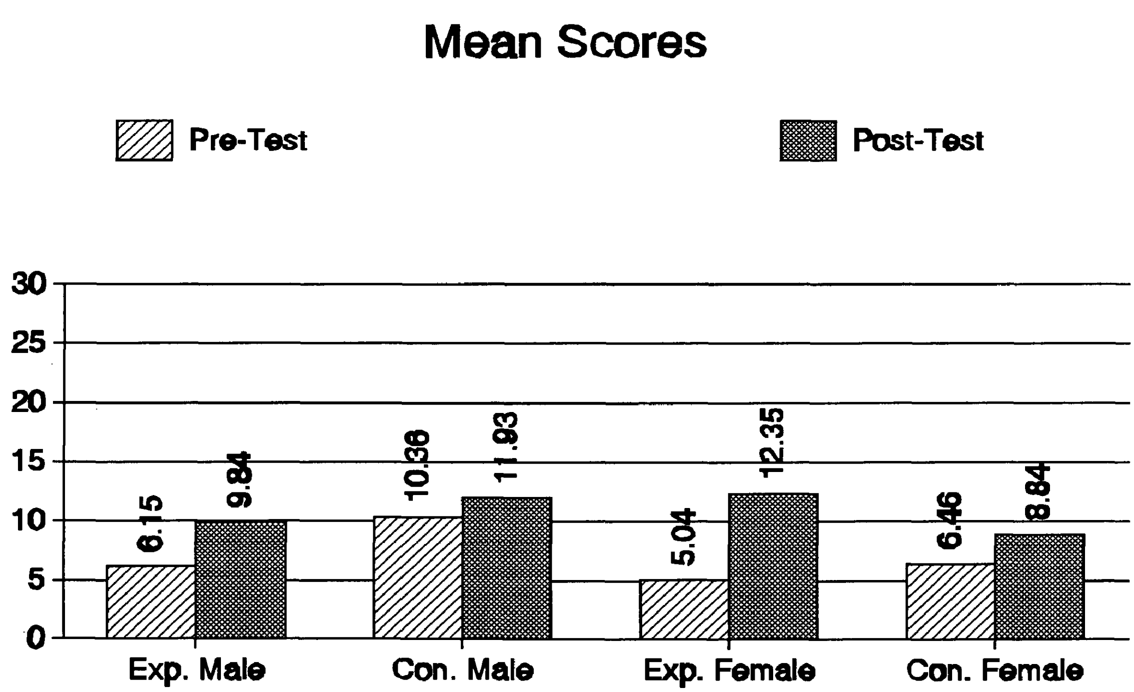
Student Self-Perception Experimental Male/Female and Control Male/Female Bar Graph



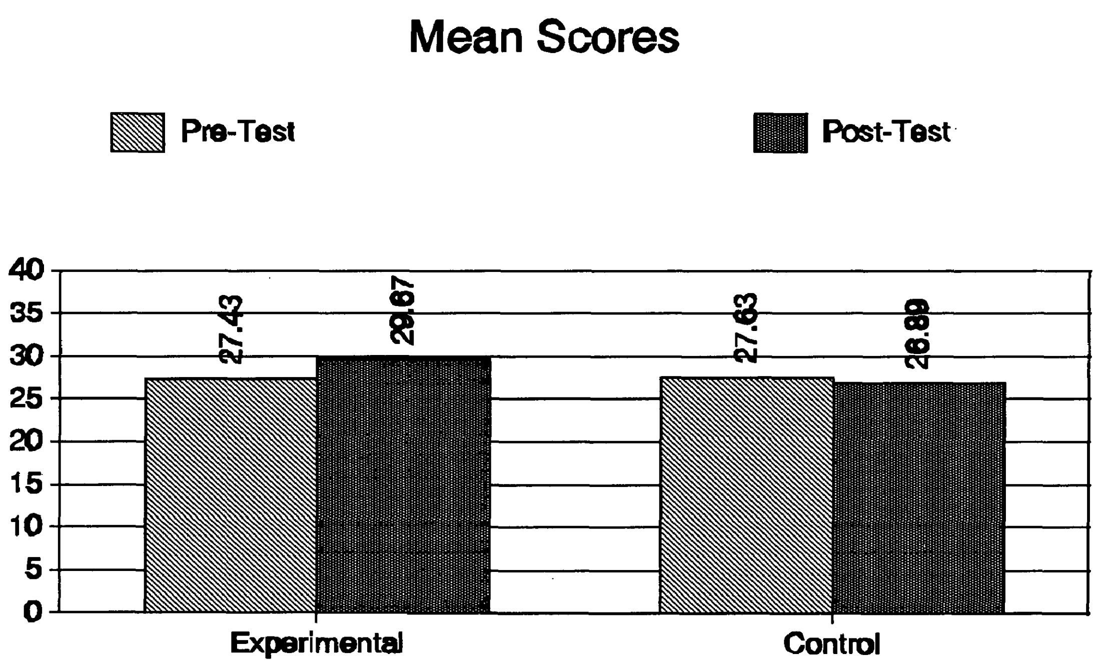
Student Attitude and Interest Toward Science Experimental and Control Group Bar Graph



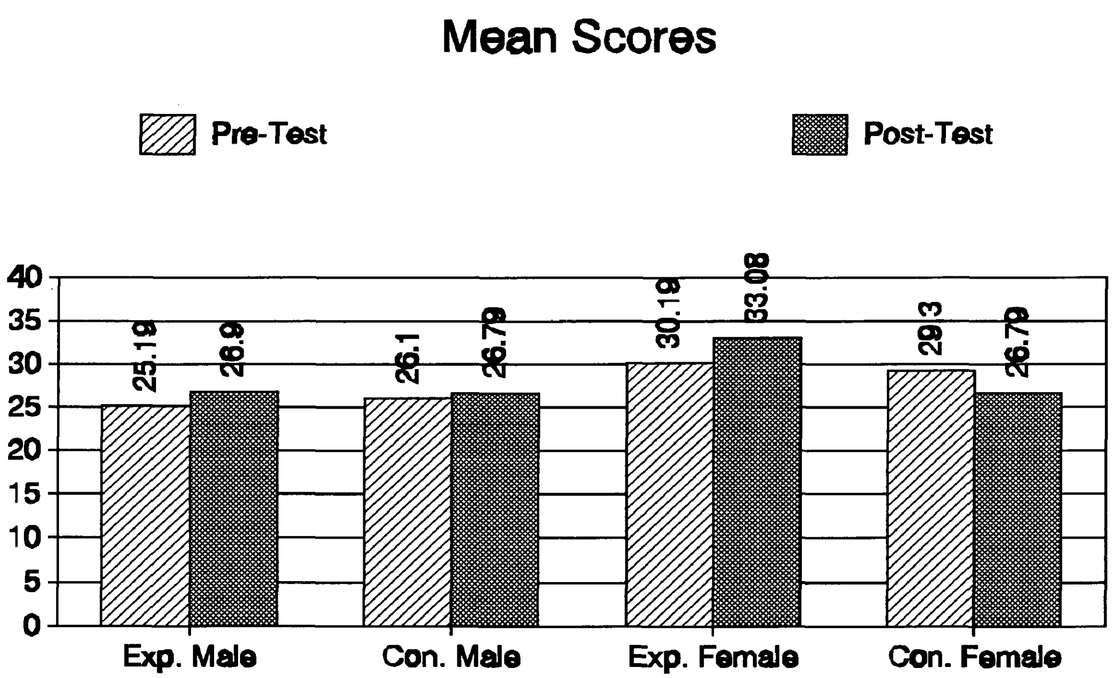
Student Attitude and Interest Toward Science Experimental Male/Female and Control Male/Female Bar Graph



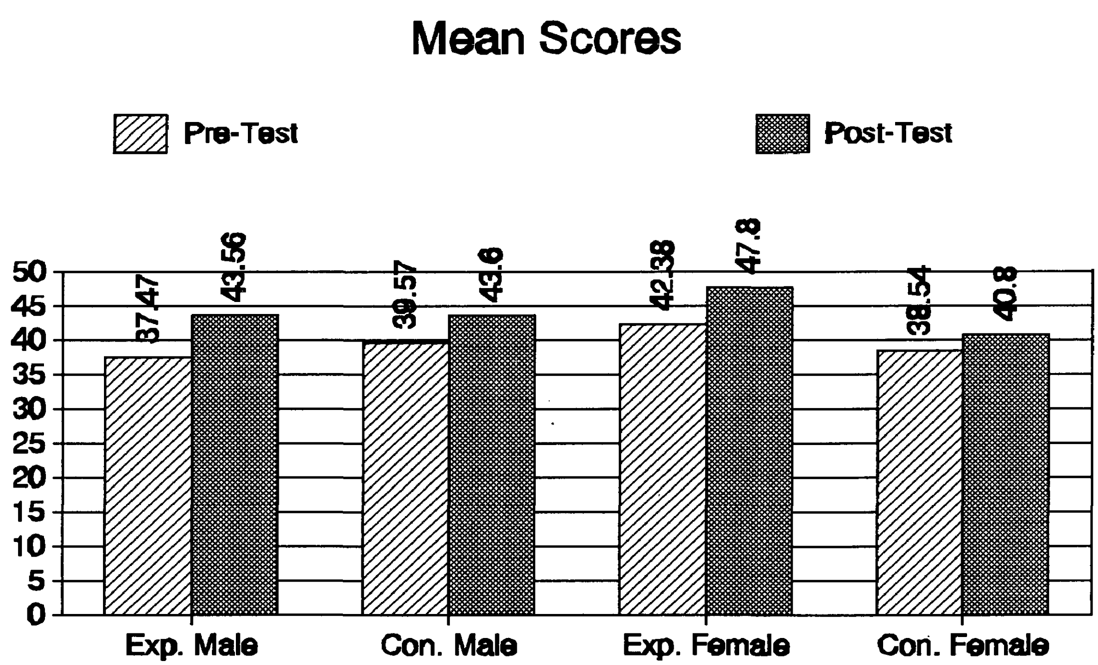
Student School Perception Experimental and Control Group Bar Graph



Student School Perception Experimental Male/Female and Control Male/Female Bar Graph



Hueneme Computerized Interactive Test on Science Achievement Experimental Male/Female and Control Male/Female Bar Graph



Hueneme Computerized Interactive Test on Science Achievement Experimental and Control Group Bar Graph