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ABSTRACT
         A review of the literature on the use of the computer
in teaching reading included studies that centered on basic reading
skills and studies that, for the most part, supported the use of
computer assisted instruction (CAI) to assist in developing these
skills. The research indicated that CAI in reading is effective for a
wide variety of reading skills and concept areas. Many researchers
believed and produced evidence that the computer has already begun to
bring students great benefits, such as better, more comfortable and
faster learning of basic reading skills. CAI has been effective in
raising reading achievement, especially when used to supplement
regular teacher-presented instruction, and has produced a decided
advantage in reducing the time taken to learn. Some investigators
believed computers were more effective with younger students. The
research dealt with diverse age levels, and varied from the
intellectually handicapped to the gifted and talented. CAI has had a
positive effect on student and teacher attitudes and motivation. A
few research studies found no advantage in using CAI to increase
student achievement since scores on post-tests were no better than
those which involved only traditional methods. However, even those
studies suggested that there were other advantages, such as student
motivation, saving of teachers' time, savings of students' learning
time, and opportunities for increased practice and reteaching. The
computer is limited in its ability to contribute to this literacy
only by man's capabilities and imagination. Thirty-four references
are attached. (MG)

THE IMPACT OF THE COMPUTER ON THE

TEACHING OF READING: A

REVIEW OF THE LITERATURE

Clarence L. Darter, Jr. and Lucy N. Phelps

ABSTRACT

The use of computers is becoming more common in American schools. Literature
was reviewed to determine computer capabilities in improving basic reading skills,
application to students of all ages and abilities, and effect on student and
teacher attitudes and motivation. The research indicated Computer Assisted
Instruction (CAI) in reading was effective in improving reading skills and concept
areas for various age groups and ability levels. Additionally, CAI had a positive
effect on student and teacher attitudes and motivation. Computers are valuable
additions to drill and practice of reading skills resulting in a better
personalized tutoring program for all levels of students. Most studies found
reading achievement was raised when CAI was used, particularly if it was used to
supplement regular teacher-presented instruction.

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THE IMPACT OF THE COMPUTER ON THE TEACHING OF READING:

A Selected Review of the Literature

Rosario is embarking on the long path of education.
His parents assist him as he assembles the personal computer
system issued by his school. Educators are convinced the
expenditure is economical since every child has access to
individualized programs of learning which saves two years of
work previously required. Rosario's system, the 27x, has a
holographic projector, voice synthesizer and listening
capabilities, digitizer light pens for drawing and writing,
and touch response. Rosario's personal computer grades his
work and transfers results by modem to his teacher's system.
She has a continuous record of his skills mastery, grades
and averages, and prescriptive recommendations.

Since Rosario has spoken mostly Spanish in his
preschool years, his equipment includes a Spanish/English
Automatic Translation Device with which he can call up the
text in Spanish or English as his needs require. All the
children have the Spelling Check Software Package and
English Grammar/Usage Word Processing Program which give
them immediate feedback on their errors. Rosario's
textdiscs are all programmed with manipulations for four
readability levels, background information, word
definitions, and main-idea function.

In the future computer equipment and programs will likely be a reality for students in every American school. A new world of school and personal computing will meet the diverse needs of students. Seymour Papert said, "The computer is the Proteus of machines. Its essence is universality, its power to simulate. Because it can take on a thousand forms and can serve a thousand functions, it can appeal to a thousand tastes" (1980, p. viii). The computer will be a powerful tool, assisting reading instruction in almost every conceivable way. The learner can be explicitly directed or can be completely in control, free to follow the internal desire of curiosity and inventiveness.

As educators realize how much computers have to offer for the future in the teaching of reading, a number of ideas have been accepted. Computer-aided instruction for gifted students allows individualization in enrichment, critical thinking, and other areas of interest. For the slow learner, or the learner with disabilities, repeated practice is given in areas of difficulty or in new concepts. Immediate feedback reinforces correct responses or points out errors needing correction. These advantages are applied to the teaching of reading and offer a multitude of possibilities for assisting students in optimum reading development.

Despite these advantages, evaluation of computer applications should provide foundation knowledge for future development and expansion. To determine the present state of computer capabilities, literature was reviewed in three areas: effect of computer-assisted instruction in the teaching of basic skills in reading; impact of teaching using computers with different grades, ages, and ability levels of students; and changes taking place in student and teacher attitudes and motivation as a result of computer-assisted instruction.

Review of Literature

"At a time, when state and national commissions have consistently call for renewed emphasis on the teaching of reading and the other fundamental skills, an instructional technology with the computer's apparent promise ought to be carefully scrutinized" (Tanner, 1984, p. 35). Many authorities believe that in the school of the future, the microcomputer is the answer to handling, accommodating, and reducing complexity in both the student and the teacher aspects of education. Perhaps the teacher may take the role of a learning guide and the student may become more of an individual learner interrelating with the computer as the guide.

Computer-assisted Instruction in Teaching Reading

Computers have been studied as a means for developing
the basic reading skills needed for successful reading
ability. These skills fell into several broad areas
including comprehension and retention, phonological word
analysis, and vocabulary and sight word recognition.

Comprehension Skills and CAI. Researchers were not in
agreement as to the effects of computer-aided instruction on
comprehension and retention. Gambrell, Bradley, and
McLaughlin (1987), and Kattman, Midgett, and Thompson (1983)
reported no statistically significant difference in
students' reading comprehension for computer-assisted
instruction (CAI) than when they received traditional
instruction.

In a print versus microcomputer-generated text study,
urban students with mixed ethnicity of high ability reading
levels showed no significant differences in performance
while low ability reading students showed significant
improvement (Feldmann & Fish, 1987). The microcomputer did
not hinder the performance of poor readers any more than
print. However, the microcomputer group scored significantly
better (p=.02) than the print group on comprehension, and
males using microcomputers performed better than females on
the direction following task.

Computer-assisted instruction in language skills
assisted volunteer tutors in improving students' reading
skills (Duffy, Bowen, Langston, & McNealy, 1985). The
program was designed to raise the reading·level and increase
the literacy retention of students. Through the use of
questionnaires, interviews and observations, the study found
tutors and students wanted the program as a supplement in
remediation of reading comprehension difficulties.

Several researchers, however, found that CAI improved
reading comprehension and achievement. Hunter and Kearsley
(1981) reported a case study at Bennott College in which
high-risk and remedial students were particularly assisted
in the program. Many students' scores in reading were
significantly increased when a teacher/technology
combination was used. As a result, students were better
prepared and completed programs in less time. Riding and
Powell (1987) conducted a study using 64 five-year-olds who
were divided into four similar groups. They cited
significant improvement (p <.05) for those who had low
initial reading attainment and did the computer activities
compared to the low attainment control groups. Children in
this low attainment group developed more efficiency in
learning to read and in comprehension.

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Roth and Beck (1987) took fourth graders from low socioeconomic backgrounds with a history of low reading achievement and instituted CAI programs for remedial instruction. Substantial improvements (p <.01) in comprehension at the word- and proposition-sentence level were noted, but no improvement was found at the passage level. Other processes improved were accuracy and efficiency of decoding and word recognition. While the study provided positive assessment of the enhanced achievement in basic skills, intense instruction and practice were seen as necessary to producing effective change for students whose skills were at the low end of development.

Reinking and Schreiner (1985) looked into the effects of computer-mediated text on measures of reading comprehension and reading behavior. Their results showed reading comprehension can be influenced by computer-mediated text, which was reflected in the mean score of the off-line group being higher on low-difficulty passages. Of particular interest were the text manipulations available to some readers in the study. The first group read traditionally printed pages and were tested on them. The second group read passages on-line and were tested. The third group read on-line and had several text manipulations available to

them, if they so chose. Manipulations available were
definitions of key vocabulary words; a simpler, less
technical version of the text; supplemental background
information; and passage structure in the form of the main
idea for each paragraph. The fourth group read on-line and
were required to view all text manipulations before
answering the questions. The fourth group made the most
progress and improvement. The inclusion of these options in
the computer-mediated text permitted readers to interact
overtly with the text in a manner not easily replicated with
conventional print technology.

In sum, the present study points to potential
applications of computer technology in mediating
written text in ways which may affect
comprehension. .....The advent of computer
technology and the capability to achieve
previously unavailable manipulations of print may,
however, significantly affect typical reading
behavior and the processing of written text
(p. 550).

"Comprehension may increase if the computer can be used
to relieve the processing burden placed on the reader and/or
stimulate more active processing on the part of the reader"
(Reinking and Schreiner, 1985, p. 539).

Phonological word analysis. Teaching-game structure for
word analysis instruction served effectively for the
teaching of principles and procedures in skills needed
through providing students with independent practice
activities in an enjoyable game format. Weaver et al.
(1982), Roth and Beck (1984, 1987), and Frederiksen et al.
(1983) reported substantial improvement in word attack skill
development with the use of learning games and CAI. Using a
hierarchal game model for training in developing particular
reading components sequentially, Frederiksen et al. (1983)
found learning games to be an effective way to build reading
skills for secondary school students with poor reading
skills. Weaver et al. concluded that the teaching-game
method worked effectively and should have general
applicability for others. Roth and Beck (1984, 1987) used
the game format for developing low readers' word analysis
skills and found that not only was the game format
successful, but the learning transferred to other uses, such
as word decoding skills, developing a word recognition
strategy, and a greater attention to interior parts of
words.

Vocabulary, sight words, and CAI. Two of four studies
in the area of teaching of vocabulary and sight words noted
considerable improvement in knowledge of words through the

use of CAI. Duffy et al. (1985) reported considerable
success using computer instruction. The computer allowed
literacy instruction to be individualized. Frederiksen et
al. (1983) found that students with poor reading skills were
able to reach levels of performance in word recognition in
context that equaled or exceeded those of high ability
readers.

However, Alfano (1985) found no difference in
vocabulary development for a sample of low-average seventh
graders given computerized instruction. Sudia (1985)
presented another view. She investigated whether any
differences occurred when 11 first grade children were
taught sight words on the computer as compared with 11
children who were taught in the classroom using flashcards
shown by the teacher. Sudia concluded from her results for
a five week period that the group taught by the teacher on
flashcards had a significantly higher score than those
taught on computer. Kastler and Roser, as reported by
Sudia, concluded that "'computers serve an important role
in reinforcing the learning of reading, but they do not
replace human interaction'" (Sudia, 1985, p. 7).

Application to Various Ages and Ability Levels

Beginning Readers. In teaching beginning readers,
teachers felt computers saved time and promoted student

motivation. With a recent emphasis on critical thinking, Riding and Powell (1987) conducted a study on the effect of reasoning and reading performance of computer-presented critical thinking activities in five year old beginning readers. Results showed significantly greater improvement (p =.01) for the treatment group. Of particular interest was the superior reading attainment by the low initial attainment subjects. In another study, Casey (1984) found that the use of the microcomputer with speech synthesizer enhanced beginning reading instruction.

"Writing to Read" is a computerized writing and reading program that was used in many schools. "When children begin writing and reading simultaneously a symbiotic relationship appears to be established in which each process was stronger than either could be alone" (Spillman and Lutz, 1986, p. 265). Working in pairs for about fifteen minutes each day, the children worked through sequenced, self-paced computer cycles to learn letter-sound correspondences. In addition, electric typewriters were available for practice in typing words, sentences and eventually stories. Teachers encouraged the children to spell words the way they sounded.

Three recent studies reviewed "Writing to Read" programs (Naron, 1986; Spillman et al., 1986; & McBeath, 1986). McBeath reported that students' scores were

significantly higher than those of the comparison group. She
also commented that the scores of the first grade students
in the program were not as high as expected when looking at
the kindergartners' achievement level. Spillman et al.
(1986) reported from Lee County, Florida, that results
showed writing samples from the students using the computer
program contained twice as many communication units as those
of the control group. The findings made a strong statement
for the inclusion of computers and the LEA approach through
"Writing to Read."

The Fort Worth Independent School District researched a
two year program with "Writing to Read" (Naron, 1986). The
results with respect to the outcome measures of reading and
writing were much weaker than expected. Problems involved
numerous equipment failures and considerable expense.
Teachers felt the program was better suited for some
kindergarten and first-grade students than others. They
also believed it was an exciting but expensive program for
the results achieved.

Developing readers. Some researchers, such as Kattman
et al. (1983), Alfano (1985), Kochinski (1986) and Gambrell
et al. (1987), used children in the middle grades and were
convinced that the use of CAI made no difference in the
learning of developing readers. Others (Roth and Beck,

1984; Ragosta, Holland, and Jamison, 1982) found significant differences in children's learning as a result of CAI.

Zuk and Danner (1986) studied the effects of microcomputers on children's attention to reading tasks. They concluded that children preferred the computer tasks to print but did not perform better, were not on-task any more often, did not stay on-task longer, and did not comprehend any better when reading from the computer.

Another interesting work used interactive fiction. Lancy and Hayes (1986) attempted to determine whether students in grades five through eight, whose interest in reading was at an average level, would become more interested in reading if they used interactive fiction computer games involving a quest or solving a problem in conjunction with required reading. Although a considerable amount of reading was required in most of the programs, students did not react negatively. If they were successful at carrying forward with the quest, students, with no more than average interest in reading, were willing to spend large amounts of time engaged in interactive fiction even though heavy amounts of reading was required. They also discovered that interactive fiction encouraged developing readers to read independently, thereby increasing reading abilities.

Readers with special problems   CAI produced positive

results with children who had special reading problems.

Ragosta et al., (1982) and Ragostc (1983) studied the use of

CAI with compensatory students.   The programs were effective

for learning accomplishments with these students.   Jones,

Torgeson, and Sexton (1987) concluded that learning disabled

children improved substantially in speed and accuracy after

the use of CAI to promote fluency.   Intellectually

handicapped school children improved and retained that

improvement after a year, as reported in Lally's study

(1981).   Lally believed this type of instruction had much to

offer intellectually handicapped students in areas of

handwriting, reading, and concept development.   The problems

of severe and profound hearing impaired students were

addressed by Prinz and Nelson (1985). These students were

found to improve as a result of the CAI programs combined

with exploratory learning.

Others concluded that CAI had little effect or made no

difference in students' progress as demonstrated by its

contrast with traditional methods.   Bass, Ries, and Sharpe

(1986) reported CAI use with low achievers resulted in

little difference as compared to traditional methods.

Kleinmann's study (1987) was concerned with students who

were learning English as their second language (ESL).   He

found CAI was not more effective than similarly constructed
instructional programs that lacked a CAI component.

The drill and practice nature of much of the present
CAI software was advantageous when students in these special
categories needed to spend more time in learning particular
skills. The endless possibilities for individualizing
learning for these students was a great time saver and help
for the planning teacher.

Student and Teacher Attitudes and Motivation

All but one of the studies reviewed showed that both
students and teachers favored the use of the computer as
supplemental to traditional classroom instruction. Bass
et al. (1986) reported that CAI resulted in equal or better
achievement in less time and with more positive student
attitudes than traditional instruction. Cicchelli and
Richards (1983) stated, "The student enthusiasm for working
with the computer is universal..... The hyperactive students
will engage themselves attentively while working at the
computer, but will fail to do so while involved with
classroom seatwork" (p. 8-9).

Although students are highly motivated by the use of
CAI, Duffy et al. (1985) believed students did not accept
tutoring without a human tutor or teacher. They strongly

valued the emotional support as well as the range of
feedback the tutor provided.

One advantage of CAI was the learner's control over
instruction. Learners could, for instance, enjoy the
freedom of choice and proceed at their own rates. Reinking
and Schreiner (1985, found evidence, however, that students'
ability to recognize when they have been successful, may not
have been sufficiently mature enough to benefit from learner
control in computer-presented textual choices.

Students and teachers appeared to appreciate the
characteristic of immediate feedback available in computer
lessons. Many believed this to be one of the greatest
advantages of CAI. However, some believed feedback must be
accompanied by an explanation of why the answer was
incorrect. Without this informative feedback, the value of
feedback was negated. Informative feedback was not
included in many available programs.

Many educators feared students' reactions to being
placed in computer work stations for numbers of hours to
work independently. Again, a variety of researchers
reported increased social interaction revolving around the
computer applications as students asked one another for help
and advice (Duncan, 1985). Some believed boys to be more
adept and to have more aptitudes for computer activities

than girls, as well as tending to be willing to work at the computer for longer periods of time (Hawkins, and Schrock et al., as cited by Balajthy, 1987).

Most teachers, as well as students, had positive attitudes toward computers. Bass et al. (1986) stated that, "Although participating teachers expressed positive comments about using microcomputers in the classroom, they were sometimes reluctant to give up their direct instructional time with students" (p. 217). However, most teachers did not hesitate to agree that a combination of technology and the personal touch was the best method for promoting student growth. Teacher acceptance of CAI was, at times, less than wholehearted. But one such instance showed teachers changed their attitude from the beginning of the study and were most enthusiastic about the help CAI gave in improving students' skills (Ragosta et al., 1982).

Computers are particularly helpful in saving both teachers' and students' time. The computer reduced substantially the amount of time students needed for learning (Hunter & Kearsley, 1981; Bass et al., 1986; Blanchard, as cited by Alfano, 1985). Teachers found them most helpful in providing drill and practice for needed skills through varied and lively formats. CAI allowed children to choose activities and provided automatic pacing

and feedback. The teacher was greatly assisted in her work

through programs that helped her simplify her tasks

(Pittelman & Levin, 1985), such as in revising letters,

printing posters, signs, and greeting cards. Programs are

also available that keep children's records and grades.

Although such use of technology was not a direct educational

priority, it improved the working climate and led to

positive teacher

attitudes.

Conclusions and Implications

The review of literature included studies that centered

on the basic reading skills and studies that, for the most

part, supported the use of CAI to assist in developing these

skills. The research indicated CAI in reading was effective

for a wide variety of reading skills and concept areas.

Many researchers believed and produced evidence that the

computer has already begun to bring students great benefits,

such as better, more comfortable and faster learning of

basic reading skills. Computers provided opportunities to

work with vastly richer materials and more sophisticated

programs. The programs personalized tutoring, as well as

drill and practice. Computers automatically diagnosed

individual reading difficulties, prescribed remedies for

problems, kept records of student progress, and presented
results in print and diagram form.

CAI was effective in raising reading achievement,
especially when it was used to supplement regular
teacher-presented instruction. Also, CAI produced a decided
advantage in reducing the time it took to learn.

Some investigators believed computers were more
effective with younger students. However, CAI was very
effective with all ages and ability groups. The research
dealt with various ages, and varied from the intellectually
handicapped to the gifted and talented. CAI did indeed make
a contribution to the learning of each particular age or
ability group.

CAI had a positive effect on student and teacher
attitudes and motivation. Some credence was given to the
reasoning that increased social interaction took place when
students were involved in asking for help and in assisting
others in computer tasks Some believed that computers
isolated students from one another, but most did not
consider it to be a problem. An increase in positive
attitudes and interaction was seen in classrooms using CAI.
Especially motivational was the chance for students to be in
control of learning through the use of programs such as word
processing, data manipulation, and exploration tools, such

as Logo. The learner became free to follow the stimuli of
his own imagination and ingenuity. Creativity associated
with CAI brought students to the highest levels of critical
thinking. Such motivation was a driving force that caused
students to reach for the pinnacle of learning.

A few research studies found no advantage in using CAI
to increase student achievement. Scores on post-tests were
no better than those which involved only traditional
teaching methods. However, even these studies suggested
that there were other advantages, such as those of student
motivation, saving of teachers' time, savings of students'
learning time, and opportunities for increased practice and
reteaching.

Time on the computer is a valuable commodity. Computer
time is of utmost value to Rosario and to others like him.
He needs the extra incentives and productive home and school
computer lessons that CAI will provide to motivate him to
the heights of learning. Time on the computer will assist
Rosario to explore things in ways which otherwise would have
been difficult, if not impossible. The computer was not
found to be a panacea to all reading ills, and it is not a
passing fad. The computer is a valuable tool to be used as
part of the equipment of learning to read. This tool is a

unique but realistic marvel with potentially enormous impact upon the teaching of reading.

Education provides our children with the intellectual tools needed for the technological world of the future. The foundation of education was laid upon literacy and particularly on the ability to look at print, either technologically or traditionally, and derive from it the ideas contained therein. The computer is limited in its ability to contribute to this literacy only by man's capabilities and imagination. Already, the computer has contributed greatly in the acquisition and development of reading skills.

References

Alfano, Jo Ann L. (1985). Seventh grade vocabulary computer instruction vs. classroom instruction. New Jersey: Kean College of New Jersey. (ERIC Document Reproduction Service No. ED 257 053).

Balajthy, Ernest. (1987). What does research on computer-based instruction have to say to the reading teacher? Reading Research and Instruction, 27(1), 54-65.

Bass, George, Ries, Roger, & Sharpe, William. (1986). Teaching basic skills through microcomputer assisted instruction. Journal of Educational Computing Research, 2(2), 207-219.

Casey, Jean M. (1984). Beginning reading instruction using the LEA approach with and without micro-computer intervention. Paper presented at the annual meeting of the Western Regional Reading Conference of the International Reading Association, Reno, NV. (ERIC Document Reproduction Service No. ED 245 192).

Cicchelli, Jerry J. & Richards, Edgar L. (1983). The
implementation and preliminary results of an action
research project in the Mahopac schools. New York:
Mahopac Central School District. (ERIC Document
Reproduction Service No. ED 380 440).

Duffy, Thomas, Bowen, B., Langston, D., & McNealy, M.
S. (1985). Technology transfer of a reading skill
improvement program for the National Commission on
Libraries and Information Science. Aberdeen, MD:
Army Human Engineering Lab. (ERIC Document
Reproduction Service No. ED 271 110).

Duncan, Maureen Venti (1985). Computer Programs and
Learning Styles. Computers, Reading and Language
Arts (CRLA), 2(2), 8-12.

Feldmann, Shirley C. & Fish, Marian C. (1987). Reading
comprehension of high school students in print vs.
microcomputer-generated text. Paper presented at
the annual meeting of the American Educational
Research Association, Washington DC. (ERIC Document
Reproduction Service No. ED 282 175).

Frederiksen, John R., Weaver, P. A., Warren, B. M.,
    Gillotte, H. P., Rosebery, Ann S., Freeman, B., &
    Goodman L. 1983). A componential approach to
    training reading skills. Washington, DC: National
    Institute of Education. (ERIC Document
    Reproduction Service No. ED 229 727).

Gambrell, Linda B., Bradley, Virginia N., & McLaughlin,
    Elaine M. (1987). Young children's comprehension
    and recall of computer screen displayed text.
    Journal of Research in Reading, 10(2), 156-163.

Hunter, Beverly & Kearsley, Greg. (1981). Academic
    computing at Bennett College: A case study.
    Washington, DC: National Science Foundation. (ERIC
    Document Reproduction Service No. ED 210 022).

Jones, Kathryn M., Torgeson, Joseph K., & Sexton, Molly
    A. (1987). Using computer guided practice to
    increase fluency in learning disabled children.
    Journal of Learning Disabilities, 20(2), 122-127.

Kattman, Sharon, Midgett, Jeanice, & Thompson, R. A.
(1983). A computer-assisted instruction reading
comprehension experiment in Seminole County. In
Bohning,G., & Read, Donna (Eds.), <u>Selected Symposium</u>
<u>Summaries</u>, <u>Annual Conference of the Florida Reading</u>
<u>Association</u> (21st). (pp. 26-29). Florida: Florida
Educational. Research and Development Council. (ERIC
Document Reproduction Service No. ED 253 864).

Kleinmann, Howard H. (1987). The effect of
computer-assisted instruction on ESL reading
achievement. <u>The Modern Language Journal</u>, 71(3),
267-276.

Kochinski, Veronica A. (1986). The effect of CAI for
remediation on the self-concepts, attitudes, and
reading achievement of middle school readers.
(Doctoral dissertation, University of Pittsburgh,
1986). <u>Dissertation Abstracts International</u>.
47(6), 2100A.

Lally, Mike. (1981). <u>Computer-assisted instruction</u>
<u>for the development of basic skills with</u>
<u>intellectually handicapped school children</u>.
Canberra, Australia: Australian Education Research
and Development

Committee. (ERIC Document Reproduction Service No. ED 222 170).

Lancy, David F., Hayes, Bernard L. (1986). Building an anthology of "interactive fiction." Paper presented at the annual meeting of the American Educational Research Association (67th). San Francisco, CA. (ERIC Document Reproduction Service No. ED 275 991).

McBeath, Marcia. (1986). Writing to Read program. Final evaluation report. ECIA Chapter 2, 1985-86. Washington, DC: District of Columbia Public Schools, Division of Quality Assurance. (ERIC Document Reproduction Service No. ED 279 018).

Naron, Nancy K. (1986). Writing to Read program 1985-86. Fort Worth Independent School District. Ft. Worth, TX: Texas Department of Research and Evaluation. (ERIC Document Reproduction Service No. ED 283 843).

Papert, Seymour (1980). Mindstorms. New York: Basic Books, Inc.

Pittelman, Susan & Levin, Kathy M. (1985). An exploration of the use of a speech-enhanced microcomputer-based language experience program to

facilitate beginning reading instruction. (Report

No. 85-6). Washington, DC: National Institute of

Education. (ERIC Document Reproduction Service No.

ED 264 524).

Prinz, Philip M. & Nelson, Keith E. (1985).

"Alligator eats cookie:" Acquisition of writing and

reading skills by deaf children using the

microcomputer. Applied Psycholinguistics, 6(3),

283-306.

Ragosta, Marjorie, Holland, Paul W., & Jamison, Dean T.

(1982). Computer-assisted instruction and

compensatory education: The ETS/LAUSD study.

Princeton, NJ: Educational Testing Service. (ERIC

Document Reproduction Service No. ED 222 169.)

Ragosta, Marjorie. (1983). Computer-assisted

instruction and compensatory education: A

longitudinal analysis. Machine-Mediated Learning,

1(1), 97-127.

Reinking, David, & Schreiner, Robert. (1985). The

effects of computer-mediated text on measures of

reading comprehension and reading behavior. Reading

Research Quarterly. 20(5), 536-552.

Riding, R. J., & Powell, S. D. (1987). The effect on
    reasoning, reading and number performance of
    computer-presented critical thinking activities in
    five-year-old children. Educational Psychology,
    7(1), 55-65.

Roth, Steven F., & Beck, Isabel L. (1984). Research
    and instructional issues related to the enhancement
    of children's decoding skills through a
    microcomputer program. Paper presented at the
    annual meeting of the American Educational Research
    Association (68th). New Orleans, LA. (ERIC
    Document Reproduction Service No. ED 248 461).

Roth, Steven F., & Beck, Isabel L. (1987).
    Theoretical and instructional implications of the
    assessment of two microcomputer word recognition
    programs. Reading Research Quarterly, 22(2),
    197-218.

Spillman, Carolyn V., Hutchcraft, G. R., Olliff, C.,
    Lutz, J. P., & Kray, A. (1986). Writing via
    reading software: An empirical study. Paper
    presented at the annual meeting of the Southern
    Association on Children Under Six (37th). Orlando,
    Fl: Southern Association on Children Under Six.
    (ERIC Document Reproduction Service No. ED 268
    526).

Spillman, Carolyn V., & Lutz, Jay P. (1986). A Writing
to Read Philosophy. Childhood Education, 62(4),
265-268.

Sudia, Dell. (1985). The computer's effect on the
learning of new words. New Jersey: Kean College of
New Jersey. (ERIC Document Reproduction.Service No.
ED 255 895).

Tanner, David E. (1984). Horses, Carts, and Computers
in Reading: A Review of Research. Computers,
Reading and Language Arts (CRLA), 2(1), 35-38.

Weaver, Phyllis, A, Frederiksen, John R., Warren, Beth
M., Gillotte, Helen P., Freeman, Barbara, & Goodman,
Lorraine. (1982). Perceptual units training for
improving word analysis. Washington, DC: Office of
Naval Research. (ERIC Document Reproduction Service
No. ED 219 739).

Zuk, Dorie & Danner, Fred. (1986). The effects of
microcomputers on children's attention to reading
tasks. Paper presented at the annual meeting of the
American Educational Research Association (67th).
San Francisco, CA. (ERIC Document Reproduction
Service No. ED 272 859).