Effects of using an integrated learning system on middle school student achievement in reading

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Effects of using an integrated learning system on middle school student achievement in reading

by

Joan Frances Johnson

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE

Department: Curriculum and Instruction
Education (Curriculum and Instructional Technology)

Signatures have been redacted for privacy

Iowa State University
Ames, Iowa
1992
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CHAPTER I. INTRODUCTION

The introduction of microcomputers in 1977 ushered in a computer revolution in schools. The microcomputers were complete computer systems with all necessary input, output, memory, processing, and permanent storage. They were also more reliable and much easier to use than their predecessors (Alessi & Trollip, 1985). This revolution in computers triggered a second revolution in education where individualization of learning, teachers as the facilitators of learning rather than the single source of information, and technology providing basic instruction and supplementary instruction in classrooms (Rockman, 1990) became elements of education. More and more schools were seeking new computer hardware and software as a vehicle for improving poor academic performance and providing enrichment options for students already performing well by traditional standards (Hixson & Jones, 1990). For the foreseeable future, it is predicted that computing will play an increasingly important role in human learning (Taylor, 1980).

Well before this microcomputer revolution, experiments in
Computer-Assisted Instruction (CAI) began in the United States in the late 1950s and early 1960s. While the 60's did not produce any widespread use of CAI, the promise of an easy programming language and drill and practice materials in the basic skills area, produced a feeling of excitement. By the mid-seventies educators and funding agencies were becoming disenchanted and CAI was used very little in the nation's schools. Computers lacked instructional flexibility and the cost was too high (Balajthy, 1988). Then in 1977, when interest in CAI was at its lowest ebb, microcomputers were introduced commercially (Chambers and Sprechter, 1983).

The introduction of reasonably priced microcomputers literally revolutionized the use of Computer-Assisted Instruction (CAI) in education in the United States (Chambers & Spechter, 1983). By 1981, Frost & Sullivan found in a nationwide study of CAI at all levels in U.S. education that CAI was used in 50 percent or more of U.S. educational institutions (1982). As the decade of the 1980's progressed, the use of drill and practice and tutorials evolved into simulations, microworlds, Logo, and the teaching of programming. Disadvantaged students,
handicapped students, as well as the gifted benefitted from this use of technology.

Although computer use expanded in schools, critics believed that since a computer lacked human qualities communication could only be superficial (Johnson, 1971). According to the critics computers could not interpret emotion or read a facial expression so communication did not truly exist. This idea was refuted by proponents of CAI who praised the advantages of student empowerment allowed by a computer. The proponents argued that the computer motivates; it is non-judgmental. The computer does not meet a student with preconceived ideas of ability and/or attitude. Proponents further argued that a computer will inform a student of success or failure without saying by work or deed that the student is good or bad. The computer individualizes learning, permitting mastery at one's own pace and gives prompt feedback (Hornbeck, 1990).

Between 1982 and 1983, the proportion of schools with microcomputers doubled (Becker, 1986). By 1990, 98% of surveyed schools had computers. Elementary schools averaged 20 computers per
building as compared to six computers in the earlier survey. The proportion of schools with enough computers so that if they were located in one place, one class with paired students, could simultaneously be served is now 57% as compared to 24% in the earlier survey (Becker, 1990).

Currently, computers are employed in many facets of education. In administrative offices computers manage attendance, inventories, fiscal records, payroll and master schedules. In computer labs, classes that teach primarily computer literacy are still prevalent in many schools (Bennett, 1987). In computer networked labs basic skills programs such as IBM's "Writing to Read" and integrated learning systems are offered to students. Other schools distribute their computers in classrooms as tools for learning. Drill and practice, tutorials, and simulations still make up a large percentage of computer use in school (Joiner, Ross, Silverstein & Vensel, 1982).

This computer use was surveyed in 1983 and again in 1985 (Becker, 1986). Computer-using teachers responded that significant benefits occurred mainly in four areas: student motivation, student
cooperation and independence, opportunities for high-ability students in programming and higher-order thinking skills and opportunities for low-ability students to master basic skills. Average ability student's needs were seen as unfulfilled. Teachers and principals also saw opportunities for special populations - gifted and learning disabled.

In the last five years, changes in school usage of computer have been modest but are taking a fairly clear direction. The practice of basic skills in elementary computer laboratories has become more common. The major development is the concentrated effort to use computers as tools for expressing ideas and recording and analyzing information, primarily at the middle and high school level (Becker, 1990).

One facet of computers in education is the power they provide for individualization of instruction especially in working with At-Risk students. Using computers in the framework of an integrated learning system to motivate and educate these students, studies have suggested significant improvement in basic skill areas of reading and mathematics (Austin, 1988; Swan, Guerrero, Mitrani, Schoener, 1988).
An integrated learning system (ILS) is both a computerized management system, for keeping track of each student's work, and courseware that provides students with remediation, practice or enrichment activities in the basic skill areas. ILS instructional software is typically traditional computer-assisted instruction (CAI), a combination of tutorial presentations and drill and practice exercises. Most of the software is targeted to the teaching of basic skills such as mathematics and reading, and it includes a comprehensive management system for tracking student progress (Balajthy, 1988). It differs from the typical classroom microcomputer primarily in that its component workstations are terminals connected to a central computer or memory storage device. Instruction software is supplied by the publisher (Balajthy, 1988).

The philosophy and concept of monitoring individual progress is certainly not new. By the beginning of the nineteenth century, the Industrial Revolution had inspired educational practices such as Joseph Lancaster's "monitorial system" of instruction. In that primitive system, using wall charts and copying slates, older students monitored
the progress of younger students as they recited and rote-learned their way through a series of graded lessons in what today would be considered the most basic of skills (Office of Educational Research & Improvement, 1989).

The heart of this systematic approach to instruction was the graded series of linear lessons. These graded lessons were eventually organized into book form, and the books systematically organized into graded, linear series which reflected the grade-by-grade, linear organization of the growing system of public schooling. These graded textbook series became the "integrated system" of the mid-nineteenth century. Many of today's educators feel frustrated because these textbooks have not been replaced by alternative, integrated systems utilizing superior means and methods. Early developments were considered supplements, not alternatives to the established textbook centered system. Such supplemental materials, in the order of their appearance, were workbooks (beginning in the 1920s); teachers' guides (1930s); film and other audiovisual materials (1930s and 40s); television (late 1950s); teaching machines and programmed texts,
language labs and dial access computer-assisted instruction (1960s); management systems (during the 1970s); and microcomputers (in the 1980's) (Office of Educational Research & Improvement, 1989).

Today's integrated instructional systems combine some of the best new developments in educational technology with strengths the systems have inherited from the mainframe and minicomputer systems that started drilling low-achieving students in mathematics and language skills nearly 30 years ago. Now on more economical microcomputers, integrated systems still provide electronic drill and practice, but the range of lessons available and the ability to individualize those lessons have expanded substantially.

One of the implications of these shifts in types and numbers of options available in education is the problem of sorting out, identifying, and effectively using these options to fill a particular need in a school's curriculum. A prevalent need now relates to the At-Risk population. Teachers are searching for trustworthy and reliable information and techniques for implementing computer-assisted learning systems to motivate students who previously have experienced
little success in basic skills learning.

There is considerable controversy and concern about ILS's and the studies regarding them. Studies have produced mixed results. The New York City Board of Education studied effects of ILS on their disadvantaged students (Swan, Guerrero, Mitrani, Schoener, 1988) with positive results. Studies in New Mexico (Norton & Resta, 1985) and Calvert County, Maryland, (Austin, 1989) reinforce the positive results for disadvantaged students.

Other research results suggest that intermediate and middle school students show little or no gain from ILS use (Lore and Chamberlain, 1988). Hartley's (1977) meta-analysis on CAI also points out that elementary students fared better than secondary students. This was replicated by Swan, Guerrero, Mitrani, Schoener (1988), who evaluated students at the elementary, middle, and high school levels with similar results. While students showed positive effects through use of an ILS, effect size diminished as grade level increased.
Need for the Study

Integrated learning systems are expensive and while they have many advantages, the effectiveness of their use across grade and ability levels has not been demonstrated. There are relatively few research studies available in the area of ILS use and even fewer that address use with the middle school child. Most studies deal with the Chapter I Reading programs, English as a Second Language (ESL), or special education students and not with a heterogeneous group. As technology continues to be implemented into our schools and integrated learning systems continue to produce programs, there exists a need for empirical research to determine whether these programs can indeed raise the test scores in reading achievement of the middle school student.

The Marshalltown Community School district found that there was little evidence that supplied them with the answers that addresses their concerns. This study was conducted to address those concerns.
Statement of the Problem

It has been suggested in the literature that most integrated learning systems provide the individualization necessary to remediate and promote the skills in reading needed to succeed in school. Such statements certainly agree with the literature that states that one on one tutoring helps children succeed. The literature has further shown that the non-judgmental, immediate feedback environment of an integrated learning system facilitates reading achievement, especially for lower ability elementary students. There is research available that addresses the use of CAI and integrated learning systems with elementary students. However, there is little research that addresses the use of integrated learning systems and the middle school child and very little research that addresses the middle and higher ability child's achievements with ILS use. Specifically a study is needed that investigates the use of the Integrated learning system with a group of seventh grade students of varying reading abilities to determine if there is a significant gain in tests of reading achievement.
Purpose of the Study

The purpose of this study is to collect data from a middle school group of students on a test of reading achievement prior to the use of an integrated learning system and again after one semester's use on the ILS. The problem is two-fold. Can an integrated learning system be effective with middle school students, and will it work with students of a higher reading ability as well as those with a lower reading ability? The control group in the study will have no use on the ILS, but will participate in some reading enrichment activities. Both groups will receive the same classroom instruction in their regular schedule. The results from the empirical data collected in this study should provide a basis to determine whether the ILS should remain in the middle school developmental reading program, be shifted to the Chapter I - special education program, or be moved to an elementary school. The results would also generate hypotheses for later empirical work that will substantiate the findings.
Dependent and Independent Variables

Dependent Variables

The variables to be measured in the study include:

- growth in reading achievement according to a nationally standardized test

Independent Variable

The independent variable of this study is:

- the use or non-use of an integrated learning system

Research Questions

The following questions will be addressed in this study:

1. Will there be a significant gain in the scores on a standardized test of reading achievement by users of an ILS?
2. Will the gains be significant for lower-ability users of an ILS?
3. Will the gains be significant for higher-ability users of an ILS?
4. Will the experimental group show a significantly larger gain in reading achievement as the control group?
Limitations

This study was conducted in view of the following limitations:

1. The sample size was small (N=35).

2. The generalizability of the study is limited due to the fact that the study was performed in one school.

3. Exogenous variables such as gender and race were not considered.

4. Environmental variables (home, family, peers, class) were not considered.
CHAPTER II. LITERATURE REVIEW

This literature review will cover related areas of theory and research in computer-assisted instruction, reading, and the use of integrated learning systems. The review begins with a background discussion of the philosophy of computer assisted instruction and then some of its applications as they pertain to reading achievement. Studies that exemplify current theories of teaching reading with computers and those that demonstrate the need for this study will be discussed. These studies follow a description of integrated learning systems in general with specific information about the Computer Curriculum Corporation which was used in this research study. The review concludes with areas of concern in research with computer-assisted instruction and integrated learning systems.

Computer-Assisted Instruction

Computer-assisted instruction (CAI) is a term applied to a learning environment characterized by instructional interaction between computer and student (Wright & Forcier, 1985). The major
advantage of computers in education is that they make learning an active process, in which a constant thinking role is played by students (Bork, 1981). Computers in education can promote a stimulating environment for learning. They can also introduce both efficiency and effectiveness into the lives of teachers, by giving them the time and facilities they need to work with individual students. Computers should do the part of teaching they can do best and free the teacher to do what he/she does best (Licklider, 1984).

In the last decade issues concerning computer-assisted instruction (CAI) in education have emerged as rapidly as computer use has evolved. One issue is the tendency among educators to favor computer applications that support, but do not supplant the curriculum. Microcomputers on their own do not promote or guarantee any particular educational outcome (Zucher, 1984). CAI is regarded as having at least two distinct advantages in supporting a curriculum. First, CAI facilitates diagnostic prescriptive teaching. Second, it makes possible immediate reinforcement (Sanders, 1981).
Individualization and the computer

Educators have long recognized that instruction given to students should be individualized when possible. Accommodating the individual differences is a continuing and overriding concern of education (Suppes, Jerman, & Brian, 1968). Individualized instruction implies that each student is able to move through the content of a course at his/her own rate, being given explanations and materials appropriate to his/her unique needs (Johnson, 1971). The problem of providing students with feedback on the correctness of an answer, problem after problem, can be a tedious task for a teacher. Computers can do this and generate a large number of problems of a given type (Franklin, 1984). One may look at the computer and computer-assisted instruction as an instructional medium to provide tutorials and drill and practice of related skill areas and also a tool for computer-managed instruction (CMI) which enables teachers to cope with the record-keeping and decision demands of individualized instruction (Norton & Resta).

This individualization also has other advantages. Observers of students working on CAI programs agree that there is a level of student
concentration rarely observed in a classroom, far greater productivity, and the infinite patience and tolerance of the machine. An ILS will backtrack and offer further instruction. A computer does not tire of a student who fails to understand. Conversely, the brighter students can move quickly along. Because of this patience and ability to backtrack, research (Congressional Office of Technology Assessment) strongly endorses CAI suggesting that CAI is more effective at raising achievement among low-achieving students, and that students complete material faster with CAI than with traditional instruction. Increases in student attendance, motivation, and attention span have also been reported. The process is pupil-centered (Poirot, 1980).

Further support for individualization suggest that computers provide clearly defined stimuli and expectations, active responses, immediate reinforcement, and gradual increase in the complexity of the material (Berthold and Sachs, 1974). Machines have infinite patience, minimize social stress, and often reduce factors such as teacher motivation and negative preconceptions about a child's ability. Good education programs do not put a child down (Stonier & Conlin, 1985).
These above mentioned attributes have been examined as to their effectiveness. Most reviews and meta-analyses have concluded that computer-assisted instructional programs studied in the 1960's and 1970s were generally more effective in raising students' scores on standardized achievement tests than alternative approaches (Becker, 1986). Elementary school children who received CAI in the form of drill and practice generally showed performance gains of 1 to 8 months over those who received traditional instruction (Vinsonhaler & Bass, 1972). CAI raised the examination scores of students and also had positive effects on student attitudes and on the amount of time needed for instruction (Kulik, Bangert, & Williams, 1983).

Computer-Assisted Instruction and Reading

Reading is unique among school activities in being both a subject of instruction and a tool for the mastery of other content areas of the curriculum. By third grade students shift emphasis from "learning to read" to "reading to learn" (Gover, Ronning & Bruning, 1990). Subject area teachers are realizing the value of students who possess the
reading skills necessary to obtain information from classroom reading assignments.

By middle school, the discrepancy in reading abilities among children becomes greater. A child whose initial efforts to read have been unsuccessful gets caught in a vicious cycle (Harris, 1961). He/She learns to dislike reading and, therefore, avoids it. By doing a minimum of practice he achieves a minimum of improvement. By middle school age, this attitude is firmly entrenched. Efficient teaching of reading requires a program that can effectively guide students of varying potentialities for learning. Such a reading program accepts limitations, is slower paced, and uses different materials and interests. Accommodating the diverse needs of heterogeneous groups of students is a concern of educators more than any other aspect of the reading program (Harris, 1961). The keeping of records, encountering the difficulties, and overcoming these difficulties successfully have always been important in a successful reading program (Barbe, 1961).

One effort to address these above difficulties in meeting student needs was to use machines. Machines and reading are not a new
combination in education. Perry and Whitlock (1954), who helped produce the original Harvard Reading Films, suggest that machines may be effective because of their motivational influence. Machines add variety, additional motivation, economy in dealing with large groups and a certain attitude toward improvement (Spache, 1964). Although the original reading machines are no longer used, the previously mentioned assets they possessed hold true for the computers of today. Research that focused on the machines of today, the computer, and the teaching of reading continued.

Investigations using computers to teach reading and language arts were undertaken at the Stanford University Institute for Mathematical Studies in the Social Sciences under the direction of Richard Atkinson and Patrick Suppes. Early results were encouraging, but implementation was expensive. By the late 1970s, expectations and interest had diminished because of the cost of computing and the lack of instructional flexibility. Yet from the two decades (1959-1979) of research, a clear picture emerged that the computer can teach reading, can save instructional time, and can be an enjoyable way to learn.
Among the benefits expected for learners were better, more comfortable, and faster learning since students would learn at their own pace and at their own convenience (Kulik, Bangert, & Williams, 1983). According to Edwards, Norton, Taylor, Weiss, & Dusseldorp (1975), computer-based teaching reduced the time it took students to learn. Teachers also benefitted by removing from their workload the drudgery of repetition, providing more accurate appraisal and documentation of student progress, and allowing more time for meaningful contact with learners.

The successes of CAI and reading are documented. In a meta-analysis of computer assisted instruction in basic reading skills (Roblyer, 1985), the research cited consistently reported that students showed slight (one-third of a standard deviation) advantages in achievement gains, learned information in less time, and seemed to enjoy the activity more than when taught by more traditional approaches. It is important to note that these studies involved drill and practice programs with perhaps limited tutorial elements.

While the achievement elements of CAI are naturally of
foremost importance, it is also important to look at how students view this method of delivery of instruction.

Student Attitudes

One current advantage of using computers for instruction is that they are favorably viewed by students. Students using computers have positive attitudes toward ease of use and toward learning through the use of a computer or terminal (McDermott, 1987). In surveys (Becker, 1986) teachers saw computers as helping students to enjoy their school experience more. They also observed the motivational effect of CAI in relation to attention to academic work.

Students seem to find the system fun, yet educational, challenging but not frustrating. Whether it breaks the monotony of the day or adds a stimulus the increase in motivation at least indirectly effects achievement by adding interest and motivation (Alifrangis, 1990).

Older students who have become disillusioned with school may view the computer as a new method by which they may achieve success.
While the motivational effects of the computer may wear off as they lose the novelty or Hawthorne effect, they are for now a positive mode of instruction.

Integrated Learning Systems (ILS)

Theory

When considering an integrated learning system questions need to be addressed as to how the system should be used, who should use it, where it should be used, and how often it should be used to make a difference in reading achievement. Very little research exists that answers these question (Smith & Sclafari, 1989).

There have been studies conducted on learning theory and its relationship to achievement (Skinner, 1968; Piaget, 1966). These basic tenets of learning theory, such as motivation, active participation, and use of feedback, are currently being related to the design and implementation of many computer-based instructional programs (Baker, 1978; Chandler, 1984; Dillon & Steinberg, 1986; Polson & Richardson, 1988). The premise of such work is that if CAI units are
implemented according to established learning theories, increased
achievement will result. Integrated learning systems have
incorporated much of what is considered sound learning theory into
their design (Alifrangis, 1988).

Capitalizing on the potentials of CAI and CMI for reading
instruction and reading assessment, integrated learning systems have
been developed along lines consistent with traditional
conceptualizations of reading instruction. This traditional view is
based largely on the conception of reading as the accumulation of a set
of identifiable and teachable skills, usually referred to as the skill
approach (Norton & Resta, 1985). Following guidelines established by
reading experts, these systems include practice with such skills as
reading readiness, decoding, word recognition, and vocabulary
development, as well as literal, inferential, and critical comprehension
skills. Comprehension skills are typically further divided into
identifying details, identifying main ideas, drawing conclusions,
making inferences, making predictions, and summarizing (Cheek and
Collins-Cheek, 1984). An integrated learning system is one attempt to
combine many of the elements of CAI (curriculum support, decision-making capabilities for assessment, and computer-managed instruction) into a single unit.

**Description**

An integrated learning system is a computer-based instructional system of hardware and software. It differs from the typical classroom microcomputer primarily in that its component workstations are terminals connected to a central computer or memory storage device. Instructional software is supplied by the publisher. Perhaps the best definition of the term ILS is "a system that includes both hardware and management software running on networked hardware" (U.S. Congress Office of Technology Assessment, 1988, p.2). Integrated learning systems offer some important advantages, although there are serious disadvantages as well.

ILS instructional software is typically traditional computer-assisted instruction, a combination of tutorial presentations and drill and practice exercises. Most of the software is targeted to the teaching of basic skills such as mathematics and reading, and it
includes a comprehensive management system for tracking student progress. Instruction becomes more individualized and focused through the development of specific instructional plans which are based upon each student's measured strengths and weaknesses.

The systems are usually designed to provide students with some specified amount of time each day for practicing the targeted basic skill, perhaps 15 minutes or so. Many school systems find ILS's particularly appropriate for supplying underachieving students with additional drill and practice work (Reinhold, 1986). ILS software has typically been developed specifically for the ILS system and is not available commercially for use on ordinary classroom microcomputers.

The ILS operating system allows "multi-tasking" - that is, different students can have access to different parts of the software at the same time. Some students might be working on letter recognition, others on comprehension development, and still others on arithmetic drills. All are working at their own workstations, accessing microcomputers as terminals.

A school district that has made the commitment to CAI has only
begun the process. There are several considerations with integrated learning systems. One consideration is the wide variety of systems. An "open" system allows for the use of third party software to better meet district curriculum needs. A "closed" system is a prepared package of software, such as Computer Curriculum Corporation. Most vendors of the integrated systems have components written to match the various basal reading and math programs. Purchasers must consider skill-based programs designed primarily to provide diagnostic/prescriptive intervention for remediation of precise skills and concept based programs which pay more attention to problem-solving and higher-order thinking skills (Wilson, 1990).

The subjects in this study used the ILS published by the Computer Curriculum Corporation (CCC). It is a closed, skills-based program but has been expanded to include strands in algebra, computer programming and data processing with COBOL.

Computer Curriculum Corporation (CCC)

The CCC is an integrated learning system that has been in existence for 24 years. It was founded in 1967 by Patrick Suppes and
two associates, Atkinson and Estes, after they conducted research into how children learn. It was on these findings that Suppes created CCC.

The CCC's basic skills packages provide individualized instruction in mathematics, reading, and language arts for students in kindergarten through twelth grade. The new version includes full-color graphics, animation, and mouse-driven environments. The heart of the CCC program is a management component that monitors student performance, selects and presents individualized exercised, analyzes the responses to each exercise, and updates and stores each student's performance record. The program provides the student with immediate feedback during each exercise and with a score for a series of exercises at the end of each lesson. Exercises are typically drill and practice consisting of multiple choice and short answer questions.

Material is presented in small chunks carefully organized into strands. Depending on the type of response a student makes, the material next presented to him/her is appropriate. A correct response results in reinforcement and a move to the next piece of material. An incorrect response results in remedial material being presented to
correct whatever misunderstanding may have caused the incorrect response (Metric Associates, 1981).

The management component of the CCC program makes student progress reports available to teachers on request. Progress reports list each student's current position by grade level and lesson and highlight low performance areas to facilitate grouping of students. In addition, they describe student progress over time and in each of several categories.

The CCC program is organized into sections designed to be completed to 10 to 20-minute session. Its authors suggest that students complete three or four sessions each week. The system is comprised of review strands, courses and a management system. Students in this study will primarily be using Readers Workshop, Critical Reading skills, and The Reading Network.

Reader's Workshop (WE) is a comprehensive curriculum designed to develop literacy skills. It supplements the classroom reading program by providing individualized practice and reinforcement for remedial, developmental, and accelerated students. The course
promotes overall reading and critical thinking skills by combining focused practice in specific reading skill areas with integrated reading of passages. Passages are supplemented by informational graphics and present a wide range of topics from the content area. It is designed for grades 2.8-7.5 and has 120 hours of content available. Readers' Workshop contains five strands that contain exercises to develop the specific skills of: Word Analysis, Word Meaning, Literal and Interpretive Comprehension, and Reference Skills. Two Additional strands, Passage Comprehension and Thematic Lessons, develop integrated and content area reading skills.

Critical Reading Skills (CRS) is designed to develop advanced vocabulary and comprehension skills. Students read passages from a variety of content areas and apply critical interpretive skills to answer questions. As students make inferences, recognize author's tone, identify character traits, and see the relationship of ideas, they develop critical thinking skills. Approximately one-fourth of a session is devoted to vocabulary and three-fourths to reading comprehension. Critical Reading Skills is designed for grade 7 and above with 100
hours of content available.

The Reading Network (TRN) is an innovative course that develops comprehensive reading skills for adult learners. The course is appropriate for adult learners, but the varied formats, color graphics and digitized speech make it appealing to adolescents as well. The course builds a solid foundation in reading by providing instruction in four specific skill areas and by focusing on the integration and application of basic reading skills. TRN is organized in six strands. The Word Analysis, Sight Words, Vocabulary, and Comprehension strands build specific skills and develop competence in connecting oral language to print. The Applied Reading and integrated strands provide real-life contexts in which learners use basic reading skills. The base vocabulary includes high-frequency words and functional vocabulary words important for daily life.

These three programs comprise the offerings by CCC for the remediation and/or enrichment of reading skills for students at the middle school level. All three were used in this study for the purpose of remediating or enriching reading achievement.
 Areas of Research

Research in the area of integrated learning systems is presented by categorizing it into three groups. The first area of reported research concerns itself with reading, CAI and the educationally disadvantaged student. The next area focuses on reading and the elementary student and finally the third area is concerned with the secondary student.

Reading, CAI and the educationally disadvantaged

Educationally disadvantaged learners may be comprised of minority students, students from low socio-economic families, slow learners, and/or reading disabled students. They become known through their inability to master basic content (Shepherd, 1978). These students pose an unprecedented challenge for American education. Schools seek to improve the level of student achievement significantly, and simultaneously they must reach those higher levels of achievement with a much greater proportion of their students, including those who are black, limited English-speaking, or poor and the disabled (Hornbeck, 1990).
Niemiec and Walberg (1987) suggested four reasons for CAI’s particular effectiveness among educationally disadvantaged student populations. They contended that (1) CAI is less threatening than instruction relying on classroom recitation; (2) educationally disadvantaged students may benefit more from the extensive drill and practice exercises typically offered in CAI programs; (3) the diagnostic procedures integral to most such programs help disadvantaged students because they are more likely to need specific remediation; (4) and extra teaching resources are available to students involved with CBI programs.

Educationally disadvantaged students can significantly benefit from individual, self-paced instruction (Taggert, 1987). Several studies (Austin, 1989; Lore & Chamberline 1988; Swan, Guerrero, Mitrani, Schoener, 1988) have shown that the daily individualization of an integrated learning system can provide these benefits. This computer time also provides a learning time with feedback that is private and task-related (Fisher, 1989) providing the student a more secure environment.
Chapter I and minority students have shown significant gains using an ILS. Lore and Chamberlain (1988) investigated a Chapter I reading program in grades 1-8. The experimental group used an ILS by Prescription Learning Co. and Computer Curriculum Corporation. A control group was served by the regular Chapter I program. Students were pre- and post-tested on the California Test of Basic Skills reading test. Students who received CAI in grades one through three outgained their peers by a wide margin.

A study done for the New York City School Board of Education (Swan, Guerrero, Mitrani, Schoener, 1988) reflected the effects of an ILS with disadvantaged students. The researchers found many positive effects of these systems as measured by the Metropolitan Achievement Test (MAT) for math and the Degrees of Reading Power (DPR) for reading achievement. Swan (1988) indicated that effectiveness varied with the system used, kinds of students, and the grade level of students using the system. The strongest results were found for an open system that involved teachers to a great extent in the integrated instruction (Gates, 1986). Results weakened as grade level increased.
Swan also found that certain ILS programs to be more effective at certain grade levels. For example, CCC was more effective at the elementary level than at the junior high level.

As earlier stated, reading instruction is generally focused at the elementary level. Because of this, research on CAI and reading is also generally focused on the elementary student and achievement.

**Reading, CAI and the elementary student**

The importance of reading is clearly recognized by the elementary school. (Harris, 1961). More time and effort is spent on teaching reading than any other phase of the school program. Integrated learning system developers have focused their instruction and research on the elementary student and reading. Few schools have had the ILS as long as Calvert County, Maryland. Here, the University of Maryland conducted a longitudinal study on the impact of daily lessons on the CAI in reading and math. The subjects were 4th and 5th graders in Calvert County Public Schools from 1983-1987. These students were offered 10 minute daily computer learning sessions in reading/language arts and math. The program supplemented the existing curriculum.
Researchers used a five year span, from the two years prior to the time when students received CAI plus the three years students received CAI. Results revealed that over the three years of CAI, students sustained an average growth of 1.5 years per year in reading and 1.25 years per year in math (Austin, 1989).

A study commissioned by the New York City Board of Education (Swan, Guerrero, Mitrani, Schoener, 1988) also suggested that at the elementary level students at the lower levels of instruction experienced greater achievement score increases that students at higher levels of instruction.

Reviewers using box-score methods concluded that CBE was effective in raising student achievement, especially in elementary schools. Vinsonhaler and Bass's review (1972), reported results from 10 independent studies showed substantial advantages for computer instruction. Elementary school children who received computer-supported drill and practice generally showed performance gains of 1 to 8 months over children who received only traditional instruction. Hartley (1977), who applied meta-analysis to findings on CBI, also
pointed out that elementary students fared better with CBI than did secondary students. Reviewing evidence from his own quantitative syntheses of findings and from Hartley (1977), J. Kulik (1981) concluded that CBE effectiveness may be a function of instructional level (the grade level at which a student receives instruction regardless of grade placement). Although the grade placement of a student may be sixth through twelfth grade, he/she may need instruction at a grade level below that placement. CAI has been one method employed to help meet the diverse instructional needs of the secondary student.

Reading, CAI and the secondary student

Formal reading instruction is generally discontinued at the end of the sixth grade. This practice is based on the assumption that pupils have learned to read by this time. Evidence is plentiful that this premise is faulty (Blair, 1964). Now most middle and junior high schools offer developmental and/or remedial reading programs. Integrated learning systems and other CAI have been implemented at this level with varied results.
In the drill and practice format of integrated learning systems, middle school and secondary students have not fared as well in achievement gains as their elementary counterparts. Lore and Chamberlin found that in grades 1-3, students who received computer-assisted instruction outgained their peers by a wide margin. However, in intermediate and middle school grades the reverse was true (1988). In the Portland study of CAI use on grade 5-8, Adams & Morgan (1984) found reading and language usage showed a non-significant negative gain after one year of CAI use.

During the 1987/88 school year, 13 ILS’s were evaluated in 10 elementary, seven junior high/intermediate, and nine high schools throughout New York City (Swan, Guerrero, Mitrani, Schoener, 1988). The results showed that in general, students showed significant increases in both reading and math performance. Effect sizes, however, decreased as grade level increased. This supports Kulik's (1981) assertion that an inverse relationship exists between instructional level and achievement gains resulting from CBI use. The same study also suggests that at the elementary level students at the lower levels
of instruction experienced greater achievement score increases than students at higher levels of instruction. At the junior high level for reading, general education students showed the smallest gains.

Instructional level, as well as grade level, is a factor in the effectiveness of CAI and achievement in reading. Scores of average and above readers have shown negative gain results (Lore and Chamberlain, 1988). A study in Albuquerque, New Mexico, (Norton and Resta, 1985) pretested and posttested fourth through sixth graders with the Gates-MacGinitie Reading Test. Eighty-seven percent of these students had received federally funded support in the school. The skills group of this study received their computer instruction from an integrated learning system. Results of the testing showed a decline in mean scores in reading vocabulary, reading comprehension, and problem-solving ability for the skills group. The research results suggest that skills instruction alone does not represent the most effective method for reading instruction.

Overall, research findings are positive for integrated learning systems at the elementary level and with educationally disadvantaged
students. Findings are relatively consistent in stating that as grade levels and instructional levels rise the achievement gains go down. Why this happens is not exactly known, but as student characteristics and learning needs change, ILS's methods do not.

As research into integrated learning systems continue and school districts consider their use, it is important to be aware of some areas of concern in current and future literature.

Areas of Concern in Research

Reading and the teaching of reading remain crucial issues in education. The best method(s) of delivery reading instruction seems to remain a question. CAI is one method currently in place to help students at all grade levels and at different levels of ability with their reading. CAI has many forms with one of the more recent being the integrated learning system.

Research in the area of achievement through use of an integrated learning system is inconclusive and contradictory (Becker, 1990). Studies of the effectiveness of ILS's raise concern in four areas. In an
analysis of existing ILS research, Becker identified some of the following problems. First, many studies were reviewed by vendors themselves, weakening objectivity. Wicat system results were highly variable, showing some negligible effects, others modest effects, and others showing substantial effects. CCC results appear to be skewed toward favorable publicity for the new software. Studies from the vendor all show substantial positive effect sizes. Those from independent sources show modest or negligible effects. Reports, for example, that PLATO can raise achievement by 5 years with only six months work, or that 12 hours of PLATO instruction raised reading achievement by 1.6 grade level (Schneck, 1984) are of dubious validity to anyone familiar with the teaching of reading (Balajthy, 1987).

Second, many of the studies have design or data analysis problems. The most comprehensive compilations of research studies on the effectiveness of computer-based instruction are those carried out by James Kulik at the University of Michigan (Kulik, Bangert & Cohen, 1980; Kulik, Kulik, & Schwalb, 1986). The results of these meta-analyses indicated generally positive results from CBI. Reading
specialists must consider, however, the very damaging criticisms of these analyses before accepting their results at face value (Balajthy, 1987). Clark and Leonard (1985) examined a cross section of the studies used in Kulik's analyses and found crippling experimental design weaknesses in the majority. Many researchers had not used random assignment to treatments or had not given the control group equivalent instruction while the experimental groups were receiving instruction from the computer. In addition, relatively few of the studies used by Kulik had to do with language or reading instruction. Most were directed toward mathematics. Becker (1983) noted that CBI may have greater impact on mathematics instruction because it more closely simulates the practice of math than of reading or language use.

Third, there is a concern about students' ability to read screen text. With regard to on screen reading and comprehension performance, Askwall (1985); Blank, Murphy, and Schneiderman (1986); Hansen, Doring, & Whitlock (1978); Hepner et al. (1985); Muter et al. (1982); and Olsen et al. (1986) present research suggesting that on screen reading does not result in much different comprehension performance than does
off screen. At this point, researchers can tentatively conclude that on
screen reading of text will not affect reading comprehension
performance, either positively or negatively.

Fourth, a general weakness of all ILS investigations is the
reliance on standardized tests as the measure of effectiveness.
Standardized tests are criticized for their multiple choice format,
emphasis on quick response and factual recall, and more. Developers of
such tests rely on texts and workbooks already in use in schools, and
the tests don't reflect new developments and innovations in place in
the curriculum, such as hands-on science and whole language
approaches to reading. Many of the school districts involved use the
standardized tests to fill requirements of a federal program that is
being used to fund ILS purchases. As curriculums change and those
changes are incorporated into ILS's, past evaluations based on
standardized tests may quickly become useless.

Most reviews and researchers alike warn against the use of
reported achievement gains as the single basis for determining the
effectiveness of instruction. In most cases, reviewers cite flaws and
research problems that render the data suspect (Bond, Rakes & Smith, 1988).

The last area of concern is research. Critical areas that need to be addressed are the lack of a systematic, controlled, or rigorous evaluation of the use of technology and the lack of information on the educational and developmental consequences of children using technology. If school districts are to successfully develop and implement an effective use of technology to increase student achievement, they must become involved in the design and development of research projects (Fung, 1986).

Summary

Computer-assisted learning has made rapid impact on education. While it has been infused in many areas of education, it has been focused primarily in the teaching of reading and math. Research suggests that drill and practice and the individualization of instruction on a computer format have been successful in helping student achievement. Integrated learning systems combine the above with
diagnosis, prescription, and record-keeping capabilities. These factors allow for greater instructional time for the student as well as more time for the teacher to devote to students.

Research suggests that this individualization coupled with the diagnostic/prescriptive capabilities of an integrated learning system provide success for the elementary and the educationally disadvantaged student. This research also suggests that the computer environment plays an important role in that success.

There is relatively little research in CAI as it relates to integrated learning systems. In the research that does exist there are areas of concern at which an educators need to look when evaluating the research. This is especially true for those considering the implementation and/or purchase of computer-assisted instruction products.
CHAPTER III. METHODOLOGY

In this chapter the methodology used to examine the research problems will be described. Sections included in this summary of the research methodology pertain to subjects, research design, research procedures, limitations, and data analysis.

Subjects

Subjects for this study included students from Miller Middle School, Marshalltown, Iowa. Miller Middle School students include representatives from a wide range of socio-economic backgrounds, but can be categorized as predominately middle class. The national average of the reading subtest on the Iowa Test of Basic Skills (ITBS) for the seventh grade was 73%. Miller Middle School is one of two middle schools in the Marshalltown District fed by six public schools and one parochial elementary school.

The Miller faculty, in conjunction with Area Education Agency VI, has initiated a new curriculum structure of integration of special
education students into the regular classroom. In this system, ten to fifteen 'special needs' students are placed in classes with 'regular' students. Special needs students are those who have been identified as learning disabled (LD), behaviorly disruptive (BD), mentally disabled (MD), or Chapter I. Resource, special education, and Chapter I teachers, who normally would serve these special need students in a pull-out situation, now join the regular classroom teacher and cooperatively teach the regular content area class.

The subjects for this research were members of two of these cooperatively taught seventh grade developmental reading classes. The classes are taught by the content teacher in cooperation with a Chapter I Reading instructor. Both classes are taught by the same two instructors and receive the same content and the same delivery of instruction. The students are a heterogeneous mix of ability, with 1/3 to 1/2 being identified as 'special needs' students.

There are 59 students in the two sections of cooperatively taught reading classes. Due to the limited number of computers in the network, scheduling permitted only eighteen subjects for the
experimental group. In order to research groups of varying abilities the students from the above two classes were first ranked from lowest to highest according to their national percentile rank of Iowa Test of Basic Skills Reading subtest which was taken in the fall of 1990. This list was then divided into three groups. Group 1 consisted of all students who scored 70% or above on the fall '90 ITBS to represent the high ability group. Group 2 was composed of all students who scored between the 26% - 69% on the fall '90 ITBS. This group represents the average ability. Group 3 included those students who scored at or below the 25% on the fall '90 ITBS and represent the low-ability group.

Consent forms were issued to all 59 students and schedules were evaluated. By this process, 22 students were eliminated. Using randomized sampling the remaining 37 students were divided into the two research groups using randomized matching for ability. Group 1, the high ability students, had 6/37 in this ability level or 22% of the total. Group 2, average ability, was comprised of 16/37 members for 43% of the total. Group 3, low-ability, was comprised of 13/37 for
36% of the total. Two students from the experimental group, high ability level, were lost during the semester. The division within each group closely matches the percentiles of the total of the two cooperative classes. Because these cooperatively taught classes are weighted heavy on the average and low-ability, the research groups were also weighted heavily for average and low ability. The sampling procedure allows for determination of the effect of the ILS on low, average, and high ability students.

All subjects had taken the required course in computer literacy as sixth graders and possessed adequate experience in keyboarding to run the integrated learning system.

Testing Instrument

The Gates-MacGinitie Reading Test in a nationally standardized achievement test comprised of a vocabulary and comprehension subtest. This test has a reliability of .85. The test is widely used in federally funded programs in the United States as an accurate assessment of reading ability. The Comprehension subtest has 43 items consisting of
multiple choice questions over selected passages of reading. The Vocabulary subtest has 48 items.

The Vocabulary subtest samples a student's ability to recognize and analyze isolated words. The student is required to select the word from among four choices that most nearly means the same as the test word for each item. For example:

the **massive** ship  
a. enemy  
b. heavy  
c. full  
d. dirty  
e. primitive

The Comprehension Subtest measures the student's ability to read and understand whole sentences and paragraphs. This ability includes many strategies not involved in the ability to recognize single words. The students must grasp the total thought to answer correctly.

Passages in the field test for the Third Edition of the Gates-MacGinitie were selected to provide an appropriate range of readability. Readability of the passages was assessed with three readability formulas: Dale-Chall, Fry (Fry, Fountoukidis, & Polk, 1985),
and Harris-Jacobson (Harris & Jacobson, 1982). Readability estimates from at least two of the three formulas were averaged to obtain an average readability figure for each prose passage (Gates-MacGinitie Reading Test, Technical Report).

Research Design

Since full control over the ability to randomize could not be realized in this research, a quasi-experimental design was used with an experimental and a control group measured at two different times. The pretest-posttest design (Table 1) included measurement of both computer-assisted reading instruction with an integrated learning system in the experimental group and reading enrichment in a homeroom base for the control group. The study took place over a five month period.

Research Procedures

The proposal for this research study was reviewed and approved by the Iowa State University Human Subjects Committee. Permission
Table 1. Research Design: Randomized matching, Control Group, Pretest-Posttest Design

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Independent Variable</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Y</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

was obtained from the Marshalltown Community School district to study students at Miller Middle School (See Appendix A).

The research was carried out in the networked ILS lab at Miller School. The lab contains six networked Macintosh LC computers and a file server with a printer.

Computer Curriculum Corporation provided a two day training session for all district staff using the program and the lab proctor who would be running the network system full time at Miller School.
Procedures

**Experimental group**

Each student in the experimental group was assigned a daily 15 minute time segment in the lab. Students were enrolled in two reading courses or strands. They each had an initial lesson to become familiar with logging on, using each of the HELP (See Appendix B) features available in the program, scoring procedures, and the recording of his/her daily accomplishments (See Appendix B). The first 10 lessons of a CCC course are called the Initial Placement Motion (IPM). During these first sessions that the student takes, the system automatically adapts the level of instruction presented, based on the student's actual performance. The result is that each student is working at his or her functional level regardless of the initial enrollment level.

In October, all subjects were administered the Gates-MacGinitie Reading Test, Form K, Level 7/9. The researcher then enrolled the experimental group subjects into *The Reader's Workshop*, *The Reading Network*, and the *Critical Reading Skills* course using the management system of CCC. The strands courses of CCC are drill and practice and
are based on grade level equivalents and students are enrolled according to the grade level at which the student can function. Lesson courses of CCC are tutorial in nature and all students are enrolled at Level 1.00. The pretest score on the Gates-MacGinitie Reading Test was the determining factor for enrollment level for the strands courses.

A session begins with a student checking in with the lab proctor and getting his/her record sheet from the file. The student then goes to an assigned computer and enters his/her 3-digit code number and first name. These procedures were established by the researcher in the management system to avoid accidental or intentional crossing of records. If the two entries match, the computer then presents the student with a menu of course listings (See Appendix C). They selected the appropriate course, then proceeded with the lesson. At the end of the session the computer displays for the student his 'report card' for the day. The student then copies this information onto his/her sheet and places the sheet back in his/her file. The lab proctor was available to answer questions the computer could not, maintain
discipline, and provide positive feedback to the students.

Control group

The control group met with the researcher 20 minutes every other day in a homeroom setting for reading enrichment activities. During this time a variety of approaches were used to present reading. The activities were:

(1) students read silently from book of their own choosing.

These selections were made during a homeroom time with the help of researcher if such help was requested.

(2) the researcher read newspaper and magazine articles, short stories, or textbook assignments out loud to the group. This was used to generate discussion.

(3) students gave book talks over the book they had chosen to read

(4) the researcher introduced an author that might be of interest to other students.

(5) students raised questions or points about something they had read.
This group met for the same length of time as the experimental group. They were also administered the pretest and posttest of the Gates-MacGinitie Reading Tests.

**Timetable**

- **September:** Students were randomly selected and given the training lesson on the ILS.
- **October:** The Gates-MacGinitie Reading Test, Level 7/9, Form K was administered. Students were enrolled and began Initial Placement Motion (IPM).
- **November - January:** Subjects continued their work. Motivational activities were designed to keep interest.
- **February:** Students finished their sessions. The Gates-MacGinitie Reading Test, Level 7/9, Form L was administered to both groups. The informal attitude survey was conducted (See Appendix D).

**Analysis of Data**

Data from the scoring and norming tables of the Gates-MacGinitie
Reading Test were analyzed using the SPSSx procedure for paired t-tests to determine any statistically significant differences in achievement between the integrated learning system experimental group and the enrichment control group.

A t-test comparing achievement scores within the ability groups was run to determine any statistically significant differences among students of varying abilities. A t-test was also run to establish change scores in both the experimental and the control groups. The informal attitude survey was administered following the time spent on the ILS and is discussed in the auxiliary findings in Chapter IV.
CHAPTER IV. RESULTS AND FINDINGS

In this chapter, results and findings are presented in relationship to the research questions explained in Chapter 1. Auxiliary findings are also reported.

Research Question 1

The first research question was stated as follows: Will there be a significant gain in the scores on a standardized test of reading achievement by users of an integrated learning system?

Paired t-tests were run on the raw scores of the pretest and posttest to detect significant differences in scores between the two tests. The tests were run on the vocabulary, comprehension and total achievement raw scores. The paired t-test on vocabulary (Table 2) indicates no significant change in vocabulary achievement from pretest to posttest for the users of the ILS (t=1.29). The mean gain between pretest and posttest was 1.6.

On the paired t-test on comprehension (Table 3) the experimental group also showed no significant gains in achievement from pretest to
posttest for the users of the ILS \( (t=1.70) \). In fact, scores in the posttest were lower than score in the pretest. The mean loss from pretest to posttest was -2.9.

Table 2: Paired t-test of experimental group pretest and posttest raw mean scores on vocabulary

<table>
<thead>
<tr>
<th>EXPERIMENTAL</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>17</td>
<td>20.2</td>
<td>6.75</td>
<td>1.29</td>
<td>.215</td>
</tr>
<tr>
<td>Post</td>
<td>17</td>
<td>21.8</td>
<td>7.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Paired t-test of experimental group pretest and posttest raw mean scores on comprehension.

<table>
<thead>
<tr>
<th>EXPERIMENTAL</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>17</td>
<td>27.4</td>
<td>4.68</td>
<td>1.29</td>
<td>.215</td>
</tr>
<tr>
<td>Post</td>
<td>17</td>
<td>24.5</td>
<td>7.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
On the paired t-test (Table 4) for total achievement the experimental group of ILS users again showed no significant change in total achievement scores from pretest to posttest ($t=.58$). The mean difference from pretest to posttest was $-.10$, thus indicating a decline.

Table 4. Paired t-test of the experimental group pretest and posttest mean raw scores for total achievement.

<table>
<thead>
<tr>
<th>EXPERIMENTAL</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>17</td>
<td>47.6</td>
<td>10.0</td>
<td></td>
<td>.58</td>
</tr>
<tr>
<td>Post</td>
<td>17</td>
<td>47.5</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean difference in the pretest total achievement score was 3.9 with the control group having the higher mean. The posttest mean difference was 3.1 higher also for the control group.
Research Question 2

Research question 2 was stated as follows: Will there be significant gains in achievement for lower to average ability users of an ILS?

The lower ability group, those earlier described as having ITBS scores of 25% or below, showed no gains or a loss in the vocabulary subtest. The experimental group maintained a 16.8 mean score on both the pretest and posttest in vocabulary. On the comprehension subtest there was again a negative change by the lower ability group with a mean loss of -2.33. The total scores of achievement also showed a loss (Table 5). The mean difference was a -4.0.

In the average ability group, those earlier described as having an ITBS score between 26%-69%, there was a gain in the mean vocabulary scores between pretest and posttest from 20.2 to 22.2. This gain was not significant. On the comprehension subtest there was a non-significant loss for the students of average ability. The experimental group declined from a pretest mean of 28.1 down to 24.1 on the comprehension posttest.
63

Table 5. T-test of the lower-ability students in the experimental group pretest and posttest mean raw scores for total achievement

<table>
<thead>
<tr>
<th>LOWER-ABILITY</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>6</td>
<td>42.0</td>
<td>7.4</td>
<td>.96</td>
<td>.418</td>
</tr>
<tr>
<td>POST</td>
<td>6</td>
<td>39.6</td>
<td>10.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The total achievement scores of the group of average ability is illustrated in Table 6. The experimental group had a non-significant negative change of -2.0.

Research Question 3

Research question 3 was stated as follows: Will there be significant gains in achievement for the higher-ability users of an ILS?

A t-test to detect significant differences was run to compare the
Table 6. T-test of the average-ability students in the experimental group pretest and posttest mean raw scores for total achievement.

<table>
<thead>
<tr>
<th>AVERAGE ABILITY</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>8</td>
<td>48.4</td>
<td>10.3</td>
<td></td>
<td>.335</td>
</tr>
<tr>
<td>POST</td>
<td>8</td>
<td>46.4</td>
<td>13.5</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

mean scores of the students in the high ability group, those earlier defined as having scores of 70% of above on the ITBS. On the vocabulary section of the test students showed a gain on the mean pretest and posttest from 27.0 to 30.6. However, this gain was not significant. On the comprehension subtest, the experimental group had a non-significant loss with a pretest mean of 29.6 and a posttest mean of 28.6.

Table 7 illustrates the pretest and posttest non-significant gains
Table 7. T-test for higher-ability students in the experimental group pretest and posttest mean raw scores for total achievement.

<table>
<thead>
<tr>
<th>HIGHER ABILITY</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>t</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>3</td>
<td>56.6</td>
<td>8.5</td>
<td>.41</td>
<td>.071</td>
</tr>
<tr>
<td>POST</td>
<td>3</td>
<td>59.3</td>
<td>9.07</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

of the higher ability groups for the total scores of achievement on the Gates-MacGinitie Reading Test.

Research Question 4

Research question was stated as follows: Will the experimental group show a significantly larger gain in reading achievement than the control group?

A t-test for gains scores was run on the experimental and control group. In the area of vocabulary the control group had a mean change
score of .555 with a standard deviation of 4.65. The experimental group had a mean change score of 1.58 with a standard deviation of 5.07. The t-value was .63 with a non-significant 2-tail probability of .534.

On the t-test run on comprehension for gains scores the control group had a mean change score of -1.38 with a standard deviation of 6.90. The experimental group's mean change score was -2.88 with a standard deviation of 6.99. The t-value was .64 with a 2-tail probability of .529. On the t-test for total achievement results showed negative mean change scores (Table 8).

Table 8. Change scores of experimental and control groups.

<table>
<thead>
<tr>
<th>CHANGE SCORES</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>18</td>
<td>-.833</td>
<td>9.71</td>
<td>.14</td>
<td>.887</td>
</tr>
<tr>
<td>EXPERIMENTAL</td>
<td>17</td>
<td>-1.29</td>
<td>9.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Auxiliary Findings

On an informal, student attitude survey (See Appendix D) concerning reading, and computers and reading, students in both group expressed a neutral attitude about reading as a pleasurable activity in which they would choose to participate. Most felt that the reading of assignments was not an activity they enjoyed. Eighty percent of all students felt that reading was, however, a valuable life skill and an equal number did appreciate getting help with their reading skills.

A high percentage of students viewed computers as a positive experience. Over 90% of the students agreed that computers were fun, but almost 60% disagreed with the statement that computers were used mostly for playing games.

When asked questions about the usefulness and importance of computers, the experimental group rated the computer higher in importance than did the control group. Both groups agreed that a computer could help review basic skills. Fifteen percent of the control group answered that a computer would not be a good teacher or were neutral in their feeling. Only 6% of the experimental group felt this
way. While 33% of the control group expressed that a computer could be a good teacher, 42% of the experimental group agreed with that statement. More students than not try to use a computer to do their homework when possible.

Regarding the student's attitudes about the role a computer might play in their future, over 50% of all students believe that they will need to know how to use a computer for a job someday, with only 6% believing they will not need one. A large percent believe that computers are used to train people.

Responses to questions concerning the integrated learning system brought an overall positive response. Only 11%, or two students, felt that their time on the ILS was a waste while 59% stated that they would volunteer to continue working on the ILS. Seventy-one percent of the students said they enjoyed working on the computer and 59% felt that they were better students because of the ILS.

The attitudes of the control group about the homeroom setting, was generally positive. Sixty-two percent of the students stated that they viewed reading as more enjoyable than they had prior to this
situation. Only 12.5% felt that the homeroom was a total waste of time.

Summary

The subjects in this study were first pretested on the vocabulary and comprehension achievement using the Gates-MacGinitie Reading Test. At the end of approximately eighteen weeks of use of an integrated learning system subjects were again tested with a different form of the same test. Results showed no significant gain by the experimental computer group or by the control group which received reading enrichment activities from the researcher. The subjects were divided into three groups according to ability as determined by their ITBS fall, 1990, reading percentiles. Within these three groups, the average and lower ability groups showed negative, non-significant gains from the pretest to the posttest, while the higher ability group showed a non-significant positive gain.

In auxiliary findings in the form of results of an attitude survey, students overall expressed positive feelings about their work on the
In both groups subjects expressed that the computer is a valuable tool that can help them learn and that is probably part of their future. When asked about reading, subjects again expressed that reading is a valuable skill and that a computer can help them improve that skill.
CHAPTER V. SUMMARY, DISCUSSION, RECOMMENDATIONS
AND CONCLUSIONS

Summary

The expansion of the use of computer-assisted instruction was a natural successor to the microcomputer revolution. The computer has been used in classes as a tool, tutor, and tutee (Taylor, 1980). Tool packages give any student a chance to use the computer to access, manipulate, organize, evaluate and synthesize information thus improving his/her writing and organizational skills. Programming software offers students a chance to be in control as tutors with the computer acting as the tutee. Integrated learning systems have also been incorporated into curriculum in schools to help remediate basic skills. All of the above have in some way helped teachers to fulfill their roles and students to accept greater responsibility for their own learning.

Integrated learning systems have added to computer-assisted instruction the dimensions of prescriptive, diagnostic, and record-keeping capabilities. These additions have taken over many of the time
consuming duties of the teacher. ILS's have also allowed for a degree of individualization that would be extremely difficult for a teacher to accomplish with so many students. The reteaching drill and practice activities are delivered in an environment of privacy that is non-threatening and non-judgmental.

The purpose of this study was to measure the effectiveness of an integrated learning system on the reading achievement scores of middle school students of varying abilities. Pretests and posttests of reading achievement were administered to an experimental and a control group of seventh grade students. An informal attitude questionnaire also was administered at the end to survey students' perceptions of reading and computers.

Two groups of seventh grade students from Miller Middle School in Marshalltown, Iowa, participated in this study. The study lasted for 18 weeks or one semester. The experimental group received daily sessions in reading delivered by Computer Curriculum Corporation's integrated learning system. This was done in a networked computer lab with six computers with a full-time lab proctor to help students. The
control group met every other day, also for 18 weeks, on a homeroom basis with the researcher to do reading enrichment activities. All subjects were members of one of two cooperatively taught reading classes and, therefore, received the same classroom instruction in reading from the same teachers.

The study was designed to measure how an integrated learning system affected reading achievement of seventh graders who represented varying ability levels. High, average, and low-ability students were all included in the study. The subjects had received computer instruction in sixth grade so were familiar with keyboarding and the use of a mouse. They also received a training session on the ILS prior to starting their sessions.

The design of this study incorporated an effort to eliminate some of the research concerns stated earlier. This research was an independent project and not completed with the endorsement or support of any vendor. Attempts were made to follow closely the elements of a true research design.
Summary of the Results

Results addressing gains in scores on a standardized test of reading achievement by users of an integrated learning system indicate that overall the experimental group showed a non-significant gain on the vocabulary and comprehension subtests. The total achievement score had a mean difference gain of 1.6.

This study then asked if there would be significant gains for subjects of lower and average abilities who used an ILS. Results of the t-test indicated that students on the ILS had non-significant negative gains on both subtests and in total achievement with a mean difference in total achievement between pretest and posttest of -2.0.

The next area of focus was testing whether higher ability students who used an ILS would demonstrate significant gains in reading achievement scores. T-test results showed a non-significant gain on all three sets of scores. The total achievement posttest mean raw scores were 2.7 higher than the pretest scores for this group.

Research question four addressed whether the experimental groups would show a significantly larger gain in reading achievement
than the control group. The gains scores collected by the t-test were negative for vocabulary, comprehension and total achievement scores. The control group had a mean gains score difference of posttest over pretest of -.833 and the experimental group had a mean gains score of -1.29 in total achievement.

Discussion of the Results

One goal of this study was to determine if seventh grade users of an integrated learning system would show achievement gains in reading scores. The research suggests significant improvement gains in reading achievement for elementary students who use an integrated learning system (Merriss, 1990; Austin, 1989; (Swan, Guerrero, Mitrani, Schoener, 1988; Lore and Chamberlain, 1988; Roblyer, 1985). This study confirms other findings (Swan, Guerrero, Mitrani, Schoener, 1988; Lore & Chamberlain, 1988; Kulik, 1981) suggesting that middle school students do not experience significant gains or experience a negative gain. The results suggest that there is an inverse relationship between instructional level and achievement gains by users of an ILS.
Integrated learning systems have been shown to be successful in raising reading achievement scores at the elementary level (Austin, 1989). The significance of that success, however, appears to diminish as the system is used with older students. This research reiterates the earlier findings (Swan, Guerrero, Mitrani, Schoener, 1988; Lore & Chamberlain, 1988; Kulik, 1981) that older students do not gain at significant levels in reading from the use of an integrated learning system. While the higher ability students had an increase in their test scores, the gain was not significant. This type of gain is generally expected from students who have already demonstrated success.

Lower and average ability students were also considered in this study. While previous research (Lore & Chamberlain, 1988; Becker, 1986; Roblyer, 1985; Vinsonhaler & Bass, 1972) has shown achievement gains by these students at the elementary level, the same was not true for seventh graders (Alifrangis, 1990). The possible reasons for this relate to the nature of the child and the ILS program itself.

First, it may be that the characteristics of students comprising the educationally disadvantaged category change as grade levels
increase. It further suggests that students of lower ability at this age level do not appear to benefit from the drill and practice approach to reading upon which the ILS bases its instruction. It may be that the constraints of programmed instruction are better fitted to the subskill approach characteristics of early instruction than the cognitive operations of older students (Balajthy, 1987).

Second, these scores are a reflection of attitude as well as aptitude of the subjects. The researcher noted varying degrees of inattention during the posttesting period as compared to the pretesting period. During the fall pretesting, students were more focused on doing their best and pleasing the teacher. By February, many students, especially the lower achievers, were putting forth less effort and had lowered the goals for themselves. Many expressed displeasure at having to take the test again. The novelty of being part of a research project had worn off.

Third, the ILS uses a drill and practice approach in its reading program. It closely matches in format a workbook page from an elementary basal reading series with the addition of motivating
graphics. However, unlike elementary school, by middle school this workbook approach is infrequently matched with any actual work students do. The content reading requirements are more involved and deal with more passage comprehension than isolated statements unrelated to any "big picture". Comments as reported by the computer lab proctor indicated boredom with the ILS reading program, usually by the higher ability students and a general dislike for reading by the lower ability students. Similar comments were not heard about the mathematics programs perhaps because they more closely match the student's daily work in the math classroom and had more relevance to the student.

The third question dealt with gains for higher ability users of the ILS. It would be predicted that higher ability students would meet with more success during their school year and reach greater levels of achievement. The higher ability research students did show non-significant gains. These students were observed by the researcher during testing to be more on task and were more accepting of testing for a second time. Being part of a research project appeared to inspire
some intrinsic motivation for these students.

The fourth research question dealt with the comparison between the experimental group who used the integrated learning system and the control group who were exposed to reading enrichment activities. Results of the t-tests indicate that neither group significantly gained in their scores of reading achievement. Again, these scores seem to reflect attitudes of the students. Both groups of students began to question why they were being singled out as different. Peer acceptance at the middle school level is an extremely strong motivator. Time to socialize with peers is equally important. Comments from both groups of students about missing study hall time and a "regular" homeroom time, both considered to be social situations by most middle school students, increased as the semester progressed.

While the enrichment activities were more relevant to the students' school setting, they involved very little teaching of strategies that might improve a standardized test score.
Recommendations for Further Study

Results of this study indicated that further research is needed in the use of integrated learning systems and their impact on achievement at the middle school level.

The first recommendation is to have a control group that has instruction, as opposed to enrichment, delivered in another medium. Possibilities might include peer tutoring, a paper and pencil worksheet format, a small group setting for remediation. These would more closely match the efforts of the integrated learning system.

A second recommendation would be to test math achievement as delivered by the integrated learning system with middle school students. Since some of mathematics is more of a step-by-step process of subskills perhaps it would meet with more success than the results of this study.

A third recommendation is to develop a way of measuring reading achievement other than standardized testing. Perhaps the principles of outcome based education offer an alternative. Curriculum outcomes are established by the school and teachers. A student reaches mastery only
when he/she is able to successfully complete 80% of the test items. A more specific test that is regarded by teachers to be relevant might create a closer working relationship between the ILS and content area teachers and, therefore, its usefulness. A quality school (Glasser, 1990) suggests that when student achievement on test is low, teachers get blamed. To get quality it is suggested that schools get rid of outside measures of productivity as they do not measure quality products. Finding a better testing situation would also help alleviate one of the research concerns.

Attitudes regarding the individual as a reader are also important if value is placed on reading as a lifetime activity. Perceptions by the individual as being someone who enjoys reading should be a goal of any reading program.

Conclusions

Research results suggest that integrated learning systems have met with success at the elementary level of education. There also has been success documented with educationally disadvantaged students.
However, little research exists that shows significant gains for older students of average or above average ability.

This study investigated the ability of an integrated learning system to raise the level of achievement in reading according to a nationally standardized test. An experimental group participated in daily sessions on the system for an 18 week time period. A control group met every other day for 20 minutes for activities dealing in reading enrichment.

The results of this study reinforced previous results that overall an ILS is not able to produce significant gains in achievement in middle school children. Low and average ability students showed no gains or negative gains, and high ability students showed no significant gains.

The attitudes toward the usefulness of the computer as a tool and tutor were favorable with all students in the study. Although some students indicated a dislike for the CCC program, they still expressed a positive attitude about their time spent on the computer. Students generally viewed the computer as a helpful tool that is part of their future.
While integrated learning systems had been earlier predicted to soon die out, they are today the fastest growing segment of the educational software industry (Sherry, 1992). Their strength is in their ability to grow and change. This ability to mature will make them a formidable force in shaping education. However, ILS's cannot currently meet the needs of all children and all grade levels. Current research replicates previous findings indicating that middle school age students receiving help from and ILS do not show the gains in achievement as their elementary counterparts (Johnson, 1992).
REFERENCES


ACKNOWLEDGEMENTS

I would like to thank all those who have encouraged me to carry out my research study and to complete my thesis. These people have provided a variety of types of assistance.

First, I want to thank Dr. Ann Thompson for her encouragement in working on this study. Her expectations and her knowledge encouraged me to do work I wasn't sure I was capable of doing. She also inspired me to apply that which I have learned in my coursework to my middle school reading curriculum.

I am also very grateful to those seventh grade students at Miller School in Marshalltown, Iowa, for their effort and cooperation with this study. I also want to thank my principal, Brad Clement, for his support in this project. I am also grateful to my peers who supported me through this very hectic time and to Cindy Howard, the lab proctor who kept the show running. A special thanks to Lois for believing in me.

I appreciate the contributions of Dr. Michael Simonson and Dr. Rex Thomas toward my knowledge of instructional technology and their
ideas and recommendations enhancing my thesis.

Finally, I want to thank my husband, Brian Johnson, and my children, Elizabeth, Emily, and Derek who showed encouragement and patience as I worked through the research process.
APPENDIX A: HUMAN SUBJECTS FORM AND LETTERS TO INSTITUTION, PARENTS, AND STUDENTS

Checklist for Attachments and Time Schedule

The following are attached (please check):

12. [ ] Letter or written statement to subjects indicating clearly:
   a) purpose of the research
   b) the use of any identifier codes (names, #s), how they will be used, and when they will be removed (see Item 17)
   c) an estimate of time needed for participation in the research and the place
   d) if applicable, location of the research activity
   e) how you will ensure confidentiality
   f) in a longitudinal study, note when and how you will contact subjects later
   g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. [ ] Consent form (if applicable)

14. [ ] Letter of approval for research from cooperating organizations or institutions (if applicable)

15. [ ] Data-gathering instruments

16. Anticipated dates for contact with subjects:
<table>
<thead>
<tr>
<th>First Contact</th>
<th>Last Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-6-91</td>
<td>1-17-92</td>
</tr>
</tbody>
</table>

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:
   4-92

18. [ ] Chairman of Departmental Executive Officer  Date  Department or Administrative Unit

19. Decision of the University Human Subjects Review Committee:
   [ ] Project Approved  [ ] Project Not Approved  [ ] No Action Required

   Patricia M. Keith  9-10-91
   Name of Committee Chairperson  Date  Signature of Committee Chairperson

GC: 1/90
2446 Coppock Park Rd.
Marshalltown, Iowa 50158
August 30, 1991

Mr. Brad Clement
Miller Middle School
South 11th St.
Marshalltown, Iowa 50158

Dear Mr. Clement:

In an effort to substantiate the need for an Integrated Learning System in the remediation and promotion of reading skills at the middle school level, I have designed an experimental study to determine the effectiveness of the Computer Curriculum Corporation's system. While this research is being conducted as a part of the requirement for the Master of Science degree in Curriculum and Instructional Technology at Iowa State University, I feel that it is particularly valuable as Miller moves forward in technology and restructuring.

The School Board of the Marshalltown Community School District has accepted the recommendations of the Long Range Instructional Planning Committee that implement technology into our curriculum. Integrated Learning Systems are a relatively new technology and there is little known about their value at the middle school level. This study will yield necessary information about grade level placement of this system. Similarly, it will serve to indicate what kind of student can most benefit from the program.

Attached are copies of the consent letters which will be sent to parents and students involved in the study. Thank you very much for your prompt response in approving this research.

Sincerely,

Joan P. Johnson
Dear Parent/Guardian of Seventh Grade Student,

As a part of the reading curriculum at Miller Middle School, we try to provide individualization as much as possible within a group setting. This is obviously difficult in large classes. This year we will have access to Computer Curriculum Corporation's Integrated Learning System. This is a computerized individualization program in math and reading. Students may spend ten to thirty minutes a day in the program depending on their needs. It is important we analyze the effectiveness of this program at the seventh grade level as well as the effectiveness of the program with students of varying abilities.

During the first semester of the 1991-92 school year, each student in the research study will be measured by standardized testing in the area of reading achievement. This will be done in September and again in January. Please sign below if you would or would not like your student's data to be included in the statistical analysis. If you have questions about this study, please contact Joan Johnson, seventh grade reading teacher, at the number listed below.

(Student's name)  
YES, I give permission for student's data to be used for the study. I understand that no personal data records will be kept, only group results, and all data will be destroyed when the group statistics are calculated.

Signature of Parent/Guardian

(Student's name)  
NO, I do not give permission for student's data to be used in the study.

Signature of Parent/Guardian

Thank you for promptly returning this permission form.

Sincerely,
Dear Miller Middle School Seventh Grade Student,

You have been selected to be part of a study on the effectiveness of Computer Curriculum Corporation's Integrated Learning System (ILS). The purpose of this research is to determine if seventh grade students of varying abilities show significant gains in their reading achievement scores on a standardized test when given appropriate work time on the ILS.

For the first semester of 1991-92 school year you will be part of a computer or non computer group of students. The computer group will spend 20 minutes a day, two 10-minute sessions, on an individualized reading and writing program on the ILS, while the non computer group will spend this time in the regular reading classroom. Student progress in the ILS will be monitored by a teacher on a weekly basis.

To ensure confidentiality, each student is identified by a number and first name only on the computer. When printing scores for this study only student numbers will be used. Group scores will be used in the analysis for the study and not your individual progress. You and your parents or guardian will be able to see your own scores.

Please sign below to indicate your consent to be a part of this research project. Grades for the reading class are in no way affected by consent or non-consent. Thank you for your cooperation and active participation.

Sincerely,

Mrs. Joan Johnson

Signature of student ________________________________
Click on a picture.

**Help**
- Answers an exercise for you.

**Audio Repeat**
- Repeats the instructions.

**Tutor**
- Shows you how to do the exercise.

**Tools**
- Contains a ruler, calculator, or protractor. Click on a tool to use it. Click again to put it away.

**Report**
- Shows your score in this session.

**Glossary**
- Contains definitions of words.
APPENDIX C: CCC WELCOME MENU

MAC LC

SIGN ON
Number
First Name

Course Selection (click)

Hello, Ross Methode

Please select a course

Back Previous Next Help
APPENDIX D: INFORMAL ATTITUDE SURVEY

Name_________________ Date ___________ Sex _M_ _F_ Age _____

Complete the following survey by circling a number after each statement. Please indicate your agreement or disagreement with each statement by selecting the appropriate number.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1. I like to read for fun. 1 2 3 4 5
2. I like to read assignments. 1 2 3 4 5
3. Reading is a valuable life skill. 1 2 3 4 5
4. I appreciate help I get with my reading. 1 2 3 4 5
5. Reading is easy for me. 1 2 3 4 5
6. I think computers can be good teachers. 1 2 3 4 5
7. I think computers can help me review my basic skills. 1 2 3 4 5
8. A computer screen is harder to read than a page in a book. 1 2 3 4 5
9. Computers are fun. 1 2 3 4 5
10. Computers can help me learn. 1 2 3 4 5
11. Computers are mostly used for game playing. 1 2 3 4 5
12. I'll probably need a computer in my job someday. 1 2 3 4 5
13. Many people are trained BY computers. 1 2 3 4 5
14. I plan to take Computer Applications next year. 1 2 3 4 5
15. I use computers to do my homework when possible.

**HOME ROOM GROUP ONLY do the next five questions.**

16. I enjoyed the planned HR time.

17. I view reading as more enjoyable than I did before this HR.

18. Reading enrichment is better than reading skills.

19. I would like to do this again and add a writing element.

20. The type of HR is a waste of time.

**COMPUTER GROUP ONLY do the next five questions.**

21. I'm excited about working on the computer.

22. I would volunteer to continue working on the ILS.

23. I think I am a better student because of the ILS.

24. I would like to add a computer writing element.

25. The ILS was a waste of time.
APPENDIX E: POSTTEST-PRETEST INDIVIDUAL PERCENTILE CHANGES - EXPERIMENTAL GROUP

PERCENTILE CHANGES FROM HIGHEST TO LOWEST:

STUDENT: 1 / +27%
2 / +9
3 / +8
4 / +7
5 / +6
6 / +5
7 / +1
8 / -4
9 / -4
10/ -6
11/ -9
12/ -14
13/ -16
14/ -20
15/ -26
16/ -30
17/ -46