THE EFFECTS OF ELECTRONICALLY ENHANCED INSTRUCTION ON READING ACHIEVEMENT AND ATTITUDES OF FIRST GRADE CHILDREN

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF EDUCATION

BY

SHARON LYNN CAPLAN, B.S., M.ED.

DENTON, TEXAS

MAY 1982

The Graduate School

Texas Woman's University

Denton, Texas

April 7 19 82

We hereby recommend that the dissertation prepared under our supervision by Sharon Lynn Caplan entitled The Effects of Electronically Enhanced Instruction on Reading Achievement and Attitudes of First Grade Children

be accepted as fulfilling this part of the requirements for the Degree of Doctor of Philosophy.

Dissertation/Theses signature page is here.

To protect individuals we have covered their signatures.

DEDICATION

To my dad.....

Who would have been so proud

To my husband.....

Who is so proud

To my sons.....

Who make me so proud

ACKNOWLEDGMENTS

No person can complete a project of this magnitude without the direct support, encouragement, and supervision of many significant persons. The author is deeply indebted to teachers, colleagues, and family members for their assistance throughout the entire doctoral program and in the preparation of this dissertation.

The author wishes to acknowledge the support of Sid Nolte of Texas Instruments, Inc., who provided an audience for the ideas of the author and directed her to Barbara Thompson, Ph.D. Dr. Thompson contributed her talents, concern, understanding, and support for this project. As a result of Dr. Thompson's efforts on the author's behalf, Texas Instruments, Inc. graciously donated thousands of dollars worth of equipment to the school in which the study took place. Without Dr. Thompson's support, this research could not have taken place.

The author wishes to acknowledge the support of the Assistant Superintendent for Curriculum and Instruction of the Denton Independent School System who gave permission for the study. The author is indebted to the principal, faculty, parents, and children of the school in which the study was conducted.

The author acknowledges the assistance of the members of the Dissertation Committee at the Texas Woman's University for their contributions, advice, and friendship. The author is particularly grateful to Dr. Sam Ed Brown, Chairman, for his encouragement, advice and generosity in giving his time and expertise to this project. Dr. Brown became much more than a Committee Chairman in this project, he became a dear friend and advocate. The many hours spent on weekends and holidays will never be forgotten by the author and the campus police!

Other committee members, Dr. Barbara Hammack, Dr. Chester Gorton, Dr. Howard Stone, and Dr. Sidney Bergquist, gave their time and interest to this project. Their guidance and encouragement throughout the doctoral program is deeply appreciated. The assistance of Dr. Patricia Fagan Payne in the beginning of this study is also gratefully acknowledged. The assistance of Dr. David Marshall in statistical analysis and content areas is gratefully acknowledged.

The author wishes to also acknowledge the support and encouragement of the staff at the Texas Woman's University Library. The author is particularly grateful to Mr. John Hepner and Dr. James Galloway for their assistance, advice, and knowledge in assisting with the location of research sources and computer searches.

The author is especially grateful to Ms. Nancy Byrom for her typing skills, patience, and friendship.

The author is indebted to her husband, Dr. Harry M. Caplan, her sons, Jordan and Bradley, for their love, care, and special support for this project. The support, encouragement, and long babysitting hours from her Mother and Bill are also gratefully acknowledged.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Background of the Study

Technology within the latter half of the twentieth century is producing resources that are bound to have an impact, for better or for worse, on education in the elementary schools. The decade of the fifties brought an enormous influx of hardware and software. Available then in the hardware category was the slide projector, the tape recorder, the 8 mm. film projector with sound in cartridges, the filmstrip projector with rear-projection screen, and the film-loop projector. More recently a sound-slide projector with thirty-five seconds of talking time for each slide has appeared on the market. Software instructional materials usable in the hardware cited appeared, too: films, filmstrips, loops, slides, tapes, and transparencies (Ohanian, 1971).

The 1970's and 80's have brought into the classrooms and homes the microcomputer. Well respected publishing companies in the field of education, such as Milliken, now have computer departments actively researching and producing courseware designed by educators who proclaim to know

what really works in the classroom. Their mathematics and language packages are available for grades one through eight (Milliken, Note 1).

Names such as Apple, Atari, PET, Texas Instruments, and Radio Shack's TRS-80, are becoming household words. All are vying for a chance to emerge foremost in the educational spectrum. Every seven years, the cost of computer power goes down by a factor of ten. Some claim that if the automobile industry had been able to develop its technology at the rate the computer industry has, a Rolls Royce would cost $2.98 and would get 10,000 miles to the gallon (Isaacson, 1981). As a private and neutral instructional device, the computer can be a means to true individualization, freeing teachers from the tedius parts of teaching and making new ways of learning possible.

However, what about the schools that are being hurt by inflation, and cannot find room in their budgets for a computer in every classroom? Fortunately, there are alternatives. Texas Instruments has an entire line of electronic learning aids for computer-assisted instruction. These are relatively inexpensive machines which can provide some of the motivation, self-correction, and reinforcement aspects of computers in the classroom. Electronic calculators have evolved into hand-held learning aids in just a few years, and the technology that makes them more

inexpensive and more capable every year is expected to continue to improve at about the same incredible slope for at least twenty years (Zinn, 1978).

The producers of personal computers need to take notice of the role of hand-held products in areas previously the domain of general-purpose and more expensive machines. Educators (including parents) may consider adopting both personal computers and hand-held electronic devices as learning aids in the not so distant future (Zinn, 1978).

The avalanche is just starting and everyone, adults and children alike, are fascinated. Like hand-held calculators, battery-operated electronic computer games are a fact of life (Bitter, 1979). Whether they are promoted as games, toys, or educational aids, it is of the utmost importance that we examine these materials to get an idea of the educational merit of these devices.

Problem

There are many electronic products on the market that purport to do certain things and achieve certain goals with young children. It is felt that these should be investigated.

Purpose

The purpose of this study was to determine the effectiveness of the use of electronic technology in early childhood education. More specifically, to determine if the use of Texas Instruments' Speak & Read, in addition to the traditional basal series and workbooks resulted in greater levels of achievement and an increase in positive attitudes toward reading.

Definition of Terms

For the purpose of this study the following definitions applied:

Basal Series - A graded series of texts, used for reading instruction in the first grade.

Computer - A machine designed for the input, storage, manipulation, and output of symbols (digits, letters, punctuation) and which can automatically follow a step-by-step set of directions (computer program) that has been stored in its memory.

Computer-Assisted Instruction - A program of instruction, organized and programmed in a way that puts actual teaching under the control of the computer. This system includes complete individualization of instruction and allows for each child to proceed at his own pace (Atkinson

& Hansen, 1966).

Hand-held electronic devices - Portable, electronic, computer-assisted instructional devices.

Microcomputers - Machines whose electronic circuitry is based on a few tiny silicon chips, each bearing integrated circuits incorporating hundreds to thousands of transistors.

Hardware - Physical machinery, such as slide projectors, tape recorders, film projectors, computers, and microcomputers.

Software - Any instructional materials usable in hardware, such as: films, filmstrips, slides, tapes, transparencies, and computer programs.

Speak & Read - A portable, electronic device, developed to supplement reading instruction.

Traditional Approach to Reading - The use of a basal series and workbooks.

Research Questions

To carry out the purpose of this study, the following questions were formulated:

1. Does the addition of the Speak & Read to the first-grade classroom curriculum help to promote better reading skills than the traditional approach?

2. Does the addition of the Speak & Read to the first-grade classroom enhance attitudes toward reading more than traditional classroom programs?

3. Do the teachers see the Speak & Read as a valuable aid in the teaching of reading skills?

4. Do the children enjoy working with the Speak & Read?

The Null Hypotheses

The following null hypotheses were tested in this study:

Null Hypothesis I: There will be no significant difference between the treatment and the control group in posttest achievement controlling for:

a. Pretested reading readiness scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

Null Hypothesis II: There will be no significant difference between the treatment and the control group in posttest attitude toward reading, controlling for:

a. Pretested Reading Attitude Inventory scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

Null Hypothesis III: There will be no significant difference in proportions of subjects who like and those who do not like the Speak & Read instrument, as measured by each of five checklist items.

Procedures

Sample

Subjects were 71 first grade children who attended four classes in an elementary school in North Central Texas. The school was selected to represent a low, middle, and upper socio-economic status enrollment, based upon the occupation and education level of the head of the household. The social status scale used was an adaptation of McGuire and White's Index of Social Status (Note 2), devised by Ritchie (1969). This information was obtained from each family in the form of a reply to a letter (see Appendix B), and school records. Two classes of 34 children were assigned as control classes and two classes of 37 children were assigned as experimental classes. Comparisons were made between intact groups.

Method for Data Collection

Teachers, with the aid of the researcher, administered the Metropolitan Reading Readiness Test and the Reading Attitude Inventory (see Appendix C) to both the experimental and control classes prior to the introduction of the Speak & Read instrument in the experimental classrooms. In February, children in both the experimental and control groups were posttested using the Metropolitan Achievement Tests, Primary I Battery. They were also posttested on the Reading Attitude Inventory. The information was used to determine whether the use of the Speak & Read did, in fact, significantly increase both achievement and attitude scores in the experimental groups as compared with the control groups. Teachers in the experimental classrooms were also asked to fill in a rating sheet for the Speak & Read (see Appendix D). Children in the experimental classrooms were also given a questionnaire to determine their feelings toward the Speak & Read program (see Appendix E).

Analysis of Data

Analysis of covariance between the experimental vs. control classrooms on the posttest reading achievement (Metropolitan Reading Achievement Test, Primary I) was used. Covariates were the pretest (Metropolitan Readiness

Tests, Level II), age, sex, socio-economic status, with or without preschool experience.

Analysis of covariance between the experimental vs. control classrooms on the posttest reading attitude (Reading Attitude Inventory) was used. Covariates were the pretest (Reading Attitude Inventory), age, sex, socio-economic status, with or without preschool experience.

Covariance analysis controlled for the pretest and demographic variables, allowing examination of group differences on posttest scores which have the influences of covariates "adjusted out" or removed. Conclusions about treatment differences can, therefore, be made without regard to possible effects of the covarying variables.

The Speak & Read Questionnaire items were analyzed by the chi-square goodness of fit test to determine any significant tendency for the experimental group to prefer or not prefer the Speak & Read instrument.

Teachers were administered a questionnaire to determine their perceptions of the effectiveness of the Speak & Read.

Limitations of the Study

This investigation was conducted and the results interpreted within the following limitations:

1. The sample included a relatively small number of

teachers and children.

2. The sample included children between 6 years 2 months of age and 8 years 2 months of age.

3. Children in the control groups may have had access to the Speak & Read as they are available commercially.

4. Since the Speak & Read instruments were only in the classrooms for five months, the effectiveness of the treatment may be lessened.

5. Both the experimental and control groups were statistically controlled for age, sex, and pre-school, as these were uncontrollable variables in this study.

6. All children in both the experimental and control groups were pretested for both attitude and achievement in order to equate the experimental and control groups for possible differences in starting position.

Assumptions of the Study

This investigation was based on the following assumptions:

1. The children in the control groups would not have access to the Speak & Read.

2. The teachers and children in the experimental classes would use the Speak & Read as prescribed in the study.

3. When the children took the Reading Attitude

Inventory they would answer the questions honestly.

4. When the children would answer the Speak & Read Questionnaire they gave honest answers.

5. The teachers in the experimental classrooms would honestly rate the Speak & Read's effectiveness using the Teacher's Ratings of Speak & Read.

6. The Metropolitan Readiness Test and the Metropolitan Achievement Test are reliable and valid instruments.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

This study was designed to determine if the use of a popular piece of electronic equipment now available to families and school systems throughout the country can be adapted to classroom use as a valuable supplement to the curriculum in early childhood education. Texas Instruments' Speak & Read instruments were placed in two experimental classrooms, and were used as a supplement to the traditional reading curriculum. The control classrooms carried on reading instruction in a traditional manner, utilizing only basal readers and workbooks. All children were pre and posttested for reading attitude and reading achievement, in order to determine if a significant difference could be found when instruction is enhanced by electronic technology.

The following review of literature was undertaken to investigate the following questions:

1. What is the theoretical basis for using computer-assisted instruction (CAI) with relation to the initial teaching of reading?

2. Are there any major experimental programs utilizing

computer-assisted instruction?

3. What are the advantages and disadvantages of computer-assisted instruction?

4. How shall electronic technology serve education?

5. Is the use of hand-held electronic equipment tenable in early childhood education?

6. Summary

Literature Involving Theoretical Constructs of Computer-assisted Instruction

The psychological constructs concerning the use of computers and computer-assisted instructional devices are perceived as largely seated in reinforcement theories. One of the most prolific spokesmen for this theoretical base has been Skinner (1968). His work The Technology of Teaching seems to provide a theoretical base for the inclusion of immediate reinforcement devices such as computers into the instructional program.

In order to support the use of technology in the instructional program, Skinner listed three major objections to the classroom procedures of the past. He stated that negative reinforcement has traditionally formed the basis for educational control and that the progressive movement only substituted one type of aversive stimuli for another. Skinner (1968) described the child's educational

experience as follows:

> The child at his desk, filling in his workbook, is behaving primarily to escape from the threat of a series of minor aversive events--the teacher's displeasure, the criticism or ridicule of his classmates, an ignominous showing in a competition, low marks, a trip to the office "to be talked to" by the principal, or a word to the parent who may still resort to the birch rod. In this welter of aversive consequences, getting the right answer is in itself an insignificant event . . . . (pp. 15-16)

The second objection by Skinner to normal classroom procedures involves the length of time between the pupil's correct response and the teacher's reinforcement of that response. He saw the condition of time-lag in reinforcement as detrimental to learning since ". . . the lapse of only a few seconds between response and reinforcement destroys most of the effect" (p. 16).

The third objection of Skinner (1968) to the typical classroom procedure also was seated in the limited capabilities of the teacher to reinforce the student. "The teacher is seldom able to reinforce at each step in a series because she cannot deal with the pupil's responses one at a time" (p. 16). Thus, reinforcement has to be given for "blocks of responses" (p. 16)

Just as he listed objections to the normal classroom procedure, in terms of reinforcement type and efficiency, so did Skinner support the pacing of educational devices that the student could manipulate. According to Skinner,

any device that the child could manipulate and that fed back changes in the environment would occupy the child for long periods of time. As Skinner (1968) said, "The sheer control of nature is reinforcing" (p. 20).

Skinner found that not only was the inclusion of the manipulative device important to improvement of instruction, but that "if the teacher is to take advantage of recent advances in the study of learning, she must have the help of mechanical devices" (p. 22).

Though Skinner's comments on "teaching machines" and the advantage of their use were directed toward the type of teaching machines used by Pressey (1926) and others, it would seem that a number of the advantages of such machines would likely extend to computers. Skinner (1968) further stressed that care should be taken in encouraging the student to use teaching machines. He encouraged the use of the type of equipment which would encourage the student to take an active role in the instructional process, rather than a passive role.

Computer-assisted instruction would appear to be the tool most appropriate to the needs of students and teachers alike, if one is to agree with Skinner's theories. When looking at computer-assisted instruction in relation to the more specific task of teaching reading, the theoretical constructs of Atkinson, Fletcher, Chetin, and Stauffer (1970),

regarding the rationale behind the development of a computer-based curriculum for initial reading must be studied. Atkinson et al. (1970) assumed, along with Bloomfield (1942), Carroll (1964), and Fries (1963), that two major aspects of reading are communication (reading for meaning, aesthetic empathy, enjoyment) and decoding. According to Atkinson et al. the communication aspect of reading seemed best presented in the classroom by a human teacher, in some sort of dialogue mode, and the decoding aspect of reading seemed best presented by a computer, in a consistent drill or practice mode.

Fries (1963) states that learning to make grapheme-phoneme associations is not only necessary for learning to read, but that the graphic shapes themselves sink below the threshold of attention. An effective way for these associations to become automatic is by repetitive presentations for short intensive drill periods with the students being given immediate feedback concerning the correctness of their responses. Such drill can be accomplished effectively, at this time, by an individualized computer-assisted drill-type program.

Rodgers (1967) listed some tenets of the Stanford Computer-Assisted Instructional Curriculum as follows:

1. Reading and spelling should be taught independently. This tenet was adopted on the assumption that most

reading obstacles are unrelated to spelling obstacles.

2. Reading should be initiated with a decoding or transfer state during which the student learns to associate graphic patterns with speech sequences.

3. The association of sight to sound is initially effected between letter patterns and vocalic center groups and is meaning dependent. A vocalic center group looks very much like a syllable and, in fact, the reader will not be seriously misled if he associates the units which result from standard dictionary syllabification with the vocalic center group.

4. The sequence of items to be presented for association learning should be determined primarily by a difficulty scaling of vocalic center groups as documented by Hansen, Rodgers and Wilson (1966). Four principles for ordering vocalic center groups as enunciated by Rodgers (1967) include the following:

a. Groups containing single consonant elements should be introduced before those containing consonant clusters (TAP before TRAP);

b. Groups containing initial consonant clusters should be introduced before those containing final consonant clusters (TRAP before TARP);

c. Groups containing short vowels should be introduced before those containing long vowels (TAP before

TAPE);

d. Single vocalic center group sequences should be introduced before multiple sequences (TRAP before TRAPPER).

5. Every graphic pattern should be presented as a member of a rhyme (final unit) set and an alliteration (initial consonant) set, the distinguishing characteristics of these sets being displayed in a matrix format.

6. Word items presented in matrix format should be immediately introduced in sequential contexts that emphasize their morphological, syntactic and semantic functions.

7. Patterned word items should appear in poems, stories, essays, and descriptions in which the features of pronunciation, grammatical function, and meaning are shown to function together to convey the writer's intention to the reader.

Obertino (1974) describes the theoretical basis for the Programmed Logic For Automatic Teaching Operation (PLATO) Reading Project. PLATO is a second, well known computer-assisted instructional reading program. Obertino describes PLATO as an eclectic approach to the teaching of reading. However, some of the ideas upon which the program is based are as follows:

1. For the purposes of teaching and evaluation, reading can be defined in terms of observable, measurable

behaviors.

a. The acquisition of some of these behaviors is prerequisite to the acquisition of others.

b. Some behaviors may be acquired independently of others.

c. The detailed, explicit statement of these behaviors, their order and interrelations, provides a sound structure for a computer-based system of teaching reading and diagnosing reading difficulties.

2. Different children learn in different ways and at different rates. An effective reading program will allow the child to proceed at his own pace and will offer him learning experiences which capitalize on his natural style.

3. Children do not profit from public exposure of their mistakes and weaknesses.

4. Testing and diagnosis should be carried on continuously as the child works through the curriculum materials, but should be transparent to the child.

5. No computer-based curriculum will gain widespread and lasting acceptance unless it is sufficiently flexible to allow teachers to shape it to their own classroom practices (Obertino, 1974).

The elementary reading lessons and exercises currently available from the PLATO Program fall into the following categories: (a) Orientation, (b) Date Activities, (c)

Letter Discrimination, (d) Word Detail, (e) Memory Skills, (f) Letter Names, (g) Alphabet, (h) Letter Sounds, (i) Blending, (j) High-Frequency Sight Words, (k) Enrichment Sight Words, (l) Word Meanings, (m) Sentence Building, (n) Stories, (o) Timed Reading, (p) Stories Written by Students, and (q) Games. Many of these lessons can be prescribed in different parts and levels of difficulty, according to the child's previous experience and academic needs (Obertino, Fillman, Gilfillan, Silver & Yeager, 1977).

Yeager (1977) emphasizes that the PLATO Elementary Reading Curriculum project (PERC) lessons have been purposely designed from a particular perspective. This perspective affects how a child learns to read. The emphasis is on the process of learning rather than on the content.

PERC lessons are designed to make the student feel in control of the computer terminal. Yeager hypothesized that students who use PERC lessons develop confidence in themselves sooner than those students using traditional lessons. PERC teachers report that their students are more creative than when they are prior to their experience with computer terminals; and that students often draw pictures and develop stories based on ideas which they saw on the computer terminal. PERC lessons encourage students to explore the limits of the machine and to experiment with

words. Yeager (1977) also hypothesizes that such interaction with computer terminals may promote creativity in other areas. Yeager also proposes that if students can understand that typing a special key can represent "ready to proceed," they may better comprehend that a grapheme can represent a phoneme. Since PERC lessons use a multi-media approach and require the students to interact in many different ways, it may be possible that these kinds of experiences broaden the learning abilities of typical students. It may also be possible to reach students who normally do not learn very much from traditional educational experiences.

The preceding section has dealt with that portion of the literature which the researcher thought best presented the theoretical constructs underlying the study. The following section deals with major experimental programs which utilize computer-assisted instruction.

Experimental Programs Utilizing Computer-Assisted Instruction

The Stanford Project

The first well documented attempt to teach reading with the computer was made at Stanford University (Atkinson & Hansen, 1966). The computer-assisted instructional

curriculum was designed to supplement whatever reading instruction occurred in the classroom. It was assumed to be far easier to adjust and modify the computer programs used for instruction than to adjust and modify the established practice of classroom teachers.

The Stanford Project utilizes the easily operated Model 33 teletype (a typewriter which communicates with a computer) for both experimental and pedagogical purposes. Even the youngest school child quickly learns to type on the keyboard; in fact, the child learns with an ease contrary to everyone's expectations. Added to the teletype is a headphone jack with a small-gain amplifier that conveys a vocabulary of some 5,000 words. Atkinson et al. (1970) also state that those students less advanced than their peers are among the most enthusiastic. This is seldom the case in a classroom milieu where those students who lag behind the group are often painfully self-conscious of this fact. Ideally, a computer will not "put a student down" for a wrong answer, or no matter how foolish his answer might seem or how often he is wrong, expose him to the slightest form of ridicule.

The first strand (<u>strand</u> is the term used to designate a component part of the initial reading program) is called the Reading Readiness Strand. On the teletype paper or printout, the child receives typed messages that are more

fully explained by the audio. The Reading Readiness Strand covers all the aspects of the sign-on procedure and attempts to teach the manual skills required to interact with the program. The program is divided into seven strands: 0 - Reading Readiness; I - Letter Identification; II - Sight Word Vocabulary; III - Spelling Patterns; IV - Phonics; V - Comprehension; VI - Language Arts.

Students move through each strand in a roughly linear fashion. Branching or progress within strands is criterion dependent; a student proceeds to a new exercise within a strand only after he has attained some (individually specifiable) performance criterion in his current exercise. Branching between the strands is time dependent; a student moves from one strand to take up where he left off in another after a certain (again, individually specifiable) amount of time regardless of what criterion levels he has reached in the strands. Within each strand there are progressively more difficult exercises that are designed to bring students to fairly high levels of performance.

Entry into each strand is dependent upon a student's performance in earlier strands. A student may work in several strands simultaneously. Once he enters a strand, however, his advancement within that strand is independent of his progress in other strands. Time on both the system and time per strand can be either fixed or variable. The

strands are comprised of sections of curriculum items, and it is in these sections that a student must reach criterion before progressing in the strands.

Students receive instruction for the exercises by means of digitized audio messages. A vocabulary of approximately 5,000 words has been recorded and stored in digital form on the computer's magnetic disk. The student inputs his response on the teletype keyboard. When the student has completed his response, he presses the space bar which returns control of the terminal to the computer for response evaluation. If the student discovers an error in his response, he may press the rubout key before pressing the space bar and the entire problem will be presented again for a second trial. If a student presses the rubout key too many times before entering a response, he receives a "too many rubouts" message. The student receives a printed record of the work completed at the end of each session.

When the student responds correctly, he receives randomly scheduled audio reinforcement messages. Efforts have been made to keep this an ungraded program. Although marks exist in a curriculum guide to indicate specific levels for comparison or referral by the teacher, no indication is made on the student's printout of score, percentages, or grades.

A complete status report for an entire class is available to a teacher at any time. A report on an individual

student is also available to the teacher. At a glance, the teacher can note a student's progress in a strand, and the particular items in the exercise. These data give an accurate, up-to-date evaluation of the student's progress as well as an indication to the teacher of the areas in need of reteaching.

As the program now works, a child is on the system for about 12 minutes per day. This time is neither arbitrary nor fixed, but was found to be the necessary time to maintain the students, on a class average, at grade level. Given longer periods, children could advance more rapidly. Another alternative is to have slow learners spend more than twelve minutes per day on the program, either extending the single session or having more than one session per day so that those students who were lagging behind the norm could be brought up to the class average.

The computer-assisted instructional program described above is in no way intended to replace the teacher. On the contrary, it is a teacher's tool and can free the teacher for more creative, generative forms of instruction. Using the program is the teacher's option, and although cooperation is sought, it is anticipated that there will be a time when more and more teachers will turn to computer-assisted instruction to relieve them of the tedium of classroom drill-and-practice routines.

Fletcher and Atkinson (1972) evaluated the reading achievement of pupils who received computer-assisted instruction in initial reading in comparison to those pupils who did not have such a program during the 1969-70 school year. Twenty-two pairs of first-grade boys and 22 pairs of first-grade girls were matched on the basis of Metropolitan Readiness Test scores. Three posttests were administered: the Stanford Achievement Test, California Cooperative Primary Test, and an individually administered test designed to measure directly the principal goals of the computer curriculum. Separation of girl and boy matched pairs was maintained to allow cross-sex comparisons.

The experimental group received 8- to 10-minute CAI sessions in initial reading for 5½ months. Results indicated improvements on posttest performances that were significant at the .05 level from both a statistical and practical standpoint. These improvements were not limited to the specific, phonics-oriented goals of the CAI curriculum, but included improvements in more general reading skills related to sentence and paragraph comprehension. Fletcher and Atkinson stated that the fact the observed differences were so substantial may suggest that the CAI treatment administered over several years could well have dramatic results.

Wilson and Atkinson (1967) reported on the Stanford CAI Project in the Brentwood School located in the Ravenswood City School District in East Palo Alto, California. There were four first-grade classrooms at Brentwood, two of which received instruction in mathematics under computer control and two received instruction in reading under computer control. Of the two classrooms in the reading program, the student population was approximately 90 percent Black, 6 percent Mexican-American, 2 percent Oriental-American, and 2 percent Caucasian. Children received CAI instruction on a daily basis for a 20-minute instructional period. At the end of the school year the children were tested utilizing the Gates-MacGinitie Reading Test, California Reading Test, Stanford Achievement Test, and Project developed tests. Students in the CAI mathematics program provided the control group. Analysis of the individually administered Stanford Binet I.Q. tests at the beginning of the school year indicated that the students in the mathematics program may be considered as two samples from the same population. Any "Hawthorne effect" which might be induced by the CAI experience is controlled since the mathematics students had an equal amount of time on the system but for a different subject matter. The mathematics students received a program of reading instruction which might be termed traditional, relying primarily upon the Ginn and the Allyn and Bacon

first-grade readers.

Wilson and Atkinson reported results after seven months of CAI instruction on reading performance. Eight of the nine tests of decoding skills resulted in differences in favor of the CAI group which were significant at the .05 level and in six of those eight tests the significance was at the .01 level or beyond. Three of the tests of comprehension at less than the paragraph level resulted in differences in favor of the CAI group which were significant at the .05 level. No significant differences were found in the tests of comprehension at the paragraph level.

It is felt by Wilson and Atkinson that the results of this first year's evaluation may suggest a positive impact of a CAI program on the acquisition of initial reading skills which is not only statistically significant but practically significant as well. Similar studies done by Atkinson and Suppes (1968) Hansen, Rodgers, Wilson, Hartley, Anselm, Lee, Wilson, Lilleston, Smith, Weeks, Alexander, Bruggemann, and Perry (1966), Atkinson et al. (1970), Fletcher and Atkinson (1970), and Atkinson and Fletcher (1972), using the same school systems and similar samples reported results that substantiated Wilson and Atkinson (1967).

The PLATO System

A second attempt to teach with the aid of the computer was the PLATO system. It was developed at the Computer-Based Education Laboratory at the University of Illinois. After several revisions, it is now known as Control Data PLATO, available commercially from the Control Data Corporation.

The PLATO Elementary Reading Curriculum project (PERC) at the University of Illinois, under the direction of Robert Yeager and his associates, has produced between twenty and twenty-five hours of beginning reading instruction and over 200 lessons (Mason, 1980).

PERC lessons, as described by Yeager et al. (1977), follow lesson design principles which govern the interactions within lessons, and which give the students control over their computer terminals in subtle ways. The following is a list of some of these principles:

1. All responses should be meaningful; they should be tied as closely to the skill being learned as possible.

2. Remedial feedback should be kept to a minimum. This is contrary to conventional wisdom which celebrates individualized remediation as one of the greatest benefits of computer-assisted instruction. But there are a number of good reasons for minimizing remedial feedback:

a. There is no way to really know why students make a given error; therefore, it is useless to make differentiated responses to them based on the type of error they made.

NO Ker Goodman's miscue anal

b. Students are often positively reinforced by remedial sequences; if their goal has been to make the computer terminal work, the remedial sequence is proof to them that they have been successful.

c. Remedial sequences are often more spectacular than the main line instruction; it is difficult to correct students' responses without engaging in a great deal of audio and graphics. Students typically enjoy the remedial sequences more than the main line instruction and, again, feel positively reinforced for having triggered remediation. Therefore, wrong responses are handled the same way that other machines react when they are incorrectly operated: nothing happens except that the students are encouraged to try a different answer. Of course, eventually students may need additional help; that help is described in the next point.

3. Students must always be forced to make the correct response. If the students have made several errors, all of the wrong responses are erased from the screen and the students are forced to touch the one remaining answer before they can continue.

The student control which PERC advocates gives students more control than they would have in most other computer-assisted instructional lessons; but not so much that the control becomes meaningless. The computer terminal is viewed as an experimental laboratory; and each lesson is designed to give the students experience with the skills being learned.

Lessons available from the PLATO System fall into the following categories: (a) Orientation, (b) Date Activities, (c) Letter Discrimination, (d) Word Detail, (e) Memory Skills, (f) Letter Names, (g) Alphabet, (h) Letter Sounds, (i) Blending, (j) High-Frequency Sight Words, (k) Enrichment Sight Words, (l) Word Meanings, (m) Sentence Building, (n) Stories, (o) Timed Reading, (p) Stories Written by Students, and (q) Games (Obertino et al., 1977).

PLATO also allows for teacher management options which enable classroom teachers to control how PLATO is used in their classrooms without much additional work. PLATO allows the teacher to do these three things:

1. Select activities for each student.

2. Obtain information about how each student performed.

3. Communicate with the PLATO staff and with other teachers (Obertino et al., 1977).

Yeager (1977) states that there are several ways in which simply using the computer terminal might improve the reading process: (a) students may come to understand the symbolic nature of reading by learning that their symbolic interactions with the terminal have concrete consequences, (b) students may come to understand that there are logical relationships which govern their interactions with the terminal; such an understanding may strengthen their comprehension abilities, and (c) successful interactions with the PLATO terminals may build the confidence students need in order to begin to learn.

Although the PLATO Elementary Reading Curriculum project (PERC), 1971-76, attempted to develop a CAI curriculum in beginning reading, PERC's ambitions exceeded its abilities (Yeager, 1977). PERC developed around five hundred separate activities. Each of the activities takes about 2.5 minutes; the shortest lessons run around 1.5 minutes; and the longest lessons could last five or six minutes. At the end of each lesson, students are asked if they would like to see that lesson again. Since the lessons are short, this gives the students a chance to practice to their own level of mastery. Students repeat lessons about twenty percent of the time. That statistic has remained very constant over three years of experience (Yeager).

All PERC lessons were delivered on the PLATO terminal; PERC did not create any materials to be used away from the terminal; nor did it provide any activities for teachers to use to follow up on lessons completed at the terminal. Consequently, PERC lessons were never more than supplementary to the normal classroom instruction.

Yeager reports that the findings of the PLATO Elementary Reading Curriculum Project from 1971 to 1976 indicated that PERC never accomplished its goal of developing a CAI curriculum in beginning reading. The experience in the classrooms proved again that any new innovation has to be integrated into the existing classroom structure. PERC has, therefore, begun to move into a complementary role in the classroom; and some plans have been discussed to provide off-terminal activities to reinforce lessons (Yeager, 1977).

In the fall of 1976, a phonics sequence was introduced into the PERC curriculum. These lessons emphasized the instructional sequence rather than lesson formats; in fact, most of the formats were very dull drills. As a result of the dullness of the formats, students and teachers rebelled against the lessons. Phonics lessons were given to students about fifteen percent of their time; other PERC lessons made up the other eighty-five percent. It was observed that students became highly frustrated in the phonics lessons because they tried to do things which other lessons allowed

them to do; for example, they would try to type the response, but were ignored; they tried to enter their response before the audio finished giving directions, but were not allowed to do so; and they were taken through extended remedial sequences. Not only were students frustrated by the phonics lessons themselves, but they carried their frustrations over to other PERC lessons (Yeager, 1977).

Yeager reports on another unique experiment PERC was engaged in to determine whether young children could use CAI. A class of kindergarten students was used to determine whether young children could use CAI. It was found that even kindergarteners were able to learn how to use PLATO. Either a PERC staff member or the teacher and her aide oriented students to PLATO. Usually students had to be supervised during the first three times they signed on to the terminal; each time, the supervisor introduced a little more to the students. After the first three sessions, the supervisor did not help the students; sometimes the teacher had to help some students type their names; but that stage quickly passed.

Yeager found that this simple orientation process was very effective. Another finding was that it might not be advisable for students to use the terminals every day. Reasons for this decision ranged from economics to evaluation plans. Finally, the most important lesson which PERC

learned, according to Yeager (1977), was that teachers must be intimately involved in the implementation of a new curriculum in their classrooms.

Obertino (1974) reported that in June of 1972 testing of PLATO materials began with observation of a group of low socio-economic status first-grade and kindergarten children in a remedial summer school program interacting with PLATO reading activities. For purposes of this experiment, an answer to the question "Will children attend to our medium?" was sought. Children in this sample group did attend to some activities as long as 40 minutes at a time. The 10- to 20-minute sessions which had been allotted per child turned out not to be long enough. This phenomenon persisted to the end of the six-week session.

At the same time, it was noted by Obertino that an interactive display could not in itself sustain interest. Poorly constructed lessons were rejected on PLATO as they would be in the classroom.

In 1973, the testing of the PLATO material continued in a public school setting (Obertino). Twenty-five kindergarten students from one class, distributed bimodally but shifting toward the upper end of the spectrum, were used. Twenty-five percent of the children were Black, and approximately two percent were from low socio-economic backgrounds. Obertino states that although hard data were not collected,

answers to the following questions were pursued: (1) What kinds of child behavior should our programs be equipped to handle? (2) What form and sequencing of audio-visual display and child response best maintain the child's interest and promote ready understanding of the task?

PLATO developers would appear to be following the hazardous path of simultaneous system and curriculum development referred to by Swinton, Spencer, Amarel, and Morgan (1978). An absence of any hard data through 1974 is also a major weakness in reporting on this project.

Slattow (1977) reported a similar study in 1972-73 and 1973-74, including a total of 400 children, kindergarten through second grade, and 15 teachers participating in the experimental development of the PLATO Elementary Reading Curriculum Project (PERC) lessons. Lessons were kept short (averaging about three minutes) and highly interactive, demanding a response from the child at least every ten seconds. In addition, children had the option at the end of a lesson to do the lesson again or to go on to another lesson. Depending upon the structure of the classroom, the session might occur during the child's regular reading period or some other time during the day when the child was free. Slattow does not report any test results for the children involved in this study. Rather he concludes by stating that teachers and students enthusiastically

interacted with the materials which were developed, and the degree of use depended upon the validity of the lesson design, for which PERC had developed effective guidelines.

Swinton et al. (1978) report on negative pilot-year results in a well-controlled study of grade one PLATO Elementary Reading Curriculum. The outcome of this study led to a reassessment of evaluation priorities for the demonstration year. The readiness-oriented curriculum and malfunctioning automated management system held first graders in letter-recognition and phonics long after the point at which these skills had been mastered. The reading developers placed their highest demonstration year priority on improving introductory materials, rather than on extending coverage to blending and comprehension content appropriate to the end of grade one.

Findings further indicated that although most teachers maintained a positive view of the potential of PLATO for teaching reading, and felt that procedural learnings had taken place, few specific reading outcomes from this curriculum were noted. Children encountered continuing difficulties with the mechanics of discs, headphones, and the touch panel, as well as with system failures. Phonics lessons, which had been redesigned proved to be confusing, and disrupting requests for teacher help were not infrequent. Reading attitudes were assessed in the pilot and

demonstration years among first-graders. Although attitudes toward PLATO were clearly positive among the children in both years, there was no evidence that these positive feelings transferred to the activity of reading.

The PLATO Elementary Reading Curriculum demonstrated negative impact on first-grade reading achievement in the pilot year and on kindergarten reading readiness achievement in the first semester of the demonstration year. No effect on attitudes toward reading was found.

Swinton et al. attribute some of the failures of this project to the additional ancillary hardware (in particular the audio device) with attendant production and implementation problems, and the immaturity of the target population (ages five to seven). However, they also state that the discrete and slow-moving curriculum was a major contributing factor to this disappointing outcome.

The reading development group worked according to an *a priori* hierarchical theory of reading acquisition which kept curriculum development on its initial path long after it became clear even to most of the reading developers that the approach was not reaching its goal. Swinton et al. caution that simultaneous system and curriculum development may be hazardous.

The Edison Responsive Environment

Several programs employ the Edison Responsive Environment (ERE) which is also known as the "Talking Typewriter" (Richardson & McSweeny, 1970). This is a three-phase, computer-driven teaching machine. In Phase I, the machine performs like any other electric typewriter. In Phase II, the ERE typewriter responds to the pressing of its keys with a recording (the "key-voice"), which may give the letter name, the phoneme it represents, or any other information which can be imparted in one second. Phases I and II are free phases, that is, the child can press any key. In Phase III, the machine is controlled by computer programming so that no key can be depressed until it has been programmed to be depressed. This "locked key" feature may be used in conjunction with the "key-voice" to provide simultaneous oral and visual stimuli in complex instructional combinations (Mason, 1980).

The Edison Responsive Environment reading achievement results have been favorable with target populations of preschoolers, adult illiterates, and poor readers in the middle grades. Recently, a method called Oralographic Instruction has been devised for presentation by the ERE. In this 60-lesson program, the student is presented with "letter-sounds" and symbols which he or she learns to

blend into words. The machine then prints these words for the student to hear, read (and record), and write from memory for comparison with machine-printed words. The 60 lessons require from 120 to 200 hours to complete (Ratekin, 1977).

Frazier and Zaslav (1970) addressed the problem of determining the particular value of the ERE for teaching pupils to improve their reading ability as compared with an alternative method. Results revealed a statistically significant difference in favor of the ERE system for improving reading ability.

Martin (1966) conducted a study involving twenty kindergarten and mentally retarded children in the Freeport, Connecticut, Public Schools. He found that the ERE instrument taught within five months these children how to read significantly better than twenty children who were carefully matched but who were taught by enriched traditional methods. Actual time at the instrument ranged from 22 hours to 36 hours. Other findings revealed that:

1. The children with less intelligence scored as significantly superior in reading as did the brighter children.

2. Black children in the group were indistinguishable by their scores from the remainder of the group.

3. Sex differences were not apparent in the scores.

4. The mean difference for the experimental group in

reading score at the end of the five month period was 1.7 months over the control group.

5. There was evidence to indicate that the difference between the experimental group and the control group would have increased had the experiment continued.

Computer Curriculum Corporation

Several programs are now utilizing the drill-and-practice computer-assisted instructional program developed by the Computer Curriculum Corporation (CCC). The CCC programs trace their ancestry to the principles of the early computer-assisted instructional reading programs developed at Stanford. There are usually five strands, a sequence of related items arranged in order of increasing difficulty. A student placed, by the computer, at the proper level in each strand then progresses as quickly as his or her performance in each strand warrants. Reinforcement to students, as well as record-keeping for teachers and administrators, is provided by the computer (Mason, 1980).

Whenever the teacher wishes, he or she may call for student and class performance information. The computer will give: (a) each student's placement in each of the five strands, (b) the amount of time the student has spent on the program, (c) the number of time-outs for each program, (d) which students used the program on the day of the

report (Mason, 1980).

Adkins and Hamilton (1972) state that the goals of the Computer Curriculum Corporation's reading curriculum are to: (a) familiarize the student with commonly encountered word structures, vocabulary, and sentence constructions, (b) to provide practice in the literal and interpretive comprehension of written prose, and (c) to develop the student's work-study skills. The reading program for grades 3 through 6 consists of reading practice items designed to develop the student's skills in five areas: (a) word analysis, (b) vocabulary extension, (c) comprehension of sentence structure, (d) interpretation of written material, and (e) development of study skills.

Lysiak, Wallace, and Evans (1976), in their study on the Computer-Assisted Instruction program in the Fort Worth Independent School District during the 1975-76 school year, looked at the effects of the Computer-Assisted Instruction program, developed by Computer Curriculum Corporation, on 2,298 educationally deprived students in grades three through seven in eight elementary schools and in four middle schools. These children were provided with 10 minutes practice daily on mathematics and on reading in a laboratory containing video screen terminals. Children in carefully matched groups were provided only with traditional Title I Programs.

Lysiak et al. (1976) listed three main findings from this project:

1. Computer-assisted instruction was more effective at grade three than the comparison Title I Program in increasing standardized test scores in reading and mathematics.

2. Progress of students who used the Computer Curriculum Corporation curriculum was greater in mathematics than in reading. Students averaged a gain of about seven months on reading and 1.0 year on mathematics in the seven months interval.

3. Elementary classroom teachers indicated that they perceived computer-assisted instruction as beneficial.

Litman (1973) reported on the results of a program in which the Board of Education of the City of Chicago implemented a drill and practice Computer-Assisted Instruction program developed by the Computer Curriculum Corportation, in seven selected elementary schools. All students qualified under the Elementary and Secondary Education Act Title I guidelines and all were achieving at least one year below grade level before entering the program. The results, which are based on the use of the computer-assisted instructional program for 10 minutes per day for seven months, are listed as follows:

1. Pupils made gains across all of the strands.

2. Almost all pupils gained at least one month grade equivalent for each month in the program.

3. Between 90 and 100% of the students showed a gain in grade equivalent during the program.

4. Especially high gains were noticed for students who completed more than 100 sessions.

5. Greater gains were made in the language arts and mathematics curricula than in the reading program.

Achievement by pupils on the Metropolitan Reading Test also indicated that computer-assisted instruction was successful. The average gain in the sample population of 447 students was six months during a pretest to posttest period of seven months even though computer-assisted instructional students averaged only 74 ten minute sessions during that period. The average gain for the national compensatory population is 5.6 months over an eight month pretest to posttest period, while in Chicago the average gain among all Title I eligible students is even lower.

Litman (1973) concluded that computer-assisted instruction achieved considerable success by highly individualizing part of the instructional process. He stated that drill and practice types of curriculum programs, such as those offered by Computer Curriculum Corporation, free the teacher for the more creative aspects of instruction. It was also found that pupil progress, based on standardized tests and

on computer-assisted instructional programmed materials, indicated that Title I eligible students could achieve success at the normal rate of one month gain for each month in the program.

Operationally Relevant Activities for Children's Language Experience (ORACLE)

The development of a computer-based interactive instructional system in the language arts was undertaken in the 1967-68 school year at the Harvard Computer Aided Instruction Laboratory. The basic rationale of the elementary language program was two-fold: (1) that every child would receive instruction according to his or her own individual learning needs, a degree of individualization impossible in the ordinary classroom, and (2) that every child would be involved in a variety of computer-assisted instructional interactions, not only drill and practice routines (Serwer & Stolurow, 1970).

Serwer and Stolurow report the ORACLE is accessible on-line from either IBM 1050 terminals or teletypes. The individualized instruction made possible by ORACLE consists of four main steps: (1) Diagnosis, (2) Prescription, (3) Remediation or Treatment (phonics, comprehension, spelling) and, (4) Enrichment. A management and monitoring program enables a teacher to keep track of each student's

progress in detail. The program is organized by class and course.

The Differentiated, Oral, Visual, Aural, Computerized, Kinesthetic Program (DOVACK)

The DOVACK Program requires little computer knowledge of the teachers using it. Teachers and aides help project pupils dictate new stories each day. Each evening the stories are typed into the computer at an on-site terminal, where a printout is generated. On the next day, each student reads the printout of the story dictated on the previous day. They then read some of their previous stories and practice their new words, which are listed. Every sixth day, the computer devises a word recognition test (multiple-choice) for teacher administration as a check on pupil progress in learning words. The words tested are selected from those most recently added to the student's list. The computer serves as the record-keeper and test developer for teachers using what is essentially a language experience approach to reading (Way, 1972). This program is no longer in use.

Control Data Corporation (CDC)

Control Data Corporation is another leading company in marketing computer-assisted instructional packages in

reading. In order to use the program marketed by Control Data Corporation, one needs the hardware for the PLATO Program. Of particular importance is the PLATO terminal, with its touch panel, which allows learners to respond by either typing at the terminal keyboard or by touching the screen in the appropriate place (Mason, 1980).

Hewlett-Packard

Hewlett-Packard is yet another company which maintains a library of programs contributed by organizations using its equipment. Some of these programs are for the development of vocabulary and reading skills. Hewlett-Packard markets an Adult Reading Skills program, which is very similar to the Computer Curriculum Corporation programs (Mason, 1980).

Apple Computer Company

The Apple Computer Company both markets computer-assisted instructional programs for use in its own microcomputer and produces the microcomputer which Bell and Howell now markets to schools (Mason, 1980).

ATARI Company

The ATARI Company is now marketing its computers and programs to schools through Science Research Associates (Mason, 1980).

Texas Instruments, Inc.

Texas Instruments, which has its own microprocessor capable of computer-assisted instruction, has developed the Speak & Spell, Speak & Read, and Speak & Math. These instruments are the first hand-portable, battery-operated, low-cost reading and mathematics programs. These may be considered rudimentary computer-assisted instructional programs (Mason, 1980).

On a more sophisticated level, Texas Instruments has a program known as LOGO, a computer language based on a philosophy of education developed over a 12-year period by Professor Seymour Papert and the staff of the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology. The core principle of LOGO is to create computer-based environments in which mathematics and other areas of formal learning can occur in a natural manner. Many of LOGO's premises are based on Jean Piaget's theory of intellectual development, which describes a child's development as taking place in a series of stages (Texas Instruments, Inc., Note 3).

Texas Instruments' LOGO is a child appropriate computer langauge, which means that it lets students of all levels of ability communicate with the computer using an easy-to-understand language. LOGO enables the student to

"teach" the computer what to do and allows the student to determine the level of challenge he or she wants to explore in the areas of problem-solving and communication skills (Nolte, Note 4).

In summary, each of these companies is seeking markets for its computers and software, and schools are possible markets. The challenge of the 1980s is clearly in the development of computer-assisted instructional reading software - the hardware is already here.

The Advantages and Disadvantages of Computer-Assisted Instruction

Advantages of Computer-Assisted Instruction

Thompson (1980) states that the computer can serve as text, test, or tutor. Also, the great variety of input/output modalities, speech synthesizers, teletypewriters, television-like screens, touch-sensitive screens, beams of light pens, color graphics, and mobile units, can support diverse student needs and interests. Other advantages include: (a) immediate feedback, (b) self-pacing, (c) self-selection, (d) non-threatening, challenging, motivating multi-language capabilities, and (e) impartiality. Thompson (1980) also states that the capabilities of computers in reading are as follows:

1. Containing programs based on different theories of reading.

2. Supporting a variety of reading content, such as word recognition, vocabulary development, and comprehension.

3. Being used with different types of learners - gifted, average, remedial, or handicapped.

4. Being accessed under a variety of conditions - group or individual; in the home, library, or school; at any time.

5. Facilitating achievement of a variety of educational goals and purposes (p. 38).

Maeger (1972) has described the diversity of computer-assisted instructional programs, including the use by deaf children in Washington, D.C., by retarded readers in New York City, and by illiterate prison inmates. Wexler (1980) reports results of the use of computers and computer-assisted instruction with severely handicapped children at Boston's Cotting School for Handicapped Children. She states that results with severely handicapped children have exceeded all initial expectations.

It would appear that the main argument supporting the use of computer-assisted instruction is the argument for independent or individualized learning of any kind. The computer can be programmed to respond to a student's poor performance by providing extra examples related

specifically to the more difficult aspects. As students work their way through a program, a record of their different responses can be maintained. The parts of the program still to be presented can be modified in pre-determined ways to take account of this (McCulloch, 1980).

With computer-assisted instruction, motivation and enjoyment are increased, active involvement is demanded, and teacher time can be more effectively utilized. Computer-assisted instruction offers flexibility of sequencing. Steps or skills within a program can be accelerated, repeated, or skipped through branchings (usually dependent on the correctness of a student response) (Thompson, 1980).

Disadvantages of Computer-Assisted Instruction

Both computers and computer-assisted instructional programs have definite limitations and drawbacks. As far as the hardware is concerned, Mason (1980) states that the initial cost of installation can be high. While it is true that several brands of microcomputers are now available for under a thousand dollars, few schools or colleges will be satisfied with the limited memory of the most inexpensive microcomputers. Furthermore, Mason goes on to say that the purchase of printers, terminals, tape or disk players, and other peripherals will add a considerable amount to the

price of installing any system. Therefore, the initial installation expense may run to much more than the cost of the computer itself. The cost of creating programs for computerized instruction is also high. To balance these two costs, the computerized instruction must serve a relatively large number of persons. Yet another disadvantage of the computer is the relative difficulty of reading text printed on the cathode ray tube or display screen. Some students complain of glare, and others report fuzzy images. As a consequence, the length of time students can spend at a terminal may be limited. And as yet, the computer cannot listen to someone read and help that person improve his or her fluency or oral interpretation of the subject matter (Mason, 1980).

Thelen (1977) states that successful employment of the computer as teacher depends on many human variables, including the adequacy of the courseware design, the off-line follow-up activities conducted by teachers, the consistency of course objectives with student interest, and the way in which the computer-assisted instructional experience is integrated into the student's instructional and socialization program.

There is also a definite limit to how much time students can profitably spend working with a computer terminal. Some authorities recommend a maximum of 20 to 30 minutes a

day. The computer is an intense and demanding teacher. Students generally tire more quickly than they would in group instruction involving changes of pace, wider perceptual fields, and social experiences (Joiner, Miller & Silverstein, 1980).

Lavine (1981) states that training of key personnel is required. Those educators who are the key instructional leaders should be given extensive training designed not only to increase their knowledge of computers, but to provide the necessary skills to impart this knowledge to other members of the instructional staff.

Lavine also cautions that when a computer is down (not operating) frequently, it can effectively undermine a computer-assisted instructional program. Maintenance must be readily available. Software and courseware must also be available. It should be noted that software for many microcomputers is <u>not</u> interchangeable. Thus, the microcomputer is tied to the software written for it.

Swinton, Armarel, and Morgan (1979) speak of children having difficulty with the mechanics of disks, headphones, and touch panels, as well as system failures.

Swinton et al. (1978) state that developers of courseware are needed who are immersed in the subject matter, who have extensive teaching experience, and who, ideally, have a track record of successful curriculum development in

the subject-matter in other media.

Electronic Technology Serves Education

The sixties marked the decade when ideas for using the emerging media, hard and soft, were proposed and applied experimentally in classrooms in the United States. In such projects, according to the meager literature available, the roles of the teacher and the educational process were being altered and redefined. Individually Prescribed Instruction (IPI) was one of the first experimental projects to apply technology to modify the role of the teacher and the process of education (National School Public Relations Association, 1968). Today, all over our country, where modern computer technology is being used, the role of the teacher is being modified from one who teaches predominantly to one who diagnoses, prescribes, and guides children through individual learning activities. Thus, the teacher's major functions involve diagnosis, prescription, creation of individual learning experiences, guidance, testing, and evaluation. Instruction is placed largely on a self-service basis. It is believed that learning results from self-administered activity: education is viewed largely as a do-it-yourself enterprise (Ohanian, 1971). An environment is created in which children learn by doing and where they are provided immediate and relevant information with regard

to their accomplishments. A very similar design and theory was discussed by Richardson and McSweeney (1970), in their discussion of the Edison Responsive Environment "Talking Typewriter" device for teaching beginning reading skills. Basically, they state that the responsive environment approach is concerned with intrinsic rewards derived from an environment which responds constantly and consistently to what the learner is doing.

Davis (1968) has evaluated the attitudes of educators toward technology in the classroom. He states that recognition by professionals in the field of education for the value of technology is long overdue. He points out that the possible contributions machines may make to each child's education are considerable. He believes that much of the debate concerning machines and technology in the learning environment has centered on foolish thoughts. Ideas that man-made machines may control the maker or machines may replace the teacher are less than realistic if sound principles of education are followed. Davis further states that schools in the future should be media plants which provide both stable and mobile machinery to expose all students to learning materials and activities.

Davis goes on to state that machines and technology, imaginatively used in the classroom, may liberate teachers from the time-consuming tasks of collection and arrangement

of material for the more personal task of contacting the child and centering on his or her educational needs. The encouragement of schools toward more self-direction and self-responsibility will make learning a self-gratifying experience.

Moursund (1980) states that today, with the availability of the computer, teachers may now find that they have more time than they ever dreamed of to attend to the task of education of our children. Calculators and computers are an everyday tool of adults working in business, government, and industry. Our educational system evidently does not realize the educational implications of this fact. He also states that changes need to be made in our curriculum, even if we are not yet able to make calculators and computers readily available to students. This means, according to Moursund, that we must decrease the emphasis upon the routine and rote skills of carrying out a plan to solve a problem, and that we must place increased emphasis upon the higher level skills of understanding, figuring out how to solve problems, and understanding the meaning of results produced when these plans are carried out. What we need to do is prepare our students to work with the computer tool, rather than to compete with it.

Leaders in the computers-in-education field agree that all students should become computer-literate. This means

that they should learn about the capabilities and limitations of computers; they should learn the social, vocational, and educational implications and effects of computers. This can be taught at any age level. Computer-assisted instruction at its simplest level is merely rote drill and practice, with the computer serving as a drill master and record keeper. At a more sophisticated level, computer-assisted instruction can be thought of as a programmed text. Various materials are presented to the student based upon the correctness of answers to questions previously presented by the machine. A student's rate of progress is governed by his or her rate of learning the material. At the most sophisticated level there exist a few dialogue systems, in which the computer and student interact in higher level problem solving activities (Moursund, 1980).

Computers are everywhere: in our homes, libraries, and schools. Most often, they have been used to serve administrative responsibilities, such as scheduling of students, storing records, payrolls and inventory. With the advent of the microcomputer, computers are now found in many classrooms. Programs in reading, science, and math at all levels are now readily available. But what about those school systems which feel the pinch of inflation? Rudimentary, computer-assisted instructional devices or hand-held

electronic equipment appears to offer a viable alternative.

Hand-Held Electronic Equipment in Early Childhood Education

Although the cost of computers continues to decline, there are still school systems as well as families who cannot afford a microcomputer. Fortunately, there are inexpensive products which are available that can provide many of the same functions as the more expensive computers. Anderson (1980) has conducted a study in which she analyzed five such products on today's consumer market. All products received excellent ratings based on educational value, motivation, sustained interest, ease of operation, distractibility, instructions, durability, packaging, attractiveness, and overall impression. None of the items cost over $150.00 and most were available for less than $50.00.

Bitter (1979) states most emphatically that electronic learning aids must be evaluated for their educational pluses and minuses. He rates Texas Instruments' electronic learning aids as being the most versatile and having significant educational value.

To be successful in strategy sports games, Bitter states that the students are highly motivated to improve their eye-hand coordination and develop manual dexterity. Also, because players are eager to develop winning

strategies, they get a lot of practice at guessing and second-guessing the computer, which is pre-programmed to oppose the player with its own random moves. Since most of the games have time limits, children become more aware of the meaning of seconds and minutes. Scoring gives practice in counting and computing.

Bitter (1979) states that the educational merits of each game will have to be evaluated separately. However, he does feel that it is important to recognize that some of the beeping, flashing, devices that students bring to school, as well as those intended for school, can be used to enhance their educational opportunities.

Zinn (1978) speaks of the introduction of Texas Instruments' Speak & Spell and Spelling B as setting a new trend line. He predicts a dramatic impact of hand-held electronic products (from $10.00 to $50.00) on the personal computer and video games market. Zinn states that a marketing strategy is emerging which separates the learning aids from calculators and also from toys. Texas Instruments plans to support merchandisers in establishing a Learning Center concept for the display area providing a collection of electronic aids for spelling, reading and time telling as well as computation.

Teaching/Learning Technologies has produced the Study Pak which is the first totally portable, computer-directed,

self-instructional learning system. Study Pak offers an economical, effective instructional alternative, which combines computer and educational technology. The system maximizes participant involvement by appealing to sight, sound and touch, and permits the user to control the program pace. Since Study Pak is portable, users can also decide when and where to use it, and do not have to fit their schedules to group instruction. Study Pak is easy to operate, is self-prompting and can provide immediate feedback so users can evaluate their own capabilities and learn by doing (Knapp, Note 5).

The Speak & Read is Texas Instruments' newest learning aid for young children. Many of the major techniques of learning to read are presented through exciting activities and games. Auditory and visual memory skills are developed. Truly, a multi-sensory approch to the teaching of reading, the child is asked to say the word, form the word by pressing the correct order of letters, and to listen to letters and words and to recall them. The child is actively involved in hearing words, seeing words, pronouncing words, and spelling words by pressing letters (Thompson, Note 6).

The Speak & Read unit itself is housed in a very attractive bright yellow plastic casing, which is lightweight and easily portable. A blue plastic cover with velcro closure is provided for storage of the Speak & Read.

All units are equipped with earphones and are able to be used with adapters or batteries. The usefullness and longevity of the Speak & Read learning aid is extended through use of the plug-in modules. Each module contains an additional word list to offer further reading practice, three levels of difficulty, and comes with a 64-page book filled with stories and activities to involve the child even further. Presently these modules are available through the third grade reading level (Texas Instruments, Inc., Note 3).

The Speak & Read instrument was developed as a supplemental instrument for reading instruction, ranging in use from preschool to third grade. It was developed by several persons, who have received doctoral degrees in reading and education. It encompasses a wide range of beginning reading skills in an eclectic manner. Some of the skills, which are introduced through six different modes or games, are: word attack skills, sight vocabulary, comprehension, auditory discrimination, visual discrimination and memory.

By pressing the "On" button the device emits a tune which indicates the device is ON and working. The display window will show "Zap 1" and "WORD ZAP, LEVEL 1" is heard. WORD ZAP is a flash card approach to sight recognition of words. The child pushes the WORD ZAPPER key when he recognizes the word he hears. There are three levels of difficulty in WORD ZAP, as is found in all of the other modes.

The speed of WORD ZAP increases with each level change. Level 3 is the fastest. To change levels, the child simply presses ON again and "ZAP 2" will be displayed. By pressing ON once again, "ZAP 3" appears. Pressing ON again brings the device back to "ZAP 1."

After five groups of three words each, a score, based on the number of correct responses, is displayed in stars and spoken. The words for WORD ZAP are selected randomly from the total word list. This list of 250 commonly used words was derived as a composite from lists such as the Dolch (Dolch & Buckingham, 1936) and the Kucera-Francis lists (Kucera & Francis, 1967), and from a thorough review of children's textbooks appropriate to the age group using this device (Thompson, Note 6).

The WORD MAKER mode is designed to develop many phonetic skills using word families and structural analysis skills. It has three levels which increase in difficulty. For example, the child hears "Add (B) to AT. What word does it make? Say it. Press the letters." A cursor or line appears in the display to show where the letter(s) are added. The child is encouraged to say the word and to press the letter keys to spell the requested word. By pressing ENTER, the word is checked. If the answer is still incorrect, a second chance is given. If the answer is still incorrect, the correct answer is displayed and

spoken. After WORD MAKER has presented five words, a score, based on the number of correct responses, is spoken and displayed with stars.

The READ IT mode is intended to develop comprehension and word analysis skills. There are three levels which increase in difficulty. The most difficult level, "READ IT 3," is not spoken to encourage readers to rely on their reading skills. The child hears "Which word? Press the letters." The display then shows the words of a sentence. In "READ IT 1" and "READ IT 2" the words are spoken as they are displayed. For example: THE MAN HAD ON A ___? Three answer choices are then presented, such as: cat, dog, hat. The child selects the word that correctly completes the sentence and presses the letter keys to spell the selected word. The REPLAY key may be pressed to have the sentence and words replayed. By pressing ENTER the word is checked. If the answer is incorrect, the correct answer is displayed and spoken. In each level of difficulty, sentences are randomly presented. These sentences are presented with many different word choices. READ IT continues for five sentences. Then a score, based on the number of correct responses, is spoken and displayed in stars.

The PICTURE READ mode is intended to develop vocabulary skills, word meaning, and comprehension skills. The first section in the "YOU CAN READ!" book should be used

with PICTURE READ. Speak & Read gives the direction "Find picture number (24)." Then "What word goes here? Say it. Press the letters." The child finds that picture number in the "YOU CAN READ!" book. The child then presses the letter keys to spell the selected word. By pressing ENTER the Speak & Read indicates if the word is correct. If the answer is incorrect, a second chance is given. If the answer is still incorrect, the correct answer is displayed and spoken.

The LETTER STUMPER mode is a game for all ages to develop auditory memory skills. For beginning readers, it introduces sounds of letters and the corresponding alphabet symbols. The child first hears, "Press the letters I say." If the letter is correct, the device repeats it and adds another letter to the sequence. The child presses a letter key for each letter he or she hears. If an incorrect letter key is pressed, the correct sequence is displayed, and a score is given based on the number of letters remembered. LETTER STUMPER has three levels which increase in difficulty. "STUMPER 1" presents a maximum sequence of five letters. "STUMPER 2" presents a maximum sequence of nine letters. "STUMPER 3" instructs you to "Press the letters I say, backwards (in reverse order)," and presents a maximum sequence of six letters.

The HEAR IT mode allows the child to enter any word on the word list and hear it pronounced. For example, when reading a story in the "YOU CAN READ!" book, the child can enter an unknown word letter by letter and have it pronounced immediately. This immediate pronunciation is important to aid fluent reading. HEAR IT allows for instant access to any word in the product. By pressing the HEAR IT mode, the child hears, "Which word?" The child then presses the letter keys to spell the selected word. When the spelling of the word is complete, the child presses the ENTER. The word is pronounced: "This word is _____." If a word is entered which is not on the word list, "Not found" is heard.

The Speak & Read, through innovative technology, can provide motivation and reinforcement for the child's learning and an important supplement to the classroom reading experience.

Summary

This review of literature has focused on:

1. Theoretical constructs of computer-assisted instruction.

2. Major experimental programs utilizing computer-assisted instruction.

3. Advantages and disadvantages of computer-assisted instruction.

4. Electronic technology serves education.

5. The use of hand-held electronic equipment in early childhood education.

The following statements are offered as summary:

1. The theoretical basis for using computer-assisted instruction appears to be well substantiated by persons such as Skinner (1968), Atkinson et al. (1970), Rodgers (1967), Obertino (1974), Obertino et al. (1977), and Yeager (1977).

2. Major experimental programs to date are: (a) The Stanford Project available through Computer Curriculum Corporation, (b) The PLATO Elementary Reading Curriculum Project available through Control Data Corporation, (c) The Edison Responsive Environment, (d) LOGO developed by Texas Instruments, Inc., (e) Hewlett-Packard which is similar to the Computer Curriculum Corporation programs, (f) Apple computer-assisted programs, and (g) ATARI Company which is now marketing its computers and programs to schools through Science Research Associates.

3. Major advantages of computer-assisted instruction are: (a) immediate feedback, (b) self-pacing, (c) self-selection, (d) non-threatening, (e) challenging, (f) motivating, and (g) impartiality.

Major disadvantages of computer-assisted instruction are: (a) initial cost of installation and hardware may be high, (b) the cost of creating programs for computerized instruction is also high, (c) difficulty in reading text printed on the cathode ray tube or display screens, (d) inadequacy of courseware design, (e) definite limit to how much time students can profitably spend working with a computer terminal, (f) necessity of training key personnel, and (g) when a computer is down (not operating) frequently, it can effectively undermine a computer-assisted instructional program.

4. Electronic technology is modifying the role of the teacher from one who teaches predominantly to one who diagnoses, prescribes, and guides children through individual learning activities. An environment is being created in which children learn by doing and where they are provided immediate and relevant information with regard to their accomplishments. Technology is liberating teachers from the time-consuming tasks of collection and arrangement of material for the more personl task of contacting the child and centering on his or her educational needs.

5. Hand-held electronic learning aids provide many of the same functions as the more expensive computers. Students are highly motivated to improve their eye-hand coordination and develop manual dexterity. Texas Instruments'

Spelling B, Speak & Spell, Speak & Math, Speak & Read, and Data Man, provide self-pacing, immediately reinforcing, highly motivating techniques for skill development; each instrument costs less than $100.00.

It is apparent that there have been successes and failures in experimental programs. The Stanford Project produced positive results while the PLATO System did less well. The success of any program depends upon program design. It is apparent that the major faults with the PLATO System were lack of program design and clearly defined and attainable goals.

In conclusion, it appears that the merging of electronic technology and education is just beginning. Teachers must be educationally prepared and ready to accept the challenge presented today by computer and electronic technology. Mirin (1981) states that educators must have the experience with, and the confidence in, computers. They must be able to stretch the computer's teaching potential to its limits. If students are educated to control the computer rather than be controlled by it, microcomputers (and electronic devices) in the schools can have a profound and positive impact on education.

CHAPTER III

DESIGN AND PROCEDURE

The purpose of this study was to determine the effectiveness of the use of electronic technology in early childhood education. More specifically, to determine if the use of Texas Instruments' Speak & Read, in addition to the traditional basal series and workbook pages, resulted in greater levels of achievement and an increase in positive attitudes toward reading.

To carry out the purpose of this study the following questions were formulated:

1. Does the addition of the Speak & Read to the first-grade classroom curriculum help to promote better reading skills than the traditional approach?

2. Does the addition of the Speak & Read to the first-grade classroom enhance attitudes toward reading more than traditional classroom programs?

3. Do the teachers see the Speak & Read as a valuable aid in the teaching of reading skills?

4. Do the children enjoy working with the Speak & Read?

Procedures

The Population

The population of the study was comprised of four classes of first grade children in a North Central Texas school system. All teachers volunteered to participate in the study in either an experimental or control capacity.

The Sample

Subjects were 71 first grade children who attended four classes in an elementary school in North Central Texas. The school was selected to represente a low, middle, and upper socio-economic status enrollment, based upon the occupation and education level of the head of the household. The social status scale used was an adaptation of McGuire and White's Index of Social Status (Note 2), devised by Ritchie (1969). This information was obtained from each family in the form of a reply to a letter (see Appendix B), and school records.

Two classes of 34 children were assigned as control classes and two classes of 37 children were assigned as experimental classes. Comparisons were made between intact groups.

Design of the Study

A review of the literature revealed some well-planned experimental studies such as the Stanford Project, as well as some poorly planned and executed experimental studies such as the PLATO Project. The researcher incorporated the successful methods and attempted to avoid the mistakes made by the poorly designed studies to produce the design of this study.

Teachers, with the aid of the researcher, administered the Metropolitan Readiness Tests and the Reading Attitude Inventory (see Appendix C), to both the experimental and control classes, prior to the introduction of the Speak & Read instrument in the experimental classrooms. The researcher met with the teachers of the experimental classes prior to the placement of the Speak & Read instruments in the classes to thoroughly acquaint them with the devices and to work out a plan of classroom management that would be compatible with their daily routine.

Teachers in the experimental classrooms followed the manual of the basal series and workbooks used in their classes and supplemented this with the Speak & Read. The two experimental classes each were supplied with 10 Speak & Reads (a total of 20) with adapters. Each child spent 20 minutes per day with the Speak & Read. They used a quiet

area of the classroom for this activity. The control rooms carried on reading instruction with a basal reader and workbooks, but without the use of the Speak & Read instruments.

The researcher visited the classrooms each day, to determine if there were any needs to be met, or if there were any questions or difficulties.

In February, children in both the experimental and control groups were posttested for achievement by means of the Metropolitan Achievement Tests, Primary I Battery. They also received a post-Reading Attitude Inventory. From this information it was hoped to determine whether the use of the Speak & Read did, in fact, increase both achievement and attitude scores in the experimental groups as compared with the control groups. Teachers in the experimental classrooms were also asked to fill in a rating sheet for the Speak & Read (see Appendix D). Children in the experimental classrooms were also given a questionnaire to answer pertaining to the use of the Speak & Read and their feelings toward it (see Appendix E).

Instrumentation

The Metropolitan Readiness Tests, Level II, was administered as a pretest to both the experimental and control groups. This test focused on the more advanced,

higher-level skills important in beginning reading and mathematics. The tests included at Level II were:

1. Beginning Consonants
2. Sound-letter Correspondence
3. Visual Matching
4. Finding Patterns
5. School Language
6. Listening
7. Quantitative Concepts
8. Quantitative Operations

The Metropolitan Readiness Tests (MRT) provide a survey of some important skills needed in beginning reading and mathematics. Tests in the Auditory and Visual Areas concentrate on rather narrow, but important abilities which are needed in decoding sounds and symbols, while tests in the Language and Quantitative Skill Areas emphasize broad language comprehension, reasoning, and conceptual abilities that are important in both reading and mathematics. The Metropolitan Readiness Tests allow the teachers to obtain information about their pupils' levels of development in important pre-reading and pre-mathematics skills.

Reliability indices for the MRT were computed using the data from the equating of forms study in which pupils took both Form P and Form Q in counterbalanced order with about two weeks intervening between administration. Kuder

Richardson reliabilities range from .88 to .96, having an average reliability of .92 (Nurss & McGauvran, 1976).

The most important aspects of test validity for the MRT are content validity and predictive validity. For content validity, it is necessary to show that the content of the MRT is related to beginning reading. In the initial stages of development of the MRT, an analysis of the beginning reading process and an extensive review of the reading research literature were made to determine the skills which were shown by the research to be related to reading. A sequential list of the skills necessary for beginning reading was then prepared and tests measuring these skills were developed and examined during item analysis programs in 1971 and 1973. Predictive validity can, therefore, be demonstrated by showing that scores on the MRT administered to Grade 1 pupils in the Fall are closely related to achievement test scores in the Spring of the same school year. The total Pre-Reading Skills Composite Validity is .70 when the MRT is correlated with the Metropolitan Achievement Tests (Nurss & McGauvran, 1976).

The Reading Attitude Inventory consists of ten questions about how a child feels about reading activities. The child listens as the teacher reads each item, then circles the happy face, neutral face, or the sad face depending on how the child feels about each question. The

faces are alternately placed to reduce perseveration. The child is told there are no right or wrong answers and to circle the face which indicates best how he or she feels. Scoring is from 0 to 2, with the 0 indicating the sad face, 1 indicating the neutral face, and 2 indicating the happy face. The lowest score possible would be a 0, while the highest score possible would be a 20 (see Appendix C). While the present test has only face validity, it is felt by the researcher to be the best measure available to measure attitude toward reading for first graders, after an extensive review of the literature on attitude inventories. The Reading Attitude Inventory (Crandall, 1973) was also used as a posttest, in order to determine if, in fact, the use of the Speak & Read did influence the students' attitude toward reading.

The Metropolitan Achievement Tests, Primary I, was used as a posttest to assess achievement upon completion of the treatment. The Metropolitan Achievement Tests (MAT) are a series of measures designed to tell teachers and administrators how much pupils have learned in important content and skill areas of the school curriculum. The tests are basically a source of information yielding comparable measures from one level to another and one subject to another. These features help educators in evaluating pupil progress over the years and in identifying particular

strengths and weaknesses. The test contents are based on careful and extensive analyses of contemporary textbooks, syllabi, and other curricular sources (Durost, Bixler, Wrightsone, Prescott & Balow, 1971).

The validity of an achievement test, such as the Metropolitan Achievement Tests, is defined primarily in terms of content validity. A test has content validity if the test items adequately cover the curricular areas that the test is supposed to evaluate. Since each school has its own curriculum, the content validity of Metropolitan Achievement Tests must be evaluated by each school.

Reliability data for the MAT, Primary I Battery are based on split-half (odd-even) coefficients corrected by the Spearman-Brown formula. Split-half reliability ranged from .93 to .95, with an average reliability of .81 (Durost et al., 1971).

The Teacher's Ratings of Speak & Read is an inventory developed by the researcher and adapted from Anderson (1980). The educational value, ease of operation, motivation, distractibility, instructions, sustained interest, durability, packaging, attractiveness, and overall impression were rated by the teachers of the experimental classrooms (see Appendix D).

Children in the experimental classes were also asked to respond to the Speak & Read Questionnaire (see Appendix

E) developed by the researcher in order to ascertain how they felt about the Speak & Read learning aid.

Statistical Analysis

Analysis of covariance between the experimental vs. control classrooms on the posttest reading achievement (Metropolitan Reading Achievement Tests, Primary I) was used. Covariates were the pretest (Metropolitan Readiness Tests, Level II), age, sex, socio-economic status, with or without preschool experience.

Analysis of covariance between the experimental vs. control classrooms on the posttest reading attitude (Reading Attitude Inventory) was used. Covariates were the pretest (Reading Attitude Inventory), age, sex, socio-economic status, with or without preschool experience.

Covariance analysis controlled for the pretest and demographic variables, allowing examination of group differenes on posttest scores which have the influences of covariates "adjusted out" or removed. Conclusions about treatment differences can, therefore, be made without regard to possible effects of the covarying variables.

The Speak & Read Questionnaire items were analyzed by the Chi-Square Goodness of Fit Test to determine any significant tendency for the experimental group to prefer or not prefer the Speak & Read instrument.

Teachers were administerd a questionnaire to determine their perceptions of the effectiveness of the Speak & Read.

CHAPTER IV

FINDINGS

The purpose of this study was to determine the effectiveness of the use of electronic technology in early childhood education, more specifically, to determine if the use of Texas Instruments' Speak & Read, in addition to the traditional basal series and workbook pages, resulted in greater levels of achievement and an increase in positive attitudes towards reading.

Subjects were 71 first grade children who attended four classes in an elementary school in North Central Texas. Thirty four children comprised the control classes and 37 children comprised the experimental classes. The school represented a low, middle, and upper socio-economic status enrollment. The children ranged in age from 6 years 2 months to 8 years 2 months.

For the purpose of this study, answers to the following Null Hypotheses were sought:

Null Hypothesis I: There will be no significant difference between the treatment and the control group in posttest achievement, controlling for:

a. Pretested readiness scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

Null Hypothesis II: There will be no significant difference between the treatment and the control group in posttest attitude toward reading, controlling for:

a. Pretested Reading Attitude Inventory scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

Null Hypothesis III: There will be no significant difference in proportions of subjects who like and do not like the Spead & Read instrument, as measured by each of the five check list items on the Speak & Read Questionnaire (See Appendix D).

Findings For Each Null Hypothesis

Null Hypothesis I: There will be no significant difference between the treatment and the control group in posttest achievement, controlling for:

a. Pretested reading readiness scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

Analysis of Covariance (ANCOVA) was used to assess treatment differences in reading achievement between the experimental and control groups. The dependent variable was defined as the Metropolitan Reading Achievement Tests, Primary I percentile rank. Covariates were defined as the Metropolitan Reading Readiness Tests, Level II composite percentile rank, subject's age, sex, socio-economic status, and number of years in a preschool program.

ANCOVA revealed a significant difference between the experimental and control group on the adjusted posttest percentile rank score ($F\{1,64\}=7.41$, $P=.008$) (See Table 1). The experimental group scored 14 percentile points higher than the control group on reading achievement.

Table 1

Reading Percentile Means

Group	Reading Readiness Pre Percentile	Reading Achievement Post Percentile	Reading Achievement Adjusted Post Percentile
Control	69.79	54.88	52.30
Experimental	58.73	64.19	66.56
Total	64.03	59.73	

The effect for covariance overall was significant ($F\{5,64\}=10.47$, $P<.0001$), indicating significant correlation between percentile rank and the set of covariates. However, only the pretest percentile rank appeared to have a pronounced influence on the dependent variable (see Table 2).

Table 2

Regression Statistics for Covariates

Covariate	Regression Coefficient	Standard Error	T-Value
Sex	7.63494	5.14695	1.48339
Preschool	2.75179	2.51776	1.09295
Socio-ec. Status	3.71802	4.46478	0.83274
PRERANK	0.58427	0.10893	5.36365**
AGE	-5.53097	5.25392	-1.05273

**p<.01

The regression parallelism test was not significant ($F\{5, 59\}=1.39$, N.S.). Regression slopes were not significantly different between the experimental and control groups, thus satisfying the parallelism assumption of ANCOVA.

Given the results of ANCOVA, Null Hypothesis I was rejected. The experimental group scored significantly higher in reading ability than the control group,

controlling for factors of reading readiness, age, sex, socio-economic status and preschool attendance.

The four classes (two experimental, two control) were also directly compared, using ANCOVA and the identical dependent and covariate variables as above. A significant main effect for teacher/class was found ($F\{3,62\}=2.76$, $p<.05$) (see Table 3).

Table 3

Reading Percentile Means by Class

Class	Pre	Post	Adjusted Post
1 (Control)	57.65	49.59	54.91
2 (Control)	81.94	60.17	49.41
3 (Exp.)	57.71	66.35	69.35
4 (Exp.)	59.60	62.35	64.43

Newman-Keuls Post-Hoc Analysis showed classes 3 and 4 both significantly higher than classes 1 and 2. No differences were found between classes 1 and 2 or between classes 3 and 4. This finding recapitulates the finding of a significant main effect between experimental and control conditions collapsed across classes.

Null Hypothesis II: There will be no significant differences between the treatment and the control group in

posttest attitude toward reading, controlling for:

a. Pretested Reading Attitude Inventory scores

b. Sex

c. Socio-economic status

d. Preschool attendance

e. Age

ANCOVA was used to assess treatment differences in attitude toward reading between the experimental and control groups. The dependent variable was defined as the posttest Reading Attitude Inventory score. Covariates were defined as the pretested Reading Attitude Inventory score, subject's age, sex, socio-economic status, and number of years in a preschool program.

ANCOVA revealed no significant treatment difference in attitude ($F\{1,64\}=.12$, N.S.) (see Table 4).

Table 4

Reading Attitude Scale Means

Group	Pretest	Posttest	Adjusted Posttest
Control	16.47	16.38	16.24
Experimental	15.03	15.86	16.00
Total	15.72	16.11	

The effect for covariates overall was not significant ($F\{5,64\}=1.71$, N.S.), and the regression parallelism test was not significant ($F\{5,59\}=.36$, N.S.).

Given the ANCOVA results, Null Hypothesis II was retained. Experimental and control group mean posttest attitude scores were approximately equal, with factors of pretest attitude, age, sex, socio-economic status, and pre-school attendance controlled for.

The four-classes were also directly compared using ANCOVA and the identical dependent and covariate variables as above. No significant difference was found between classes on attitude ($F\{3,62\}=.49$, N.S.).

Null Hypothesis III: There will be no significant difference in proportions of subjects who like and do not like the Speak & Read instrument, as measured by each of the five check list items on the Speak & Read Questionnaire (see Appendix D).

The Chi-square Goodness of Fit Test, with one degree of freedom, was used to assess subjects' reaction toward the Speak & Read instrument as measured by each item of the Speak & Read Questionnaire.

Significantly more subjects responded with "yes" than with "no" on each of the five items (see Table 5).

Given the Chi-square Goodness of Fit Test results, Null Hypothesis III was rejected.

Table 5

Chi-square Analysis of Speak & Read

Questionnaire Items

Item	Yes	No	$\chi^2(1)$
1. I liked using the Speak & Read.	26	11	6.08*
2. I would like to use a Speak & Read when I am in second grade.	27	10	7.81**
3. I felt that the Speak & Read helped me to learn to read this year.	34	3	25.97***
4. Would you like to have a Speak & Read in your home?	32	5	19.70***
5. Would you like your best friend to have a Speak & Read?	29	8	11.92***

*p<.02
**p<.01
***p<.001

Other Analysis: In order to assess the comparability of the experimental and control groups, the distribution of each demographic variable (i.e., each covariate) between the experimental and the control conditions was examined.

Chi-square tests of association between sex and treatment conditions (see Table 6) and socio-economic status and treatment conditions (see Table 7) showed both sex and socio-economic status categories to be evenly distributed between conditions. Kolmogorov-Smirnov

Table 6

Distribution of Sex by Treatment

Count Row % Col % Total %	Control	Experimental	Row Total
Male	17 51.5 50.0 23.9	16 48.5 43.2 22.5	33 46.5
Female	17 44.7 50.0 23.9	21 55.3 56.8 29.6	38 53.5
Column Total	34 47.9	37 52.1	71 100.0

Corrected χ^2=0.11028 df_1 α=0.739
Raw χ^2=0.32518 df_1 α=0.568

two-sample tests between treatment conditions on age and years of preschool attendance (see Table 8) revealed no measurable differences in central tendency, variability, or distribution on either age or preschool years between the conditions. It was concluded that the experimental and control conditions were directly comparable as defined by the distributions of measured subject characteristics between conditions.

When the teachers of the experimental classrooms were asked to rate the Speak & Read instrument in terms of

Table 7

Distribution of Socio-Economic Status

by Treatment

Count Row % Col % Total %	Control	Experimental	Row Total
Low	2 33.3 5.9 2.8	4 66.7 10.8 5.6	6 8.5
Medium	7 46.7 20.6 9.9	8 53.3 21.6 11.3	15 21.1
High	25 50.0 73.5 35.2	25 50.0 67.6 35.2	50 70.4
Column Total	34 47.9	37 52.1	71 100.0
χ^2=0.60766	df_2	α=0.7380	

educational value, ease of operation, motivation, distractibility, instructions, sustained interest, durability, packaging, attractiveness and overall effectiveness, both experimental teachers agreed perfectly on 70% of the items. They disagreed within one point on sustained interest, durability, and overall effectiveness. The lowest rating given was for distractibility, while other characteristics rated good to excellent.

Table 8

Kolmogorov-Smirnov Tests: Age and

Preschool by Treatment

Variable	Experimental	Control	Maximum (Abs Diff)	Maximum (+ Diff)	Maximum (- Diff)
Age	37	34	0.1002	0.1002	-0.0779
	K-S Z 0.422	2-tailed P 0.994			
Preschool	37	34	-0.1486	0.0000	-0.1486
	K-S Z 0.626	2-tailed P 0.829			

Summary of Findings

The summary of the findings of this study are as follows:

1. There was a significant difference between the experimental and control groups on reading achievement. The experimental group scored 14 percentile points higher than the control group.

2. There was no significant treatment difference in attitude toward reading. Experimental and control group mean posttest attitude scores were approximately equal. Also, no significant differences were found among the four classes on attitude toward reading.

3. Significantly more subjects responded with "yes" indicating liking the Speak & Read than with "no" when

asked to respond to a questionnaire to determine like or dislike of the Speak & Read instrument.

4. Teachers using the Speak & Read instrument rated it high overall, and agreed on 7 of the 10 items. Distractibility was the lowest item scored.

CHAPTER V

SUMMARY, DISCUSSION AND RECOMMENDATIONS

Summary

Summary of Investigation

This study was designed to determine if the use of electronic equipment now available to families and school systems throughout the country can be adapted to classroom use as a valuable supplement to the curriculum in early childhood education. A sample of 71 first grade children were selected from an elementary school in North Central Texas. The control group consisted of 34 children in two control classrooms. The experimental group consisted of 37 children in two experimental classrooms. The children were between 6 years 2 months of age and 8 years 2 months of age. They were representative of lower, middle, and upper socio-economic levels. Both females and males were equally represented. Children ranged in preschool experience from "none" to four years.

In September, 1981, the children were administered the Metropolitan Readiness Tests, Level II in order to assess their readiness for formal reading instruction. A

Reading Attitude Inventory was also administered at that time in order to assess their attitude toward reading. A total of twenty Speak & Read instruments were placed in the experimental classrooms. The control classrooms carried on reading instruction as usual - utilizing a basal series and workbook. The experimental classrooms augmented the same basal series and workbook with twenty minutes use of the Speak & Read instruments daily for each child.

At the end of a five-month period, the children in both the experimental and control classes were posttested for attitude toward reading and reading achievement. The Reading Attitude Inventory and the Metropolitan Achievement Tests, Primary I, were utilized. The children in the experimental classrooms were also given a questionnaire to determine their like or dislike of the use of the Speak & Read instrument. Teachers in the experimental classrooms were also asked to respond to a check-list in order to determine their overall feelings about the Speak & Read instrument.

Summary of Findings

This study sought answers to four specific research questions:

1. Does the addition of the Speak & Read to the first grade classroom curriculum help to promote better reading

skills than the traditional approach?

The results of this study revealed a significant difference between the experimental and control group. The experimental group scored 14 percentile points higher than the control group on reading achievement.

2. Does the addition of the Speak & Read to the first-grade classroom enhance attitudes toward reading more than the traditional classroom programs?

The results of this study revealed no significant treatment difference in attitude toward reading.

3. Do the children enjoy working with the Speak & Read instrument?

The results of this study indicated that significantly more students indicated "liking" the Speak & Read instrument than "disliking" the instrument.

4. Do the teachers see the Speak & Read as a valuable aid in the teaching of reading skills?

The results of this study clearly indicate that the experimental classroom teachers saw the Speak & Read instrument as a valuable tool in the teaching of reading.

Discussion

The results of this study would appear to substantiate the hypothesis that computer-assisted instruction, in even such a rudimentary form as the Speak & Read, augmented to

the reading curriculum in a first grade classroom, can increase reading achievement scores significantly.

The amount of time spent with the Speak & Read instrument was arbitrarily decided upon by the teacher and investigator, as appropriate to the attention span of a child in first grade. However, this time may be increased, by distributing the sessions throughout the day, and/or by having the Speak & Read made available more frequently to those children lagging behind in reading. An important factor in sustaining interest in the Speak & Read instrument was the continued use of reinforcing techniques by the experimental teachers. A nod of the head or a pat on the back to acknowledge the progress being made by the student was an important factor in sustaining interest and motivation. The "human factor" should not be underestimated or overlooked when a child is placed in front of a computer.

Although attitude toward reading was not increased in either the experimental classrooms or the control classrooms, it should be noted that the children generally had a positive feeling toward reading, as indicated by their pretest mean score on the Reading Attitude Inventory. Both experimental teachers reported how eager and involved the children were when it was time for them to work with the Speak & Read instruments. However, in this study, attitude

toward reading was evaluated by a pencil and paper test only. This and other test instruments may not be discriminative to record degrees of eagerness or how much the children enjoyed the daily twenty minute sessions with the Speak & Read. A written test may also be unable to measure such things as how many times the children voluntarily choose a reading activity or the amount or kinds of reading in and out of school. Another consideration may be that a five-month experimental period may be too short a time to measure a change of attitude. Longitudinal testing is necessary.

Although the experimental students favored the use of the Speak & Read instrument significantly, some of the negative answers to the Speak & Read Questionnaire may warrant explanation. Three of the five children who responded that they would not like to have the Speak & Read at home stated that they wanted something special to play with at school. Those children who responded that they would not like their best friend to have the Speak & Read stated that they wanted the Speak & Read and did not want to give it to their best friend. Those children who did not want to use the Speak & Read instrument in second grade stated that it was because they knew how to read now and no longer needed one. Several of the children who said that they did not like using the Speak & Read reported that

this was because they already knew how to read and didn't need it. The remainder and majority of the answers by the students were favorable to the Speak & Read instrument.

The experimental teachers were favorably impressed by the Speak & Read. They rated it highly in educational value, ease of operation, motivation, instructions, sustained interest, durability, packaging, attractiveness and overall. They felt that the children were moderately distracted by other classroom occurrences.

Three suggestions were made by the experimental teachers. They were as follows:

1. Parents and teachers should be instructed as to the importance of human contact and reinforcement.

2. Texas Instruments should suggest an order in which the games should be played.

3. The letter "I" on the panel needs to have a top and bottom line, so that it does not look like a lower case "l" or number one.

The teachers of the first grade in this school expressed their desire to continue use of the Speak & Read instruments after the completion of this study. Texas Instruments has graciously consented to giving the instruments to the school as a token of their appreciation for their assistance in this study.

Conclusions

The following conclusions are based upon the statistical analysis and findings of the present study:

1. The addition of the Speak & Read instrument to the first-grade reading curriculum in the experimental classes resulted in a significant increase in reading achievement adjusted posttest percentile rank scores. This significant increase in reading achievement scores would indicate the value of a device such as the Speak & Read instrument to the first-grade classroom.

2. The addition of the Speak & Read did not influence the attitude towards reading held by the children in the experimental classrooms. Reading attitude scores remained high throughout the study for both the experimental and control groups, indicating that children in the first-grade have positive feelings toward reading.

3. Children in the experimental classrooms overwhelmingly enjoyed using the Speak & Read instrument and felt that it helped them to learn to read in first grade.

4. Teachers of the experimental groups using the Speak & Read instrument found it a valuable asset to their curriculum for the teaching of reading in first grade.

5. No adverse effects caused by use of the Speak & Read were found in the experimental group.

Implications

As a result of the data collected and the nature of this study the following implications are possible and appear reasonable. The following suggestions for the enhancing of first-grade reading instruction are offered:

1. The addition of an electronic learning aid, such as Texas Instruments' Speak & Read, designed to supplement beginning reading instruction, may be valuable in early childhood education.

2. Children in this study entered first grade with positive attitudes toward reading. The instructional program used does not appear to alter this attitude.

3. As achievement scores were significantly raised but attitude was not, this may indicate that achievement was due solely to the Speak & Read instrument itself, and not to the novelty of the approach.

Recommendations for Further Reasearch

The results of this experimental study raise many interesting questions for further investigation. Further research in this subject area might include:

1. Replication of the present study using a larger sample of subjects and a longer treatment period.

2. A similar study using a different instrument, such as Texas Instruments' Speak & Spell, or Speak & Math.

3. A longitudinal study to see if the students who were exposed to treatment maintain their increased reading achievement levels.

4. A study in which the control children are later exposed to treatment conditions and then posttested to see if their achievement levels equal those in the original experimental classrooms.

5. Attitudinal inventories should be refined in order to more precisely assess reading attitude in beginning readers.

6. A similar study should be conducted at different grade levels with emphasis placed on the primary levels.

In view of these findings, it is the hope of the investigator that other educators will take the initiative to further investigate the importance of electronic technology in education today.

APPENDICES

APPENDIX A

LETTER ACKNOWLEDGING PERMISSION FOR STUDY FROM THE DENTON INDEPENDENT SCHOOL DISTRICT

Denton Independent School District
OFFICE OF CURRICULUM/INSTRUCTION
1205 UNIVERSITY DRIVE WEST
DENTON, TEXAS 76201

September 2, 1981

Ms. Sharon L. Caplan
2317 Salado Street
Denton, TX 76201

Dear Ms. Caplan:

This letter acknowledges the Denton Independent School District's permission for you to use two classes at both Stonewall Jackson and Newton Rayzor elementaries for your reading research study. This permission is extended within the parameters outlined in the research application guidelines and with the agreement to provide the District with a summary of all project results.

Respectfully,

Ray Chancellor

Ray Chancellor, Ass'st Sup't.
Curriculum/Instruction

RC/am

APPENDIX B

LETTER REQUESTING PERMISSION FOR PARTICIPATION IN THE STUDY AS WELL AS STUDENT BACKGROUND INFORMATION

TWU Texas Woman's University
P.O. Box 23029, Denton, Texas 76204 (817) 387-0412

DEPARTMENT OF CURRICULUM AND INSTRUCTION
COLLEGE OF EDUCATION

Dear Parent of _____,

I am very pleased to inform you that your child has been selected to participate in a study to ascertain the benefits of computer-assisted instruction as a supplement to the teacher's usual reading instruction.

Basically, your child will be tested as usually done by the teacher, in September and then tested again in February.

If you have any further questions regarding this study, I will personally be happy to answer them. Please feel free to call me at home, 382-7458 any evening.

If you are willing to give your child permission to participate in this study, please complete the bottom portion of this letter. All information will be held strictly confidential.

Sincerely,

Sharon L. Caplan, B.S., Ed.M.
Certified Reading Specialist
Doctoral Candidate

Confidential Information

Child's Name_____Birthdate_____Sex_____

Did Child Attend Any Preschool Programs? Yes No If yes, how many years?_____

Parent or Guardian's Signature _____Date_____

Occupation of Head of Household _____

Highest Educational Level of Head of Household - CIRCLE ONE -

Grade School or Less
Some high school and/or vocational training
Completed high school
Completed high school and some college or special training
Completed college and/or graduate work

APPENDIX C

READING ATTITUDE INVENTORY

READING ATTITUDE INVENTORY

Introduction to the Teacher:

The Reading Attitude Inventory is designed to find out how children feel about reading. This is not a test and there are no right or wrong answers. Each child should mark honestly the picture that best shows how he or she feels about each question. Read each question moderately and allow sufficient time for each child to mark his or her booklet. Questions may be repeated if necessary. The Reading Attitude Inventory is not timed.

Grouping:

Children may take the Reading Attitude Inventory as a whole class, if they may be seated so that copying is difficult. Smaller groups may take the Reading Attitude Inventory. Markers may be used to facilitate keeping place. Markers may be made from manilla paper 7 inches x 2 inches.

Directions for Administration:

1. Be sure each child has a pencil and a marker.

2. Pass out booklets.

3. Teacher reads aloud:

   THIS IS LIKE A READING GAME. I AM GOING TO ASK YOU SOME QUESTIONS ABOUT HOW YOU FEEL ABOUT DIFFERENT THINGS. YOU HAVE A BOOKLET WITH PICTURES OF FACES THAT ARE HAPPY, SO-SO AND SAD UNDER EACH QUESTION. I WILL READ EACH QUESTION TO YOU AND YOU WILL CIRCLE THE FACE THAT BEST SHOWS HOW YOU FEEL. NOW LOOK AT THE FACES ON THE FIRST PAGE. PUT YOUR MARKER UNDER THE FIRST ROW OF FACES. (Teacher checks to see that this is done correctly.) THE FIRST FACE IS HAPPY. HE HAS A BIG SMILE. THE NEXT FACE IS UNHAPPY OR SAD. THE LAST FACE IS SO-SO. HE IS NOT HAPPY OR NOT SAD. LET'S TRY A SAMPLE QUESTION. HOW DO YOU FEEL ABOUT PLAYING BALL? IF

YOU LIKE TO PLAY BALL, CIRCLE THE HAPPY FACE. (Teacher demonstrates on chalk board.) PERHAPS YOU DON'T LIKE TO PLAY BALL. WHAT PICTURE WOULD YOU CIRCLE? (Have child mark unhappy face.) ALL RIGHT, THAT'S THE FACE YOU WOULD CIRCLE IF YOU DON'T LIKE TO PLAY BALL. NOW WHAT FACE WOULD YOU CIRCLE IF SOMETIMES YOU DO LIKE TO PLAY BALL AND SOMETIMES YOU DO NOT LIKE TO PLAY BALL. YOU FEEL JUST SO-SO. (Have child circle last face.) Complete the sample questions in the same way.

Have children turn the page and place their name in the upper right corner.

Read questions from booklet. Repeat instructions as necessary.

Scoring:

0 - Unhappy face

1 - Neutral face

2 - Happy face

Lowest Score Possible = 0

Highest Score Possible = 20

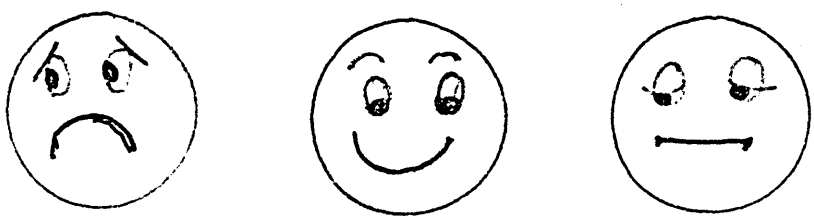
READING ATTITUDE INVENTORY *

Adapted from Crandall, Audrey Hackett. A Comparison of Reading Attitude and Reading Achievement Among First-Grade Children in Open Concept and More Formal Classes. (Doctoral dissertation, University of Connecticut, 1973). Dissertation Abstracts International, 1973, 34(05), Sec. A, P2266. (University Microfilms No. ADG73-26572)

NAME_____

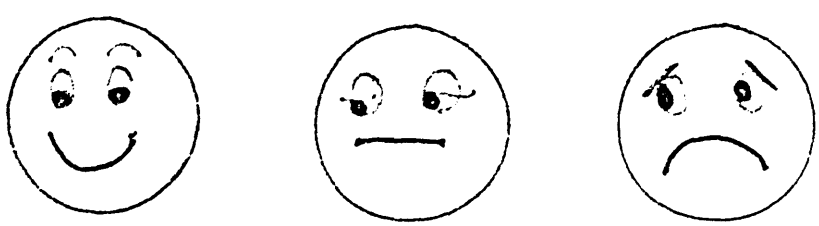
1. How do you feel when someone reads a story aloud?

2. How do you feel when someone gives you a book?

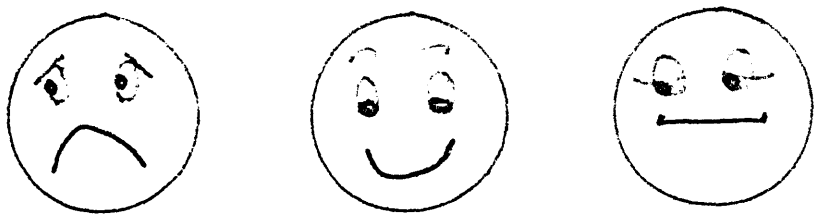


3. How do you feel about reading a book when you may pick out whatever one you want?

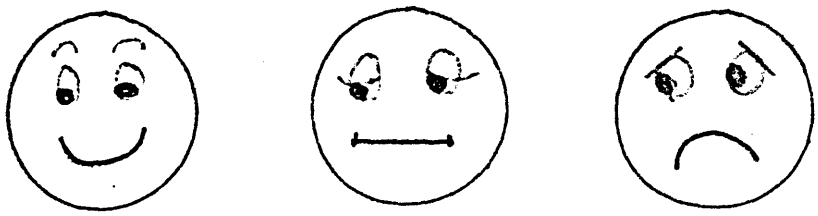
4. How do you feel when you are asked to read aloud to others?



5. How do you feel when you are asked to read aloud to a teacher?



6. How do you feel when you come to a new word while reading?



7. How do you feel when it is time to do a worksheet for reading?

8. How do you feel about how well you can read?

9. How do you feel about reading silently to yourself?

10. How do you think you'll feel about reading when your're bigger?

APPENDIX D

TEACHER'S RATINGS OF SPEAK & READ*

TEACHER'S RATINGS OF

SPEAK & READ *

	Excellent 5	4	3	2	Poor 1
EDUCATIONAL VALUE					
EASE OF OPERATION					
MOTIVATION					
DISTRACTIBILITY					
INSTRUCTIONS					
SUSTAINED INTEREST					
DURABILITY					
PACKAGING					
ATTRACTIVENESS					
OVERALL EFFECTIVENESS					

* Criteria rated on a 5 point scale (5=excellent, 1=poor).

Adapted from: Anderson, B. Inexpensive Alternatives to Computers for Classroom Use. Educational Resources Information Center (ERIC). ERIC Document Reproduction Service No. ED 196 006, 1980.

APPENDIX E

SPEAK & READ QUESTIONNAIRE

STUDENT RESPONSE SHEET

SPEAK & READ QUESTIONNAIRE

Student Response Sheet

1. I liked using the Speak & Read.

   Yes No

2. I would like to use a Speak & Read when I am in second grade.

   Yes No

3. I felt that the Speak & Read helped me to learn to read this year.

   Yes No

4. Would you like to have a Speak & Read in your home?

   Yes No

5. Would you like your best friend to have a Speak & Read?

   Yes No

Directions for Administration:

Teachers will read the above statements to the students and request that they circle either "Yes" or "No" as a response.

REFERENCE NOTES

REFERENCE NOTES

1. Milliken Publishing Company. 1981. Computer Department, 1100 Research Boulevard, St. Louis, Mo. 63132.

2. McGuire, C., & White, G. A. The measurement of social status. Department of Educational Psychology. Research Paper in Human Development, No. 3 (revised). University of Texas. Austin, 1955.

3. Texas Instruments Incorporated. 1981. Post Office Box 10508, MS 5707, Lubbock, Tx. 79407.

4. Nolte, S. Manager of Education, Technology Branch. Texas Instruments Incorporated, Post Office Box 225474, MS 439, Dallas, Tx. 75265. Personal communication, August 18, 1981.

5. Knapp, S. R. Partnership Manager. Teaching/Learning Technologies, 2 Adler Park Plaza, 1641 North Milwaukee Avenue, Libertyville, Ill. 60048. Personal communication, September 24, 1981.

6. Thompson, B. Educational Activities Development Manager. Texas Instruments Incorporated, Post Office Box 10508, MS 5707, Lubbock, Tx. 79407. Personal communication throughout the study. August - February, 1982.

REFERENCES

REFERENCES

Adkins, K., & Hamilton, M. Teacher's handbook for reading, grades 3-6. 1972. (ERIC Document Reproduction Service No. ED 076 977)

Anderson, B. Inexpensive alternatives to computers for classroom use. 1980. (ERIC Document Reproduction Service No. ED 196 006)

Atkinson, R. C., & Fletcher, J. D. Teaching children to read with a computer. Reading Teacher, 1972, 25(4), 319-327.

Atkinson, R. C., Fletcher, J. D., Chetin, H. C., & Stauffer, C. M. Instruction in initial reading under computer control: The Stanford Project. Technical Report No. 158, 1970. (ERIC Document Reproduction Service No. ED 073 421)

Atkinson, R. C., & Hansen, D. N. Computer-assisted instruction in initial reading: The Stanford Project. Reading Research Quarterly, 1966, 2(1), 5-25.

Atkinson, R. C., & Suppes, P. An automated primary-grade reading and arithmetic curriculum for culturally deprived children. Final Report, 1968. (ERIC Document Reproduction Service No. ED 023 773)

Bitter, G. What about those electronic games? Teacher, 1979, 97(3), 78-92.

Bloomfield, L. Linguistics & reading. Elementary English Review, 1942, 19, 125-130.

Bunderson, C. V. The TICCIT Project: Design strategy for educational innovation. Technical Report No. 4. Provo, Utah: Institute for Computer Uses in Education, 1973.

Carroll, J. Theories of learning and instruction. Chicago: University of Chicago Press, 1964.

Crandall, A. H. A comparison of reading attitude and reading achievement among first-grade children in open

concept and more formal classes. (Doctoral Dissertation, University of Connecticut, 1973). Dissertation Abstracts International, 1973, 34(04), 2266-A. (University Microfilm No. 73-26572)

Davis, D. C. The neglected dimension in reading instruction: Machines. Tri-University Project, 1968. (ERIC Document Reproduction Service No. ED 048 246)

Dolch, E. W., & Buckingham, B. R. A combined word list. New York: Ginn, 1936.

Durost, W. N., Bixler, H. H., Wrightstone, J. W., Prescott, G. A., & Balow, I. H. Metropolitan Achievement Tests, Primary I. New York: Harcourt Brace Jovanovich, Inc., 1971.

Fletcher, J. D. Computer applications in education and training: Status and trends. San Diego: Navy Personnel Research & Development Center, 1975.

Fletcher, J. D., & Atkinson, R. C. Computer-based instruction in reading, grades k-3. 1970 (ERIC Document Reproduction Service No. ED 040 827)

Fletcher, J. D., & Atkinson, R. C. Evaluation of the Stanford CAI Program in initial reading. Journal of Educational Psychology, 1972, 63(6), 597-602.

Frazier, R. I., & Zaslav, S. S. An automated and non-automated system of teaching. The Reading Teacher, 1970, 24(2), 115-119.

Fries, C. Linguistics and reading. New York: Holt, 1963.

Hansen, D. N., Rodgers, T. S., & Wilson, H. A. A reading curriculum for a computer-assisted instructional system: The Stanford Project. Palo Alto: Institute for Mathematical Studies in the Social Sciences, Stanford University, 1966.

Hansen, D. N., Rodgers, T., Wilson, H. A., Hartley, R. N., Anselm, K., Lee, R., Wilson, J., Lilleston, S., Smith, M., Weeks, T., Alexander, K., Burggemann, C., & Perry, S. A reading curriculum for a computer-assisted instructional system - The Stanford Project. Progress report. 1966. (ERIC Document Reproduction Service No. ED 013 722)

Isaacson, D. What's holding back computer use in education? Classroom Computer News, 1981, 1(5), 1-28.

Joiner, L. M., Miller, S. R., & Silverstein, B. J. Potential and limits of computers in school. Educational Leadership, 1980, 37, 498-501.

Kucera, H., & Francis, W. N. Analysis of present day American English. Providence, R.I.: Brown University Press, 1967.

Lavine, R. S. Computer literacy. The School Administrator, 1981, 38(4), 22-23.

Litman, G. H. CAI in Chicago. 1973. (ERIC Document Reproduction Service No. ED 087 423)

Lysiak, F., Wallace, S., & Evans, C. L. Computer assisted instruction. 1975-76 evaluation report. A Title I Program. Revised. 1976. (ERIC Document Reproduction Service No. ED 140 495)

Maeger, K. Computer-assisted instruction and reading. In W. E. Blanton & J. J. Tuninman (Eds.), Reading process & pedagogy. Bloomington: Indiana University, 1972.

Martin, J. H. Freeport public schools experiment on early reading using the Edison Responsive Environment instrument. 1966. (ERIC Document Reproduction Service No. ED 002 586)

Mason, G. E. Computerized reading instruction: A review. Educational Technology, 1980, 20(10), 18-22.

McCulloch, D. W. Uses of a computer-assisted learning system in principle and in practice. Educational Technology, 1980, 20(10), 12-15.

Mirin, S. TERC: A place to learn and share. Classroom Computer News, 1981, 1(5), 12.

Moursund, D. School administrator's introduction to instructional use of computers. International Council for Computers in Education. La Grande, Oregon: Eastern Oregon State College, 1980.

National School Public Relations Association. Individually prescribed instruction: Education U.S.A. Special report. Washington, D.C.: Author, 1968.

Nurss, J. R., & McGauvran, M. E. Metropolitan Readiness Tests, Level II, Form P. New York: Harcourt Brace Jovanovich, Inc., 1976.

Obertino, P. The PLATO reading project: An overview. Educational Technology, 1974, 14(2), 8-13.

Obertino, P., Fillman, L., Gilfillan, J., Silver, D., & Yeager, R. Elementary reading on Plato IV. 1977. (ERIC Document Reproduction Service No. ED 163 993)

Ohanian, V. Educational technology: A critique. The Elementary School Journal, 1971, 4, 182-197.

Pressey, S. L. A simple device for teaching, testing, and research in learning. School and Society, 1926, 23, 373-376.

Ratekin, N. The effect of oralographic instruction on the reading achievement of disabled learners: A final report. West Orange, N.J.: Prentice Hall Developmental Learning Centers, 1977.

Richardson, E., & McSweeney, J. An analysis of the E.R.E. talking typewriter as a device for training beginning reading skills. Educational Technology, 1970, 10(2), 81-88.

Ritchie, M. A. A comparison between socio-economic status, health practices and the health knowledge of first grade pupils. Unpublished Doctoral Dissertation, Texas Woman's University, 1969.

Rodgers, T. S. Linguistic considerations in the design of the Stanford computer-based curriculum in initial reading. 1967. (ERIC Document Reproduction Service No. ED 012 688)

Serwer, B. L., & Stolurow, L. M. Computer-assisted learning in language arts. Elementary English, 1970, 47(5), 641-650.

Skinner, B. F. The technology of teaching. Englewood Cliffs, N.J.: Prentice-Hall, 1968

Slattow, G. Demonstration of the PLATO IV computer-based education system. Final report. January 1, 1972-June 30, 1976. 1977. (ERIC Document Reproduction Service No. ED 158 767)

Swinton, S. S., Amarel, M., & Morgan, J. A. The PLATO elementary demonstration educational outcome evaluation. Final report: Summary & conclusions. 1978. (ERIC Document Reproduction Service No. ED 186 020)

Swinton, S. D., Amarel, M., & Morgan, J. A. The PLATO elementary demonstration educational outcome evaluation. Final report. 1979. (ERIC Document Reproduction Service No. ED 186 019)

Teaching/Learning Technologies. 2 Adler Park Plaza, 1641 N. Milwaukee Avenue, Libertyville, Illinois 60048.

Thelen, H. Profit for the private sector. Phi Delta Kappan, 1977, 58(6), 458.

Thompson, B. Computers in reading: A review of applications and implications. Educational Technology, 1980, 20(8), 38-41.

Way, F. L. DOVACK: Method for teaching reading. July 1, 1968 - August 31, 1971. Project report. 1972. (ERIC Document Reproduction Service No. ED 071 268)

Wexler, H. Rescuing trapped minds. American Education, 1980, 16, 38.

Wilson, H. A., & Atkinson, R. C. Computer-based instruction in initial reading--A progress report on the Stanford Project. 1967. (ERIC Document Reproduction Service No. ED 015 847)

Yeager, R. F. Lessons learned in the PLATO elementary reading curriculum project. 1977. (ERIC Document Reproduction Service No. ED 138 966)

Yeager, R. F. The reading machine. 1977. (ERIC Document Reproduction Service No. ED 142 990)

Zinn, K. L. Speak & Spell - Spelling B. Creative Computing, 1978, 4(5), 6061.