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# A Proposal for the Development of a Computer Literacy Curriculum in the Charleston School District

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A PROPOSAL FOR THE DEVELOPMENT OF A COMPUTER LITERACY

CURRICULUM IN THE CHARLESTON SCHOOL DISTRICT

(TITLE)

BY

David Robert Carey

FIELD EXPERIENCE

~~THESIS~~

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Specialist in Education

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

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YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
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ABSTRACT

The purpose of this study was to develop a computer literacy infusion plan for Community Unit School District Number One in Charleston, Illinois. The plan was developed to extend and build upon the existing computer usage study prepared in 1982. Specifically, this plan was prepared to provide direction and recommendations in the form of curriculum development, planning for staff development, and improved software and hardware selection processes for the elementary schools in Charleston.

A review of the research and literature revealed that the computer and its use has developed at a remarkable rate since the late 1970's. Successful projects throughout the country were studied closely in order to identify ideas which could be useful to the Charleston schools.

An infusion plan was designed and implemented in the author's second grade classroom with the idea that if the plan was successful, it could serve as a model for grades K-6 in the Charleston school district. Objectives, lesson plans, activities and evaluation instruments were developed and utilized during the 1983-84 school year. The plan was designed to answer the following questions:

1. Can young students learn to use correct terminology to describe the different components of computer systems?

2. Can young children learn to handle, load, and interact with appropriate software?

3. Can young children learn to discuss verbally three ways in which computers are used in society?

4. Can young children learn simple programming and write their own programs on the computer?

Based on the positive results of the plan, implementation of a computer literacy curriculum was determined to be feasible. A suggested outline and scope and sequence for computer literacy in grades K-6 was presented.

A list of recommendations for Community Unit School District Number One was then presented. These recommendations concerned the following areas:

--formation of a microcomputer committee
--staff development
--selection of hardware
--selection of software
--computer-assisted instruction

Finally, it was concluded that in order for any school district to enter the computer age successfully, careful planning and preparation are necessary.

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By
David Robert Carey

B.S. in Ed., Eastern Illinois University, 1973
M.S. in Ed., Eastern Illinois University, 1978

ABSTRACT OF A FIELD STUDY

Submitted in partial fulfillment of the requirements for the degree of Specialist in Education at the Graduate School of Eastern Illinois University

Charleston, Illinois

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CHAPTER I

## Introduction

Computers have become a common sight in most school districts within the last five years. Anyone visiting an elementary school is almost certain to witness several young operators completely mesmerized by a video screen patiently giving them directions or drill over a myriad of subjects. The computer politely reinforces correct answers with colorful dancing bears, mechanical beeps, or familiar musical strains and gives assistance when problems arise. The computer has essentially become a surrogate teacher's aide.

In a survey (6*) conducted by Electronic Learning magazine in 1981, it was found that just about every state in the union was sitting by waiting to see if computers were going to stay. Minnesota was the only state listed in the survey as being very involved in promoting the instructional use of computers.

A recent survey, conducted in 1983 by the same magazine (6), still reflects a "wait and see" attitude by

* numbers in parentheses refer to numbered references in the bibliography: those after the colon are page numbers.

most states, but at least now there are signs that most everyone is getting with the times. At present 6 states require their schools to teach students computer skills and 12 states recommend it. A total of 47 states "have launched campaigns aimed at enabling their schools to impart those skills to their students. (6: 36)"

In addition, and just as important, 2 years ago there were only a few districts involved in providing teacher in-service and other computer training courses. According to the survey, the number of state agencies "actually involved in computer in-service projects has climbed to 40. (6: 37)"

## Statement of the Problem

The Charleston, Illinois Community Unit District Number One school board and administration has completed a computer usage study (19). Released in the summer of 1982, this study outlines the philosophy and the direction the process of infusing computers into the schools should take. The following major philosophical statements were determined to be worthy of adopting for the Charleston schools:

1. Become familiar with the microcomputer through its use in a classroom.
2. Gain a non-technical understanding of how a computer functions.
3. Develop an understanding of how computers are used.
4. Become familiar with computer related career opportunities.

On the surface these statements sound very appropriate and initially have set the district in the right direction. However, upon closer inspection of the statements and then observing what is actually taking place in the schools these statements do not provide enough information or direction for administration and staff to continue computer instruction in a continually developing manner. Students at the elementary level commonly use the computer as a tutor. After being instructed in one skill or another they quietly parade to the computer and take a bite of the "Apple" for approximately 10 minutes a day for one week a month. There they respond to various drills which hopefully reinforce what has been taught in the classroom.

This type of organization and arrangement of computer use is all well and good. It has, during the past 2 years, given all students the opportunity to become comfortable with the keyboard, the monitor, and a cross-section of software and in so-doing has also allowed the majority of elementary students in grades K-6 to become computer aware.

Herein lies the problem. The Charleston school district appears to be at a standstill at the elementary level, content to remain at the computer awareness stage of development. This can be likened to a baby learning to crawl and never going beyond that stage.

Has all of this expensive hardware and software been purchased for the shallow reasons of simply introducing students to the computer and keeping up with what the next district is doing?

It is the purpose of this study to, through a review of the literature and study of existing projects, develop a plan for the Charleston elementary schools which will extend and build upon the existing plan adopted in 1982. It is hoped that, through the use of this plan, the students, teachers, and administrators in this district will begin to benefit from the tremendous, yet untapped, potential the computer has to offer. This plan will be designed to provide direction in the form of curriculum development, adequate planning for training of faculty, and improved software selection processes. It is hoped that through the use of this plan the future of the computer in the Charleston elementary schools will be as bright as it should be. It is also hoped that through the use of this plan the computers in the Charleston schools will survive the fate of many other teaching machines now found buried in cloak closets and boiler rooms in many schools all over the country.

## Limitations of the Study

Due to the interests of this researcher and the perceived need of the Charleston, Illinois Community Unit District #1, this research will be limited to a focus on the elementary grades K-6. Because of the rapid development of the computer and its use, this study and resulting plan will be limited to the most recent and most successful research available. The large number of programs being developed at the national and state level can create conflicting views. The possibility of reproducing mistakes made by other school districts will limit this research to those programs considered successful by the researcher.

Other limiting factors to be considered include enrollment, school resources, and financial restrictions of the administration. Resistance by the faculty and administration in the Charleston schools will be limiting factors as well.

The changing nature of the computer's potential and its limited access to people involved in successful programs will be problems to be overcome by careful research.

## Definitions of Terms

Clearly there are many terms involved in developing a computer use study of this type. These terms include the following: byte, central processing unit, chip, computer assisted instruction, computer managed instruction, cathode ray tube, data processing, documentation, diskette, input device, microcomputer, network, random access memory, read only memory, software and languages--including: BASIC, Pascal, Fortran, Pilot, and Logo. These terms are becoming common-place and their definitions (if not known) can be easily determined through other sources, so time and space will not be allotted in this study.

There is one term, however, which is extremely important and must be defined for the purposes of this study. This term is "computer literacy."

There are a multitude of definitions for computer literacy. There are, in fact, as many definitions as there are districts that have defined the term. This is as it should be for each district will have its own ideas about what a computer literate student should be.

One of the most comprehensive computer literacy curriculum (6) is in use in Cupertino, California. The program has at its foundation the idea that all students (at the K-8 level) should have an opportunity to become computer literate. This district has defined computer literacy as, ". . . the ability to function in a computer and technology-oriented society. Students will understand computers and their applications and implications in the world around them. They will develop the skills necessary to communicate with computers and recognize the computer's capabilities and limitations." (6: 57)

Starting at the kindergarten level and reinforcing and expanding as the student progresses through the school, the curriculum includes: recognizing the parts of a computer, running a program, listing different languages, describing how computers affect our lives, and learning historical and moral issues of computers. Also included is the requirement that in order to be computer literate the student must perform basic programming skills using Logo, Pilot and BASIC languages.

To some computer literacy simply means being able to use a computer, not "being afraid" of it, and knowing what it can do for you. Programming is rarely mentioned in this definition of computer literacy while others claim that even knowing programming is not enough to be considered computer literate.

A report (6) by the Academic Council Committee on Computers and Information Technology of Stanford University lists three main criteria for computer literacy: 1. Some facility with at least one text editor, computer and operating system; 2. the ability to write and debug a program successfully; 3. the ability to design, implement, debug and maintain reliable algorithms, perhaps even efficient ones, in the service of serious professional goals.

For the purposes of this study a broad definition of computer literacy which recognizes that computers are both a tool and a subject of instruction will be utilized. This definition can be broken down in the following manner:

Students will be able to discuss and demonstrate:

--the uses of computers;

--the ways computers do their work;

--the theory of programming computers at the elementary level;

--societal implications and limitations of computer use.

The student should be able to use the computer in the following ways:

--to simulate real problems

--to solve problems

--to edit text and other word processor functions

--to make decisions

--to convey information in a usable manner

--to receive instruction

--to program to a varying degree using Logo and possibly BASIC and Pilot.

## CHAPTER II

### Rationale

In order to fully understand why it is necessary to include the teaching of computer literacy in an already full curriculum at the elementary level one must accept the fact that society has changed radically since the 1950's. One excellent source of information about this change is John Naisbitt's (16) Megatrends: Ten New Directions Transforming Our Lives which points out very clearly the direction American society is going and the need to realize this change and adjust for it. According to Naisbitt (16), society has been moving from the old to the new, and is still in motion. Although most people continue to think of ours as an industrial based society, modern society is actually based on the creation and distribution of information.

As leaders in education, teachers and administrators need to accept the reality that society is changing. If they don't adapt and guide the education of children in the same direction that society is going, they fail in their responsibility to children and ultimately to society. The following facts found in Megatrends should help to open educator's eyes.

According to Naisbitt (16) a 1980 report by the U.S. Department of Education and the National Science Foundation stated that most Americans are moving toward ". . . virtual scientific and technological illiteracy." (16: 25) Science and math programs in U.S. schools are lagging far behind other developed countries. There is a sixteen year decline of SAT scores. The generation graduating from high school today is the first generation in American history to graduate less skilled than its parents.

Naisbitt also cites a report by the Carnegie Council of Policy Studies in Higher Education which states that "because of deficits in our public school system, about one-third of our youth are ill-educated, ill-employed, and ill-equipped to make their way in American society." (16: 26) Recent estimates of the number of functional illiterates in the United States range from 18 million to 64 million, the higher figure representing one quarter of our population.

The bottom line is that schools, whether one chooses to admit it or not, are turning out individuals who are not prepared to meet the challenges that a changing society is presenting them. In response, some corporations have reluctantly entered the education business. Some 300 of the nation's largest companies now operate remedial courses in basic math and English for entry-level workers. Just when offices are demanding more highly skilled workers (to operate a word-processor for example) what they are getting is graduates who would have a hard time qualifying for the jobs that are technologically obsolete. (16)

Once educators realize the importance of this role as change-agent, they must then begin to make decisions about the direction education in general should be heading, and more specifically, where local districts need to be changing. Changes must be made and made soon if children, communities, and the nation are to compete in the world of the future. The computer can help us reach this goal of preparing ourselves for future competitiveness. However, we must plan carefully, train efficiently, and start early.

Review of the Literature (The computer as a tool, a tutor, and a tutee)

In reviewing the literature concerning the use of microcomputers in the schools, many topics were encountered. One source in particular provided an excellent overview of the three ways computers are used in the school setting. In his book *The Computer in the Schools: Tutor, Tool, Tutee*, Taylor (19) provided a forum for various experts in the field of computers in education. An exploration of each of these three uses for computers and a look at recent articles concerning these three approaches will follow.

The Computer as a Tool

For the purposes of this study and its effect on computer use in the Charleston school district, the computer must be considered a tool. Although students at the elementary level will not have much opportunity to use the computer as a tool (19), they should be exposed to the computer's capability for functions such as statistical analysis and spreadsheet calculation to a moderate degree and database management and word processing to a much larger degree.

Through such programs as "Bank Street Writer" from Broderbund software company and "Kid Writer" and "Story Writer" from Spinnaker software company children can very easily see how powerful and useful the computer can be. When children are allowed to create stories using a simple word processor which allows them to correct misspellings, edit sentences and print what they have composed, they can truly discover the thrill that writing can provide. Many budding young authors have been discouraged by well-meaning teachers who require neatness and correct spelling. Endless recopying has a tendency to extinguish creativity. The computer can help overcome this problem.

According to Caravella (2), and many others (5, 19) interested in writing about computers in the schools, the microcomputer will be widely used for telecommunication terminals to access database networks before the students in elementary school today graduate from high school. Database networks, such as "The Source" and "Compuserve", can be accessed (5) directly through a computer terminal which has been hooked up to a telephone via a modem (a device which connects a microcomputer to telephone lines.) These databases can provide massive amounts of data in a variety of subject areas including: references to articles, conference papers, reports, science, current affairs, humanities, and education. At this point teachers will be more apt to use databases than students. However, as students in the elementary school become more sophisticated in the ways of using computers, databases will more than likely become an important source of information for them.

## The Computer as a Tutor

To function as tutor in a subject, the computer must be programmed by experts in programming. The student is then tutored by the computer executing the program. The computer presents the material and the student responds. The computer evaluates the answer, then determines what to present next. With well-designed software the computer tutor keeps complete records on each student being tutored. With teacher input (19) the computer can easily tailor its presentation to accommodate a wide range of student differences.

Historically, this mode has its roots in programmed instruction. However, when properly deployed it is far more flexible than any book or material-based programmed instruction. In the tutor (19) mode, the material can be presented interactively and sophisticated graphics and other teaching aids can be integrally used. As mentioned earlier, in the tutorial setting the computer can keep a performance record or history of each student participating allowing the instructor to evaluate and input any changes deemed necessary. This mode can also be designed to move the student at a wide range of speeds and to be interruptible more or less at the student's convenience.

In an article by Heck (9), found in the February 1983 journal Arithmetic Teacher, we again find this allusion to the computer programmer's ability to individualize software and its presentation of material. Heck refers to the "computer's infinite patience" (9: 27) and ability to select appropriate exercises based on answers to previous questions.

## The Computer as Tutee

Martin (14) expresses similar views concerning the computer's ability to individualize and recognize learning styles in an article entitled "The Learning Machines." As a critic of the tutor mode of computer use Martin states that CAI or computer assisted instruction may machine-orient children, isolating them from important socializing experiences. She feels that even though there is a place for CAI in the schools it shouldn't be the be-all and end-all of computer use at the elementary level. She fears that CAI use encourages logical thought to the detriment of more intuitive and holistic thinking.

According to Martin (14) schools must look to the microcomputer for a new awareness. Rather than using it strictly as an instructional delivery system, educators should see in them the power to give expression to experience. Programming microcomputers can become a medium for the expression of individual learning styles.

To use the computer as tutee (19) is to tutor the computer. In order to accomplish this the student must learn to talk to the computer. To do this he or she must talk in a language the computer understands. To talk to a computer means to program it. The benefits of learning to program are several. First, one can't teach what he doesn't understand. The human programmer will learn what he or she is trying to teach the computer. Second, through the process of programming using computer logic, the human tutor will learn something about how computers work and his or her own thinking processes. As a result, using the computer as tutee can shift the focus of education in the classroom from end product to process, from memorizing facts to manipulating them and understanding them.

One of the foremost authorities on teaching young people to program computers is Seymour Papert. A professor of mathematics and an educator at the Massachusetts Institute of Technology, Papert is best known for his development of the Logo language and its application to teaching computing and mathematics to young people.

Papert (17) devised Logo because of a longtime concern with the problems in the western educational system. Five years of work with Jean Piaget in Geneva made Papert aware of the ease and joy with which infants and toddlers learn the complexities of language, spatial relationships and the fundamental physical laws of nature. This awareness created a paradox in Papert's mind. "How is it, with children being such marvelous learners, that our educational systems don't work?" (11: 81)

Papert concluded that children were not failing to learn, but that schools were failing to teach them ideas that were relevant in their worlds, in ways they could fully absorb and own.

According to Papert, (17) in his book Mindstorms: Children, Computers, and Powerful Ideas, the next step was to look for a way to change the way children are taught, to make learning more real. Recalling his experience with infants and toddlers, Papert noted that ". . . children do their best learning in the culture." (17: 25) He began to look for a change in the culture he could exploit. What he found, even in the late 1960's, was the coming computer revolution into the American culture. With the introduction of small, relatively inexpensive personal computers Papert found his vehicle for change.

According to Papert, (11) Logo itself was created as a programming language, since "by programming, children feel they can own a piece of the future." (11: 82) Papert and his colleagues at M.I.T. asked what kind of exercise leads to the best learning? Because they saw that children respond well to visual images in motion, they designed Logo programming to center around commands to a "turtle" that moves around a video screen or on the floor, and draws a path.

Papert believes that this visual stimulation allows children to accept programming better than they might accept other educational tasks.

As the use of Logo becomes more and more prevalent in the elementary schools, teachers have developed ideas which further help children accept programming.

Jack McLeod (15), a third and fourth grade teacher at Angiers School in Newton, Massachusetts, uses a different terminology altogether in describing programming with the Logo language. He tells the children to "take the turtle to school" (15: 63) (or into the edit mode where actual programming or teaching the turtle takes place.) This simple metaphor makes procedure writing an exercise that children can understand, remember and explore on their own.

As this writer has experienced first hand, writing programs in Logo becomes fun as students begin to see the potential for creating different shapes. Since there are no right or wrong shapes students can test their theories or ideas, receive immediate feedback, and acquire a sense of their own accomplishments as they program and debug combinations of increasingly complex procedures.

## Review of the Research

Several sources were used in an attempt to thoroughly research the topic of the use of microcomputers in the schools. The use of ERIC (Education Resources Information Center) and the CIJE (Current Index to Journals in Education) facilities in Booth Library on the campus of Eastern Illinois University in Charleston, Illinois provided many citations to be examined. Many articles from current trade publications were also utilized. A major discovery of the research was that almost all of the information available was written within the last decade. A majority of this information was written within the last three years. This fact shows the rapid and recent development of microcomputer technology.

Between December 1982 and February 1983, Johns Hopkins University's Center for Social Organization of Schools surveyed principals and computer-using teachers at approximately 1600 public, private and parochial elementary and secondary schools in the U.S. (1) The results presented here are based on data from those respondents as presented in the September 1983 issue of Classroom Computer Learning.

Seventy percent of those individuals surveyed completed an in-depth 18-page questionnaire. The results of this survey can be interpreted as coming from a representative sample of all microcomputer-using schools in the United States.

Results of the survey reveal some interesting facts. Even though most of the software being marketed today is targeted at the elementary school level, designed to reinforce basic skills in math and language, the evidence from the survey reveals that secondary schools are the largest pre-college users of microcomputers. Emphasis at the secondary level is on teaching students about computers and how to program them using BASIC.

By January 1983, 53 percent of all schools in the United States had at least one computer being used for instruction. Secondary schools, however, are much more likely to have computers than elementary schools. By January 1983 about 80% of all junior and senior high schools had at least one computer while only 42% of all elementary schools had a computer.

Most secondary schools use computers for general computer literacy and programming while drill and practice leads programming as the most common application of micro-computers in elementary schools.

In about half of the schools surveyed which have micros, only one or two teachers, at most, are regular users.

"Regular users" are teachers who either use packaged programs such as those for math or language drills, or who teach programming. In the other half of surveyed schools more than two teachers are regular users of the computers. When more than a few teachers are involved, it is most often by using packaged "learning games" or drill-and-practice programs.

According to the survey (1) the typical elementary school microcomputer is used 11 hours per week and the typical secondary school microcomputer is used 13 hours per week. However, about one-fifth of secondary schools and one of every seven elementary schools use their computers more than five hours a day.

Because of the fact that most elementary schools only have one or two computers it is difficult for each student to have major exposure to them. The typical elementary student receives less than 30 minutes exposure during a week. Only 1 student user in 50 at the elementary level gets more than one hour of time on a microcomputer during a given week. Most elementary schools extend the opportunity of using micros to more students as the school acquires more micros. This means that students do not receive any more computer time as new computers are purchased.

Two separate approaches to using computers came out of the survey. This indicates two separate philosophies regarding the appropriate role of computers.

Some schools believe that by providing computer software and machines for lower-achieving students, the schools can help them catch up to other students.

The other approach allocates computers to better-prepared students assuming that slower-learning students require more personal attention of professional teachers in order to master basic skills. By providing faster-learning students with a challenge on which they can work for long periods of time, the teachers aim to prevent classroom management problems that occur when students become bored with the slow pace of instruction.

Although this survey contained little data to help determine which is the most effective way to use microcomputers it did allow a comparison between the nation and the schools in the Charleston district. Computer use in Charleston seems to be developing at about the same rate and direction as the majority of schools in the country. All of the elementary schools in the Charleston district have at least 2 microcomputers which are shared by teachers in various ways. Very little programming instruction is being offered except to a few gifted 5th and 6th graders. Most of the computer time involves using drill and practice software. A small amount of time is used for administrative and classroom management purposes.

In comparing the nation and the Charleston district two differences were noticed. Rather than focusing on high-achievers or low-achievers, the Charleston schools seem to be approaching computer use in a more equitable manner. In every elementary building all the children from kindergarten to sixth grade receive exposure to the computer. In addition when new computers are purchased the students receive increased exposure because there are more computers to circulate.

Through reviewing various research projects it is obvious that there are pockets of innovative computer users in the country. Hunter (10), a senior staff scientist with the Educational and Training Systems Division of the Human Resources Research Oganization in Alexandria, Virginia, recently completed a pilot project in six schools in Virginia and Maryland during the 1981-1982 school year. The project involved schools that had volunteered to use a new guide for integrating computer use into the K-8 curriculum. The guide, entitled My Students Use Computers, was developed by the Human Resources Research Oganization. The guide provided sequences of objectives from kindergarten through the 8th grade. It was organized into six strands:

--procedural thinking

--using computer programs

--fundamental characteristics of computers

--applications of computers

--social impact of computers

--writing computer programs

The guide provided sample lesson plans for most objectives at most grade levels. Teachers prepared lesson plans to meet those objectives and used them in their classes.

The conclusions drawn from this project revealed that infusing computer literacy into the existing curriculum can be successfully carried out if the following factors are present: enough and appropriate hardware and software, teacher training, teacher collaboration, administrative support and student and teacher enthusiasm. These factors were present in varying degrees and did encourage computer literacy in this project. However, other factors were found that worked against it. The most complex of these negative factors is the difficulty of integrating new tools into an existing curriculum. Finding software and other computer materials that are educationally sound was very difficult but more discouraging was the fact these materials sometimes failed to fit into current curricular plans. It was determined that there is no room for adding on to the existing curriculum so new skills and content must either replace existing materials or be ignored.

Papert (17) addresses this idea of weeding the existing curriculum. He sees school math as a social construction or a set of historical accidents that determined the choice of certain mathematical topics. For example, before electronic calculators existed it was practical to teach such operations as long division. But now that we can purchase calculators cheaply we should reconsider the need to spend several hundred hours of every child's life on learning such arithmetic functions. Weeding out the chaff from the grain would leave room and time in the mathematics curriculum for teaching and exploring new ideas.

One study which addresses the effects of learning a computer programming language was done by Seidman (18). The study was designed to determine if learning a computer language could have an effect on the logical reasoning ability of school children. Subjects in a Stony Brook, New York fifth grade were randomly selected and placed in an experimental and a control group. The experimental group was taught the Logo computer langauge. The control group was not taught a programming language. The study demonstrated that under certain specific conditions learning Logo programming does have a statistically significant effect upon logical reasoning ability.

Another study was designed in an attempt to raise low mathematics scores on the Iowa Test of Basic Skills. DelForge (4), an Associate Professor of Elementary Education at Western Carolina University in Cullowhee, N.C., discovered that math scores went up significantly among students who made daily use of computer assisted instruction at the Log Cabin Elementary School in Jackson County, North Carolina.

Kraus (12) also focused on elementary mathematics to introduce children to microcomputers. From his study Kraus concluded that instructional computer games can provide an easy, low-stress, enjoyable introduction to microcomputers for both students and teachers. The study also determined that, at least in the lower elementary grades, the computer belongs in the classroom where the teacher can depend on its being available throughout the day. It was also determined that the microcomputer is very useful as a learning center to supplement regular instruction.

After 35 years of working in the area of children's learning Martin (13), a retired educator, decided that it was time to change the tradition of teaching children to read before they learn to write. His theory, based on the phonemic alphabet, is simple--a child can write what is heard and thought without getting bogged down in the intricacies of the English language. Using computers with voice capability and typewriters, Dr. Martin developed a program which raised pre-experiment scores in the 44th percentile on standardized reading tests to the 70th percentile in the first year of the program and to the 82nd percentile in the second year of the program.

## Uniqueness of the Study

The use of microcomputers for instruction in schools is growing rapidly and will have an incalculable effect on education. It is important that schools not be unwitting victims of the enthusiasm of amateur computerists or the aggressive marketing of producers of computer-related materials. Too many quality innovations that are capable of improving educational programs fail to reach their fullest potential because of poor planning. Microcomputers are being purchased by school districts at an increasing rate, and it is predicted that more than one hundred thousand computers will be purchased by schools in the next few years (7). Many of these machines may fall victim to poor planning and the corresponding programs will fade away. If this occurs the students will be the ones to suffer. Correct innovation involves careful planning to enhance the success of the microcomputer program by identifying and implementing the best uses of the computer in schools. In trying to identify the correct uses one may also be able to identify and avoid problems that can lead to failure.

The uniqueness of this study will be seen in its attempt to emulate those successful projects involving infusion of microcomputers into the existing school curriculum, with modifications made to fit Community Unit Number One School District in Charleston, Illinois.

# CHAPTER III

## Design of the Study

### General Design

In order to efficiently determine the correct process by which a computer literacy curriculum should be infused into the existing curricula, it seemed necessary to actually develop and carry-out an infusion plan. The design, implementation, and results of this plan will serve as a model for the Charleston Community Unit #1 School District. The objectives, lesson plans, and activities developed will, hopefully, serve to prove to administrators, faculty, parents and students alike that children from kindergarten through sixth grade can benefit from computer literacy.

The study will attempt to answer the following questions:

1. Can young students learn to use correct terminology to describe the different components of computers?
2. Can young children learn to handle, load, and interact with available software?
3. Can young children learn to discuss verbally three ways in which computers are used in society?

4. Can young children learn simple programming and write their own programs?

## Sample and Population

The population for this study was the student population in kindergarten through sixth grade in the Charleston, Illinois public school district. The sample studied was one second grade class containing sixteen students at Lincoln Elementary School in Charleston, Illinois.

## Specific Design

The purpose of this study was to provide specific goals, objectives and activities that would develop the skills and information necessary for the students in the sample to operate the building computers on an independent basis.

## Objective One

The students were to use correct terminology to describe different components of the building computer system including: the keyboard, the disk drive, the monitor, the printer, the game controllers, and the diskettes. 100% accuracy was required. A three week time span allowed all children to meet this objective.

## Activities for Objective One

1. A slide presentation was shown to the group as a whole in order to isolate and enlarge each piece of equipment. A discussion of the purpose of each component was included. Time required for this activity was one week.

2. The program entitled "Introduction to Microcomputers" was used by the students in pairs while seated at the computer. This program uses animated color graphics to explain the computer and its components. Time required for this activity was two weeks.

### Evaluation for Objective One

The students were given a pre and posttest (Appendix A) designed to test their knowledge of the correct terminology used to describe the various components of the building computer. Each student verbally named the components while preparing to boot the disk operating system.

### Objective Two

The students were to demonstrate the ability to handle diskettes, load diskettes and boot the disk operating system properly so that all programs were visible on the monitor and prepared for interaction with the student. 100% accuracy was required. Time required to meet this objective was two weeks.

### Activities for Objective Two

Each student received individual instruction while seated at the computer in handling diskettes and booting the disk operating system. Time required for this activity was two weeks. A supplementary activity for Objective Two was the program entitled "Alphakey". This program is designed to teach children the location of the keys on the keyboard.

Evaluation for Objective Two

The teacher observed as each student booted the disk operating system for interaction. Successful preparation of the computer for interaction indicated proficiency.

Objective Three

The students were to list three ways in which computers are used in the sciences, business, in government, and in other real-life situations in the local community and elsewhere. 100% accuracy was required. Time required to meet this objective was 4 weeks.

Activities for Objective Three

1. The students took field trips to various businesses and the local university to experience firsthand the practical applications of the computer. Time required for this activity was two weeks.

2. Local resource people were invited to speak to the

students about ways in which computers are used in the local community. Time required for this activity was two weeks.

3. The program entitled "Computer Literacy: Introduction" was used by the students in pairs. This program is designed to give the students a basic understanding of computers and how they are used in business, industry, and society.

## Evaluation of Objective Three

A pre and posttest was designed to determine if students understood three practical applications of computers in real-life situations.

## Objective Four

The students were introduced to computer programming and problem solving. They interacted with the computer and commanded, directed, and animated what was produced. Time required to meet this objective was five weeks.

## Activity for Objective Four

Through the use of the easy-to-learn computer language called Logo, the students individually created pictures with simple "turtle" commands such as: FORWARD and RIGHT. Time required for this activity was five weeks.

## Evaluation for Objective Four

A program using Logo was developed and saved on diskette by each student thereby demonstrating mastery of Objective Two as well as Objective Four.

## Collection and Instrumentation

The data was collected by administering pretests and posttests to each student in the sample for each objective in the design of the study. The instruments or tests were designed by the author.

## Data Analysis

Data collected during this study was analyzed only to determine if the objectives were successfully met by each subject or student in the class.

# CHAPTER IV

## RESULTS AND CONCLUSIONS

This chapter will present the results for each of the four research questions (objectives) posed for study.

Question One was concerned with whether or not young children can learn to use correct terminology to describe the different components of computers.

TABLE 1 presents the results for Question One. This analysis examines each subject as a separate individual and as a member of the class.

TABLE 1. ABILITY TO USE CORRECT TERMINOLOGY TO DESCRIBE THE DIFFERENT COMPONENTS OF COMPUTERS.

| Subject | Pretest Scores | Posttest Scores | Objective Met |
|---|---|---|---|
| A | 0% | 100% | y |
| B | 75% | 100% | y |
| C | 17% | 100% | y |
| D | 33% | 100% | y |
| E | 42% | 100% | y |
| F | 42% | 100% | y |
| G | 75% | 100% | y |

TABLE 1, continued

| Subject | Pretest Scores | Posttest Scores | Objective Met |
|---|---|---|---|
| H | 67% | 100% | y |
| I | 58% | 100% | y |
| J | 58% | 100% | y |
| K | 42% | 100% | y |
| L | 50% | 100% | y |
| M | 42% | 67% | n |
| N | 33% | 83% | n |
| O | 0% | 50% | n |
| P | 33% | 83% | n |
| n = 16 | Ave. Pretest Score = 38% | Ave. Posttest Score = 93% | No. of Subjects Meeting Objective = 75% |

Objective One was evaluated by administering a pretest at the beginning of the project and a posttest at the end of the project. The pretest required the subjects to match a picture of a computer component with its proper name. A very similar test was administered as a posttest (APPENDIX A).

TABLE 1 reveals an average pretest score of 38% and an average posttest score of 93% indicating that young children are capable of learning to use correct terminology to describe the different components of computers. TABLE 1 also reveals that even though only 75% of the subjects mastered Objective One, 100% made marked improvements over their pretest scores.

Question Two was concerned with whether or not young children can learn to handle, load and interact with available software.

TABLE 2 presents the results for Question Two.

TABLE 2. ABILITY TO OPERATE HARDWARE AND SOFTWARE

| Subject | Objective Met |
|---|---|
| A | y |
| B | y |
| C | y |
| D | y |
| E | y |
| F | y |
| G | y |
| H | y |
| I | y |
| J | y |
| K | y |
| L | y |
| M | y |
| N | y |
| O | y |

TABLE 2, continued

| Subject | Objective Met |
| --- | --- |
| P | y |
| n = 16 | % of Subjects Meeting Objective = 100% |

Objective Two was evaluated by teacher observation. The teacher observed as each subject prepared the computer for interaction. Successful preparation indicated completion of the objective. TABLE 2 reveals that 100% of the subjects successfully completed Objective Two, thus indicating that young children are capable of learning to handle, load, and interact with available software and hardware.

Each subject in the group eventually became proficient enough to instruct other children, as well as teachers, in operating the building computers.

Question Three was concerned with whether or not young children can learn to list three ways in which computers are used in society.

TABLE 3 presents the results for Question Three.

TABLE 3. ABILITY TO LIST THREE WAYS COMPUTERS ARE USED IN SOCIETY.

| Subject | Pretest Scores | Posttest Scores | Objective Met |
| --- | --- | --- | --- |
| A | 0% | 100% | y |

TABLE 3, continued

| Subject | Pretest Scores | Posttest Scores | Objective Met |
|---|---|---|---|
| B | 66% | 100% | y |
| C | 0% | 100% | y |
| D | 0% | 100% | y |
| E | 0% | 100% | y |
| F | 0% | 100% | y |
| G | 0% | 100% | y |
| H | 0% | 100% | y |
| I | 0% | 100% | y |
| J | 0% | 100% | y |
| K | 60% | 100% | y |
| L | 33% | 100% | y |
| M | 0% | 100% | y |
| N | 0% | 100% | y |
| O | 60% | 100% | y |
| P | 0% | 100% | y |
| n = 16 | Ave. Pretest Score = 14% | Ave. Posttest Score = 100% | % of Subjects Meeting Objective = 100% |

Objective Three was evaluated by administering a pretest at the beginning of the project and a posttest at the end of the project. The pretest required the subjects to list three ways computers are used in society. A similar test was administered as a posttest (APPENDIX A).

TABLE 3 reveals that the average pretest score was 38% and the average posttest score was 100% indicating that young children are capable of learning to list three ways in which computers are used in society.

Question Four was concerned with whether or not young children can learn simple programming and write their own programs. TABLE 4 presents the results for Question Four.

TABLE 4. ABILITY TO PROGRAM

| Subject | Objective Met |
|---|---|
| A | y |
| B | y |
| C | y |
| D | y |
| E | y |
| F | y |
| G | y |
| H | y |
| I | y |
| J | y |
| K | y |
| L | y |
| M | y |
| N | y |

TABLE 4, continued

| Subject | Objective Met |
|---|---|
| O | y |
| P | y |

n = 16 — % of Subjects Meeting Objective = 100%

Objective Four was evaluated by the subject's ability to develop a program and save it on diskette. TABLE 4 reveals that 100% of the subjects in the study were able to accomplish this objective, indicating that young children are capable of learning to write their own programs.

The overwhelming majority of the subjects in the program had a very favorable attitude toward learning to use computers. Many of the subjects were reluctant to leave the terminal when their work time concluded, especially during the programming segment.

## Conclusions

As the author worked with the subjects in the study it was necessary to repeat information frequently in order for it to be retained. Of special concern was the applications area of computer technology. Students at this age are not very concerned with the discussion of how computers are used in society. Semi-concrete representation of computer usage, however, did interest them as did the field trips to various businesses and educational settings where computers were seen in operation. Based upon these impressions it is the author's conclusion that the concepts in a computer literacy curriculum be introduced, reviewed, reinforced, and expanded at each succeeding level.

# CHAPTER V

## Recommendations

The sample used in this study was small. However, the students were representative of all second graders in the Charleston system. Based on the results of the study with these students the following full-scale implementation of computer literacy into the Charleston elementary school district curriculum is recommended.

What follows is a suggested outline and scope and sequence for computer literacy for students in grades K-6 in the Charleston school district. It is adapted from the Alexandria City, Virginia Public Schools and the Cupertino, California curriculum (6) which presently exists. This curriculum has been proven to be effective through several years of actual instruction and refinement of the concepts.

### Computer Literacy

1. SYNOPOSIS OF OVERALL PLAN

A computer literacy program for elementary students. Students develop an understanding of the capabilities, limitations, applications and effects of computers in society.

2. CURRICULUM CONTENT

History

Concepts

Process

Applications

3. GRADE LEVELS

Kindergarten through Sixth Grade

4. DELIVERY SYSTEM

Lab--two labs move throughout the system and are assigned to a school for a nine-week period. There are other computers in each school to continue the program. 24 microcomputers in each lab, one student per microcomputer.

5. SPECIFIC HARDWARE SUPPORT

Student microcomputers are networked to the teacher host microcomputer.

6. FUTURE PLANS

Program will be continually reviewed and revised based on changes in technology.

COMPUTER LITERACY PROGRAM

I = Introduce
C = Continue concept and review
R = Reinforce and introduce new material

The student will . . .

## HISTORY

| | K | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Recognize different number systems | | | I | R | R | R | C |
| Study the history of calculators | | | | I | R | C | R |
| Study early calculators | | | | | I | R | C |
| Recognize advantages of new calculators | | | | | I | C | C |
| Study punched cards | | | | | | I | C |
| Study the history of the census | | | | | | I | C |
| Study main frame computers | | | | | | I | C |
| Recognize the effect of the space age | | | | | | | I |
| Study "mini/micro" computers | | | | | | | I |

## CONCEPTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Understand computer parts | I | C | C | C | R | C | C |
| Learn special function keys | | | | | I | C | C |
| Use and understand computer terms | I | R | R | R | R | R | R |
| Study many computer languages | | | | | | | I |
| Know the basic operations of computers | I | C | C | C | R | C | R |
| Understand relationship of hardware | | | | | I | R | C |
| Distiguish between logic and illogic | I | R | R | R | R | R | R |
| Understand limitations of computers | | | | | | I | R |

## PROCESS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Follow a procedure for a familiar task | I | C | C | C | C | C | C |
| Describe a procedure for a task | I | C | C | C | C | C | C |
| Modify an existing procedure | | | I | C | C | C | C |
| List and modify a procedure | | | | | I | C | C |
| Read a simple flowchart | | | | I | C | C | C |

PROCESS, continued

| | K | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Draw a simple flowchart | | | | | I | C | C |
| Use prepared software in a computer | I | C | C | C | C | C | C |
| Become familiar with the keyboard | I | C | C | C | R | C | C |
| Power up the computer | | | I | C | C | C | C |
| Load up a diskette and execute program | | | I | C | C | C | C |
| Type in a prewritten program and run | | | | | I | R | R |
| Use Logo commands | | I | C | C | C | C | C |
| Use BASIC commands | | | | | I | C | C |
| List BASIC commands and statements | | | | | | | I |
| Use a computer as a calculator | | | | | | | I |
| Use a computer as a word processor | I | C | C | C | C | C | C |
| Create a simple program using Logo | | | I | C | R | R | R |
| Create a simple program using BASIC | | | | | | | I |

APPLICATIONS

| | K | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Discuss uses of computers in society | I | C | R | R | R | R | R |
| Identify how computers affect life | | | | I | R | R | R |
| Name fields which use computers | | | | | I | R | R |
| Identify career fields in computers | | | | | | I | R |
| Appreciate computer skills for jobs | | | | | | | I |

In order for a school district to consider adopting a computer literacy curriculum it is very important that extensive, well-organized planning be done to help pave the way. It is recommended that the following areas be addressed before adoption is considered.

## Microcomputer Committee

The need for a microcomputer committee is essential in moving a school system into the computer age. Interested and knowledgeable staff members from all levels should be selected to serve on the committee.

The role and the direction for the committee must be clear. The following suggestions are presented for consideration:

1. Review the philosophy of microcomputer use including levels of instruction.
2. Review student and staff in-service programs including instructional use.
3. Review administrative/management potential for computer use.
4. Establish one person as the resource contact for microcomputers.
5. Involve the school board in demonstrations.
6. Establish teacher in-service credit workshops.
7. Develop recommendations.

For the Charleston schools it is recommended that the high school and the junior high be represented on the committee as well as at least one staff member from each of the six elementary schools.

## Teacher Training

The school system should seek to develop computer literacy in as many staff members as possible, particularly among staff librarians and among secondary teachers in math, science, English, and business. Teachers with (8) strong disinclinations and those with strong inclinations, especially at the elementary level, should be excluded or included as they choose. To be computer literate at the staff level means familiarity with the variety of instruction-related tasks that computers can be expected to have now or in the future, including experience in using computers for text preparation and editing, test scoring, and packaged instructional programs. For many teachers, computer literacy should also include acquiring the ability to write BASIC, Logo, and Pascal langauge programs on existing computers and to teach programming.

Staff education should include the policy-makers who will have the responsibility for making computer decisions. Widespread staff understanding of computers is a prerequisite for policy discussions.

It is also recommended that a qualified individual presently employed in the district be designated as the key person in charge of microcomputing for the school system. This person should be responsible for staff development. A variety of courses should be made available to all teachers in the system. These courses should include instruction in BASIC, Pascal, Logo, software evaluation, and the use of specific software packages.

Participation in these courses should be on a voluntary basis. However, as the district computer philosophy begins to mature and develop through a unified effort, it is recommended that staff development be required of all teachers working with computers in the system.

Staff development should be differentiated depending on the role the teacher plays in the computer utilization plan developed by the committee. For example, if a second grade teacher is to teach Logo, that teacher should be required to attend staff development sessions on Logo and not on BASIC or Pascal. Staff development should be tied to the on-going system plans, and offered in-house by a person employed full-time by the school system. It is extremely necessary that staff development be recognized as a key component of successful utilization of computer technology.

Hardware Selection

Hardware acquisition should continue but it should not be the highest priority. Staff development, curriculum design for computer literacy, and the evaluation and purchase of high quality software should share equal importance with hardware acquisition.

It is recommended that acquisition of hardware continue in the Charleston schools, but only with careful consideration of what machine or peripheral is needed for a specific location and application. Different types of computers with different memory capacities and features should be purchased depending on the planned use of those machines. The simplest, least expensive machine to do the job required should be the machine purchased.

## Software Selection

It is recommended that all software purchases be based on plans that tie the software to the curriculum and textbooks in use in Charleston. Software should be kept in both a system-level software library and in school software libraries, depending on how often that software is used. A software evaluation system should be used before software is purchased. There are many systems available and one should be adopted for system use or one should be developed.

## Computer-Assisted Learning

Computer-Assisted Learning should be approached with school or system level committees evaluating software and recommending matching it to curriculum. It should be kept in mind that the computer should be used to improve teaching of aspects of the curriculum that are not being optimally served by traditional methods of instruction. It should also be recognized that some children relate to computer-assisted learning better than others. An attempt should be made to match the instruction to the learning style and preferences of the individual child.

## Summary

The advances being made during this decade in the capacity of electronic media to store, retrieve, and process intellectual information at a steadily decreasing cost is one of the more exciting trends in an often-discouraging world. Schools will soon be able to use the fruits of computer technology to help children attain greater academic competencies and skills than the generations before them. However, it will not help for us to uncritically accept every "computer-based" anything that comes to market. We must think clearly about how we want our children's education to improve, what computers can do to help, how that assistance can, in fact, be accomplished, and whether any of this is affordable. Through well-organized planning of educational program development, careful policy-making, and staff development, today's dreams about computers and kids can become tomorrow's realities.

# APPENDIX

Pretest Objective One (learning computer terminology)

Name________________________________

Date________________________________

Directions: After viewing each picture write the number of that picture next to its name.

| Number | Component |
|---|---|
| _____ | paddles |
| _____ | reset key |
| _____ | diskette |
| _____ | space bar |
| _____ | printer |
| _____ | return key |
| _____ | disk drive |
| _____ | shift key |
| _____ | keyboard |
| _____ | computer |
| _____ | monitor |
| _____ | control key |

do not write here

raw score _____

percentile _____

grade level _____

Posttest-Objective One (learning computer terminology)

Name____________________________________

Date____________________________________

Directions: After viewing each picture write the number of that picture next to its name.

| Number | Component |
|---|---|
| _____ | printer |
| _____ | shift key |
| _____ | keyboard |
| _____ | return key |
| _____ | paddles |
| _____ | space bar |
| _____ | monitor |
| _____ | reset key |
| _____ | diskette |
| _____ | control key |
| _____ | computer |
| _____ | disk drive |

do not write here

raw score _____

percentile _____

grade level _____

Pretest-Objective Three (learning computer uses in society)

Name___________________________________

Date___________________________________

Name 3 ways computers are used in society.

1. ___________________________________________________________

2. ___________________________________________________________

3. ___________________________________________________________

(possible answers: robotics, science, reservations, billing, word processing)

do not write here

number attempted _____

number correct _____

percentage _____

Posttest-Objective Three (learning computer uses in society)

Name_______________________________

Date_______________________________

Name 3 ways computers are used in society.

1. ______________________________________________

2. ______________________________________________

3. ______________________________________________

do not write here

number attempted _____

number correct _____

percentage

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