COMPUTER-ASSISTED CHAPTER 1 INSTRUCTION

by

Rosalyn P. Ewing

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APPROVED:

Dr. Kenneth E. Underwood
Co-chairman

Dr. Jimmie C. Fortune
Co-chairman

Dr. Edris W. Jones

Dr. Robert R. Richards

Dr. Andrew T. Carrington

Dr. Glen I. Earthman

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R. P. E.

DEDICATION

To my God, Jehova-Jirah, my Provider - For giving His son, Jesus Christ, that I might be saved, and have eternal life.

To my parents, and the late - For giving me life.

To my paternal grandmother, the late , and and her sister, my great aunt, the late - For jointly raising me, and instilling in me Christian principles and values, and a conviction to strive for excellence in all my endeavors.

To my cousin, the late - For the influence of all maternal love, patience, and sweet, Godly disposition upon my life.

To my beloved son, - For being my inspiration, and giving me the love, joy, and happiness that only a son can give.

To my surrogate mother, - For being my mother, in the absence of my own.

To my treasured friends, - For constant encouragement and moral support, without reserve.

To my pastors, The Reverends , and their pastoral staff - For their love, prayers, and teachings of basic Biblical truths that provided me with shelter, protection, encouragement, and inspiration when I needed it most; for being truly annointed of the Holy Spirit; and for letting me see Jesus and His realness through them.

R. P. E.

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Chapter One

INTRODUCTION

Recognition of the national need to assure that educationally disadvantaged children are provided suitable educational opportunities has spawned a number of federal programs to assist education in elementary and secondary schools. Federal programs for elementary and secondary education generally are intended to help the disadvantaged to develop their basic skills, improve their rates of academic achievement, and help them become self-sufficient and self-supporting.

The largest federal program for elementary and secondary education was directed under Title 1 of the Elementary and Secondary Education Act of 1965 (ESEA) (20 U.S.C. 241a). The Congress, recognizing the link between inadequate educational opportunities and poverty, authorized the Title 1 program to assist educationally disadvantaged children. Title 1 was envisioned as a potent tool for dealing with poverty and its attendant conditions, such as illiteracy, high dropout rates, delinquency, unemployment, and crime.

Under Title 1, funds were provided to states and local school districts to help them provide compensatory education programs for educationally disadvantaged youths. These programs focused on developing basic skills in reading, language arts, and mathematics. For this purpose, state educational agencies received formula grants from the federal government based on the number of children from low-income families in average daily attendance (ADA) at schools

within their jurisdictions. The formula included other factors, such as relative economic distress within states, counties, and school districts; the number of children in state-operated institutions or foster homes; and the number of families receiving Aid for Families with Dependent Children (AFDC).

On July 1, 1982, Title 1 of the Elementary and Secondary Act was replaced by Chapter 1 of the Educational Consolidation and Improvement Act (ECIA) of 1981, which was enacted as part of the Omnibus Budget Reconciliation Act of 1981 (Public Law 97-35). The purpose of Chapter 1 is to continue providing financial assistance to states and local educational agencies to meet the special needs of educationally deprived children; and to do so in a manner that will eliminate burdensome and unproductive paperwork and free the schools of unnecessary supervision, direction, and control. Thus, the federal government's role in monitoring and enforcing compensatory education programs for the educationally disadvantaged has changed; however, as stated in the preamble to Chapter 1, the federal policy is unchanged:

PUBLIC LAW 97-35 - AUG. 13, 1981
CHAPTER 1 - FINANCIAL ASSISTANCE TO MEET SPECIAL EDUCATIONAL NEEDS OF DISADVANTAGED CHILDREN
DECLARATION OF POLICY

> Sec. 552. The Congress declares it to be the policy of the United States to continue to provide financial assistance to State and local educational agencies to meet the special needs of educationally deprived children, on the basis of entitlements calculated under title I of the Elementary and Secondary Act of 1965, but to do so in a manner which will eliminate burdensome, unnecessary, and unproductive paperwork and free the schools of unnecessary Federal supervision, direction, and control. Further, the Congress recognizes the special educational needs of children of low-income families, and that concentrations of such children in local educational agencies adversely affect their ability to provide educational programs

> which will meet the needs of such children. The Congress also finds that Federal assistance for this purpose will be more effective if education officials, principals, teachers, and supporting personnel are freed from overly prescriptive regulations and administrative burdens which are not necessary for fiscal accountability and make no contribution to the instructional program.[1]

To determine which children should participate in the supplementary programs, school divisions establish their own standards of student selection, subject to approval by their state department of education. Selection criteria, usually based on a variety of factors, must be objective and may include standardized achievement test scores, other types of test scores, or teachers' ratings. First priority for instruction is given to children most in need of additional help.

Generally, Chapter 1 instruction is tailored to each child's ability to progress. In most cases, ten to fifteen students leave their regular classrooms for 30 to 40 minutes per period to work with a trained teacher and, frequently, with one or more trained teacher aides. Teachers and aides also work with children in their regular classrooms. In either case, the first concern is to provide help where and when it is needed so that every youngster can succeed.

Description of an LEA's Chapter 1 Elementary School Program

Chapter 1 programs, by law, must be designed "to meet the needs of educationally deprived children;" however, the local educational agency (LEA) is given the flexibility to determine which programs and services best meet the specific needs of its student population.

In an eastern-USA LEA, with a population of approximately 37,000 elementary and secondary students, Chapter 1 programs are designed to serve students in pre-kindergarten and in grades four through six of targeted Chapter 1 elementary schools--26 of the LEA's forty elementary schools.

The primary emphasis of the pre-kindergarten program is language development. Oral communication skills are both developed and expanded through an abundance of planned, first-hand experiences, as well as through ample opportunities for interaction with peers and adults. Instructional activities which promote language acquisition also provide for the development of visual and auditory discrimination skills and contribute to the young child's growing fund of general knowledge. Experiences which stimulate inquiry, problem-solving and curiosity are included as integral components of the daily program. Learning extends beyond the limits of the school environment through field trips into the immediate and extended neighborhoods. Application of communication skills in social situations is encouraged. Socio-dramatic-play provides opportunities for the child to explore and apply social skills and for the teacher to assess progress and plan strategies for expanding learning. Play also provides opportunity for nurturing a positive sense of self.

The foundation for reading in the pre-kindergarten program is established through frequent and meaningful experiences with symbols of language. Dictating stories and descriptive information, participation in composing group stories, exposure to books in the classroom,

and listening to stories are initial components of the language experience approach to beginning reading.

In addition, mathematical knowledge in the pre-kindergarten program is acquired through practical and concrete experiences. Concepts of one-to-one correspondence, quantity, measurement, and order are emphasized in daily activities. Opportunities for exploration of selected materials provide the foundation for later emergence of the concept of conservation.

The LEA's Chapter 1 mathematics and reading/language arts programs are designed to provide individualized supplemental instruction to elementary students in grades four through six who are performing academically below grade level. Each program provides a variety of learning experiences which are designed to enable student participants to gain sufficient skills to advance eventually to the instructional level of their grade placement.

The mathematics program concentrates on the LEA's curriculum objectives for mathematics. The program stresses the advancement of the student's skills in numbers and numeration; basic operations of addition, subtraction, multiplication, and division; fractions, geometry, measurement, graphing, and problem-solving. Supplementing and supporting the LEA's goals in the use of the same performance objectives provides the continuity needed to eliminate the previous poor performance of the participants.

The reading/language arts program concentrates on the LEA's curriculum objectives for reading/language arts. Emphasis is placed upon upgrading the student's skills in language experience, word

building, sentence building, composition building, reading vocabulary, reading comprehension, critical reading, study skills, and symbols of communication. In grades five and six, the performanced-based, reading/language arts curriculum provided in the targeted Chapter 1 elementary schools is reinforced with computer-assisted instruction (CAI). CAI provides additional reinforcement of skills taught within the regular classroom setting through drill and practice. CAI lessons are coordinated with specific reading/language arts curriculum objectives. CAI is designed to assist each student who has deficiencies in the areas of reading and language arts to advance eventually to the instructional level of his placement.

In order to receive Chapter 1 funding, the LEA is required to evaluate its Chapter 1 program annually. Each year the Chapter 1 program--previously evaluated as the Title 1 program--has been evaluated by the LEA as being effective in helping disadvantaged students to acquire basic education skills and to improve their rate of academic achievement; however, the LEA has not evaluated the effect of CAI upon the reading/language arts achievement of Chapter 1 elementary students in grades five and six. The LEA also has not evaluated the effect of CAI on the Chapter 1 program, in general. Therefore, it appears that there is sufficient need to justify a systematic, experimental study of the effects of the LEA's CAI program upon student achievement growth and the over all Chapter I program.

THE PROBLEM

Purpose of this Study

Federal programs for elementary and secondary education are intended to help disadvantaged students acquire basic education skills, improve their rate of academic achievement, and, ultimately, help them become self-sufficient and self-supporting. By far the largest of these programs is that authorized under Chapter 1 of the Education Consolidation and Improvement Act (formally known as Title 1 of the Elementary and Secondary Education Act). The Congress, recognizing the link between inadequate educational opportunities and poverty, authorized the Chapter 1 program to assist educationally disadvantaged children.

Each year the Chapter 1 elementary school program of an eastern-USA LEA has been evaluated as being effective in helping disadvantaged students to acquire basic education skills and to improve their rate of academic achievement; however, the LEA had not evaluated the effects of the CAI reading/language arts program upon student achievement or upon the overall Chapter 1 elementary school program. Specifically, the purpose of this study was to determine the effects of the Chapter 1 CAI reading/language arts program upon the achievement growth of sixth-grade Chapter 1 students and upon the overall achievement growth of students in the Chapter 1 elementary school program.

Statement of the Problem

This research study was designed to ascertain the answer to the

following research questions:

1. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the reading-achievement growth of Chapter 1 sixth-grade students?

2. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the language arts-achievement growth of Chapter 1 sixth-grade students?

3. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the overall achievement growth of Chapter 1 elementary school students?

Null Hypothesis

This study was designed to test the Null Hypothesis put forth in this study which holds:

> The Chapter 1 computer-assisted instruction reading/language arts program will have no significant effects upon the achievement growth of the Chapter 1 students.

Sub-hypotheses (Null)

The following Sub-hypotheses (null) were tested in this study:

Sub-hypothesis 1. There are no significant differences in the reading-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Sub-hypothesis 2. There are no significant differences in the language arts-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Sub-hypothesis 3. There are no significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 computer-assisted instruction reading/language arts program was commenced.

Significance of Study

Under Chapter 1, funds are provided to states and local education agencies to help them provide compensatory education programs for educationally disadvantaged youths. The full potential of the Chapter 1 program lies with effective and efficient implementation, utilization, and evaluation of its effect upon student achievement growth. Thus, operating on the premise that school administrators--especially, the instructional leader of the school, teachers, school board members, and other interested individuals are concerned about the achievement growth of children, it appeared to follow that a systematic study of the effects of CAI upon the achievement growth of Chapter 1 elementary school students was warranted. This study will also assist administrators and others to develop a greater awareness of computers as instructional aids and as tools in inter-disciplinary problem-solving.

Furthermore, since there were few controlled studies which have investigated the effects of CAI upon the achievement growth of students in reading and language arts--detailed discussions of these studies are presented in Chapter Two, this study fulfilled a responsibility of administrators to analyze, research and evaluate technological advances purported to improve student achievement growth. Finally, this investigation will be employed by administrators, as well as by other educational decision-makers, as a source of information.

Delimitations of Study

This study was limited to the following framework of research:

1. It was confined to an urban, eastern-USA LEA's Chapter 1 elementary school program.

2. It was further confined to the effects of the Chapter 1 CAI reading/language arts program upon student achievement growth.

3. The sample consisted of 514 randomly selected students --257 in each group--who did or did not receive specialized instruction via the Chapter 1 CAI reading/ language arts program.

4. The sample was matched and drawn from only 20 of the 26 Chapter 1 elementary schools in the district.

5. The findings and conclusions generated in this study were only generalizable to students in a similar urban school environment.

Assumptions of Study

The basic assumptions underlying this study were as follows:

1. Computer-assisted instruction would permit Chapter 1 teachers the additional time for individualized instruction.

2. Chapter 1 teachers who employed computer-assisted instruction would utilize the additional time for individualized instruction.

3. Individualizing instruction would improve the reading and language arts achievement growth of sixth-graders.

4. Reading and language arts techniques, programs, and materials were similar in each Chapter 1 school; and in each Chapter 1 classroom. Thus, the Chapter 1 CAI reading/language arts program supplemented the Chapter 1 reading/language arts program for only below-grade level achieving students.

5. Chapter 1 teachers were comparable in professional training, expertise, and competence.

6. Regular classroom teachers of the targeted Chapter 1 schools were comparable in professional training, expertise, and competence.

7. The measurement instrument employed by the LEA is both valid and reliable.

8. The observed test results are valid, reliable, and unbiased.

9. The Linear Fan Spread Model, Type 2, as developed by Bryk and Weisberg--presented in Chapter Three,

   -represents the status of an individual selected at random from a given population at a particular fixed point in time.

   -assumes that the program is operating between pretest and posttest, and that there is a relationship of particular importance between growth status.

   -assumes that the performance of a statistical estimator of an unknown parameter depends on its probability of of being very close to value.

   -assumes that the treatment group is selected from a population of interest that is describable in terms of a joint probability of distribution for any given set of characteristics.

   -assumes that at some point a subset of individuals is assigned to a treatment group. The treatment group receives some intervention for a period of time, while the control group does not.

   -assumes that the differential mean growth between groups is the result of differential growth within groups. Consquently, as the variability increases over time, so does the mean growth between groups.

   -assumes that there is no variation in individual growth starting points.

   -assumes that the treatment effects a constant increment alpha (α) level for each subject exposed to it.

DEFINITIONS

Title 1	Title 1 of the Elementary and Secondary Education Act (ESEA) as amended in 1978. Title 1 was a federally funded program which gave money to school districts for compensatory education to help them to meet the special needs of educationally disadvantaged children in poor schools.
Chapter 1	Chapter 1 of the Education Consolidation and Improvement Act (ECIA). The ECIA was passed as part of the 1981 Omnibus Budget Reconciliation Bill and replaced the ESEA. Chapter 1 of ECIA replaced Title 1 of ESEA and the purposes of Chapter 1 remain basically the same as those of Title 1, however, federal administration and monitoring have been reduced.
Compensatory Education	Instruction (usually remedial) or support services meant to help children who are doing poorly in school to do better.
Educationally Deprived Children	Children who are performing at a level below that expected for children their age.
SEA	State education agency. Also known as the state department of education or the state board of education. The agency responsible for the administration of public elementary and secondary education in the state.
LEA	Local education agency. A public board of education or any institution in a city, county, township, school district or other political subdivision recognized by the state as an administrative agency for its public elementary and secondary schools. School districts are often referred to as LEAs.
Attendance Area	Neighborhoods served by a particular public school.
Selection of Attendance Area	Process of identifying those attendance areas and children actually served with Chapter 1 funds.
Targeting	Identifying which of the eligible attendance areas and children will actually be served with Chapter 1 funds.

Needs Assessment — A Chapter 1 requirement for LEAs. Each year the LEA must do a needs assessment to

- -identify educationally deprived children in eligible attendance areas;
- -select those children most in need of special help; and
- -carefully identify the needs of the selected children so that the project can be designed to meet those needs.

Complaint Resolution Requirement — Meant to give parents and others a clearly defined process for resolving complaints about Title 1 projects. Chapter 1 does not continue these requirements but some SEAs are recommending that LEAs keep a complaint resolution policy.

Fund Allocation Requirements — An interrelated set of requirements meant to guarantee that Chapter 1 students get their fair share of services funded from state and local sources.

- -supplement-not-supplant means Chapter 1 money must be used to provide services which are not already being provided with state or local funds. Thus, Chapter 1 funds must be added to, and not used to replace, state and local funds. Children in Chapter 1 programs must receive the level of state funds they would have received if Chapter 1 did not exist.
- -comparability means Chapter 1 schools receive roughly the same support from state and local sources as non-Chapter 1 schools.
- -maintenance-of-effect is meant to ensure that a district's state and local funding does not decrease substantially from year to year. Under Chapter 1 a school district's state and local funding for public education must be held to at least 90 percent of the previous year's funding in order to receive the full Chapter 1 grant.

Pull-out Programs — Programs in which students receive compensatory instruction outside the regular classroom.

In-class Programs — Chapter 1 Services are provided by auxiliary personnel in the regular classroom setting.

Non-equivalent Control Groups — Groups where pretest and posttest scores are obtained on one group of subjects who were exposed to an intervention (the programmed, experimental or treatment group), and another group of subjects who were not (the control group).

Non-equivalent Control Group Design — A technique in which pretest and posttest data on both groups are obtained, and statistical methods are used to adjust posttest comparisons, based mainly on pretest information.

Linear Fan Spread Model — An adjustment technique for non-equivalent groups that attempts to estimate the posttest differences which would have been observed had the groups been a priori.

Linear Fan Spread Model Type 2 — The adjustment technique for non-equivalent groups that attempts to estimate posttest differences when the mean growth curves spread apart in proportion to time (T), and the variances within groups increases in proportion to posttest time (T_2).

ORGANIZATION OF STUDY

The introduction, purpose of the study, statement of the problem, delimitations of the study, basic assumptions, null hypothesis, sub-hypotheses (null), significance of the study, and the organization of the study are described in Chapter One.

A review of related research studies and selected literature are presented in Chapter Two.

Methods and procedures, a description of the sample and the measurement instruments, collection of data procedures and analytical procedures, and research design are discussed in Chapter Three.

Chapter Four presents an analysis, validation, and discussion of the null hypothesis and the sub-hypotheses (null).

A summary of the research, conclusions, and recommendations for further research are presented in Chapter Five.

CHAPTER ONE FOOTNOTES

[1]"Public Law 97-35--August 13, 1981." Federal Register. Washington, D.C.: United States Printing Office, Friday, November 19, 1982.

Chapter Two

REVIEW OF LITERATURE

Several studies have shown computer-assisted instruction to produce student learning undistinguishable from that produced by traditional instruction; however, in most instances, CAI appeared to accomplish this learning in less time than traditional instruction. The purpose of this chapter is to present a review of the literature relevant to this study.

COMPUTER-ASSISTED INSTRUCTION

Computer-assisted instruction (CAI) is basically an instructional system in which a student interacts with a computer. The computer is used to provide instruction, generally, in the form of drill and practice, tutorial games, and simulations. Therefore, as envisioned by Silvia Charp, et al., CAI is based upon some of the same theoretical foundations as found in programmed instruction, which include the following essential characteristics:

1. Precise statements of instructional objectives in behavioral terms.

2. Material presented in carefully and logically sequenced order leading to criterion performance.

3. Provision for continuous and active student involvement.

4. Provision for continuous feedback on student performance.

5. Provision for continuous re-inforcement--usually in the form of success.

6. Means by which the student is to proceed at his/her chosen rate of speed.[1]

Charp, et al., also believed that CAI added the following capabilities:

1. Sequencing of information presented as a function of student performance. For example, on the basis of his response on a specific criterion frame and/or history of performance on related criterion frames, a student can be

- given additional remedial or practice material,
- continued in the linear sequence, or
- branched ahead to more challenging material.

2. The student is given truly "immediate" response confirmation or correction.

3. A wide variety of presentation modes, such as graphics, audio, motion pictures, etc., can be used. Voice recognition techniques, which enable the computer to respond to spoken commands, are also available.[2]

Chaney Computer Associates, Inc., also believed that CAI can help teachers to teach in three principal areas--drill and practice, simulation, and tutorial.[3] The major advantage of CAI being as follows:

1. The machine (computer) never gets tired.

2. The instruction is private, with the individual proceeding at his/her own rate. The slow student is not embarrassed or pushed ahead without comprehending what's going on. The accelerated and advanced student does not get bored by a pace directed to the "average" student.

3. The student is given an opportunity to advance to new work, or repeat material aided by a training system which monitors his/her performance.

4. Curriculum is developed and tested.

5. A complete, instantly available record is provided on each student's achievement.[4]

The computer can also be used to assist students in writing activities. For example, writing assignments are often disliked by students, especially rewriting and reorganizing parts of the paper, along with other factors, are points of student frustration. According to David Ahl, "Writing and rewriting by hand is really difficult for a kid."[5] Thus, the ability of a student to make corrections, move sentences around, and delete or add letters, words, or paragraphs on the computer can make writing enjoyable.[6]

In the Norwalk-La Miranda Unified School District (California), Marsha McVey, director of curriculum and instruction, reported that CAI was being employed to teach the basic skills to students in grades three through seven, while other CAI programs were provided according to the interests, instructional needs, and the maturation level of the students.[7]

Teachers of Roseville, Minnesota, employ CAI for remediation and enrichment in all grades, especially for mathematics and reading in grades three through five.[8] Montgomery County (Maryland) Public Schools uses CAI to teach K-8 mathematics, while three-to-nine year olds of Lamplighter School, a private school in Dallas, Texas, receive fifteen to thirty minutes of CAI per day in the basic skills.[9]

The Mission Consolidation Independent School District (Mission, Texas), employs CAI to increase skills of non-English speaking pupils at the elementary and secondary levels of English language speaking, listening, and reading. Specific district goals are

. to improve listening skills through auditory training activities leading to auditory attention to the details of speech;

. to intensify concentration leading to the extension of understanding that in the act of reading or writing, one is utilizing graphic, symbolic representations of speech;

. to increase the individual's active speaking vocabulary and language patterns;

. to relate oral sounds, words, and language patterns to written form.[10]

The CAI program of the Alhambra School District #68 (Phoenix, Arizona) is designed to keep computerized records of the achievement growth and the ongoing progress of each child so that teachers will have more time to devote to instructional needs; to augment a competency-based continuous progress education program for reading (K-8) and mathematics (3-8). Information concerning student progress can be accessed by classroom teachers, reading specialists, and school/district administrators for the following purposes:

1. Identification of objectives already completed by individual students.

2. Grouping of children working on a common objective.

3. Generation of student or class profiles.

4. Preparation of parent report forms (every 9 weeks) with progress of student in relation to the instructional objectives identified.[11] This system of CAI also supports the laboratory approach used for elementary school reading and mathematics, while in the daily labs students work privately on individualized lesson plans with a teacher-aide team providing specialized assistance to students requiring extra attention.[12]

One of the most promising aspects of CAI is that students to be computer "Whiz kids" gain from it. In addition, the computer has played a successful role in teaching handicapped and disadvantaged students. For example, Westside Community (Omaha, Nebraska) School's trainable mentally retarded class uses CAI to help the students to spell and read better. CAI is also used to help improve the students' manual dexterity, hand-eye coordination, and work recognition skills.[13]

The employment of CAI in schools greatly influences and changes the traditional role of the teacher. Under CAI the teacher is relieved of routine chores and is, therefore, free to accomplish responsibilities that only a human being can do.

CAI AND STUDENT ACHIEVEMENT

Roland P. Carver, of Missouri University's School of Education, studied the effects of CAI reading practice upon reading ability. He found that the students who received 50 to 70 hours of CAI achieved a large gain in their reading scores. The researcher, however, was unable

to determine the relationship between CAI, reasoning ability, and reading ability.[14]

In Jackson County, North Carolina, CAI was credited with raising the mathematics scores of low-achieveing mathematics students. Del Forge and Bloeser observed that low scores of students as measured by the Iowa Test of Basic Skills Mathematics Subtest went up considerably among students who made daily use of CAI at the Log Cabin Elementary School. Students who were in the lower 45% of a class in mathematics achievement were scheduled for daily ten-minute exposure to CAI, while the upper 55% of the pupils were each given a ten-minute period with the computer once a week. The analysis showed that students in the lower 45% who participated daily had greater gains than those who participated only once a week. The CAI program, however, was credited with raising all the students' mathematics scores and was believed to account for the difference in the amount of student improvement between the two pupil groups.[15]

In Dallas, Texas, Pat Mattingly, director of the Lamplighter School, found that logical thinking was the area of greatest improvement because the students who use computers have to think through where they're going; have to see the end results in their minds; and have to figure steps to get there. John D'Angelo, a consultant with the school, also reported that studies indicated that children working with computers tend "to grasp ideas quicker and it stays with them longer."[16]

The purpose of Samuel Romero's study was to determine the effectiveness of CAI as an alternative instructional medium in the

middle school setting, using the drill and practice format as an instructional strategy. A secondary purpose was to investigate the modification needed in management of instruction, curriculum and staff for its implementation and the feasibility of CAI implementation in a school district. Romero found significant differences between CAI and non-CAI students. A gain from a $.55y = x$ to a $2y = x$ in the growth pattern slope was recorded for a group of CAI seventh graders.[17]

In studying the effects of computer-based education on sixth-grade students' self-concept, levels of control and mathematics achievement, Warner found the use of computer-based education (CBE) can effectively improve mathematics achievement. Students scoring in the upper 78% of the sample on the application pretest achieved significantly more as a result of using CBE. The greatest gains were experienced by those scoring highest on the application pretest. Positive shifts in mathematical self-concept were much greater for the CBE group than for the non-CBE group. Statistical significance at the $\alpha=.10$ level is suggestive that there is a relationship between CBE and those positive shifts. Teachers also reported that CBE students genuinely enjoyed using the computer for supplemental instruction, and as a result were more motivated and less deviant.[18]

Douglass Modisett studied the effects of CAI on achievement in remedial secondary mathematical computation. The purpose of this study was to compare two forms of supplementary remediation in mathematical computation: a workbook and a form of CAI. Pupils in grades 9, 10, and 11 who were one year or more below grade level were randomly enrolled in two or more sections of the remedial mathematics course for their grade.

One section of each course was randomly selected to use a workbook, and the other sections were assigned to use two teletype terminals. The investigation indicated that the teletype-terminal forms of remediation were superior to the workbooks in terms of student achievement.[19]

In researching the effects of CAI on academic achievement, school daily attendance, and library usage, Edith Skinner sought to determine (1) whether there were significant differences in achievement between tenth-grade students who were instructed with the regular teaching method combined with CAI and those instructed without the use of CAI; (2) whether there were significant differences between school attendance of students in the CAI program and those not in the program; and (3) whether there was a significant increase in the use of library resources by students in the CAI program compared with those not in the program. The findings of the study indicated that no relationship existed between reading achievement scores of students enrolled in the CAI program and those not enrolled in the program in the areas of mathematics achievement, school daily attendance, and school library usage. However, students enrolled in the CAI program surpassed those not in the program in the areas of mathematics achievement, school daily attendance, and school library usage. The mathematics achievement grade-level scores increased slightly more than one grade level.[20]

The effects of a CAI program in reading on the attitudinal variables of self concept, locus of control, and level of aspiration were examined by Patricia Maravetz. The subjects, thirty rural Caucasian junior high school students who were one or more reading

grade levels below actual grade level, were randomly placed into an experimental group and a control group. The experimental group was exposed to CAI instruction, while the control group was not provided such instruction. Results indicated that there was no significant difference in the self-concepts and reading concepts. Although both groups' scores increased, the experimental group's scores gained proportionately higher. Differences in the feelings of control in reading were statistically significant, due to a negative shift in the control group. Level of aspiration indicated a shift toward the development of more realistic learning choices. Differences in reading achievement were statistically significant, suggesting that based on this achievement, the impact of CAI may encourage attitudes of individual responsibility and realistic decisions of learning.[21]

Gustafson employed an experimental design approach to examine the effectiveness of a computer-based learning system designed specifically to provide individualized spelling instruction. The principal focus of this study was to determine the system's effectiveness in promoting spelling achievement among third and fourth-grade students. The computer-based students' post experiment and retention test achievement scores were significantly higher than the scores of the students working in the teacher-directed program. There was no interaction between the type of instructional program and spelling ability. There were no significant differences in the spelling growth rates among the ability groups within each program. The changes in student attitude toward spelling did not differ significantly between instructional programs. There was a significant difference in the amount of time teachers

invested in the two instructional programs. Teachers used three times more instructional time in the teacher-directed program than they did in the computer-based program. The rate at which students encountered unfamiliar words in the computer-based program could be increased at least a third without significantly affecting their posttest achievement scores.[22]

However, Shannon, in studying aural-visual interval recognition in music instruction: a comparison of a computer-assisted approach and a traditional in-class approach, found that the CAI approach was not as effective a method as the traditional approach. In addition, it was found that the two groups did not differ in degree of positive or negative attitude toward the two approaches. The purposes of this study were to implement a computer-assisted instructional drill program of interval recognition for music theory freshmen; to compare the effectiveness of the CAI approach to a traditional classroom approach; and to evaluate the effectiveness of the two approaches under controlled conditions. Shannon concluded that CAI was not as effective as the traditional approach in aural-visual interval recognition. Important aspects of human interaction may have been the reason for the effectiveness of the traditional approach. Student attitude was not more favorable toward ear training when learned via computer than when learned in a classroom setting. Students may have felt that isolated drill on skills was irrelevant to their musical interests.[23]

Oden's study assessed the impact of teacher training in CAI on altering teacher behavior. It also assessed the degree to which

teachers trained in techniques of CAI influenced the mathematical achievement and attitudes of ninth-grade pre-algebra mathematics students. The null hypotheses for mathematics attitudes and mathematics achievement were rejected as a result of the analysis of covariance statistic. The null hypotheses for attitudes and achievement by schools were accepted. Oden concluded the following:

1. The changes in the experimental teachers' indirect classroom influence were statistically significant, while the control teachers' influence remained essentially unchanged.

2. Changes in the experimentals' mathematics achievement and attitude scores were significantly greater than changes in the control groups' achievement and attitude scores.

3. The school attended by students in the study sample had no significant effect on their mathematics achievement and attitude scores.[24]

The effect of computer-assisted mathematical instruction upon the computer literacy of fifth-grade students using a microcomputer was studied by Sibble. The major purpose of this study was to investigate the effect of CAI utilizing a microcomputer upon the acquisition of computer literacy by fifth-grade students at various levels of intellectual ability. This study also investigated the effect of computer-assisted mathematical instruction upon the acquisition of mathematical skills. Based on the results of the study, it was inferred that the use of CAI for mathematical drill and practice significantly improved the affective and cognitive computer literacy of fifth-grade students. It was also inferred

that high intellectual ability students, as well as low intellectual ability students, improved significantly in computer literacy after using a CAI program. The comparison of methods of instruction, CAI versus a printed individualized instruction mathematical kit, did not reveal a significant difference in relation to the acquisition of mathematical skills.[25]

In examining the effects of computer programming on problem-solving abilities of fifth-grade students, Reding concluded that the employment of programming word problems on a computer did not produce significantly greater scores in achievement than did the traditional method of teaching word problems. Subjects in the control group with no access to a computer or programming, achieved a higher mean gain overall than did the subjects who used computer programming. Neither fifth-grade boys or girls were significantly effected in their achievement of word problems by the use of computer programming. The boys and girls who did not use the computer obtained higher mean gains than their counterparts who did use computer programming.[26]

Since modern education has been criticized for the lack of individualization in most school programs, the failure of too many students to learn adequately, the tremendous cost of education, and the failure of too many school programs to address the affective aspects of students' personalities, the purpose of John Wilkinson's study was to determine if an individualized CAI program, known as PLAN, would affect (1) student achievement scores and (2) student self-esteem. The hypotheses stated that no significant differences would be found between the scores of the experimental and control groups for mathematics,

reading, social studies, language arts, and science. Significant differences, however, were found on the mathematics, reading and social studies tests, In each case, the CAI students scored significantly higher than their traditional counterparts.[27]

Writing in Reading Improvement, Robert Aaron, et al., who studied the effects of CAI upon the achievement of behaviorally disordered adolescents, concluded that CAI can substantially improve student achievement among behaviorally disordered adolescents with reading problems.[28]

According to the research findings of The Northwest Regional Educational Laboratory, almost every study conducted to determine the effect CAI has upon student achievement found that traditional instruction, which is supplemented by CAI, led to higher achievement than traditional instruction alone.[29]

A CAI program developed at Indiana University's Center for Innovation in Teaching the Handicapped helped children with special learning disabilities improve as much as four grade levels. Each student was previously diagnosed as achieving at least five years below grade level.[30] While at Proviso West High School in Hillside, near Chicago, Ill., during the first semester of the 1978-79 school year, 33% of the students failed a basic mathematics course. The following year, employing CAI, the failure rate dropped to only 8%.[31]

The school district of Philadelphia uses CAI to help meet the needs of inner-city youth. The major thrust of the program is to help students improve their basic skills through programs that enable each student to work at his or her own rate, providing self-direction for

learning, fostering the development of thought processes, and encouraging motivation for learning. Through the use of individualized tutorial computer lessons, students begin at their own level of understanding. Material that is not mastered is presented again in a different manner as often or with as much variation as needed to produce sufficient comprehension. The reading program helps the teacher develop and monitor the individualized course of study, building as much on the child's competencies as on defects. Because the student is continuously and actively involved, receiving immediate feedback on responses, he/she becomes an active partner in the learning process and is aware of progress as it occurs. Substantial gains in student achievement have been observed.[32]

The use of CAI also allows a student to succeed even though the way of mastering and the rate of learning differ significantly from typical teacher expectations. Since student performance levels can be automatically recorded by the CAI program, the teacher can monitor student progress without being involved in the drill activity. Thus, Cook, et al., in their OCCE Special Report: Computers in Special Education, summarized the special advantages of a CAI system to meet the performance needs of exceptional children as follows:

1. Active learning with high student rate
2. Immediate feedback and reinforcement
3. Maintenance of attention
4. Individual pacing of instruction
5. Infinite patience with sufficient repetition to insure learning[33]

Smith and Hess of Stanford University's Center for Research and Development in Teaching investigated the effects of CAI drill and practice in elementary arithmetic upon the achievement of junior high remedial students of Mexican-American backgrounds. Substantial gains of at least one month were reported.[34] In Fort Worth Independent School District (Texas), Fae Lysiak, et al., studied the effects of CAI drill and practice upon student reading and mathematics achievement. Elementary and middle school students who received CAI in reading and mathematics scored significantly higher than non-CAI students.[35]

PERCEPTIONS OF CAI

The Northwest Regional Educational Laboratory (NREL) in Portland, Oregon, after reviewing the findings and conclusions of several studies which investigated the effects of CAI upon student achievement, concluded in its research findings that CAI is an effective supplement to traditional instruction. NREL went on to recommend that the use of CAI be actively promoted and expanded, particularly in rural areas where it is difficult to offer full schedules of classes to limited numbers of students. The study also pointed out that most students using CAI have a better attitude toward the subject matter than students who receive only traditional instruction. Students enjoy learning about the computer and from the computer.[36]

Lysiak, et al., studying the effects of CAI drill and practice in reading and mathematics upon student achievement in eight elementary and four middle schools of the Fort Worth Independent School District (Texas), found that elementary school teachers believed that CAI was

most beneficial to student achievement; however, middle school teachers were only moderately supportive of CAI. The students perceived CAI drill and practice as a personally beneficial and enjoyable activity.[37]

The basic issue investigated by Smith and Hess was the effect CAI drill and practice programs in elementary arithmetic, when used as remedial instruction, had upon the self-concept and math attitudes of junior high school students. About 75% of their sample of 320 students came from Mexican-American backgrounds. A two-group (experimental and control group), pretest-posttest design was employed. The conclusions of the study are: the CAI program promoted realistic attitudes toward math; CAI may be an efficient, effective form of remedial instruction; CAI did not prove to be dehumanizing, no across-the-board negative attitude resulted from the program; and there is no best way of presenting educational material to all students.[38]

The effects of instructional computing on students was asked by the National Education Association of a random sample of its membership. The teachers supported the position that computing has positive effects on students; the most positive effects being in motivation, subject interest, attention span, self-confidence, cognitive learning, self-discipline, and social status. The teachers were less positive in the effects of the computer upon the students in the categories of achievement test performance and social behavior.[39]

In NEA Today, Jerome McGovern, English teacher at Peru Junior/ Senior High School (Peru, New York), and president of the NEA/NYEA affiliated Peru Association of Teachers, concluded in his review that

instructional videogames are educationally redeeming in value; however, he questioned who is the teacher and what is the subject. The author believed that teachers expect anything that is considered educational to help students acquire the knowledge and skills taught. In instructional videogames the traditional roles of teachers and students are reversed--the teacher becomes the student and children explain how these inventions work.[40]

Few teachers will assert that computers are just another passing fad in education. Only a minority, nowadays, fear that these glamorous machines will make the teacher obsolete. The most compelling argument against CAI is that it is a luxury that diverts scarce school dollars from classroom necessities (especially, teacher salaries). Others listed by teachers in the June, 1983 issue of NEA Today are:

. Computers will dehumanize education and distract students from learning how to establish relationships with other people.

. No one has seriously tried to find out just what completely new approaches to teaching and learning the computer makes possible.

. At the present stage of educational software development, computers are a waste of time.[41]

Frequently, the most common complaint, as stated by teachers in a 1982 survey of NEA members, was that they did not have enough computers for instructional purposes. The teachers believed that computer learning would become common and be considered basic training for all students. Thus, most teachers want to bring computers into

the schools and make the new CAI curriculum requirement an asset to their program; however, they want to be involved in the planning of the new curriculum.[42]

At Cooper Elementary School in Tulsa, teachers employed CAI programs to determine the English skills each student needs to work on and where to go for specific instructional materials. The teachers noted that CAI has been well received by both teachers and students.[43] Teachers of Las Vegas' Hyde Park Junior High have also found a disciplinary benefit of CAI. The mere threat of "no computer" is potent.[44]

Gay Reetz, writing in the April 1983 issue of Electronic Learning, states that CAI is a fraud. She further questioned whether or not CAI is really the boom it is reported to be; or whether it is distracting students and teachers from the real benefits of computing. Reetz identified two misconceptions regarding CAI as follows:

1. The student is not learning about the computer.
2. CAI will improve the student's performance.[45]

Reetz also emphasized that CAI is characterized not only by a lack of thinking in terms of the computer's capabilities, but by a simple lack of thinking--period. Reetz believes that CAI encourages the student to guess, and not to reason.[46]

PERCEPTIONS OF COMPUTERS

Why use a computer? The computer is very patient. It will not yawn or get bored, upset, or angry if the student takes a long time to answer a question. Also, when the student answers the question, the computer will tell the student immediately if he/she is correct or not.

The student does not have to wait until the next day to get scores.

However, a computer cannot take over the role of a teacher, states Ellen Richman, because it doesn't explain things in different ways. In addition, the student can't ask it any questions and it has no feelings. Thus, the computer will not sympathize with the personal problems of students. Furthermore, since the computer is a precise machine, student answers must be exactly correct, or the computer will count it wrong. And, of course, a computer can not give the student a real smile or a pat on the back.[47]

Winner believed it would be a misuse merely to add the micro-computer to the current school curriculum because add-on curriculum innovations have been attempted before with poor results. As an add-on to the existing curriculum there is a strong possibility that the computer will not realize its full potential. Instead of becoming an instrument of profound educational change, it may instead only become another short-lived technological innovation.[48]

One of the major activities of a school is instruction. For computers, to be of benefit to classrooms, their value as an aid to instruction must be apparent. J. Richard Dennis states that there are several ways to derive such benefits. One way is to use the computer to provide a type of instruction (or potential learning) otherwise impossible or impractical to provide. Another way is to have the computer assume roles or responsibilities of a very routine but necessary nature; thus, freeing the trained human to engage more fully in more complex, less regular, but necessary parts of the activity.[49]

The issue of what should be taught in the elementary and secondary schools to prepare students for the technological changes of the future demands the immediate attention of educators, legislators, and citizens. However, many disagree over what curriculum will best meet this challenge. Generally, the disagreement focuses on the general question of whether education should become more technical at the expense of broader goals.[50]

Some educators are seriously concerned that the long-term effects on learning by substituting technology for traditional teaching methods are not sufficiently understood. While acknowledging that computers or other technologies may have some limited utility in the classroom for drill and practice and for instruction in computer literacy, numerous educators fear that any wide-spread adoption of the technology for education could have deleterious effects on the over-all quality of learning.[51]

Yet, the computer has the potential to be an integral part of language and reading instruction. To date, computer use has typically been limited to drill activities in spelling, vocabulary, reading, and grammar. It enhances individualization and performs record-keeping and prearranged curriculum sequencing. Beyond these drill capabilities, however, educators are developing expanded uses. On one system, for example, the computer pictorially acts out a sentence constructed by the student using a limited vocabulary. Also, recent advances in voice synthesizers have tied voice and print together for early reading activities.[52]

Thomas and Gustafson of Iowa State University, funded by a Texas

Instruments, Inc. grant, documented the design, development and evaluation of an economical microcomputer based spelling system. The computer system, evaluated in a suburban elementary school, was designed to incorporate the most advanced technologies with sound instructional practices. The researchers selected the subject of spelling for the project because of the recent technological breakthroughs in speech synthesis. The researchers stated that the low-cost, time-shared computing system revealed that technology can serve classroom needs to a much greater degree and much more economically than current practices.[53]

Still, Podemski, Husk, and Jones believe the government or educational forces must intervene in the technological debate soon, because there is a danger of creating a new class of disadvantaged: the computer illiterate. The researchers are afraid that only the wealthier school districts will acquire the technology, and that little or no study is given to the effects of computers on the achievement of society's "have nots". The authors believe that the computer can help to narrow the educational gap between the "haves" and the "have nots" only through government intervention.[54]

Union College of Lincoln, Nebraska, has become the first liberal arts college in the nation to provide computers in every dorm room, which had only previously affected technically-oriented schools like Carnegie-Melon and Drexel. Students will be able to use the computer to assist them to do research, write papers, etc. Professors, in turn, will be able to call up those papers on their own terminals, review and grade them, and transmit the grade and comments back to the students.[55]

Parents of New York City are so firmly behind the computers-in-the-classroom movement that approximately 25% of the funding for classroom computers is provided by parent, religious, or civic groups, according to the results of a major study sponsored by Instructor magazine. The study, a survey of 1,500 teachers conducted by McGraw-Hill Research, found that 44% of schools currently own computers for classroom use and another 19% are planning to buy computers. While 33% of the teachers polled rely on school district budgets for funding to introduce or expand computer facilities, one-fourth said that cooperative fund-raising programs with parents, religious, and civic groups provided the needed dollars.[56]

SUMMARY

The growing reliance of our society upon computer systems demands that the public come to understand this phenomenon. This chapter has presented varied studies which show the effect of computers and computer-assisted instruction upon the performance of students; however, more study is warranted.

CHAPTER TWO FOOTNOTES

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CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

The purpose of this chapter was to describe the methodology and the procedures employed in the conduct of this study. A description of the design, the population, and the methodology used to select the sample are included, as well as a description of the instrument utilized and the statistical procedure employed.

METHOD AND PROCEDURE

The method employed was descriptive research, which is concerned with hypothesis formulation and testing, the analysis of the relationships between non-manipulated variables, and the development of generalizations. The statistical data was gathered from sixth-grade Chapter 1 students through the administration of the Science Research Associates Assessment Survey Series.

The procedure for the study included the following:

1. Chapter 1 regulations were reviewed to determine federal guidelines for LEAs.

2. State Chapter 1 regulations were reviewed to determine state guidelines for LEAs.

3. An LEA which employed supplemental CAI for Chapter 1 students was selected to participate in this study.

4. Administrative approval to conduct the study was obtained.

5. After administrative approval was obtained, 514 students were randomly selected to participate--257 in the control group and 257 in the experimental group.

6. The Science Research Associates Assessment Survey Series in reading and language arts served as the instrument to measure the achievement of the students.

7. The Computer Services at Virginia Polytechnic Institute and State University were utilized to analyze and compose the data gathered by the instrument.

SOURCES OF DATA AND COLLECTION PROCEDURES

Data collected to record pertinent information for this experiment were obtained from LEA's departments of special projects and research and testing. The name, sex, and test results of each student were obtained from two sources: the 1980-81 March SRA achievement test results for language arts (which contain areas of reading as verified by the LEA's reading department), and the 1982-83 March SRA Achievement Series, Form I, Level F, test results for reading and language arts. Subtests from each main test were equated and paired to obtain comparability. The test is a part of the LEA's total reading program. The pretest and posttest data were machine scored, and were used to analyze data collected for this study. The researcher was given unlimited access to all necessary data, and employed an impartial party to select randomly the student scores from the treatment groups--a method to establish equivalency. All information relevant to student identification was kept confidential. To insure anonymity, each student score selected was assigned a code number. Code numbers and test results were transferred to data collection sheets.

Reading and language arts sections of the SRA Achievement Series were administered to all fourth-grade students during the 1980-81 school year--the "selected" sixth-grade sample. The reading and language arts tests from the SRA Achievement Series, Form I, Level F, was likewise administered approximately two years later to the "selected" sixth-grade sample. Chapter 1 students in the sixth-grade during the 1982-83 school year, and who were assigned to the Chapter 1 CAI program were candidates for the experimental group. Chapter 1 sixth-grade students of the same year, but who were not assigned to Chapter 1 CAI program, were candidates for the control group. Thus, the treatment groups were consequently drawn from the same general population. Results from these two sets of test data afforded a means of comparing any statistical significant difference ($p < .05$) in the achievement of Chapter 1 students who had or had not been taught reading or language arts through computer-assisted instruction.

RESEARCH DESIGN

The non-equivalent control group design when subjects are growing, Type 2, as developed by Bryk and Weisberg, was employed to analyze the pretest/posttest data and to test the hypotheses presented in the study.[1] In this design, depicted in Figure 1, observed standardized gain scores were used to estimate posttest scores generated by predictions made using control group relationships. The mean growth curve fan spread linear model made adjustments based on an estimated regression coefficient between growth status at pretest and growth status at posttest. The Science Research

Associates Assessment Series served as the measuring instrument.

The LEA's normal curve equivalents (NCE's)--equal-internal normalized standardized scores--were analyzed to determine if significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 CAI reading/language arts program was commenced. In addition, bivariate regression analysis was employed to predict the posttest achievement scores of low achieving CAI Chapter 1 students by comparing their pretest scores to pretest/posttest scores of moderate to high achieving non-CAI Chapter 1 students. In this analysis called "linear regression," regression analysis provides a prediction of what the students will score on the posttest. [2]

The Statistical Package for the Social Sciences (SPSS) computer subprogram was used to analyze the data presented in this study.[3] These subprograms were run on the computer at Virginia Polytechnic Institute and State University. The specific research design which was utilized to compare the achievement scores of the experimental and control groups of sixth-grade students is illustrated in Figure 2.

T_X = POINT AT WHICH THE TWO MEAN GROWTH LINES INTERSECT

T_1 = PRETEST TIME

T_2 = POSTTEST TIME

P = PROGRAM GROUP

C = CONTROL GROUP

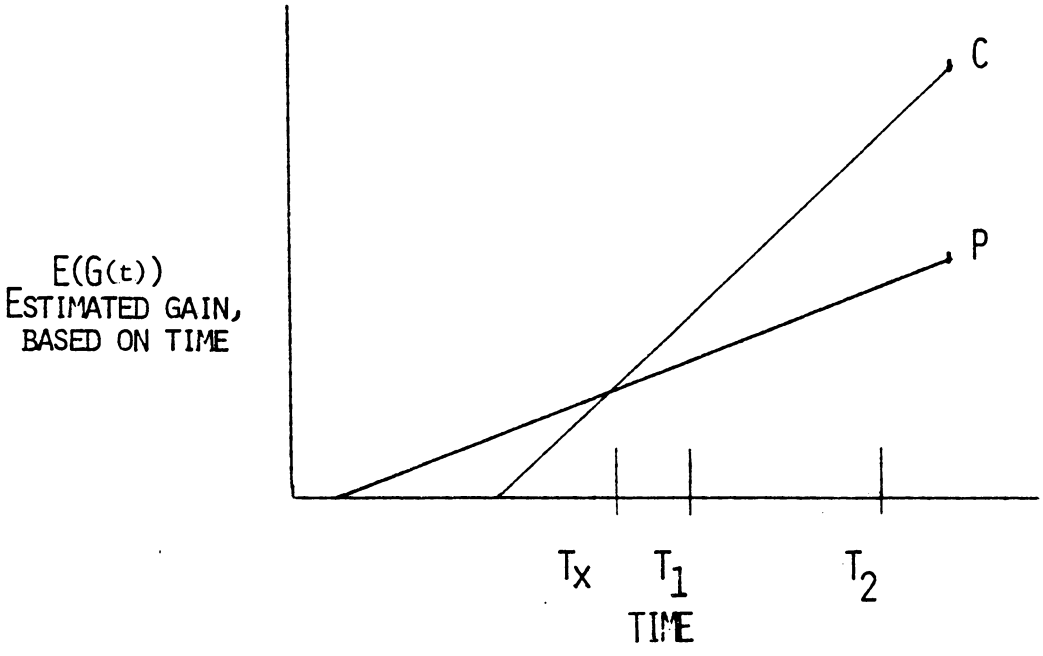

Figure 1

TYPE 2: LINEAR FAN SPREAD MODEL

	N of Pretest (SRA)	N of Posttest (SRA)
Experimental Group (Chapter 1 CAI sixth-graders)	257	257
Control Group (Chapter 1 sixth-graders)	257	257

Figure 2

An Experimental Design to Guide the Collection and Analysis of Students' Reading/Language Arts Achievement Scores on the Science Research Associates Achievement Series

The Null hypothesis and Sub-hypotheses were stated in Chapter One. For analyzation purposes, they are reiterated, here.

Null Hypothesis

This study was designed to test the Null Hypothesis put forth in this study which holds:

> The Chapter 1 computer-assisted instruction reading/language arts program will have no significant effects upon the achievement growth of the Chapter 1 students.

Sub-hypotheses (Null)

The following Sub-hypotheses (null) were tested in this study:

> Sub-hypothesis 1. There are no significant differences in the reading-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.
>
> Sub-hypothesis 2. There are no significant differences in the language arts-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.
>
> Sub-hypothesis 3. There are no significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 computer-assisted instruction reading/language arts program was commenced.

DESCRIPTION OF LEA'S STUDENT POPULATION

The student enrollment of the LEA, in accord with national trends, had declined in recent years from in excess of 60,000 to around 37,000. There were forty elementary schools, eight junior high schools, and five senior high schools. In addition, there was a vocational-technical

school for high school students, a vocational training center for adults, two schools for the handicapped, and three alternative education schools. Various skill and specialized learning centers, plus an extensive adult education program round out the offerings. Most students are in school for 180 days, at least six hours a day. The average pupil-teacher ratio is 15.7 in the senior high schools, 13.9 in the junior high schools, and 18.6 in the elementary schools. The per-pupil expenditure for the 1982-83 school year was approximately $2,500.

SAMPLE

As shown in Table 1, the sixth-grade population of the LEA for the 1982-83 school year consisted of 2,406 students. Of this total 1,018 students were supplied supplemental instruction under the Chapter 1 program. Furthermore, 366 Chapter 1 students who were performing below grade level in reading and language arts were provided additional supplemental instruction under the LEA's Chapter 1 CAI reading/language arts program. Based upon the research of Krijcie and Morgan for the research division of the National Education Association, illustrated in Table 2, a population of 1,000 students (remember the total sixth-grade Chapter 1 population is 1,018 students) requires a sample of at least 278 students.[4]

To determine the effects of the CAI reading/language arts program upon the achievement growth of Chapter 1 sixth-grade students, at least 400 Chapter 1 sixth-grade students were to be selected randomly to participate in this study. Specifically, 257 students--the control

group--were randomly selected from the 652 Chapter 1 students who received supplemental reading/language arts instruction; and 257 students--the experimental group--were selected randomly from the 366 Chapter 1 students who received supplemental reading/language arts instruction, which was further supplemented with drill and practice via the CAI reading/language arts program. Thus, the large sample for this study was judged to be representative of the Chapter 1 sixth-grade population.

Table 1

Sixth-grade Student Population

June 1983

Non-Chapter 1	Chapter 1			Total Sixth Grade
	Non-CAI	CAI	Total	
1388	652	366	1018	2406

Note: All Chapter 1 students received supplemental reading/language arts instruction; however, the CAI group who were performing below grade level in reading and language arts also received supplemental drill and practice via the CAI reading/language arts program.

Table 2

Table for Determining Sample Size from a Given Population

N	s	N	s	N	s
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	228	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	106	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	133	1000	278	75000	382
210	136	1100	285	100000	384

NOTE: N is population size
s is sample size

SOURCE: R. V. Krijcie and D. W. Morgan, "Determining Sample Size for Research Activities," Educational and Psychological Measurement, 1970, No. 30, pp. 607-610.

DESCRIPTION OF LEA'S CHAPTER 1 PROGRAM

Chapter 1 funds are provided by the federal government for use in designated schools. However, in accepting the funds, the LEA agreed to abide by certain guidelines established by the federal government. The Chapter 1 Equivalency Requirement is one of the most important of these guidelines. Equivalency means that Chapter 1 funds must be used to provide services over and beyond, and not in place of, those services paid with local and state funds. In other words, those services that are provided in the LEA's 26 Chapter 1 elementary schools must be services which are in addition to the services provided in the LEA's 14 non-Chapter 1 elementary schools (the LEA has a total of 40 elementary schools).

Selection of Target Schools

Chapter 1 schools are determined by means of a system-wide survey which identifies those schools serving a high percentage of students receiving free lunch. Those elementary schools which meet or exceed the city average of low income students per school are eligible for Chapter 1 assistance. It is important to remember that once a school has been designated as a Chapter 1 school, income levels cease to be a factor in the operation of the Chapter 1 program. Currently, 26 of the LEA's 40 schools qualified as Chapter 1 schools.

Selection of Students

Once schools are selected using the economic factor, students are selected to be in the educational program. Achievement data

are collected on each student and used to determine which students need the additional help most. Remember that students are selected only on the basis of educational need even though the school is selected on the basis of economic criteria. Any student who demonstrates an educational need in reading/language arts or math is eligible to participate in the Chapter 1 instructional program. However, in order to prevent Chapter 1 funds from being spread too thin, the number of students participating in Chapter 1 instructional activities may not exceed the number of students used to qualify the school for the Chapter 1 program.

Instructional Program

The Chapter 1 instructional program was designed to provide a variety of learning experiences which will enable student participants to gain sufficient skills to advance eventually to the instructional level of their grade placement. The mathematics area concentrates on the LEA's mathematics curriculum guide objectives. The goal of the program is to stress the advancement of the students' skills in numbers and numeration; basic operations of addition, subtraction, multiplication and division; fractions, geometry, measurement, graphing, and problem-solving. Supplementing and supporting the LEA's goals in the use of the same performance objectives provides the continuity needed to eliminate the previous poor performance of the participants.

The reading/language arts area of the program concentrates on the objectives of the LEA's reading/language arts curriculum guides. Emphasis is placed upon upgrading the students' skills in language

experience, word building, sentence building, composition building, reading vocabulary, reading comprehension, critical reading, study skills, and symbols of communication.

Coupled with the performance-based curriculum provided in target schools having grades five and six is the utilization of computer-assisted instruction (CAI). This instruction provides additional reinforcement of skills taught within the regular classroom setting through drill and practice. CAI lessons are coordinated with the specific objectives which are emphasized in the reading/language arts curriculum. Studies have shown that CAI has proven to be highly effective in assisting students who have deficiencies in the areas of reading and language arts to raise their performance level.

CAI Reading/Language Arts Labs

Students in the Chapter 1 CAI reading/language arts labs in grades five and six use microcomputers to reinforce skills taught by the LEA's classroom teachers and Chapter 1 reading/language arts teachers. Each microcomputer lesson was developed locally to reflect and reinforce the reading/language arts curriculum of the LEA. The format of each lesson includes presentation of content, and example of the content, directions, and activities.

During the 1982-83 school year 219 lessons were available. These lessons were in the areas of word building, reading vocabulary, composition building, study skills, and critical reading. Performing lessons on the microcomputer is an integral part of the total reading/language arts program. First students are taught a skill,

then they practice the skill, and finally, they are assigned a lesson on the microcomputer. This experience gives each student an opportunity to reinforce skills with drill and practice. The average student uses a microcomputer three sessions a week for fifteen minutes per session. Currently, there are 111 microcomputers available to students in the Chapter 1 CAI reading/language arts labs within the 26 Chapter 1 elementary schools.

The software for the microcomputers is error-free, utilizes graphics, provides positive reinforcement, gives help for incorrect answers, features an uncluttered screen, provides off-line stories and has a minimal amount of text. At the end of each lesson, the student's score appears on the screen.

Chapter 1 Personnel

Coordinator. Oversees all facets of the Chapter 1 program within the stated guidelines of federal, state, and local education authorities for the LEA.

Supervisor of Programs and Inservice. Responsible for school visitations and monitoring, documentation of learner needs, inventory, program planning of resource team teacher leaders' meetings, review of program leaders' logs and monitoring reports, inservice data for evaluation reports, inspection of equipment, and coordinating the work of program leaders.

Evaluator/Disseminator. Responsible for conducting testing workshops, tabulating data for reports, reviewing data for sustained effects study, evaluating portion of the resource team teacher leaders'

meetings, data collection and reporting of comparability equivalency reports, publicity, securing eligibility and participation lists, preparing newsletters, training assistance, administration of tests, and securing early identification of participants.

Planner. Responsible for solicitation of proposal ideas, documentation of learner needs, preparation of program and financial outlines, preparation and review of project application, updating and dissemination of guidelines and regulations, preparation of project amendments, and updating of school eligibility.

Program Leaders. Responsible for reviewing and updating the instructional components, coordinating instructional program, monitoring center activities, submitting requisitions for materials and supplies, selection of pupil participants, scheduling, regrouping plans, and planning field trips.

LEA Teachers. Responsible for diagnosing students' skills, screening prospective students, administering tests, selecting appropriate instructional materials, and planning and implementing appropriate instructional activities.

Chapter 1 Teachers. Responsible for cooperative planning and implementing with LEA teachers personalized prescriptions for each student, reinforcing skills or areas diagnosed by the LEA teachers, providing instructional services in the areas of reading/language arts or math, screening students for participation, maintaining records and files, maintaining contact with students and parents, and organizing and coordinating the activities of the Parent Advisory Councils.

Chapter 1 Computer Program Leaders. Responsible for coordinating usage of microcomputers, preparing and submitting computer component for proposals, monitoring use of microcomputers in the instructional program, compiling and tabulating evaluative data, assisting authoring committees, monitoring the security and operation of microcomputer systems and CAI programs.

Chapter 1 Microcomputer Aide. Responsible for maintaining equipment, assisting students in the operation of microcomputers, preparing and maintaining student progress reports, preparing daily summary of pupil progress for LEA and Chapter 1 teachers, preparing weekly progress reports, performing emergency checks and corrective procedures, and assisting the LEA and Chapter 1 and teachers in general.

Parent Advisory Councils

Although federal Chapter 1 regulations indicate that parents must be involved in the planning, development, operation, and evaluation of the Chapter 1 program, the regulations do not spell out exactly how this involvement is to take place. The few specific functions of the parent councils mentioned in the regulations include:

1. To review applications and evaluations of present and past Chapter 1 programs
2. To make recommendations about the needs of eligible children and how these needs can be met
3. To submit comments, if desired, to local school personnel and state concerning Chapter 1 programs

Beyond these duties, the functions of each council is decided jointly by council members and LEA administrators. Councils are particularly concerned with improving home/school relationships; serving as an effective go-between for other parents and the school; and involving other parents in school visits and expressing their concerns. In addition council members assist in the dissemination/ publicizing of Chapter 1 activities to the community.

MEASURING INSTRUMENT

Numerous tests are used to measure achievement. Selection was made based upon purposes for which the outcome(s) of this study were to be used, and upon the validity and reliability of the tests. The Science Research Associates Assessment Series (SRA), Form I, Level F, was used as the measuring instrument.

Science Research Associates Assessment Series

The SRA Achievement Series has a long history in educational measurement. Publication dates of the editions of the Achievement Series range, in date, from the mid-fifties through the eighties. The purpose of the battery is to measure the skills and understandings central to the attainment of important educational objectives. The emphasis is on the students' skill in applying what they have learned rather than on their recall of isolated facts.

Multilevel tests were designated in separate color-coded levels, in subsequent years, and incorporated overlapping content, with Green Level being assigned to grades 6 and 7.

The latest edition of the Achievement Series consists of eight levels (A-H), each with two forms. Each of the eight levels had unique items; therefore, there is no overlap.[5]

To make the standardization sample as representative of national population as possible, a three stage sampling technique was used. Phase I obtained representative school districts within each of the nine geographic census regions listed in the guidelines of the United States Census Bureau. Phase II was inclusive of a random sampling of schools within the selected districts. Approximately 85 non-public schools located within the boundaries of the public school districts selected were included in the standardization sample. Phase III produced a random sampling of classes within the schools selected. The standardization sample consisted of 129,900 students in 457 schools in 92 districts.[6]

Developers reviewed, examined, and utilized existing textbooks, supplementary instructional materials, existing achievement tests, curriculum guides, basal texts, professional journals, and research literature in the subject matter to be tested to determine current trends and common instructional objectives.[7] (The LEA's curriculum correlates with the basic concepts of the SRA Achievement Series.)

Item writers were provided SRA guidelines for preparing bias-free materials. Items submitted were edited and pretested to see how well they worked and to obtain other information essential for item analysis and selection. The results of the subtests for comprehension and vocabulary are combined to make a total score in the area

of reading. The subtests results from mechanics, usage, spelling, and reference materials make up the composite score for the language arts area of the series.

Statistical information on the pretest items--the difficulty, discrimination, and correlation with grade--was used to eliminate inappropriate items. As a final check, selected test items were reviewed by content and bias specialists, and by members of the SRA field force, with adequacy and balance of content being the primary consideration.[8]

CHAPTER THREE FOOTNOTES

[1]Anthony S. Bryk and Herbert I. Weisberg, "Use of the Nonequivalent Control Group Design When Subjects Are Growing," Psychological Bulletin, Vol. 84, No. 5, 1977, pp. 950-962.

[2]John C. Wilkinson, Understanding and Using NCE's (Orem, Utah: Metra Intermountain Publishing), 1980, pp. 5-14.

[3]Norman H. Nie, Statistical Package for the Social Sciences, Second Edition, McGraw-Hill, Inc., 1974.

[4]R. V. Krijcie and D. W. Morgan, "Determining Sample Size for Research Activities," Educational and Psychological Measurement, 1970, No. 30, pp. 607-610.

[5]SRA Technical Report #3, Science Research Associates, Inc. Chicago, Illinois, 1981, p. 2.

[6]SRA Achievement Series, Addendum for Fall 1978 Standardization, Science Research Associates, Inc., Chicago, Illinois, 1979, p. 3.

[7]SRA User's Guide, Science Research Associates, Inc., Chicago, Illinois, 1979, p. 11.

[8]Ibid., p. 11.

Chapter Four

PRESENTATION AND ANALYSIS OF DATA

The purpose of this study is to determine the effects of an eastern-USA LEA's Chapter 1 CAI reading/language arts program upon the achievement growth of sixth-grade Chapter 1 students and upon the achievement growth of students in its Chapter 1 elementary school program. Specifically, this research study was designed to ascertain the answer to the following research questions:

1. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the reading-achievement growth of Chapter 1 sixth-grade students?

2. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the language arts-achievement growth of Chapter 1 sixth-grade students?

3. What are the effects of the Chapter 1 computer-assisted instruction reading/language arts program upon the overall achievement growth of Chapter 1 elementary school students?

In this chapter the major steps of identifying and describing the randomly selected sample population of elementary Chapter 1 sixth-grade students, along with presenting and analyzing their test data, is undertaken. Also presented are summaries of the statistical tests and subprograms which were utilized to determine if statistically significant differences existed for the sample population.

SAMPLE

The sixth-grade population of the LEA for the 1982-83 school year consisted of 2,406 students. Of this total, 1,018 students were

supplied supplemental instruction under the LEA's Chapter 1 program. Additional supplemental instruction under the LEA's Chapter 1 CAI reading/language arts program was provided to 366 Chapter 1 students who were performing below grade level in reading and language arts.

To determine the effects of the CAI reading/language arts program upon the achievement growth of Chapter 1 sixth-grade students, as shown in Table 3, 257 students--the experimental group--were randomly selected from the 366 low achieving CAI Chapter 1 students; and 257 students--the control group--were randomly selected from the 652 moderate to high achieving Chapter 1 students. Further analysis of the demographic data shows that the experimental and control groups were matched by sex and race; therefore, each group has 105 black males, 27 white males, 103 black females, and 22 white females. Subjects were also matched by school (see Table 26 in the Appendix). In total, 23 of the LEA's 26 Chapter 1 elementary schools are represented in this study.

EFFECTS OF CAI UPON STUDENT READING ACHIEVEMENT GROWTH

The purpose of this section is to present and compare the reading achievement growth of low achieving CAI Chapter 1 sixth-grade students with the reading achievement growth of moderate to high achieving non-CAI Chapter 1 sixth-grade students to test Sub-hypothesis 1 which holds:

> There are no significant differences in the reading-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Table 3

DEMOGRAPHIC DATA
FOR
SAMPLE OF CHAPTER 1 STUDENTS

Group	Sex	Race	Number
Experimental	Male	Black	105
		White	27
	Female	Black	103
		White	22
			257
Control	Male	Black	105
		White	27
	Female	Black	103
		White	22
			257
		Total	514

Vocabulary

Presented in Table 4 are the number of students, mean scores, and selected statistics for the t-test generated by the SPSS subprogram T-TEST. Since the researcher was not in a position to assign subjects randomly to treatment groups, the t-test statistical procedure was performed to determine if a statistically significant difference ($p < .05$) existed between the SRA: Vocabulary pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group). A statistically significant difference ($p < .05$) between the experimental and control groups was observed. Based upon this finding, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

In this research study bivariate regression analysis was employed to predict the posttest vocabulary achievement scores of low achieving CAI students by comparing their pretest scores to pretest/posttest scores of moderate to high achieving non-CAI Chapter 1 students. Table 5 presents selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for moderate to high achieving non-CAI Chapter 1 students on the pretest/posttest administrations of the SRA: Vocabulary test. The Multiple R indicates that a positive relationship exists between the pretest and posttest scores; while R Square indicates that over 61 percent of the variation in the posttest is explained by linear regression on the pretest variable. To obtain a predicted posttest score (Y') for low achieving CAI Chapter 1 students on any given level of pretest (X), the A and B constants in the linear

Table 4

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Vocabulary Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	11.4047	-14.49	512	0.000
Control	257	19.4942			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

Table 5

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Vocabulary Pretest/Posttest Raw Scores

Multiple R	0.78334
R Square	0.61362
Standard Error	5.51487

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	12316.60018	12316.60018
Residual	255	7588.51655	30.41379

F = 404.96762 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.87918	0.04369	0.79315	0.78334
Constant A	3.94665	0.91853	2.13778	

prediction equation

$$Y' = A + BX$$

would be

$$Y' = 3.94665 + 0.87918(X).$$

Thus, for the experimental group's mean pretest score of 11.4047, its predicted posttest score would be

$$Y' = 3.94665 + 0.87918(11.4047) = 13.9734.$$

The outcome of this non-equivalent, no-treatment control group design is depicted in Figure 3. Its salient characteristics are that the control group initially outperformed the experimental group; however the difference between the experimental and control groups is greater at the pretest than at posttest. In fact the observed posttest score of 14.0078 was even greater that predicted. This is a particularly interesting outcome since it is the one desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Further analysis, as illustrated in Table 6, employing the SPSS subprogram T-TEST was undertaken to determine if a statistically significant difference ($p < .05$) existed between the low achieving CAI Chapter 1 students vocabulary pretest and posttest scores. A statistically significant difference ($p < .05$) was observed, which indicates that the CAI program had a positive effect upon the vocabulary achievement growth of the experimental group. However, no significant difference ($p < .05$) was observed between the expected and observed posttest scores.

Comprehension

Table 7 presents the number of students, mean scores, and selected statistics for the t-test generated by SPSS subprogram T-TEST. The

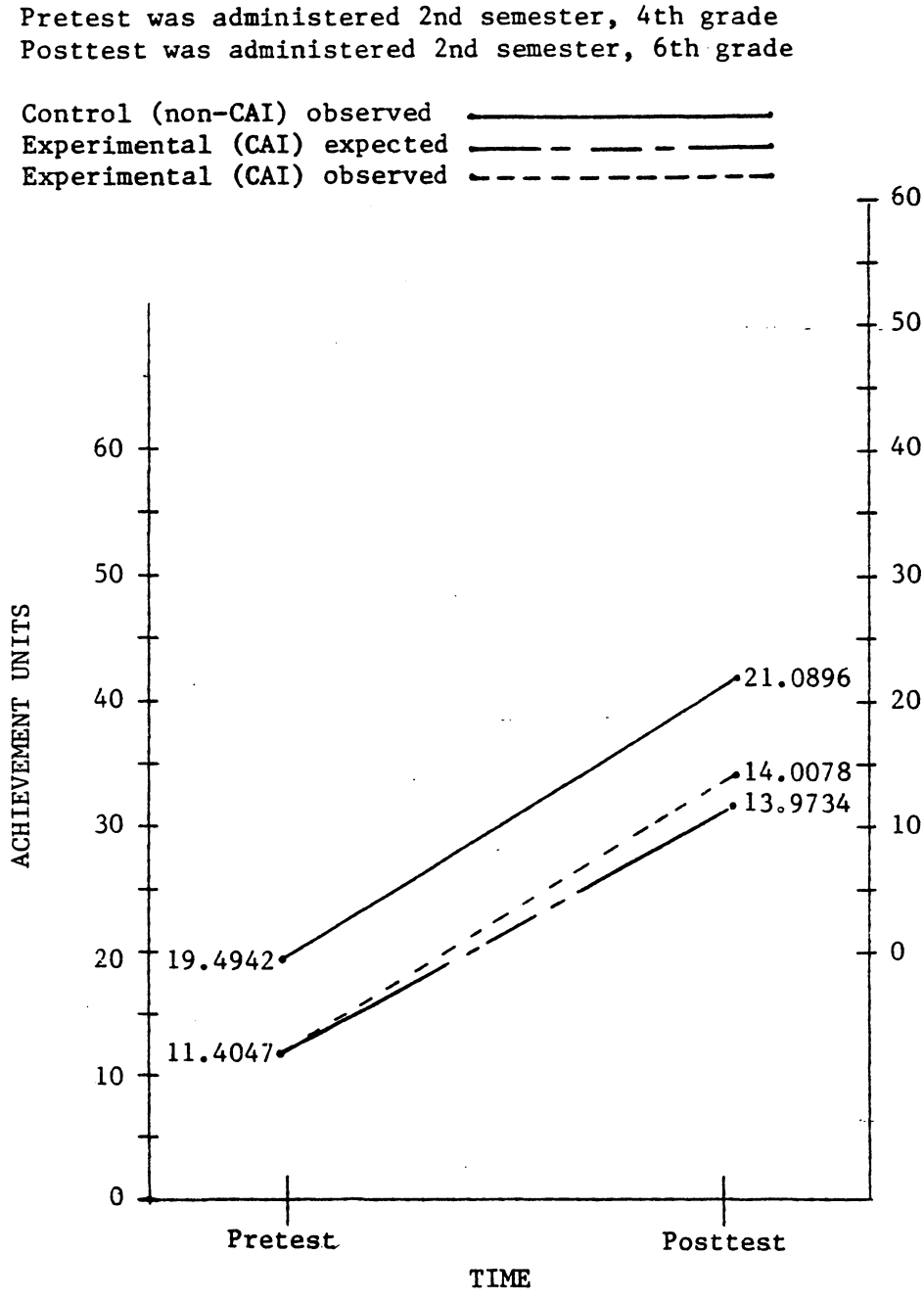

Figure 3

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Vocabulary

Table 6

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Vocabulary Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	11.4047	2.6031	257	-6.16	256	0.000
Posttest	14.0078					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	13.9734	0.0344	257	0.01	256	0.994
Observed	14.0078					

Table 7

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Comprehension Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	13.2335	-16.01	512	0.000
Control	257	23.7432			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

t-test statistical procedure was calculated to determine if a statistically significant difference ($p < .05$) existed between the SRA: Comprehension pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group), since the researcher was unable to assign subjects randomly to treatment groups. A statistically significant difference ($p < .05$) between the experimental and control groups was observed. Based upon this analysis, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

Bivariate regression analysis in this research study was employed to predict the posttest vocabulary achievement scores of the experimental group by comparing their pretest scores to pretest/posttest scores of the control group. Table 8 shows selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for the control group on the pretest/posttest administrations of the SRA: Comprehension test. The Multiple R indicated that a positive relationship existed between the pretest and posttest scores; while R Square indicated that nearly 40 percent of the variation in the posttest was explained by linear regression on the pretest variable. To obtain a predicted posttest score (Y') for the experimental group on any given level of pretest (X), prediction equation

$$Y' = A + BX$$

would be

$$Y' = 12.91024 + 0.72928(X).$$

Table 8

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Comprehension Pretest/Posttest Raw Scores

Multiple R	0.62897
R Square	0.39560
Standard Error	8.65781

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	12510.72515	12510.72515
Residual	255	19114.18536	74.95759

F = 166.90405 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.72928	0.05645	0.61811	0.62897
Constant A	12.91024	1.44501	10.06457	

Therefore, for the experimental group's mean pretest score of 13.2335, its predicted posttest score would be

$$Y' = 12.91024 + 0.72928(13.2335) = 22.5612.$$

Figure 4 illustrates the outcome of this non-equivalent, no-treatment control group design. Initially the control group outperformed the experimental group; yet, the notable characteristic is that the difference between the experimental and control groups is greater at pretest than at posttest, even though the observed posttest score was less than predicted. Still, the outcome is interesting because it is the one desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Depicted in Table 9, further analysis utilizing the SPSS subprogram T-TEST was performed to determine if a statistically significant difference ($p < .05$) existed between the experimental group's comprehension pretest and posttest scores. A statistically significant difference ($p < .05$) was observed, which indicates that the CAI program had a positive effect upon the comprehension achievement of the experimental group. A statistically significant difference ($p < .05$) was also observed between the expected and observed posttest scores.

Total Reading

The number of students, mean scores, and selected statistics for the t-test generated by the SPSS subprogram T-TEST are presented in Table 10. Due to the fact that the researcher was not able to assign subjects randomly to treatment groups, the t-test statistical procedure was performed to ascertain if a statistically significant difference ($p < .05$) existed between the SRA: Total Reading pretest raw scores

Pretest was administered 2nd semester, 4th grade
Posttest was administered 2nd semester, 6th grade

Control (non-CAI) observed
Experimental (CAI) expected
Experimental (CAI) observed

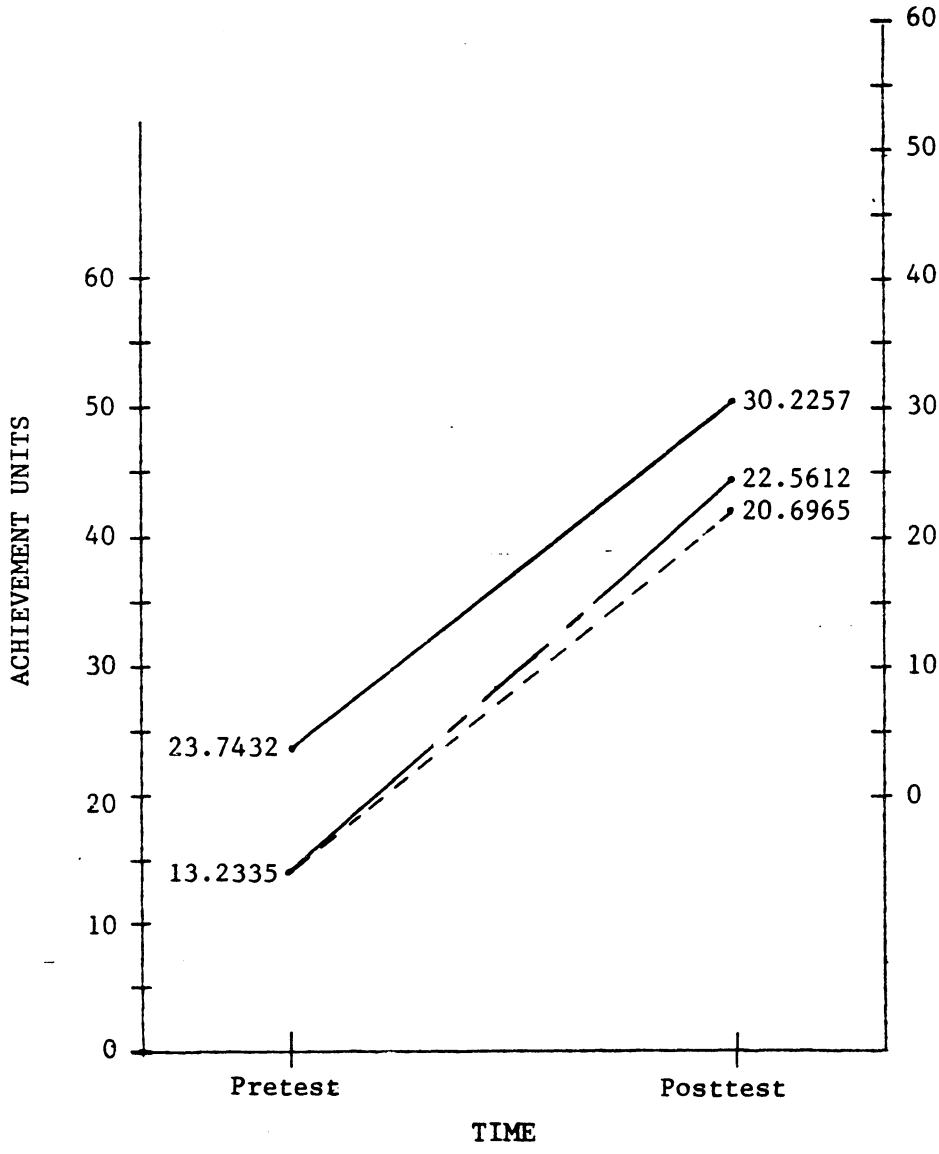

Figure 4

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Comprehension

Table 9

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Comprehension Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	13.2335	7.4630	257	-15.43	256	0.000
Posttest	20.6965					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	22.5612	1.8647	257	-3.99	256	0.000
Observed	20.6965					

Table 10

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Total Reading Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	24.6070	-16.86	512	0.000
Control	257	42.9377			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group). The analysis showed that a statistically significant difference ($p < .05$) between the experimental and control groups was present. Founded upon this analysis, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

In this research study bivariate regression analysis was employed to predict the posttest total reading achievement scores of the experimental group by comparing the pretest scores to the pretest/posttest scores of the control group. Table 11 exhibits selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for the control group on the pretest/posttest administrations of the SRA: Total Reading test. The Multiple R indicated that a positive relationship existed between the prestes and the posttest scores; while R Square indicated that over 46 percent of the variation in the posttest is explained by linear regression on the posttest variable. To obtain a predicted posttest score (Y') for the experimental group on any given level of the pretest (X), the A and B constants in the linear prediction equation

$$Y' = A + BX$$

would be

$$Y' = 16.35275 + 0.75626(X).$$

Hence, for the experimental group's mean pretest score of 24.6070, its predicted posttest score would be

$$Y' = 16.35275 + 0.75626(24.6070) = 34.9620.$$

Table 11

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Total Reading Pretest/Posttest Raw Scores

Multiple R	0.68168
R Square	0.46468
Standard Error	12.84676

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	36532.11219	36532.11219
Residual	255	42085.00844	165.03925

F = 221.35409 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.75626	0.05023	0.65616	0.68168
Constant A	16.35275	2.32503	11.77404	

Figure 5 demonstrates the outcome of this non-equivalent, no-treatment control group design. The control group initially outperformed the experimental group; however, the difference between the experimental and control groups is greater at pretest than at posttest. This is quite significant since the observed posttest score of 34.6070 is less than the predicted score of 34.9620. This outcome is particularly interesting because it is the one desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Further analysis, summarized in Table 12, employing the SPSS subprogram T-TEST was conducted to determine if a statistically significant difference ($p < .05$) existed between the experimental group's total reading pretest and posttest scores. A statistically significant difference ($p < .05$) was observed, which indicates that the CAI program had a positive effect upon the total reading achievement of the experimental group. However, no statistically significant difference ($p < .05$) was observed between the expected and observed posttest scores.

Summary

The purpose of this section was to present and compare the reading achievement growth of low achieving CAI Chapter 1 sixth-grade students (experimental group) with the reading achievement growth of moderate to high achieving non-CAI Chapter 1 sixth-grade students (control group) to test Sub-hypothesis 1 which holds:

> There are no significant differences in the reading-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

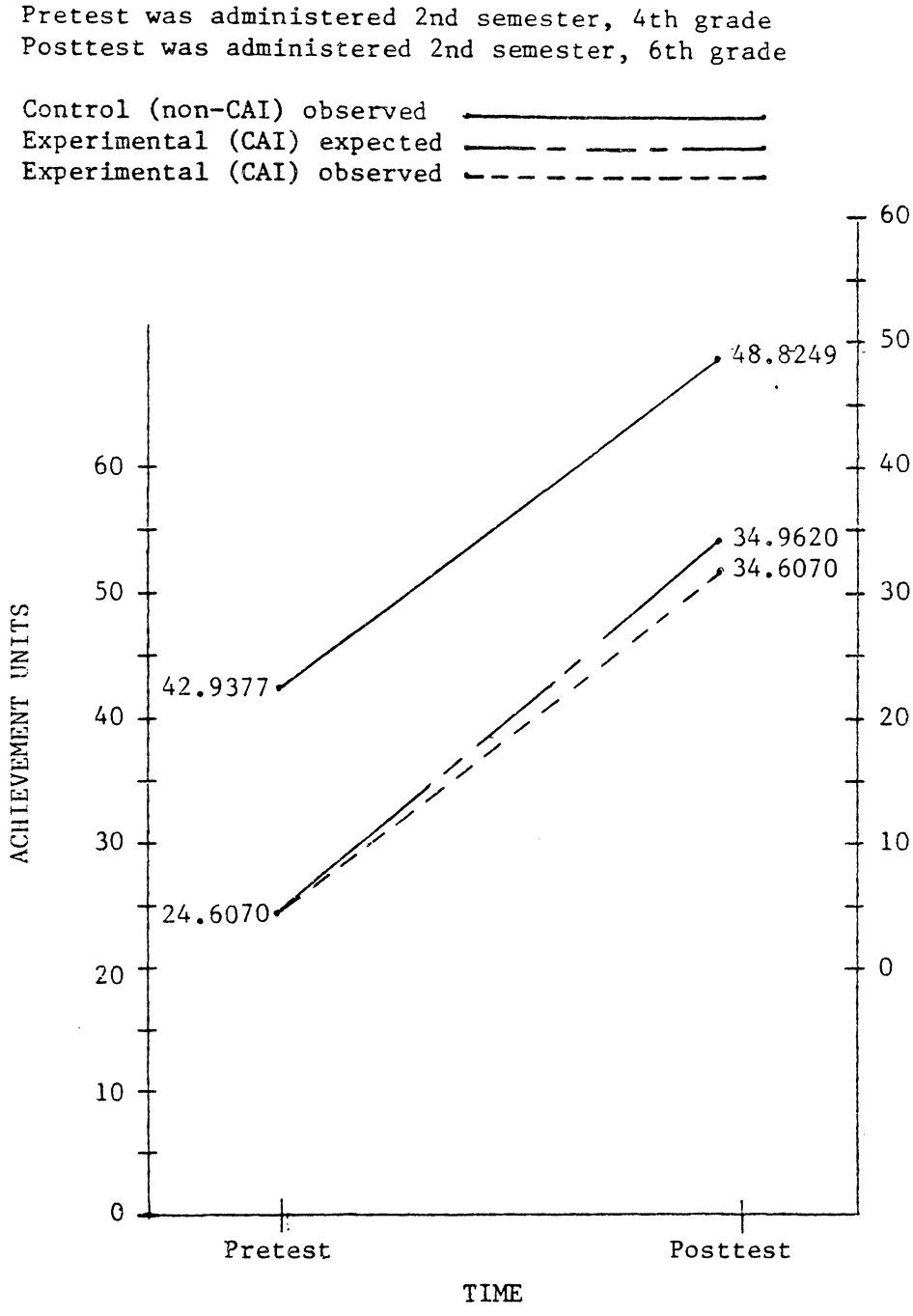

Figure 5

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Total Reading

Table 12

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Total Reading Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	24.6070	10.0000	257	-12.36	256	0.000
Posttest	34.6070					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	34.9620	0.355	257	-0.46	256	0.649
Observed	34.6070					

Based upon the findings of this research study which found significant reading achievement growth for low achieving Chapter 1 students who received supplemental reading instruction via computer-assisted instruction when compared to the reading achievement growth for moderate to high achieving Chapter 1 students who did not receive supplemental reading instruction via computer-assisted instruction, Sub-hypothesis 1 was rejected.

EFFECTS OF CAI UPON STUDENT LANGUAGE ARTS ACHIEVEMENT GROWTH

The purpose of this section is to present and compare the language arts achievement growth of low achieving CAI Chapter 1 sixth-grade students with the language arts achievement growth of moderate to high achieving non-CAI Chapter 1 sixth-grade students to test Sub-hypothesis 2 which holds:

> There are no significant differences in the language arts-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/ language arts program.

Usage

Table 13 cites the number of students, mean scores, and selected statistics for the t-test generated by the SPSS subprogram T-TEST. The t-test statistical procedure was performed to discover if a statistically significant difference ($p < .05$) existed between the SRA: Usage pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group), because the researcher was not in a position to assign subjects randomly to treatment groups. A statistically significant difference

Table 13

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Usage Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	22.1751	-7.27	512	0.000
Control	257	27.9066			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

($p < .05$) between the experimental and control groups was observed. Due to this finding, the non-equivalent control group design (see Chapter Three) was selected for further analysis, utilizing a bivariate regression statistical model.

Bivariate regression analysis in this study was conducted to predict the posttest usage achievement scores of low achieving CAI students by comparing their pretest scores to pretest/posttest scores of moderate to high achieving non-CAI Chapter 1 students. Table 14 presents selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for moderate to high achieving non-CAI Chapter 1 students on the pretest/posttest administrations of the SRA: Usage test. The Multiple R indicates that a positive relationship exists between the pretest and posttest scores; while R Square indicates that nearly 27 percent of the variation in the posttest is explained by linear regression on the pretest variable. To obtain a predicted score (Y') for the experimental group on any given level of pretest (X), the A and B constants in the linear prediction equation.

$$Y' = A + BX$$

would be

$$Y' = 15.18658 + 0.33032(X).$$

Therefore, for the experimental group's mean pretest score of 22.1751, its predicted posttest score would be

$$Y' = 15.18658 + 0.33032(22.1751) = 22.5146.$$

Figure 6 illustrates the outcome of this non-equivalent, no-treatment control group design. Initially the control group outperformed the

Table 14

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Usage Pretest/Posttest Raw Scores

Multiple R	0.51621
R Square	0.26647
Standard Error	5.50471

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	2806.95745	2806.95745
Residual	255	7726.95694	30.30179

F = 92.63338 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.33032	0.03432	0.26273	0.51621
Constant A	15.18658	1.01745	13.18290	

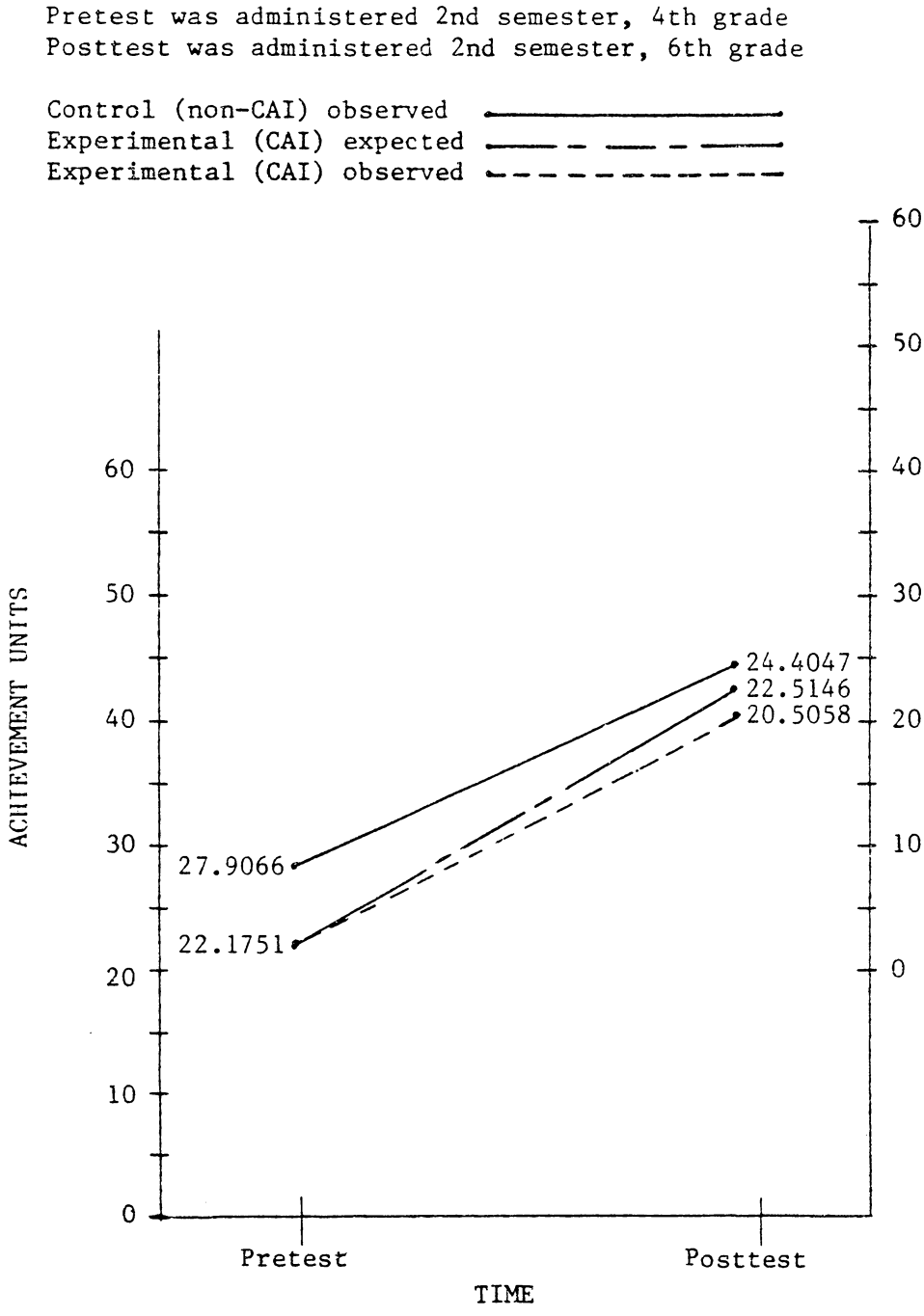

Figure 6

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Usage

experimental group. In addition, the difference between the experimental and control groups were greater at the pretest than at posttest. This is notable because both groups scored lower on their respective posttest; the experimental group even scored lower than its predicted score. This outcome is interesting even though it is not quite the classic outcome desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Further analysis, depicted in Table 15, utilizing the SPSS subprogram T-TEST was undertaken to determine if a statistically significant difference ($p < .05$) existed between the experimental group's usage pretest and posttest scores. A statistically significant difference ($p < .05$) was observed. This finding coupled with the finding that the differences between the experimental and the control groups was greater at the pretest than at posttest--even though both groups scored lower on their respective posttest--indicated that the CAI program had a positive effect upon the usage achievement growth of the experimental group. A statistically significant difference ($p < .05$) was observed between the expected and observed posttest scores.

Spelling

Table 16 presents the number of students, mean scores, and selected statistics for the t-test generated by SPSS subprogram T-TEST. The t-test statistical procedure was calculated to ascertain if a statistically significant difference ($p < .05$) existed between the SRA: Spelling pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group), since the researcher was unable to assign subjects

Table 15

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Usage Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	22.1751	1.6693	257	3.10	256	0.002
Posttest	20.5058					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	22.5146	2.0088	257	-5.83	256	0.000
Observed	20.5058					

Table 16

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Spelling Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	13.1634	-8.75	512	0.000
Control	257	17.8599			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

randomly to treatment groups. A statistically significant difference ($p < .05$) between the experimental and control groups was observed. Based upon this analysis, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

Bivariate regression analysis in this research study was employed to predict the posttest achievement scores of the experimental group by comparing their pretest scores to pretest/posttest scores of the control group. Table 17 shows selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for the control group on the pretest/posttest administrations of the SRA: Spelling test. The Multiple R indicated that a positive relationship existed between the pretest and posttest scores; while R Square indicated that over 47 percent of the variation in the posttest was explained by linear regression on the pretest variable. To obtain a predicted posttest (Y') for the experimental group on any given level of pretest (X), the A and B constants in the linear prediction equation

$$Y' = A + BX$$

would be

$$Y' = 5.08812 + 0.71511(X).$$

Therefore, for the experimental group's mean pretest score of 13.1634, its predicted posttest score would be

$$Y' = 5.08812 + 0.71511(13.1634) = 14.5014.$$

Figure 7 illustrates the outcome of this non-equivalent, no-treatment control group design. Initially the control group outperformed the experimental group; yet, the notable characteristic was that the difference between the experimental and control groups was greater at the pretest that at posttest--even though the observed posttest score for the

Table 17

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Spelling Pretest/Posttest Raw Scores

Multiple R	0.69280
R Square	0.47997
Standard Error	0.50753

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	4781.90581	4781.90581
Residual	255	5181.05139	20.31785

F = 235.35493 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.71511	0.04661	0.62331	0.69280
Constant A	5.08812	0.87871	3.35767	

Pretest was administered 2nd semester, 4th grade
Posttest was administered 2nd semester, 6th grade

Control (non-CAI) observed
Experimental (CAI) expected
Experimental (CAI) observed

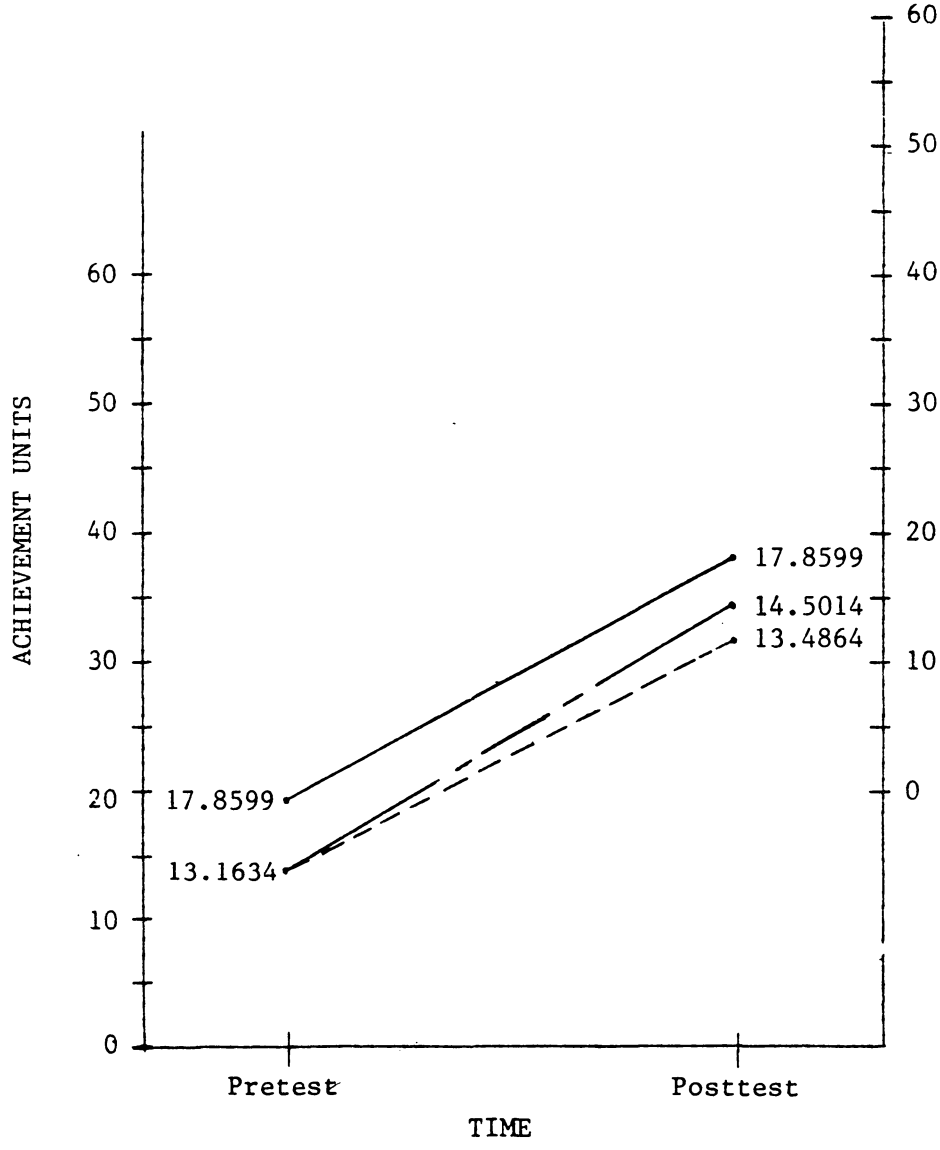

Figure 7

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Spelling

experimental group was less than predicted. Still, the outcome is interesting because it is the one desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Depicted in Table 18, further analysis employing the SPSS subprogram T-TEST was performed to determine if a statistically significant difference ($p < .05$) existed between the experimental group's spelling pretest and posttest scores. A statistically significant difference ($p < .05$) was not observed. This finding coupled with the finding that the difference between the experimental and control groups was less at the posttest--still indicated that the CAI program had a positive effect upon the spelling achievement growth of the experimental group. However, a statistically significant difference was observed between expected and observed posttest scores.

Total Language Arts

The number of students, mean scores, and selected statistics for the t-test generated by the SPSS subprogram T-TEST are presented in Table 19. Due to the fact the researcher was not able to assign subjects randomly to treatment groups, the t-test statistical procedure was performed to ascertain if a statistically significant difference ($p < .05$) existed between the SRA: Total Language Arts pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group). The analysis show that a statistically significant difference ($p < .05$) between the experimental and control group was present. Founded upon this analysis, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

Table 18

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Spelling Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	13.1634	0.3230	257	-0.68	256	0.496
Posttest	13.4864					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	14.5014	1.015	257	-2.45	256	0.015
Observed	13.4864					

Table 19

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Total Language Arts Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	34.3152	-9.73	512	0.000
Control	257	45.6381			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

For this research study bivariate regression analysis was employed to predict the posttest total language arts achievement scores of the experimental group by comparing their pretest scores to the pretest/posttest scores of the control group. Table 20 exhibits selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for the control group on the pretest/posttest administrations of the SRA: Total Language Arts test. The Multiple R indicated that a positive relationship existed between the pretest and posttest scores; while R Square indicated that approximately 55 percent of the variation in the posttest is explained by linear regression on the posttest variable. To obtain a predicted posttest score (Y') for the experimental group on any given level of the pretest (X), the A and B constants in the linear prediction equation

$$Y' = A + BX$$

would be

$$Y' = 31.30678 + 0.63135(X).$$

Hence, for the experimental groups mean pretest score of 34.3152, its predicted posttest score would be

$$Y' = 31.30678 + 0.63135(34.3152) = 52.9717.$$

Figure 8 demonstrates the outcome of this non-equivalent, no-treatment control group design. The control group initially outperformed the experimental group; however, the difference between the two groups is slightly greater at posttest. The findings indicated that the non-equivalent groups were growing at different average rates in a common positive direction. Thus, when the differential growth continued for the total course of the experiment (in the absence of other forces which affect observed growth, such as ceiling effects), it will result

Table 20

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Total Language Arts Pretest/Posttest Raw Scores

Multiple R	0.54577
R Square	0.29786
Standard Error	13.82014

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	20661.21451	20661.21451
Residual	255	48704.04619	190.99626

F = 108.17602 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.63135	0.06070	0.51181	0.54577
Constant A	31.30678	2.90139	25.59305	

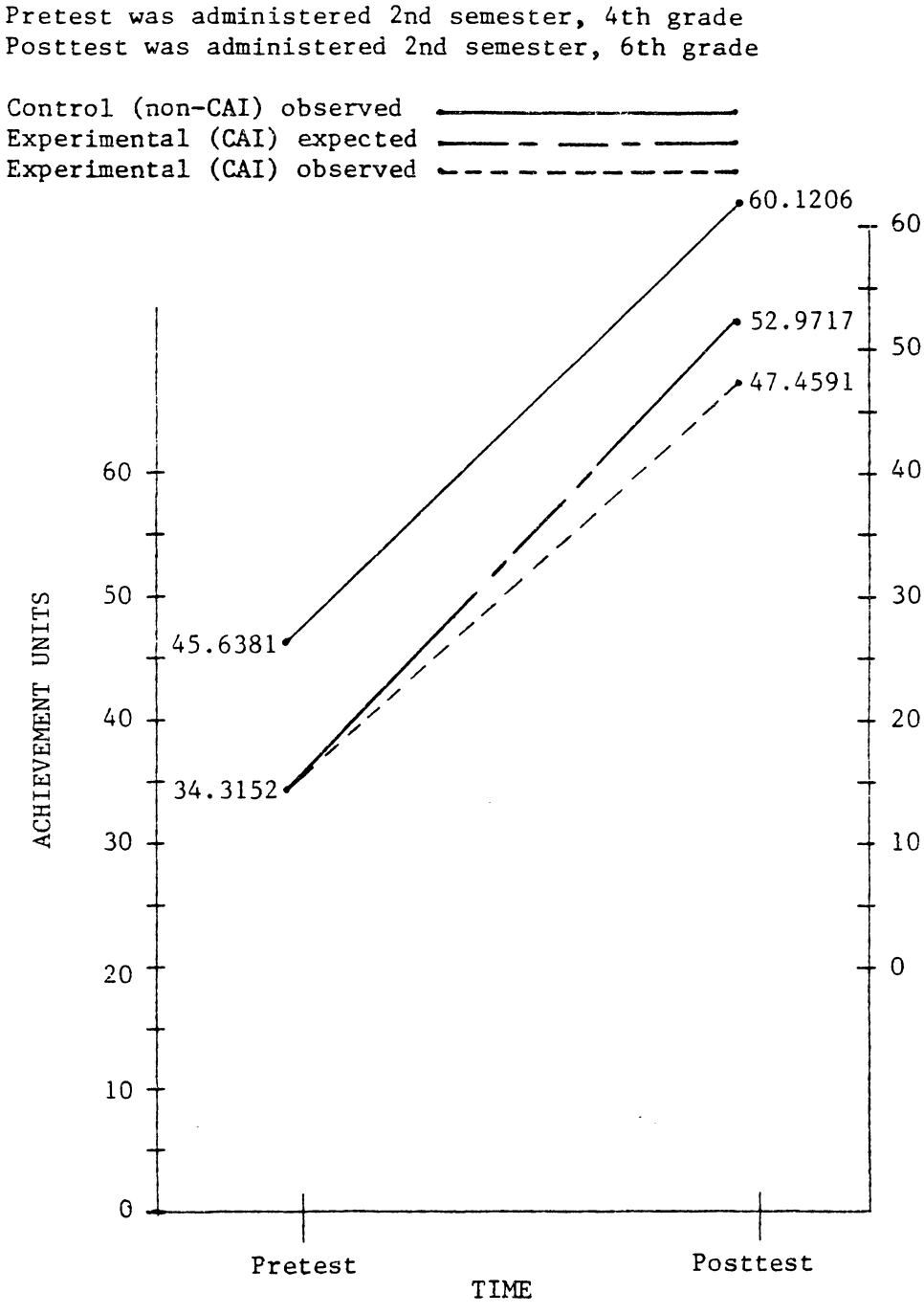

Figure 8

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Total Language Arts

in larger posttest than pretest differences between groups. This pattern has nothing to do with the effects of the treatment on the experimental group. This outcome, therefore, is not quite the particular one desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Further analysis, summarized in Table 21, employing the SPSS subprogram T-TEST was conducted to determine if a statistically significant difference ($p < .05$) existed between the experimental group's total language arts pretest and posttest scores. A statistically significant difference ($p < .05$) was observed, which indicates that the CAI program had a positive effect upon the total language arts achievement growth of the experimental group. Also, a statistically significant difference ($p < .05$) was observed between the expected and observed posttest scores.

Summary

The purpose of this section was to present and compare the reading achievement growth of low achieving CAI Chapter 1 sixth-grade students (experimental group) with the reading achievement growth of moderate to high achieving non-CAI Chapter 1 sixth-grade students (control group) to test Sub-hypothesis 2 which holds:

> There are no significant differences in the language arts-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Based upon the findings of this research study which found significant language arts achievement growth for low achieving Chapter 1 students who received supplemental language arts instruction via computer-assisted

Table 21

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Total Language Arts Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	34.3152	13.1440	257	-11.28	256	0.000
Posttest	47.4591					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	52.9717	5.5125	257	-5.48	256	0.000
Observed	47.4591					

instruction when compared to the language arts achievement growth for moderate to high achieveing Chapter 1 students who did not receive supplemental language arts instruction via computer-assisted instruction, Sub-hypothesis 2 was rejected.

EFFECTS OF CAI UPON STUDENT EDUCATIONAL ABILITY AND OVERALL ACHIEVEMENT GROWTH

The purposes of this section are to present and compare the educational ability achievement growth of low achieving CAI Chapter 1 sixth-grade students with the educational ability achievement growth of moderate to high achieving Chapter 1 sixth-grade students; and to present and compare the overall achievement growth of Chapter 1 elementary school students prior to and after the Chapter 1 computer-assisted instruction reading/language arts program was commenced. The findings of this section will be utilized to test Sub-hypothesis 3 which holds:

> There are no significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 computer-assisted instruction reading/language arts program was commenced.

Educational Ability

The number of students, mean scores, and selected statistics for the t-test generated by the SPSS subprogram T-TEST are presented in Table 22. Due to the fact the researcher was not in a position to assign subjects randomly to treatment groups, the t-test statistical procedure was

Table 22

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Moderate to High Achieving Non-CAI Chapter 1 Students with Low Achieving CAI Chapter 1 Students

SRA: Educational Ability Series Pretest Raw Scores

Group	Number of Cases	Mean	t Value	df	2-Tail Probability
Experimental	257	14.2296	-7.43	512	0.000
Control	257	19.1518			

Experimental - Low Achieving CAI Chapter 1 Students
Control - Moderate to High Achieving Non-CAI Chapter 1 Students

calculated to determine if a statistically significant difference ($p < .05$) existed between the SRA: Educational Ability Series pretest raw scores of moderate to high achieving non-CAI Chapter 1 students (control group) and low achieving CAI Chapter 1 students (experimental group). A statistically significant difference ($p < .05$) between the experimental and control groups was observed. Based upon this finding, the non-equivalent control group design (see Chapter Three) was selected for further analysis, employing a bivariate regression statistical model.

For this research study bivariate regression analysis was employed to predict the posttest educational ability achievement scores of the experimental group by comparing its pretest scores to the pretest/posttest scores of the control group. Table 23 exhibits selected statistics for the bivariate regression analysis generated by the SPSS subprogram NEW REGRESSION for the control group on the pretest/posttest administrations of the SRA: Educational Ability Series test. The Multiple R indicated that a positive relationship existed between the prestest and posttest scores; however, R Square indicated that only 18.4 percent of the variation in the posttest was explained by linear regression on the posttest variable. To obtain a predicted posttest score (Y') for the experimental group on any given level of the pretest (X), the A and B constants in the linear prediction equation

$$Y' = A + BX$$

would be

$$Y' = 12.45230 + 0.52657(X).$$

Hence, for the experimental group's mean pretest score of 14.2296, its predicted posttest score would be

$$Y' = 12.45230 + 0.52657(14.2296) = 19.9452.$$

Table 23

Selected Statistics for Bivariate Regression Generated by the SPSS Subprogram NEW REGRESSION for Moderate to High Achieving Non-CAI Chapter 1 Students

SRA: Educational Ability Series Pretest/Posttest Raw Scores

Multiple R	0.42836
R Square	0.18350
Standard Error	8.45500

Analysis of Variance

Source	df	Sum of Squares	Mean Square
Regression	1	4096.71563	4096.71563
Residual	255	18229.18320	71.48699

F = 57.30715 Significance of F = 0.0000

Variable	B	Standard Error of B	95 Confidence	BETA
Pretest	0.52657	0.06956	0.38958	0.42836
Constant A	12.45230	1.43276	9.63074	

Figure 9 demonstrates the outcome of this non-equivalent, no-treatment control group design. Initially the control group outperformed the experimental group and the difference between the two groups is slightly greater at posttest. The experimental group also performed lower than predicted for the posttest. The findings indicated that the non-equivalent groups were growing at different average rates in a common positive direction. Thus, when the differential growth continued for the total course of the experiment (in the absence of other forces which affect observed growth, such as ceiling effects), it will result in larger posttest than pretest differences between groups. This pattern has nothing to do with the effects of the treatment on the experimental group. This outcome, therefore, is not quite the classic outcome desired when organizations introduce compensatory programs, such as Chapter 1, to increase the performance of educationally disadvantaged groups.

Continued analysis, summarized in Table 24, employing the SPSS subprogram T-TEST was conducted to determine if a statistically significant difference ($p < .05$) existed between the experimental group's educational ability pretest and posttest scores. A statistically significant difference ($p < .05$) was observed, which indicated that the CAI program had a positive effect upon the educational achievement growth of the experimental group. A statistically significant difference ($p < .05$) was also observed between the expected and observed posttest scores.

Overall Achievement Growth

The primary emphasis of the LEA's reading/language arts program is placed upon upgrading the student's skills in language experience, word building, sentence building, composition building, reading vocabulary,

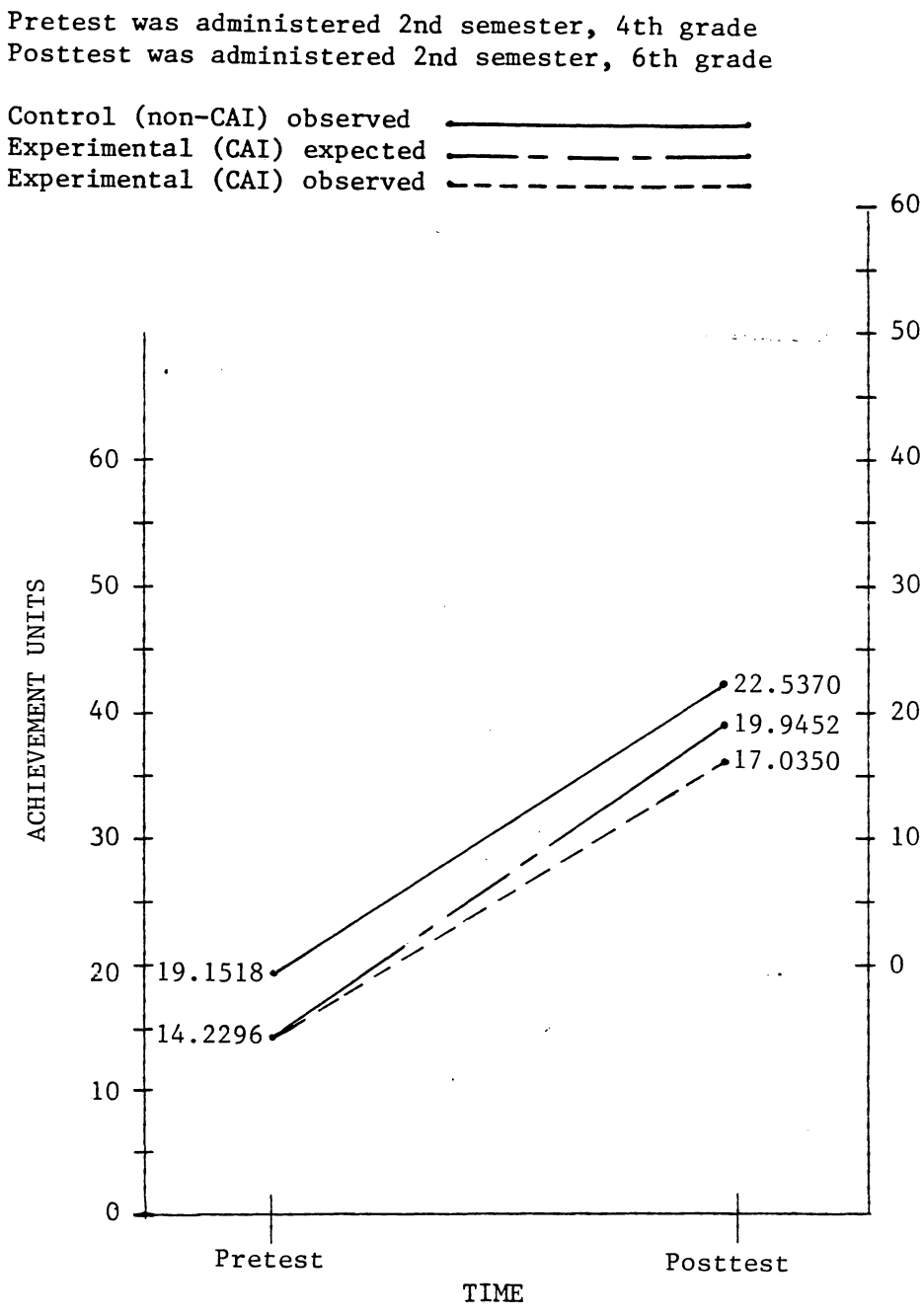

Figure 9

Comparison of Growth by Raw Scores for Moderate to High Achieving Non-CAI Chapter 1 Students (Control Group) with Low Achieving CAI Chapter 1 Students (Experimental Group)

SRA: Educational Ability Series

Table 24

Selected Statistics for the t-test Generated by the SPSS Subprogram T-TEST for Low Achieving CAI Chapter 1 Students

SRA: Educational Ability Series Pretest/Posttest Raw Scores

Test	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Pretest	14.2296	-2.8054	257	-4.67	256	0.000
Posttest	17.0350					

Posttest	Mean	Difference	Number of Cases	t Value	df	2-Tail Probability
Expected	19.9452	2.9101	257	-6.07	256	0.000
Observed	17.0350					

reading comprehension, critical reading, study skills, and symbols of communication. Since September 1981 (school year 1981-82) the performance-based reading/language arts curriculum provided for low achieving students in grades five and six of the LEA's targeted Chapter 1 schools has been reinforced through reading/language arts computer-assisted instruction (CAI).

Table 25 presents a comparison of the normal curve equivalent (NCE) achievement mean scores for Chapter 1 sixth-grade students in reading and language arts for school years 1979-80 through 1982-83; while Figures 10 and 11 illustrate comparisons of growth for Chapter 1 sixth-grade students by NCE reading/language arts achievement mean scores prior to and after the Chapter 1 CAI reading/language arts program was commenced for low achieving Chapter 1 students in grades five and six. Comparisons of observed student achievement growth in reading (Figure 10) and language arts (Figure 11) prior to and after the introduction of the CAI reading/language arts program demonstrate that more significant achievement growth in reading and language arts had taken place since the introduction of CAI. This outcome indicated that the CAI reading/language arts program had a significant effect overall reading/language arts achievement growth of Chapter 1 elementary school students.

Summary

The purposes of this section were to present and compare the educational ability achievement growth of low achieving CAI Chapter 1 sixth-grade students with the educational ability achievement growth of moderate to high achieving Chapter 1 sixth-grade students; and to present and compare the overall achievement growth of Chapter 1 elementary

Table 25

Comparison of Normal Curve Equivalent (NCE) Achievement Mean Scores for Chapter 1 Sixth-grade Students in Reading and Language Arts for School Years 1979-80 Through 1982-83

Two-year Period	Reading NCE Means		Language Arts NCE Means	
	Pretest	Posttest	Pretest	Posttest
1979/80-1980/81	27.6	35.7	32.0	38.7
1980/81-1981/82	31.8	37.0	35.4	40.8
1981/82-1982/83	31.8	45.3	34.9	40.6

Pretest was administered 1st semester, 5th grade
Posttest was administered 2nd semester, 6th grade

Pretest was administered 1st semester, 5th grade
Posttest was administered 2nd semester, 6th grade

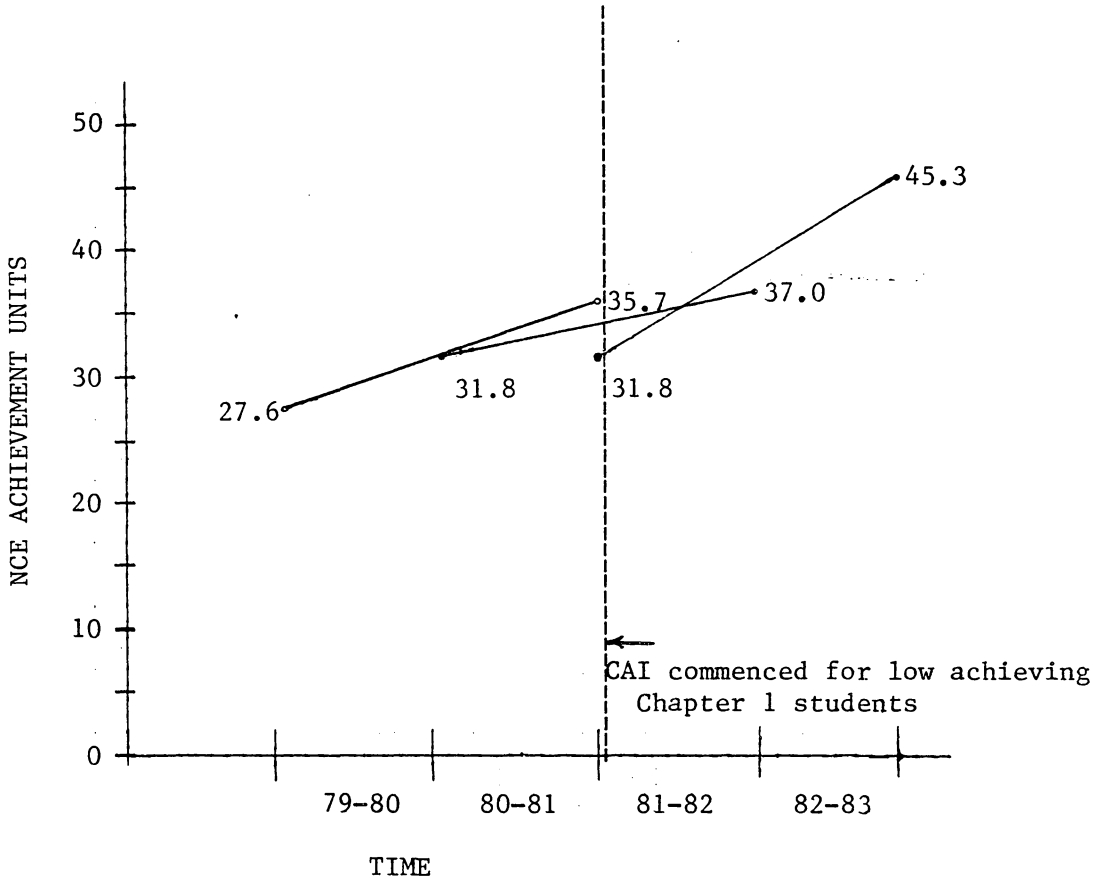

Figure 10

Comparison of Growth by Normal Curve Equivalent (NCE) Achievement Mean Scores for Chapter 1 Sixth-grade Students in Reading for School Years 1979-80 Through 1982-83

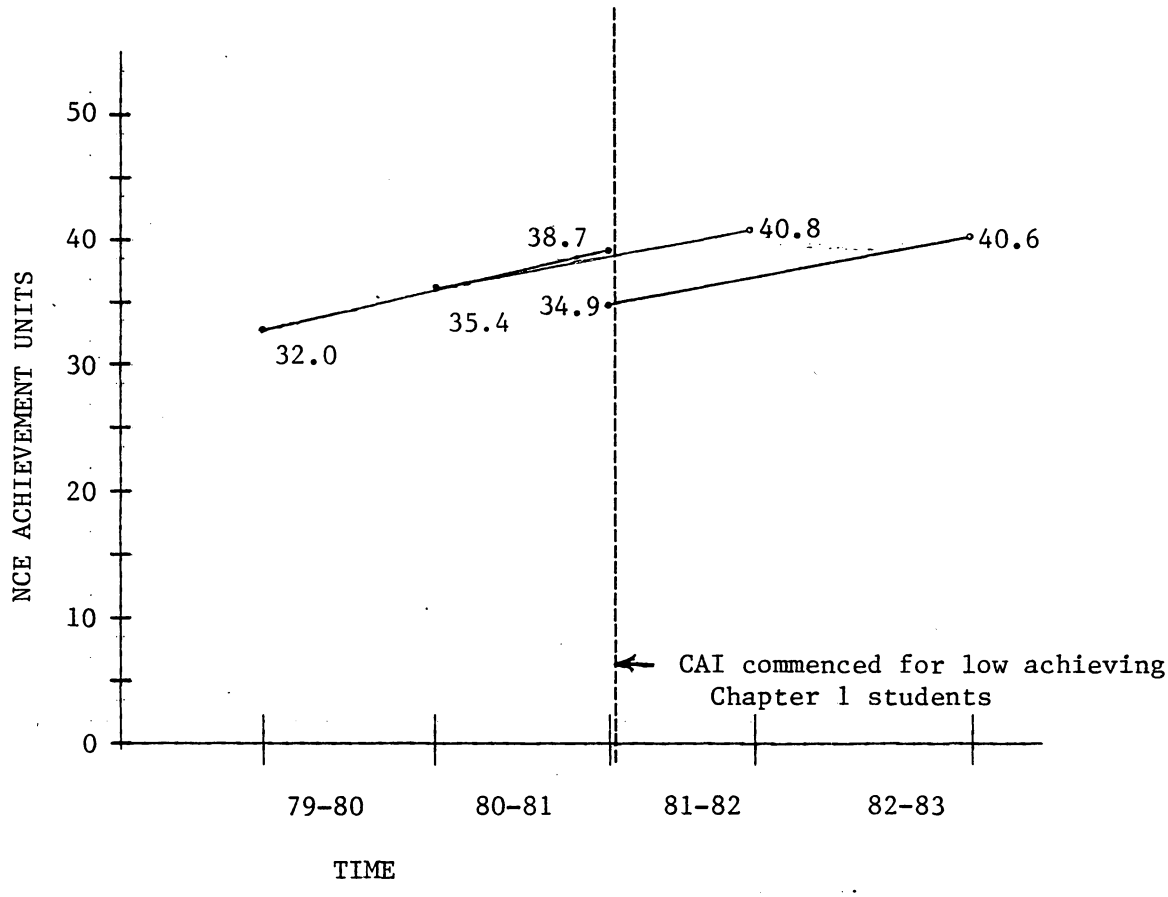

Figure 11

Comparison of Growth by Normal Curve Equivalent (NCE) Achievement Mean Scores for Chapter 1 Sixth-grade Students in Language Arts for School Years 1979-80 Through 1982-83

school students prior to and after the Chapter 1 computer-assisted instruction reading/language arts program was commenced. The findings of this section were utilized to test Sub-hypothesis 3 which holds:

> There are no significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 computer-assisted instruction reading/language arts program was commenced.

Based upon the findings of this research study which found significant educational ability achievement growth for low achieving Chapter 1 students who received supplemental reading/language arts CAI when compared to the educational ability achievement growth for moderate to high achieving Chapter 1 students who did not receive supplemental reading/language arts CAI; and which found more significant reading and language arts achievement growth for Chapter 1 elementary school students after the CAI reading/language arts program was commenced, Sub-hypothesis 3 was rejected.

SUMMARY

The purpose of this research study was to determine the effects of an eastern-USA LEA's Chapter 1 CAI reading/language arts program upon the achievement growth of students in the Chapter 1 elementary school program. In this chapter the major steps of identifying and describing the randomly selected sample population of elementary Chapter 1 sixth-grade students, presenting and analyzing the test data, and testing the three Sub-hypotheses were undertaken.

Based upon the findings of this research study which found significant reading, language arts, and educational ability achievement growth for low achieving Chapter 1 sixth-grade students who received

supplemental reading/language arts CAI when compared with the reading, language arts, and educational ability achievement growth of moderate to high achieving Chapter 1 sixth-grade students who did not receive supplemental reading/language arts CAI; and based upon the findings of this study which found more significant reading and language arts for Chapter 1 elementary school students after the reading/language arts CAI program was commenced, each of the three Sub-hypotheses was rejected. Therefore, based upon these findings the Null Hypothesis put forth in this study which holds:

> The Chapter 1 computer-assisted instruction reading/langauge arts program will have no significant effects upon the achievement growth of the Chapter 1 students.

was rejected.

Chapter Five

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The first part of this final chapter contains a brief summary of the research--including the findings. The second part contains conclusions based upon the findings. The last section focuses on recommendations for further study.

SUMMARY

The focus of this study was to determine the effects of computer-assisted instruction (CAI) upon student achievement. Specifically, the purpose of this research study was to determine the effects of an eastern-USA LEA's Chapter 1 reading/language arts CAI program upon the reading, language arts, and educational ability achievement growth of sixth-grade Chapter 1 students and upon the achievement growth of students in the Chapter 1 elementary school program.

The sample for this study was drawn from the LEA's entire population of 1,018 Chapter 1 sixth-grade students. The experimental group of 257 students was randomly selected from the 366 students identified as low achievers, while the control group of 257 was randomly selected from the 652 students identified as moderate to high achievers. The experimental and control groups were matched by school, sex, and race. Each group had 105 black males, 27 white males, 103 black females, and 22 white females. Twenty-three of the LEA's 26 Chapter 1 elementary schools were represented by this sample.

Research Design

Since the researcher was not in a position to assign subjects randomly to treatment groups, the non-equivalent control group design when subjects are growing, Type 2, as developed by Bryk and Weisberg, was employed to analyze the pretest/posttest data and to test the hypotheses presented in this study. In addition, the t-test statistical procedure was performed to determine if statistically significant differences existed between the pretest/posttest scores of the experimental group. Finally, bivariate regression analysis was utilized to predict the posttest scores of the experimental group's pretest scores to the pretest/posttest scores of the control group.

Null Hypothesis

This study was designed to test the Null Hypothesis put forth in this study which holds:

> The Chapter 1 computer-assisted instruction reading/language arts program will have no significant effects upon the achievement growth of the Chapter 1 students.

Sub-Hypotheses

The following Sub-hypotheses (null) were tested in this study:

Sub-hypothesis 1. There are no significant differences in the reading-achievement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Sub-hypothesis 2. There are no significant differences in the language arts-achivement growth of Chapter 1 sixth-grade students who did or did not receive specialized instruction via the Chapter 1 computer-assisted instruction reading/language arts program.

Sub-hypothesis 3. There are no significant differences in the overall achievement growth of Chapter 1 elementary school students prior to or after the Chapter 1 computer-assisted instruction reading/language arts program was commenced.

Findings

Analysis of the data generated by this study indicated that the reading/language arts computer-assisted instruction (CAI) program had a significant positive effect upon Chapter 1 sixth-grade students achievement. Sub-hypotheses 1 and 2 were rejected because significant reading and language arts achievement growth was observed for the students who received specialized reading and language arts instruction via the reading/language arts CAI program when compared to the achievement growth of their fellow students who did not receive the instruction. Sub-hypothesis 3 was rejected because the educational ability achievement growth of the students who received the specialized instruction was also higher than that of their counterparts; and because overall achievement growth of the students was more significant after the reading/language arts CAI program was commenced. Therefore, based upon these findings the Null Hypothesis put forth in this study was also rejected.

CONCLUSIONS

Conclusive evidence was discovered to indicate that the LEA's Chapter 1 reading/language arts computer-assisted instruction (CAI) program had significant effects upon student achievement growth. Students who received the specialized reading and language arts instruction via the reading/language arts computer-assisted instruction program exhibited

significant achievement growth over their counterparts who did not receive the instruction. Furthermore, when the pretest/posttest achievement growth of the students who received the computer-assisted instruction were compared, the evidence indicated that the achievement growth of the students was significantly increased after the instruction. Finally, the evidence indicated that the computer-assisted instruction had the effect of increasing the overall achievement growth of all Chapter 1 students.

DISCUSSIONS

Chapter 1 funds are provided to states and local education agencies to help them to provide compensatory education programs for educationally disadvantaged youths. The full potential of the Chapter 1 program lies with effective and efficient implementation, utilization, and evaluation of its effect upon student achievement growth. Thus, operating on the premise that school administrators--especially the instructional leaders of the school, superintendents, school board members, teachers, and other interested individuals are concerned about the achievement growth of children, this study was undertaken to determine the effects of CAI upon the achievement growth of Chapter 1 elementary school students.

Since this controlled study has addressed and observed the effects of CAI upon positive student achievement growth, school administrators, and others now have a source document to assist them to develop a greater awareness of computers as instructional aids and as such tools in inter-disciplinary problem-solving. Therefore, when school administrators employ CAI under the terms of this study, meaningful student achievement growth can be expected. In this case CAI has illustrated its effectiveness in

assisting educationally disadvantaged youths to close the educational gap between themselves and their more educationally advantaged peers--the type of achievement growth for educationally disadvantaged youths that founding agencies are enthusiastic to support.

RECOMMENDATIONS FOR FURTHER STUDY

Since the purpose of this research study was to determine the effects of computer-assisted instruction upon the achievement growth of Chapter 1 elementary school students, this section of the study poses some questions for further empirical investigation.

1. It is recommended that a longitudinal study be conducted to determine the long-term effects of computer-assisted instruction upon the achievement growth of the Chapter 1 students in this study. The purpose is to determine if the achievement growth of the students is maintained.

2. It is recommended that the effects of computer-assisted instruction upon the achievement growth of Chapter 1 secondary students be investigated. The purpose is to determine if similar growth is observed for secondary students as presented in this study.

3. It is recommended that the effects of computer-assisted instruction upon the achievement growth of Chapter 1 elementary mathematics students be investigated. The purpose is to determine if similar growth is realized by mathematics students as presented in this study.

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BIBLIOGRAPHY

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APPENDICES

APPENDIX A

DEMOGRAPHIC DATA FOR SAMPLE BY CHAPTER 1 STUDENTS

Table 26

Demographic Data for Sample by Chapter 1 School

School Number	Group	Males		Females		Total
		White	Black	White	Black	
1.	Experimental	0	1	1	1	3
	Control	0	1	1	1	3
	Totals	0	2	2	2	6
2.	Experimental	0	3	0	2	5
	Control	0	3	0	2	5
	Totals	0	6	0	4	10
3.	Experimental	3	0	1	7	11
	Control	3	0	1	7	11
	Totals	6	0	2	14	22
4.	Experimental	2	10	3	11	26
	Control	2	10	3	11	26
	Totals	4	20	6	22	52
5.	Experimental	5	13	2	4	24
	Control	5	13	2	4	24
	Totals	10	26	4	8	48
6.	Experimental	3	5	0	8	16
	Control	3	5	0	8	16
	Totals	6	10	0	16	32
7.	Experimental	0	1	1	0	2
	Control	0	1	1	0	2
	Totals	0	2	2	0	4
8.	Experimental	0	1	1	2	4
	Control	0	1	1	2	4
	Totals	0	2	2	4	8
9.	Experimental	1	1	0	4	6
	Control	1	1	0	4	6
	Totals	2	2	0	8	12
10.	Experimental	0	4	0	2	6
	Control	0	4	0	2	6
	Totals	0	8	0	4	12
11.	Experimental	2	7	0	8	17
	Control	2	7	0	8	17
	Totals	4	14	0	16	34
12.	Experimental	0	9	3	9	21
	Control	0	9	3	9	21
	Totals	0	18	6	18	42

Table 26 (Cont)

Demographic Data for Sample by Chapter 1 School

School Number	Group	Males		Females		Total
		White	Black	White	Black	
13.	Experimental	0	1	1	2	4
	Control	0	1	1	2	4
	Totals	0	2	2	4	8
14.	Experimental	0	6	0	8	14
	Control	0	6	0	8	14
	Totals	0	12	0	16	28
15.	Experimental	2	4	1	2	9
	Control	2	4	1	2	9
	Totals	4	8	2	4	18
16.	Experimental	4	13	1	6	24
	Control	4	13	1	6	24
	Totals	8	26	2	12	48
17.	Experimental	0	4	0	7	11
	Control	0	4	0	7	11
	Totals	0	8	0	14	22
18.	Experimental	0	1	0	2	3
	Control	0	1	0	2	3
	Totals	0	2	0	4	6
19.	Experimental	1	4	1	9	15
	Control	1	4	1	9	15
	Totals	2	8	2	18	30
20.	Experimental	2	5	1	4	12
	Control	2	5	1	4	12
	Totals	4	10	2	8	24
21.	Experimental	2	6	3	3	14
	Control	2	6	3	3	14
	Totals	4	12	6	6	28
22.	Experimental	0	4	2	2	8
	Control	0	4	2	2	8
	Totals	0	8	4	4	16
23.	Experimental	0	2	0	0	2
	Control	0	2	0	0	2
	Totals	0	4	0	0	4

APPENDIX B

MEAN AND GROWTH RAW SCORES FOR CHAPTER 1 STUDENTS SCIENCE RESEARCH ASSOCIATES

Table 27

Mean and Growth Raw Scores for Chapter 1 Students

SCIENCE RESEARCH ASSOCIATES

Test	Group	Number of Students	Pretest Mean	Posttest Mean	Expected
Reading Vocabulary	Experimental	257	11.4047	14.0078	13.9734
	Control	257	19.4942	21.0856	
Reading Comprehension	Experimental	257	13.2335	20.6965	22.5612
	Control	257	23.7432	30.2257	
Reading Total	Experimental	257	24.6070	34.6070	34.9620
	Control	257	42.9377	48.8249	
Language Arts Mechanics	Experimental	257	*	16.6887	
	Control	257	*	20.1128	
Language Arts Usage	Experimental	257	22.1751	20.5058	22.5116
	Control	257	27.9066	24.4047	
Language Arts Spelling	Experimental	257	13.1634	12.4864	14.5014
	Control	257	17.8599	17.8599	
Language Arts Total	Experimental	257	34.3152	47.4591	52.9717
	Control	257	45.6381	60.1206	
Educational Ability Series	Experimental	257	14.2296	17.0350	19.9452
	Control	257	19.1518	22.5370	

*Not administered

APPENDIX C

MEAN AND GROWTH NORMAL CURVE EQUIVALENTS FOR CHAPTER 1 STUDENTS
SCIENCE RESEARCH ASSOCIATES

Table 28

Mean and Growth Normal Curve Equivalents
for Chapter 1 Students

SCIENCE RESEARCH ASSOCIATES

Test	Group	Number of Students	Pretest Mean	Posttest Mean	Expected
Reading Vocabulary	Experimental	257	29.8988	33.0584	32.2885
	Control	257	50.3813	50.2179	
Reading Comprehension	Experimental	257	31.5720	36.7237	38.6379
	Control	257	58.2140	54.1868	
Reading Total	Experimental	257	30.9533	34.2996	32.8485
	Control	257	55.5136	50.5953	
Language Arts Mechanics	Experimental	257	*	44.9689	
	Control	257	*	56.1556	
Language Arts Usage	Experimental	257	28.7665	43.1751	47.1208
	Control	257	40.1946	53.1284	
Language Arts Spelling	Experimental	257	38.7315	42.6304	45.5502
	Control	257	52.2568	56.4125	
Language Arts Total	Experimental	257	29.6732	39.6965	43.7685
	Control	257	44.2840	52.8405	
Educational Ability Series	Experimental	257	38.3939	34.9728	40.4112
	Control	257	51.8949	47.5409	

*Not administered

APPENDIX D

LETTER OF APPLICATION TO CONDUCT RESEARCH

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF ADMINISTRATIVE AND EDUCATIONAL SERVICES

August 19, 1983

[redacted] Director
Research, Testing and Statistics
[redacted] Public Schools
[redacted]

Dear [redacted]

Currently, I am a doctoral student at Virginia Polytechnic Institute and State University. My dissertation plan is to conduct an experimental study comparing academic achievement, as measured by the Monitor and SRA tests,. of selected students who participated in a Chapter I Program and who used the computer, with Chapter I students who did not used the computer, during the year 1982-83. The idea has been discussed and approved by my committee advisors, who in turn, requested a prospectus of the same.

This letter is requesting permission to use the [redacted] Public Schools to conduct my research. Enclosed are three copies of my prospectus for review. It is my feeling that the study will be of merit to the system, as well as shed insight on the total educational program.

I would be most appreciative if you would grant my request. I look forward to hearing from you soon.

Cordially,

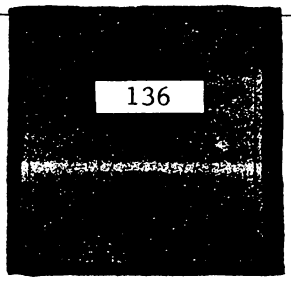
Rosalyn Ewing

RE:mjc

Enclosure (3)

APPENDIX E

LETTER OF APPROVAL TO CONDUCT RESEARCH



August 24, 1983

Ms. Rosalyn Ewing

Dear Ms. Ewing:

Your request to conduct a research study entitled "The Effects of Computer Assisted Instruction Upon Student Achievement" is approved. Please be reminded that the names of students are not to appear in your study. If I can be of further assistance, please do not hesitate to contact me.

Please send me a copy of the results of your study for my files.

My best wishes to you in this endeavor.

Sincerely,

[redacted]
Director
Research, Testing & Statistics

mk

[redacted]

APPENDIX F

LETTER OF APPLICATION TO SELECT SAMPLE

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF ADMINISTRATIVE AND EDUCATIONAL SERVICES

January 30, 1984

[redacted] Director
[redacted] Public Schools
Department of Research, Testing, and Statistics
[redacted]

Dear Dr. [redacted]

Currently, I'm conducting a research study in pursuit of the degree Ed.D. I have received permission to do the study with the [redacted] Public Schools.

This letter is requesting permission to select randomly SRA scores of 1982-83 sixth-grade students in the areas of reading and language arts. I will also need SRA scores (in the same areas), race, and sex for the same students, during the year 1980-81, when they were fourth graders.

I am aware that there is the possibility of students' names being automatically listed on data relating to them. Please be assured that all names to my disposal will be kept confidential.

Thank you for your assistance in this matter.

Cordially,

Rosalyn P. Ewing
Graduate Student
VPI & SU

APPENDIX G

LETTER OF APPROVAL TO SELECT SAMPLE

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF ADMINISTRATIVE AND EDUCATIONAL SERVICES

January 30, 1984

[redacted] Director
[redacted] Public Schools
Department of Research, Testing, and Statistics
[redacted]

Dear Dr. [redacted]

Currently, I'm conducting a research study in pursuit of the degree Ed.D. I have received permission to do the study with the [redacted] Public Schools.

This letter is requesting permission to select randomly SRA scores of 1982-83 sixth-grade students in the areas of reading and language arts. I will also need SRA scores (in the same areas), race, and sex for the same students, during the year 1980-81, when they were fourth graders.

I am aware that there is the possibility of students' names being automatically listed on data relating to them. Please be assured that all names to my disposal will be kept confidential.

Thank you for your assistance in this matter.

Cordially,

Rosalyn P. Ewing
Graduate Student
VPI & SU

1/31/84
Approved

APPENDIX H

VITA

The vita has been removed from the scanned document

COMPUTER-ASSISTED
CHAPTER 1 INSTRUCTION

by

Rosalyn P. Ewing

(ABSTRACT)

Co-chairmen: Dr. Kenneth E. Underwood and Dr. Jimmie C. Fortune

The purpose of this study was to investigate the effects of Chapter 1 computer-assisted instruction (CAI) upon the achievement of elementary educationally disadvantaged students. Specifically, this study determined the effects of CAI upon the academic performance of Chapter 1 sixth-grade students in reading and language arts.

The sample consisted of 514 sixth-grade students from an eastern-USA LEA's Chapter 1 program--257 low-achieving students in the experimental group and 257 moderate to high achieving students in the control group. Each treatment group received reading and language arts instruction through the LEA's Chapter 1 program; however, the experimental group's reading and language arts program was supplemented via CAI.

The non-equivalent control group design when subjects are growing, Type 2, as developed by Bryk and Weisberg, was employed to analyze the pretest/posttest data and to test the hypotheses

presented in the study. In this design, observed standardized gain scores were used to estimate posttest scores generated by predictions made using control group relationships. The mean growth curve fan spread linear model made adjustments based on an estimated regression coefficient between growth status at pretest and growth status at posttest. The Science Research Associates Assessment Series served as the measuring instrument.