1983

A Plan and Guide for the Implementation of a Computer Curriculum at Southeast Fountain Elementary School

Robert Joseph Baker
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A PLAN AND GUIDE

FOR THE IMPLEMENTATION OF A COMPUTER CURRICULUM AT

SOUTHEAST FOUNTAIN ELEMENTARY SCHOOL

(TITLE)

BY

Robert Joseph Baker

B.S. in Ed., Eastern Illinois University, 1970
M.S. in Ed., Eastern Illinois University, 1978

FIELD EXPERIENCE

[redacted]

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

SPECIALIST IN EDUCATION

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1983

YEAR

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FOR THE IMPLEMENTATION OF A COMPUTER CURRICULUM AT
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ABSTRACT OF A FIELD STUDY

Submitted in partial fulfillment of the
requirements for the degree of
Specialist in Education at the
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Charleston, Illinois

1983

ABSTRACT

This project was developed to provide an orderly plan for the introduction of microcomputers into the total curriculum. A computer curriculum was developed that became a vibrant part of the total experience at the elementary level. The uniqueness of an elementary curriculum has been the manner in which each subject area complemented the other. Science, for example, has not been taught as an independent content area. It has been taught as an extension of the reading program. Also computer instruction must be blended with the other disciplines.

It was the purpose of this study (1) to show a plan for implementation of microcomputer instruction as one of the "basics" within the total elementary curriculum; (2) to provide a teaching guide for implementation of microcomputer instruction; (3) to indicate the appropriate areas of the established curriculum for microcomputers; and (4) to present the goals and objectives for a microcomputer program.

The completion of this project has resulted from a review of current research literature, an inspection of other existing computer curricula, and contacts with specialists within the computer field for assistance. Special assistance was given from representatives of the

Indiana Department of Public Instruction, the Technical Assistance Center Region II, and Radio Shack Computer Center of Indianapolis, Indiana.

The final result of this project was a method for the integration of microcomputers into the elementary curriculum. This study provided the vehicle for the accomplishment of goals and objectives in the areas of programming and computer literacy. This project was designed and implemented for the 1983-84 school year at the Southeast Fountain Elementary School.

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CHAPTER I

Introduction

The computer has been a technological development that has revolutionalized society. The effect of the computer has been to increase Man's ability to access information. The birth of the computer, along with its rapid evolution, has reached into all corners of the Earth and beyond into space. One of the most remarkable aspects of the computer has been the lightning-like speed in which it has evolved. The term computer once meant a large electronic device that was very expensive to purchase and operate. Today, it may be found on desk tops in offices, homes, and classrooms.

If one were to conduct a study of computers, the researcher should complete two steps. First, before one can understand a subject, he/she must know something of its history and reason for being. Second, the researcher should limit the study to how computers relate to a specific field.

This researcher's need was to understand the relationship and applicability the computer has within the field of education. A brief study of the history of computers in education revealed that involvement began approximately thirty years ago. During the decade of the 1950's the first commercial computers were introduced at the university level. Computers were primarily used in research, thus a very small minority of students were affected.

An evolution of the computer industry began in the 1960's. Computers became smaller, more efficient to operate, and less costly to purchase. They were still, primarily, used at the university level. The computer was no longer found just in the laboratory and its use in the campus business office had begun. There was also an emergence of computer science departments on a few university campuses.

The first two noteworthy projects relating computers to public education were completed during the decade of the 1960's. The Stanford Project, conducted by Patrick Suppes, produced elementary drill and practice exercises; the Huntington Project, directed by Ludwig Braun, created simulation activities for the natural and social sciences. Further, computer researchers at Dartmouth College developed a new language given the acronym B.A.S.I.C., which enabled users to better communicate with computers (Brumbaugh and Rawitsch, 1982).

Events in the computer industry took place rapidly during the 1970's. The Federal government provided funds for projects that related computers to education. An interest in computer-assisted instruction developed. Software for education reached the market and regional computer centers were established.

One of the foremost groups established was the Minnesota Educational Computing Consortium (MECC). This organization has done much in the area of educational software and has aided schools with the integration of computers into the curriculum. The achievements of MECC can be observed throughout the state of Minnesota and the mid-west.

During the decade of the 1970's the "kit" computer was developed. The "kit" computer, later to be known as the microcomputer, revolutionized the production of computers. Microcomputers were offered for sale at a cost that made them a reality in the public schools. When the 1970's ended, 80 percent of all United States eduational institutions used some type of computer service (Brumbaugh and Rawitsch, 1982).

The growth that had taken place in the computer industry was difficult to conceptualize. An industry review was made in 1982 by Paine Webber investment group. This review projected annual sales of consumer computers to first-time buyers. The study revealed two startling statistics: a high-growth estimate and a conservative estimate. If one accepted the high-growth projection, consumer sales will continue at an increasing rate of up to 3.3 billion dollars annually with the peak year coming in 1989. The conservative estimate placed the sales of home computers at a rate of up to 1.3 billion dollars peaking in 1992. If one predicts the actual sales rate at some point in-between their projection, an accurate conclusion can be made that computers are solidly in the home market (Paine Webber Industry Review, 1982).

The demand that computer technology will make on education is dramatic. Certainly, the basic charge given to all schools is to prepare individuals for the demands of the future. Specifically, the future may be preparing elementary students for high school, secondary students for either the work force or post-secondary education. A report on education stated that, "Elementary educators have recently spoken of computer literacy as 'the fourth R'. Harvard University now requires all undergraduates to meet a 'Quantitative Reasoning' requirement that includes use of the computer" (Microcomputer News, p. 30, 1982). Certainly, few students nationally will ever attend Harvard; however, all students have encountered computer technology. In fact, "The students of tomorrow will be exposed to computers from birth" (Jones, Introduction, 1982).

Public schools and educators have involved computers in the curriculum. A survey was conducted by the Indiana Department of Public Instruction in September, 1982. That survey found that 91 per cent of the school districts in Indiana owned at least one microcomputer. At the time of the survey, there were 4,629 microcomputers in school buildings across the state of Indiana.

The introduction of computers into the public school curriculum has taken place in every state of the Union. Public education has recognized the need. This researcher was concerned about how the need had been met. Many schools had recognized a need for computer education and answered it by merely buying computers. If a curriculum dominated by a textbook was a poor curriculum, then surely a curriculum dominated by an electronic machine was just as poor. School decision-makers need to have both a framework for planning and detailed information on each aspect of the plan (Brumbaugh and Rawitsch, 1982).

Statement of the Problem

Public education should be successful in properly preparing students to meet the technology of the present and the future. It is necessary today that schools produce tomorrow's leaders who are competent to meet the demands of technology. This must be done and it must be done with accuracy.

This study developed a plan for the implementation of computer instruction at the elementary level. A computer curriculum was created that crossed the boundaries of other disciplines of study. This researcher recognized little value in making relatively large expenditures for hardware and software, then limiting its use to a relatively small segment of the school staff and student body. This curriculum was designed so that it was adaptable to the changes that will take place in the computer industry.

It was the purpose of this project to accomplish many tasks. Goals were generated (see page 86). Each goal needed the support of objectives. Each objective needed the support of specific activities for learning. A well-founded curriculum, in addition, needed some method of evaluation for the achievement of the objectives.

Computer education included many different strategies and levels of competency. The curriculum on computers involved instruction on awareness, literacy, and the ability to read and write programs. Certainly each aspect of instruction was not appropriate for all levels or all students. Decisions were made concerning who received what type of instruction and when. In-service training was provided for the teaching staff. In-service was an important provision in the curriculum because of its interdisciplinary characteristics. It was necessary for each staff member to know the computer's capability, how it functioned, and when it was an appropriate tool for classroom instruction.

A time line of planned implementation was developed. Initially, all students exhibited similar computer skills. Therefore, it was necessary for the curriculum to be phased into place. A three-year period will be needed before the curriculum will be totally implemented.

Finally, this project started with the development of a curriculum that was designed to meet the needs of a majority of the students. The result was a plan that had one intention, which was not to create additional computer scientists, but " . . . people who are aware of the potential and capacity of information technology" (Will, 1983).

Limitations of the Study

The study of computer technology is a very broad subject. The intent of this research was limited to topics relevant to elementary teaching methods. This study has been further limited by the fact that it was conducted specifically for implementation at Southeast Fountain Elementary School at Veedersburg, Indiana. Southeast Fountain was the only elementary school within the limits of the school corporation. The surrounding community, located in west-central Indiana, was rural in nature with agriculture the major industry.

The project was completed with the knowledge that computer instruction must be compatible with the other elements of the elementary curricula. The educational philosophy, schedule, and instructional methods that existed at Southeast Fountain were considered.

Another factor included the realization that the elementary role was to provide the fundamentals for the secondary school. The fact that the necessary hardware had already been purchased was another limitation. This researcher realized that many elementary schools are now involved in computer instruction. However, this project limited its review to only other curricula that had some applicability to Southeast Fountain.

This researcher reviewed literature and research of the most recent publication. Assistance was sought from other sources inside and outside of the field of education.

Definition of Terms

In order for this study to have meaning for the reader, the specialized vocabulary included the following terms and definitions:

> Authoring System Software - A software system that allows a non-programming educator to create classroom lessons and tests with a minimum of effort.
>
> B.A.S.I.C. - Acronym for the Beginner's All-purpose Symbolic Instruction Code, a general-purpose computer programming language. BASIC was developed at Dartmouth College in the mid-Sixties to make it easy for students to learn programming. BASIC has become the de facto official language of the microcomputer. Virtually every microcomputer includes a BASIC language

interpreter. Unfortunately, manufactures of microprocessors have devised a variety of enhancements to the BASIC language that are not compatible with other manufacturers' products.

Bit - The contraction of Binary Digit. Bits always have a value of either one or zero. Bits are used to encode instructions, information, and data for computers.

Byte - One keyboard character -- i.e., a letter, number, or symbol -- consisting of eight bits. The letter "m", for example, is represented by the following byte: 01101101. The capacity of various components of a computer system is frequently measured in bytes. Capacity may be expressed in kilobytes, one of which is a thousand bytes (symbolized as Kb or simply K), or in Megabytes, one of which is a million bytes (symbolized as Mb or M).

Cassette Tape - Magnetic tape housed in a plastic cartridge. Cassette tapes came into popular use with tape recorders. The same cassettes can be used to store instructions, information, and data for some microcomputer systems.

Cassette Drive - An electrical device that may be used in a microcomputer system to record/play (read/write, in computer terms) a cassette tape that has instructions, information, and data stored on it magnetically.

Central Processing Unit (CPU) - The performance center of a microcomputer. The CPU is responsible for controlling the microcomputer's various components. It handles input and output, performs arithmetic and logical operations, and generally includes both a read-only memory (ROM) and a read/write or random-access memory (RAM).

<u>Classroom Management Software</u> - Applications software used to facilitate the educational process apart from computer-assisted instruction software. There are at least three types of classroom management software: filing systems, educational utilities (e.g., readability analysis), and authoring languages.

<u>Computer</u> - An electronic device capable of performing arithmetic and logical processes at extremely high speeds. A typical computer configuration will include a central processing unit (CPU), input and output (I/O) devices, and a storage unit or units.

<u>Computer Literacy</u> - A general understanding of electronic computing; an area of knowledge that includes (1) an understanding of the technology used when processing information; (2) an understanding of the effects that computers have had and will have on society; and (3) an understanding of how computers are problem-solving tools (Horn and Poirot, 1981).

<u>Disk Drive (Diskette Drive)</u> - The electronic machine used to read/write material to and from the disk or diskette. Microcomputers use 5¼ inch and 8 inch diskettes, known as floppies. They may also use a "hard disk," known as a Winchester drive.

<u>Disk Operating System (DOS)</u> - A set of instructions, stored on a disk (diskette) that control the operation of a microcomputer, enable the central processing unit (CPU) to interact with various input/output (I/O) device systems, and are "responsible" for keeping track of instructions, information, and data stored on the disk (diskette).

<u>Diskette</u> - Thin, round, magnetized mylar surfaces encased in a square paper jacket. Standard diskettes come in two sizes: 5¼ and 8 inch. One diskette can store from 100,000 (100K) to over a million

bytes (1M), depending on the drive being used. Hard drives can store from five megabytes (five million bytes) to over 30M.

<u>Dot Matrix Printer</u> - A hard-copy output device that produces characters made up of a series of dots. For microcomputers, dot matrix printers tend to be less expensive than those which print a whole character at a time, as a typewriter does. Printers are rated by their speed. A dot matrix printer is generally rated fairly high, i.e. in excess of 100 characters per second (cps). This may be somewhat misleading, since most dot matrix printers provide for several modes that enhance the image they produce by going over the same line two or three times. This process, which produces a much more readable image, reduces the effective production speed by a factor of two or three.

<u>Drill and Practice Software</u> - Computer-assisted instruction applications software that provides the user with practice in applying some principle or technique previously learned.

<u>Graphics</u> - A type of microcomputer output, either to the video monitor or in hard copy. Video graphics may be presented in small dots known as pixels. Pixel displays are referred to as high-resolution graphics. Video graphics may also be presented as a special set of performed characters. They are then referred to as character graphics. Hard-copy graphics may be output as special characters from some printers; more generally, they are produced by a special hard copy peripheral known as a plotter.

<u>Hardware</u> - The physical equipment of a microcomputer system. Microcomputer hardware generally includes the central processing unit (CPU), an input device (keyboard), an output device (video monitor and/or printer), and a storage device (cassette player/recorder or disk drive).

<u>Input</u> - Instructions, information, or data "fed" to a computer.

<u>Input Device</u> - A machine used to convey instructions, information, and data from the outside world to the computer. Microcomputers use a typewriter-like keyboard as the most typical input device.

<u>Keyboard</u> - The typical input device for a microcomputer, i.e., the device generally used by individuals to put instructions, information, and data into the microcomputer. Keyboards for microcomputers are similar to those of typewriters; however, the micro's keyboard generally has more keys, including keys that serve more than one purpose.

<u>Kilobyte</u> - Two to the tenth power bytes or characters; i.e., 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2, which equals 1,024. A kilobyte is symbolized as Kb or simply K and is referred to as thousands. Hence, 4K is referred to as 4,000 bytes. Microcomputer capacity is frequently defined in terms of kilobytes or random access memory (RAM). Typical microcomputer capacities:

1K = 1,024	64K = 65,536
16K = 16,384	128K = 131,072
32K = 32,768	256K = 262,144
48K = 49,152	512K = 524,288

<u>LOGO</u> - A higher-level language designed primarily for educational purposes and use in the schools. LOGO is best known for its turtle graphics capabilities.

<u>Memory</u> - Central processing unit components that store instructions, information, and data. A microcomputer has two types of memory: read-only memory (ROM) and read/write or random-access memory (RAM).

<u>Microcomputer</u> - The central processing unit, including a microprocessor, ROM, RAM, and other components necessary for input/output devices.

Output - Any information sent from a microcomputer to the outside world. Output can be on video monitor or in printed images.

Peripheral - Any device connected with and controlled by the central processing unit. By this definition, any input, output, or storage device can be considered a peripheral.

Printer - An output device for the microcomputer. There is a variety of printer types for microcomputers, including thermal, dot matrix, and formed-character.

RAM - (Random-Access Memory or Read/ Write Memory) An element of the central processing unit (CPU) that contains instructions, information, and/or data currently needed by the user. RAM in microcomputer consists of large-scale integration chips mounted in dual in-line packages. Microcomputer size is frequently defined in terms of the thousands of bytes (Kbytes) of random-access memory. Microcomputers can have as little as 1K (1,000 bytes or characters) or random access memory to over 1M (1,000,000 bytes equal one megabyte). A very small amount of memory is adequate for learning the fundamentals of programming; 32 K is adequate for most educational and business applications. Word processing may require 48K or more, depending upon the applications software selected. The size of random-access memory may be misleading, since different manufacturers use different configurations of RAM and ROM. Therefore, the requirements of the applications software should be the primary concern.

<u>Read-Only Memory (ROM)</u> - An element of the central processing unit that contains instructions permanently stored there by the manufacturer. Read-only memory generally contains the BASIC language interpreter for the microcomputer. Like random-access memory, ROM is physically located in large-scale integration circuits mounted in dual in-line packages and is measured in terms of kilobytes. The size of ROM is not as important as its contents.

<u>Simulation Software</u> - A genre of computer-assisted instruction (CAI) in which the student is confronted with a simulated environment and one or more problems in that environment. The student interacts with the microcomputer to resolve the problem(s). The microcomputer generates the consequences of the student's action in the form of some appropriate feedback.

<u>Software</u> - A set of instructions used to direct a microcomputer to perform some activity. Software is also known as programs.

<u>Tutorial Software</u> - Computer-assisted instruction applications software that presents the student with new material, i.e. material not covered previously.

<u>Video Monitor</u> - The television-like console used as an output device for a microcomputer. Video monitors may be black and white, light on dark green, amber, or full color. The light green and amber images are thought to reduce eyestrain. Full-color monitors may be difficult to read if the microcomputer is used for general (as opposed to graphic-specific) applications.

Word Processor - A device using a microprocessor in creating, editing, storing, retrieving, and printing letters, contracts, manuscripts, or other word-oriented documents. While using microprocessors, the original word processors were not microcomputers; they could only do word processing. Recently, some word processor manufacturers have started using CP/M (control program for microprocessors) so that their machines can function as microcomputers. Microcomputers can function as word processors with appropriate applications software. Microcomputers are not as efficient as these text-editing tasks as true word processors.

CHAPTER II

Rationale

The public school was traditionally charged with the preparation of students to meet the needs of society. Accomplishment of this charge has required a constant evolution of the public school curriculum. Change took place when the school decision-makers observed changes in society and likewise made appropriate alterations in the curriculum.

The school should provide for the current and future needs of society. Nationwide surveys have indicated that there are certain minimums that each and every school should meet. The surveys found that schools should be places where educators transferred information, created positive attitudes toward learning, and prepared students for a productive life in society (Ahern, 1982).

One can predict, with reasonable accuracy, the needs of the class that graduated this year. However, the children entering school this year will not graduate until 1996. The needs they may have are unknown. Decision-makers can only look to current trends, evaluate the trends, and project the future implications.

When current trends were investigated, it was discovered that society has evolved from an industrial-agricultural oriented society to one that has a majority of the work force involved in the information industry. Workers that deal with the development, the use, the processing and the delivery of information, constitute over 50 per cent of the total work force (Ahern, 1982).

A revolution has taken place within the walls of factories. Computerized robots now assemble many of the durable goods that are produced. Computer related industries have been the true growth industries of the past decade. High technology has entered peoples lives at every level. Automobiles are computerized for efficient fuel usage, microwave ovens have replaced conventional methods of cooking, and the furnaces in many homes contain tiny microprocessors.

Many conclusions were made with regards to the needs of society. There will be a need for those who design and build computers. Designers and specialists of all kinds will be required to create and improve communications equipment. Computer operators, repair people, and maintenance specialists will be in great demand. Programmers are, now, and will continue to be, invaluable. Every individual will need some level of familiarity with computers and what they do (Ahern, 1982).

Educators must not fail to recognize the revolution that has taken place in society. Curricula at all levels must undergo revision. The needs of society must be met. The school has been charged with providing students with the basic ability to read, write, and do mathematical computations. This charge will remain, as well as many other mandated programs. Computer-assisted education must be placed within this broad concept of the total school curriculum. There is a danger that computer-assisted education will bypass the public schools and take place only in the homes of the affluent and elsewhere on a commercial basis (Fisher, 1982).

Educators must realize that the computerization of society has taken place. The increased use of computers in society and the low cost of microelectronics has propelled the demand for microcomputers and computer literacy in the school (Steel, Battista, Krockover, 1982). The continued advancement of high-technology has caused educational groups, such as the National Council of Teachers of Mathematics, to issue broad statements of concern related to computer education in the public schools. The NCTM stated in 1978 that computer literacy must be one of the ten basic skills which should be required in all mathematics programs (Steele, Battista, Krockover, 1982).

The future need for individuals trained in information management can be further illustrated when one considers the rate at which information is generated. All recorded knowledge since the history of man doubled between 1960 and 1970. In 1960, approximately 3,500 new book titles were printed in the fields of science and technology. In 1976, seventy-five billion words were put into printed form. In 1980, 17,000 new titles were printed in the same fields. It is believed that 90 percent of all scholars who will contribute to the world's body of knowledge are alive today (Ahern, 1982). The realization of statistics of this nature has prompted educators to re-evaluate what must be thought of as basic education. The driving force that information has increased at such a rate that the human could not keep pace (Lewis, T.H.E. Journal, Vol. 8).

In an attempt to appraise the continued demand for individuals trained to process information, certain trends may be observed. The continual decline of computer prices has made the purchase of computers affordable to a broader consumer base. The additional capacity of small computers to store information has made this tool usable in a greater number of areas. The microminiaturization of electronic equipment has affected both the cost of this equipment and its utility to a greater number of people. Trends of this nature have continued the revolution in communications (Henderson, 1982).

The perceived necessity to insure that students of the future have the capability to effectively compete in society was the primary rationale for this project. This researcher desired that a comprehensive, effective, and logical method for the impartment of this knowledge be provided to the students. The successful accomplishment of this project will benefit the student, the local community, and will insure that the needs, present and future, of society will be met.

In order for such a program to be effective, much care in its development and implementation was taken. Appropriate goals were established. The goals were supported by specific learner objectives and activities. Preparation was made by the inspection of other computer curricula, research of current literature, and the evaluation of various instructional methods that were subjected to valid study.

Review of the Literature

A review of the literature revealed that a great volume of information existed relevant to computers. This researcher limited the selection of literature to articles that were current and related to education. Literature published in educational journals was more applicable to this topic than was literature published in trade magazines.

The vast majority of literature expressed a very positive attitude with regard to the use of computers in education. Some articles stated that computers brought with them a great potential to improve classroom instruction (Brumbaugh and Rawitsch, 1982). The literature enumerated many aspects of the learning process that could be improved with the use of a microcomputer. Skills such as comprehension, reasoning, and problem solving could improve through its use (Levin, 1983).

Although most of the literature was related to the microcomputer's effect on the learner, some articles expressed the viewpoint that instruction would improve because the teacher became more efficient. Computer-managed instruction helps the instructor to optimize his use of time. He is given freedom from routine tasks such as grading papers and the need to repeat the presentation of repetitious material; for example, drill and practice (Hartman, T.H.E. Journal, Vol.8).

Many of the textbook publishers have included computer-management systems with each available program. Certain systems provide record keeping, listed additional exercises for remedial help, and some included the potential for the teacher to author exercises. Individual authoring systems are available and can be used within any subject area. Such systems will assist the teacher in meeting the needs of the class, a small group, or an individual student.

Many journals expressed the difficulty of the accurate selection of good computer software. The rapid growth of the sale of computer-assisted courseware has caused the creation of many programs that are not educationally sound. Much care must be exercised when the teacher chooses materials to be used. The literature advised that educators only purchase from companies that have provided the opportunity to pre-view the programs. Ample evidence existed that computers can be used to make instruction more effective. None of the potential benefits of computer-based instruction are inherent in CBI, they all hinge upon the dedicated ability of good teachers and courseware developers (Kearsley, Hunter, and Seidel, 1983).

Computer literacy was the catch-phrase in many journals. Several authors wrote of the need for computer literacy in the modern curriculum. Each author wrote a definition of computer literacy. Every definition was slightly different. Computer literacy was defined as a study that included the history and capability of the computer. Some authors extended the definition and included the ability to program the computer. However, the authors agreed that reading, writing, and arithmetic are the foundation of the curriculum, but the subject of computer literacy must be added (Birmingham, 1982).

Many journals researched related the necessity for schools to begin computer instruction early. Computer literacy must be introduced early in the elementary school. Children need a reassuring introduction to the computer, sound instruction in its use, ample opportunity to use it, and freedom to experiment with it (Inskeep, 1982). Many authors had varied opinions as to precisely when computer instruction should begin and opinions were also varied with regards to the content of the instruction. First grade was suggested by one author, while another recommended junior-high school. A concensus of the authors stated the third or fourth grade was an appropriate level to begin computer-based instruction.

The content of a computer curriculum for elementary age children should contain at least three elements. The children should learn to manipulate the keyboard, to communicate with the computer, and to realize the computer can respond to them (Howarth, 1983).

Instruction on how to read and write computer programs is appropriate at the elementary level if certain considerations are made. Kindergarten children can learn to program if a language such as LOGO is used. BASIC, the most common language used in education, should not be taught before fourth grade. The ability to reason logically should be considered for all students who are taught to read or write BASIC programs.

In summary, the literature was persuasive toward providing computer instruction in the public school. It was repeatedly suggested that educators begin to teach computer literacy to students at an early age (Lawton and Gershner, 1982). A variety of opinions were expressed related to the exact content within an elementary computer program. Most authors agreed that students should be taught the ability to use the keyboard, to communicate with the computer and, to a limited extent, be able to read and write programs.

Review of the Research

The primary source of information, on a current research of the effects of computers in education, was the library at Eastern Illinois University. Additional information was received from the Region II office of the Technical Assistance Center and Indiana Department of Instruction. An interview with the sales director of the Radio Shack Computer Center in Indianapolis, Indiana, provided this researcher direction in locating relevant studies for examination.

Computer companies have entered the field of education with great enthusiasm. The motivation has been potential sales and the derived profits. The segment of the personal-computer market that has grown the fastest has been hardware and software for use in the schools (Bell, 1983). By mid-1982, more than 90,000 microcomputers were in elementary and high schools throughout the country. It has been projected that by 1985 schools may purchase as many as 150,000 microcomputers per year. Gross sales, to schools, of both hardware and software would total between 375 and 400 million dollars (Watt, 1983). The effect of such market potential has been to make the computer one of the most available pieces of equipment in schools today (Hannum, 1981).

One would assume that with such large expenditures of money being made by schools on computer equipment that exhaustive research had been done to justify its expense. This researcher found the contrary to be true. Considerable research has been done; however, the reliability of much of the research is in question. Upon close examination, much of what was called research was little more than testimonials for programs offered for sale by the various computer companies.

Unfortunately, little systematic research has been done about electronic learning (White, 1983). James Kulik reported, in the Journal of Educational Psychology, that he evaluated 300 research projects and found that 250 of them included serious methodological flaws (Kulik, et. at., 1983). This information caused this researcher to become very skeptical when the studies were read. Without valid research, the school decision-maker has been left with little more than personal intuition or the mercy of individuals associated with the computer industry.

Research was read on the subject of the general effects of computer-based education and the specific area of its effect on reading, composition, and informational utilization. The reported results were predominately positive toward CBI. One study reported that the students exposed to CBI made continuous percentile gains, while the non-CBI students remained at the same approximate level (Bell, 1983). Other researchers reported similar conclusions.

Studies were completed to find if students benefited more from CBI at various levels of maturity. It was found that elementary children who receive computer-supported drill and practice showed performance gains of one to eight months over children who received only traditional instruction. This lead one researcher to conclude that elementary students fared better with computer-based teaching than did secondary students (Kulik, 1983).

Some of the studies focused on the nature of the student that benefited most from CBI. A study by Hoffman and Waters (1982) found that, "Learning by means of a computer-assisted program seemed to favor those (students) who had the ability to quietly concentrate, pay attention to details, had an affinity for memorizing facts, and could stay with a single task until completed" (Lawton and

Gerschner, p. 51, 1982). Another study found evidence that people who achieved by the use of a computer possessed such allied skills as mathematics and science (White, 1983). It was noted that a typical, sterotyped view could not be made of the student that achieved better through access to a computer.

A limited amount of research existed that found little to support the positive effects of computer-based instruction. One such study evaluated the use of the PLATO reading program. Students in kindergarten and first grade were selected for study. The project continued for a five year period and found no significant gains in achievement among the pupils involved in the program. The same study did find positive results from CBI when it was conducted in the subject of English. The study concluded that if only marginal results were realized within a particular discipline, substantial improvement was gained in computer literacy (Schuelke and King, 1983).

This researcher, however, could not find any studies that guaranteed that students could learn or would even like to learn on a computer (Lawton and Gerschner, 1982). Another study examined publisher developed computer software packages. The researcher concluded that the software did little more than aid the memorization of previously examined facts. It was speculated that schools should consider hardware that provided the possibility to author software (D. Grady, 1982).

In conclusion, the research was varied as to the expected results of computer-based instruction. Concensus did exist on the need for some type of computer instruction. There was also concensus that much thought and planning must take place before any computer curriculum be implemented.

This researcher was left with two opinions. A school that had computer literacy as the primary goal was more likely to achieve success than the school that used computers only as a mode of instruction. Second, the person responsible for the purchase of software should take extreme care in its selection.

Uniqueness of the Study

It has been illustrated, in previous portions of this paper, as to the huge expenditures the public schools have made for computer hardware and software. Even though the cost of equipment has shown a rapid decline, so has the school budget. Wisdom must, therefore, be exercised before the school enters the computer age.

The public served by each school corporation has demanded that their children be appropriately prepared to compete in a highly technological society. Meaningful instruction is required concerning the use of computers. Education has been exceedingly slow in the acceptance of this responsibility. Computer instruction must not follow the same course as did "new math" during the 1970's.

This research project was designed to provide for the needs of the students that attended Southeast Fountain Elementary School. It has listed the goals and objectives for a computer curriculum. This project has also provided the method by which the curriculum was to be implemented. The effect of this curriculum can only be evaluated at some future point in time. It is hoped, by this researcher, that adequate plans and study were made with regards to the design of the project.

CHAPTER III

Description of the Curriculum

A very important step in the development of the curriculum was the design it followed. The design of this project was to divide the topic into fourteen subtopics. Each subtopic is described in narrative form.

Implementation

A logical first step to implement any new curriculum should be to receive unilateral support from the local board of education. Next a financial commitment by the local board assures the presence of the necessary funds critical to a program's success. A computer curriculum requires significant expenditures to purchase the hardware and courseware. Failure is assured without a financial commitment from the board of education.

The Southeast Fountain Board of Education made a commitment to computer education in December, 1981. The board appropriated the funds to establish a computer lab at Fountain Central High School and to purchase three

Radio Shack microcomputers for a pilot program at Southeast Fountain Elementary School. The board directed this researcher to access the feasability of a computer curriculum at the elementary level. The computers were to be introduced in a limited fashion with periodic reports being made to the board. If the program were found to be a success, a larger commitment would be made by the board. The result has been the purchase of seven additional computers for the elementary school and the board directive to increase the level of implementation of computers into the curriculum. The board has gone on record to remain financially committed to maintain the computer curriculum.

After the board of education approved the establishment of a computer curriculum, coordinators were named at the elementary and secondary levels. The coordinators were directed to deal with anticipated problems, software and hardware selection, obtain supplemental materials, and prepare periodic progress reports for the board of education.

The next step in the implementation stage was to create the necessary environment for computers. Guidelines were developed for scheduling, placement, and security. The decision had been made that the computers were to be available for classroom use; therefore, mobility of the system was imperative. Security from theft or vandalism was achieved with the designation of a room that lacked access from the outside as the computer lab.

A plan was established for the purchase of hardware and software. This plan designated the computer coordinator with the responsibility to inform the staff of the compatible courseware available. The plan instructed the staff on the procedures that were to be followed for the requisition of materials.

The final step in this stage of implementation was the creation of a model for in-service instruction. The in-service program established eight workshops that ranged in topics from basic operation to the principles of program development. The education of the staff was seen as critical to the success of the project. This step, by necessity, was completed prior to the introduction of the computers into the classroom (Norwood, 1983).

Stage two of implementation of the computer curriculum was how it would be integrated into the present curriculum. The philosophy at Southeast Fountain was that computers should be integrated with regular classroom instruction, not treated as a separate entity or tacked onto the present curriculum (Christie and Dolan, 1982). Computer-assisted instruction was chosen as the means to accomplish integration into the curriculum.

A three step model was used to locate the areas of the present curriculum where the use of computers was appropriate. The first step was to analyze the current curriculum by subject area, to identify content, skills, and attitudes that are included. Step two was to determine what types of instructional activities were possible using computers. The final step was to compare the curriculum desires with the computer capabilities to find where matches occurred. The purpose was to find the locations where the computer and the curriculum were compatible. This step, in addition, identified the areas where computers were not appropriate (Brumbaugh and Rawitsch, 1982).

The application of the implementation model was to use the curricula that had previously been written and correlate them with the computer activities of tutorial, drill and practice, and simulation. The initial stage of integration was done in the five subject areas of language, social studies, science, mathematics, and spelling. Within each of these subject areas existed a list of program objectives. The program objectives originated with a program established in Indiana called the Comprehensive Assessment and Program Planning System (CAPPS). The CAPPS program objectives were used as a vehicle to identify the elements of the present curriculum compatible with computers. The pages which follow illustrate the results of the efforts to find those areas of compatibility:

LANGUAGE

Grade 2

TOPIC AREA	PROGRAM OBJECTIVES	COMPUTER ACTIVITY
Sentence and Paragraph Structure	In student directed and teacher directed activities, the student will write complete sentences or paragraphs using correct capitalization and punctuation.	None
Parts of Speech	In student directed and teacher directed activities, the student will use nouns, pronouns, verbs, adjectives, and adverbs in sentences.	Tutorial Drill and Practice
Reference Skills	In student directed and teacher directed activities, the student will use alphabetizing and the table of contents to locate information.	None
Composition	In student directed and teacher directed activities, the student will use sentence and paragraph structure to write poetry, short stories, and letters.	None

LANGUAGE

Grade 3

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Sentence and Paragraph Structure	In student directed and teacher directed activities, the student will use punctuation, capitalization, and word order to write sentences and paragraphs.	None
Parts of Speech	In student directed and teacher directed activities, the student will use nouns, pronouns, adjectives, verbs, and adverbs to write sentences and paragraphs.	Drill and Practice Tutorial
Reference Skills	In student directed and teacher directed activities, the student will use alphabetizing, homonyms, synonyms, antonyms, and rhyming words.	Tutorial
Composition	In student directed and teacher directed activities, the student will use sentence structure and paragraph structure skills to write stories, letters, reports, and poetry.	None

LANGUAGE

Grade 4

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Sentence and Paragraph Structure	In student directed and teacher directed activities, the student will use correct punctuation and capitalization for sentence and paragraph structure.	None
Parts of Speech	In student directed and teacher directed activities, the student will recognize and use the following parts of speech: nouns, pronouns, verbs, adverbs, and adjectives in sentence patterns.	Drill and Practice Tutorial
Reference Skills	In student directed and teacher directed activities, the student will use the dictionary and/or encyclopedia for the following skills: alphabetizing, locating guide words, entry words and word definitions, using comparisons and index.	Tutorial
Composition	In student directed and teacher directed activities, the student will compose stories, poems, and reports to be presented orally or written.	None

LANGUAGE

Grade 5

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Sentence and Paragraph Structure (Punctuation and Capitalization)	In student directed and teacher directed activities, the student will be able to use correct punctuation and capitalization in sentence and paragraph construction.	Tutorial
Parts of Speech	In student directed and teacher directed activities, the student will be able to identify and use the following parts of speech: nouns, verbs, adverbs, adjectives, noun markers, and pronouns.	Drill and Practice Tutorial
Reference Skills	In student directed and teacher directed activities, the student will be able to use the dictionary and encyclopedia for the following skills: locate guide words and entry words, alphabetizing, locate word meanings, use of card catalog, use of encyclopedia indexes, and use of pronunciation key.	Tutorial
Composition	In student directed and teacher directed activities, the student will be able to present orally or as written work the following: paragraphs, poems, stories, letters, and reports.	None

LANGUAGE

Grade 6

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Sentence and Paragraph Structure	In student directed and teacher directed activities, the student will use correct punctuation and use parts of speech for sentence and paragraph structure.	Drill and Practice Tutorial
Parts of Speech	In student directed and teacher directed activities, the student will identify and use the following parts of speech: nouns, verbs, adverbs, adjectives, pronouns, prepositions, conjunctions, and interjections.	Drill and Practice Tutorial
Reference Skills	In student directed and teacher directed activities, the student will use the encyclopedia, atlas, almanacs, card catalogs, the Dewey Decimal System, and the dictionary to develop the following skills: alphabetizing, locating information in the library, finding information in the dictionary, using a card catalog, and using an index.	Tutorial
Composition	In student directed and teacher directed activities, the student will compose stories, poems, and reports, to be presented in oral and written form.	None

SOCIAL STUDIES

Grade 2

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Locating Information	In student directed and teacher directed activities, the student will locate information from books and gather information from resource people and develop geographic skills in using maps.	Tutorial
Organizing and Evaluating Information Through Reading, Listening, and Observing	In student directed and teacher directed activities, the student will organize and evaluate information acquired through reading, listening, observing, and oral and written communication.	Tutorial
Interpreting Pictures, Charts Graphs, Tables, Maps, and Globes	In student directed and teacher directed activities, the student will interpret pictures, charts, graphs, tables, maps and globes.	Tutorial
Reading and Understanding Social Studies Material Through Applying Problem-Solving and Critical-Thinking Skills	In student directed and teacher directed activities, the student will read and understand social studies material by applying problem-solving and critical-thinking skills.	Simulation
Understanding Time and Chronology	In student directed and teacher directed activities, the student will develop an understanding of the time system and chronology.	Simulation

SOCIAL STUDIES

Grade 3

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Locating Information	In student directed and teacher directed activities, the student will locate information in text books, on maps, globes, and weekly news magazines.	None
Organizing and Evaluating Information Through Reading, Listening, and Observing	In student directed and teacher directed activities, the student will organize and evaluate information through reading, listening, observing, and oral and written communication.	Simulation
Interpreting Pictures, Charts, Graphs, Maps, and Globes	In student directed and teacher directed activities, the student will interpret pictures, charts, graphs, maps, and globes.	Simulation
Reading and Understanding Social Studies Material Through Applying Problem-Solving and Critical-Thinking Skills	In student directed and teacher directed activities, the student will read and understand social studies material by applying problem-solving and critical-thinking skills.	Simulation
Understanding Time and Chronology	In student directed and teacher directed activities, the student will learn to relate time and chronology to specific events.	Tutorial

SOCIAL STUDIES

Grade 4

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Locating Information	In student directed and teacher directed activities, the student will locate information from text books, encyclopedias, reference books, dictionaries, field trips, and audio-visual materials.	Tutorial
Organizing and Evaluating Information Through Reading, Listening, and Observing	In student directed and teacher directed activities, the student will make an outline and/or summary of topics to be investigated by organizing and evaluating information secured through reading, listening, observing and oral communication.	Tutorial
Interpreting Pictures, Charts, Graphs, Tables, Maps and Globes	In student directed and teacher directed activities, the student will relate information derived from pictures, charts, graphs, tables, maps, and globes with that gained from the textbook.	Simulation
Reading and Understanding Social Studies Material Through Applying Problem-Solving and Critical-Thinking Skills	In student directed and teacher directed activities, the student will apply problem-solving and critical-thinking skills to define and interpret social studies material.	Simulation
Understanding Time and Chronology	In student directed and teacher directed activities, the student will develop an understanding of events as part of a chronological series of events and an understanding in duration of various periods of time.	Tutorial

SOCIAL STUDIES

Grade 5

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Locating Information	In student directed and teacher directed activities, the student will locate information from text books, encyclopedias, dictionaries, newspapers, magazines, library materials, maps, and globes.	None
Organizing and Evaluating Information Through Reading, Listening, and Observing	In student directed and teacher directed activities, the student will make an outline of topics to be investigated, organize and evaluate information through reading, listening, observing, and written and oral communciation.	Simulation
Interpreting Pictures, Charts, Graphs, Tables, Maps and Globes	In student directed and teacher directed activities, the student will recognize pictures, charts, tables, and maps as sources of information and relate information from pictures, charts, graphs, tables, maps, and globes with that gained from other sources.	Drill and Practice
Reading and Understanding Social Studies Material Through Applying Problem-Solving and Critical-Thinking Skills	In student directed and teacher directed activities, the student will read social studies material and will apply problem-solving and critical-thinking skills to analyze social studies materials.	Simulation
Understanding Time and Chronology	In student directed and teacher directed activities, the student will develop an understanding of events as part of a chronological series of events and an understanding of various periods of time.	Tutorial

SOCIAL STUDIES

Grade 6

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Locating Information	In student directed and teacher directed activities, the student will locate information from books, encyclopedias, reference books, dictionaries, newspapers, magazines, field trips, audio-visual materials, libraries, maps, and globes.	None
Organizing and Evaluating Information Through Reading, Listening and Observing	In student directed and teacher directed activities, the student will make an outline of topics to be investigated, evaluate information, make tentative conclusions and acquire information through reading, listening, and observing.	Simulation
Interpreting Pictures, Charts, Graphs, Tables, Maps and Globes	In student directed and teacher directed activities, the student will interpret pictures, charts, graphs, tables, maps, and globes.	Drill and Practice
Reading and Understanding Social Studies Material Through Applying Problem-Solving and Critical-Thinking Skills	In student directed and teacher directed activities, the student will interpret and evaluate social studies material by applying problem-solving and critical-thinking skills for the purpose of summarizing and drawing tentative conclusions.	Simulation
Understanding Time and Chronology	In student directed and teacher directed activities, the student will develop an understanding of the time system and chronological events.	Tutorial

SCIENCE

Grade 2

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Motor Skills Development	In student directed and teacher directed activities, the student will use and read simple devices to measure properties of phenomena being observed and perform simple laboratory procedures by the use of the five senses.	Simulation
Information Processing Skills Development	In student directed and teacher directed activities, the student will utilize classification systems in order to discriminate among simple phenomena (objects/events) and test simple predictions about simple phenomena.	Simulation
Problem Solving and Decision Making Strategies Development	In student directed and teacher directed activities, the student will propose solutions of simple problems and appropriately modify ineffective solutions.	Simulation
Affective Skills Development	In student directed and teacher directed activities, the student will question scientific phenomena and explore various ways of using scientific knowledge.	Simulation Tutorial
Science Communication Skills Development	In student directed and teacher directed activities, the student will be able to gather, organize, and use science information from text books, trade books and other media to describe objects and events to others.	Simulation

SCIENCE

Grade 3

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Motor Skills Development	In student directed and teacher directed activities, the student will use and read simple devices to measure phenomena being observed and perform simple laboratory procedures.	Simulation Tutorial
Information Processing Skills Development	In student directed and teacher directed activities, the student will make and test simple predictions about simple phenomena.	Simulation
Problem Solving and Decision Making Strategies Development	In student directed and teacher directed activities, the student will continue to select from his/her experiences those which might help him/her solve simple problems.	None
Affective Skills Development	In student directed and teacher directed activities, the student will continue to ask questions and examine phenomena in order to gain a better understanding of how things occur.	Simulation
	In student directed and teacher directed activities, the student will continue to explore new ways of doing things.	None
	In student directed and teacher directed activities, the student will consider how his/her problem solution will affect other people.	Simulation

SCIENCE

Grade 3, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Science Communication Skills Development	In student directed and teacher directed activities, the student will be able to gather, organize and use scientific information from text books, encyclopedias, other media and to obtain science information from resource persons such as teachers, parents, older siblings, etc.	Tutorial
	In student directed and teacher directed activities, the student will describe objects and events to others in sufficient detail that they can identify the thing being described and discuss real life observations orally or with written stories.	None

SCIENCE

Grade 4

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Motor Skills Development	In student directed and teacher directed activities, the student will demonstrate the motor coordination necessary to manipulate objects in the environment and to use investigative instruments designed either to extend the five senses or to make observable phenomena not ordinarily detectable by the senses.	Simulation
Information Processing Skills Development	In student directed and teacher directed activities, the student will explore his/her environment by using the information gathering skills of observing, classifying, using number and space/time relationships, making inferences, and recognizing variables.	Tutorial
	In student directed and teacher directed activities, the student will organize and interpret data about observed phenomena in order to make and test predictions about yet unobserved phenomena.	Simulation
	In student directed and teacher directed activities, the student will design and carry out simple experiments which incorporate the use of operational definitions to test self-formulated hypotheses and/or models.	Simulation Tutorial
Problem Solving and Decision Making Strategies Development	In student directed and teacher directed activities, the student will undertake the solution of his/her empirical problems by selecting, interpreting, and organizing both acquired and previously generated knowledge pertinent to the problem.	Simulation Tutorial

SCIENCE

Grade 4, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Problem Solving and Decision Making Strategies Development	In student directed and teacher directed activities, the student will undertake the solution of his/her empirical problems by hypothesizing testable solutions, developing procedures for testing the solutions, and objectively interpreting the data generated by the test of his/her proposed solutions.	Simulation
Affective Skills Development	In student directed and teacher directed activities, the student will demonstrate his/her belief that scientific knowledge is self-corrective and revisionary by demanding verification of scientific concepts, theories, and principles; and by modifying and retesting his/her hypothesized problem solutions as dictated by objective data interpretation.	Simulation
	In student directed and teacher directed activities, the student will demonstrate his/her belief that scientific knowledge is tentative, and not absolute, by a willingness to accept modifications of previously held scientific concepts, theories, and principles, and by subjecting the knowledge he/she has generated in solving a problem to repeated testing for verification.	Tutorial
	In student directed and teacher directed activities, the student will demonstrate an appreciation of the fact that one's own scientific knowledge shapes his/her perceptions of the physical and social environment by exploring the premises and consequences of various problem solutions.	None

SCIENCE

Grade 4, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Science Communication Skills Development	In student directed and teacher directed activities, the student will demonstrate the ability to gather and evaluate previously generated scientific knowledge by appropriate use of relevant sources of information.	Simulation
	In student directed and teacher directed activities, the student will demonstrate the written (including graphics) and oral language skills necessary to transmit both self-generated and acquired knowledge to others in a form which is meaningful to the intended audience.	None

SCIENCE

Grade 5

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Motor Skills Development	In student directed and teacher directed activities, the student will estimate and measure dimensions, durations, etc. of phenomena with respect to common objects, events and/or standard units by using simple magnifying devices and construction tools.	Tutorial Drill and Practice
Information Processing Skills Development	In student directed and teacher directed activities, the student will use basic scientific concepts in recognizing classification systems, manipulating, developing predictions, and testing hypotheses using variables.	Simulation
Problem Solving and Decision Making Strategies Development	In student directed and teacher directed activities, the student will be able to make orderly use of the information processing skills to keep simple records of testing results and to more effectively modify solutions.	None
Affective Skills Development	In student directed and teacher directed activities, the student will conduct multiple tests of his predictions and to adjust his concepts and understandings of nature to include new knowledge gained through additional experiences.	Simulation

SCIENCE

Grade 5, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Science Communications Skills Development	In student directed and teacher directed activities, the student will use a variety of science information sources to gather, organize, and summarize the information needed for better understanding his environment and will describe results of simple experiments and problem solving efforts in oral, written, and/or graphic forms.	Tutorial

SCIENCE

Grade 6, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Science Communication Skills Development	In student directed and teacher directed activities, the student will expand his/her knowledge of basic concepts and principles through research, observation, and experimentation and will summarize and describe his/her findings in oral, written, and/or graphic form that is intelligible to classmates, parents, associates, and teachers.	None

MATHEMATICS

Grade 2

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Numbers and Numeration	In student directed and teacher directed activities, the student will read and write numbers, understand place value, recognize even and odd numbers and fractional parts of a whole.	Drill and Practice Tutorial
Operations and Computations	In student directed and teacher directed activities, the student will master the basic facts for simple addition and subtraction and regrouping problems.	Drill and Practice
Geometry	In student directed and teacher directed activities, the student will recognize and compare sizes and shapes.	Tutorial
Measurement	In student directed and teacher directed activities, the student will tell time, recognize coin value, make change, measure length, read a thermometer and recognize units of capacity.	None
Problem Solving and Number Sentences	In student directed and teacher directed activities, the student will write and solve appropriate number sentences for story problems using addition and subtraction and write the correct symbols to make a true sentence.	Tutorial
Graphing and Relations	In student directed and teacher directed activities, the student will construct a graph from data and interpret information.	None

MATHEMATICS

Grade 3

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Numbers and Numeration	In student directed and teacher directed activities, the student will read and write numbers and recognize place value, even and odd numbers, and fractions.	Tutorial
Operations and Computations	In student directed and teacher directed activities, the student will demonstrate the mastery of basic facts for addition, subtraction, multiplication, and division and use these facts for computation.	Drill and Practice
Geometry	In student directed and teacher directed activities, the student will recognize and compare sizes and shapes.	Tutorial
Measurement	In student directed and teacher directed activities, the student will tell time, make change, measure length, recognize units of capacity and read a thermometer.	None
Problem Solving and Number Sentences	In student directed and teacher directed activities, the student will write a number sentence for a story problem, solve open sentences and recognize symbols to make a true sentence.	Tutorial
Graphing and Relations	In student directed and teacher directed activities, the student will construct a bar graph from data and interpret information from a bar and picture graph.	None

MATHEMATICS

Grade 4

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Numbers and Numeration	In student directed and teacher directed activities, the student will read and write whole and fractional numbers, Roman numerals, and name numbers in different ways.	Tutorial
Operations and Computations	In student directed and teacher directed activities, the student will master the basic facts in addition, subtraction, multiplication and division and perform the operational computations.	Drill and Practice
Geometry	In student directed and teacher directed activities, the student will apply the terminology and concepts in solving geometric problems.	None
Measurement	In student directed and teacher directed activities, the student will tell time, make change, measure distances, recognize units of capacity, read a thermometer, and compare metric measurement.	Tutorial
Problem Solving and Number Sentences	In student directed and teacher directed activities, the student will write and solve number sentences for story problems for addition, subtraction, mulitplication, and division, and will place the proper symbols to make a true number sentence.	Tutorial
Graphing and Relations	In student directed and teacher directed activities, the student will read and construct bar, line, circle, and picture graphs; determine averages.	None

MATHEMATICS

Grade 5

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Numbers and Numeration	In student directed and teacher directed activities, the student will read and write and place in order whole numbers, fractions, decimals, mixed numerals, Roman numerals, percentages, integers, bases and know the place value of digits and numerals; round numbers to a given place and find factors of numbers.	Tutorial
Computations	In student directed and teacher directed activities, the student will add, subtract, multiply, and divide whole numbers, fractions and decimals; will estimate sums, product differences and quotations.	Drill and Practice
Geometry	In student directed and teacher directed activities, the student will measure and construct, recognize and name angles; identify characteristics of and compute the volume of rectangular prism; define points, segments, rays, line, curves, cones, cylinders, pyramids, spheres; identify symmetric and congruent figures.	Tutorial
Measurement	In student directed and teacher directed activities, the student will measure distances, calculate relationships within the metric and English system, construct and interpret scale drawings; identify basic prefixes.	Tutorial

MATHEMATICS

Grade 5, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Problem Solving and Number Sentences	In student directed and teacher directed activities, the student will solve word problems and determine the validity of sentences.	None
Graphing and Relations	In student directed and teacher directed activities, the student will locate ordered parts of whole nubmers on a graph; interpret and construct graphs and diagrams in solving problems.	None
Probability and Statistics	In student directed and teacher directed activities, the student will state the probability that an event will occur, construct a frequency table from a collection of data and find the average; identify elements of random sampling.	Tutorial
Consumerism	In student directed and teacher directed activities, the student will be able to determine and calculate unit prices.	Tutorial

MATHEMATICS

Grade 6, continued

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Measurement	In student directed and teacher directed activities, the student will add, subtract, multiply, read and identify measurements of English and metric systems, tell time, convert measurements from one unit to another within the metric and English system; choose an appropriate measurement unit for a given situation; construct and interpret scale drawings.	Tutorial
Problem Solving and Number Sentences	In student directed and teacher directed activities, the student will solve word problems, determine the validity of number sentences and know how to use a calculator.	None
Graphing and Relations	In student directed and teacher directed activities, the student will locate ordered pairs of whole numbers on a graph; interpret and construct graphs and diagrams in solving problems.	Tutorial
Probability and Statistics	In student directed and teacher directed activities, the student will state the probability that an event will occur; construct a frequency table from a collection of data and find the average; identify elements of random sampling.	Tutorial
Consumerism	In student directed and teacher directed activities, the student will determine and calculate unit prices; construct a simple budget; apply percentage to prices such as sales tax, discounts, savings and loans.	Tutorial

SPELLING

Grade 2

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Word List	In student direced and teacher directed activities, the student will write the words from the structured word list.	Drill and Practice
Word Meaning and Structure	In student directed and teacher directed activities, the student will use the meanings, word patterns, and structural elements of words.	Tutorial
Dictionary Skills	In student directed and teacher directed activities, the student will use the dictionary for meaning to locate guide and entry words, and assist in alphabetizing.	None

SPELLING

Grade 3

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Word List	In student directed and teacher directed activities, the student will write the words from the structured word list.	Drill and Practice
Word Meaning and Structure	In student directed and teacher directed activities, the student will use the meanings, word patterns, and structural elements of words.	Tutorial
Dictionary Skills	In student directed and teacher directed activities, the student will use the dictionary for the spellings, syllabications, pronunciation, derivations, and meanings of words.	None

SPELLING

Grade 4

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Word List	In student directed and teacher directed activities, the student will spell correctly words from the structured words lists.	Drill and Practice
Word Meaning and Structure	In student directed and teacher directed activities, the student will use word meanings, phonemic-graphic patterns, and the structural and lexical elements of words.	Tutorial
Dictionary Skills	In student directed and teacher directed activities, the student will use the dictionary for re-spelling, spelling, parts of speech, meaning, and pronunciation.	None

SPELLING

Grade 5

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Word List	In student directed and teacher directed activities, the student will be able to spell the list words from the fifth grade text book.	Drill and Practice
Word Meaning and Structure	In student directed and teacher directed activities, the student will be able to use the phonemic-graphemic patterns and the structural relationships of words.	Tutorial
Dictionary Skills	In student directed and teacher directed activities, the student will be able to use the dictionary for checking the spellings, syllabications, pronunciations, derivations, parts of speech, and meanings of words.	None

SPELLING

Grade 6

TOPIC AREA	PROGRAM OBJECTIVE	COMPUTER ACTIVITY
Word List	In student directed and teacher directed activities, the student will spell correctly the words from the structured word lists from the sixth grade text book.	Drill and Practice
Phoneme-Grapheme Correspondence	In student directed and teacher directed activities, the student will use phoneme-grapheme correspondences to write word lists.	Tutorial
Word Meaning	In student directed and teacher directed activities, the student will use the words from the sixth grade text book in proper oral and written context.	None
Structural Analysis	In student directed and teacher directed activities, the student will use structural analysis to write the words in the structured word list from the sixth grade text book.	None
Dictionary Skills	In student directed and teacher directed activities, the student will read the dictionary entry word from the sixth grade text book and retrieve and use the information about the selected words.	None

The last stage of implementation was the establishment of classes expressly for computer literacy and program development. The courses created were to be in addition to the remainder of the computer curriculum. The necessity existed to develop goals and objectives for each course. The students were identified that would receive this instruction; the person that would teach each class was named; and the method was established by which the classes would be scheduled into the curriculum.

The total implementation of the computer curriculum was expected to follow four phases. The first phase was to achieve the support of the board of education. This phase was completed in 1981. The second phase was to pilot a limited program in the 1982-83 school term. This phase has reached conclusion. The conclusion of phase two, as reported to the local board of education in June, 1983, resulted in the recommendation and subsequent approval, to expand the use of computers into the remainder of the curriculum. The third phase is to increase the amount of hardware and software necessary for the expansion of computer usage. Included in the expanded computer curriculum is the addition of the classes on literacy and program development. Phase three of the implementation of the computer curriculum began with the 1983-84 school term. The final phase will elicite areas where problems have occurred. A list of recommendations will be generated for the improvement and refinement of the computer curriculum.

Scope and Sequence

Valid curricula should include a plan that details the content of the instruction and identifies the students to receive the instruction. This curriculum included two strands. The broadest strand is the study of computer literacy. Since this topic was general in nature, literacy was further divided into three sections. The second major strand is the use of a computer language to program the computer.

Computer literacy was divided into the topics of basic operation, history, and uses. The content of basic operation included the skills of turning the computer on and off, loading software, operating a programmed computer, and saving loaded software.

The ability to power-up the computer was a minor, but necessary, lesson. The student had to be instructed as to the appropriate sequence to follow once the computer was operational. The TRS-80, for example, required a response to certain operational modes once the term "Cass?" appeared on the video monitor. If the student was to load a program, then the response L must be typed. The next computer display was "Memory Size?". The student responded by pressing the ENTER key. The computer then displayed the term "READY". The student typed "CLOAD" and observed the blinking asterisks which indicated the program was being loaded.

After the program has been loaded the student gives the appropriate command to cause the program to operate. In all circumstances this command was RUN. This command, however, may cause the program to generate specific instructions that were to be interpreted by the operator and completed so that the program would continue through its various designed tasks. Since there existed great variance in the nature of these instructions, the student could only be instructed to follow the computer generated instructions.

Once the student properly loaded a program, he/she was instructed to create a back-up copy of the program. The steps required were to return the program to its start, set the cassette recorder to record, and type the command CSAVE "Title". The student was instructed that a saved program was strictly for personal use and not for distribution to others.

The student was instructed that the computer may be set for operation that does not use pre-authored software. The instructions for this type of operation were similar. Once the computer was powered-up, the student's only response was to press the ENTER key two times. The computer response was a prompt symbol and the word READY on the monitor. The student was then prepared to place input into the computer. The input may have taken the form of a program or mathematical computation completed in the immediate mode of the computer.

The student received instruction on the history and uses of the computer. The topics were introduced with a three hour filmstrip cassette presentation. The presentation reviewed the evolution of the computer from its earliest form to the present use of micro-chips. The student was made aware of the degree the computer had become involved in our daily lives. Computers used in billing, finance, retail stores, and the manufacture of goods were subjects included as examples. As a culminating activity, the students participated in a field trip to a local business that used microcomputers.

The second strand taught was the development of computer programs. The foundation for instructional computer programs was the ability to use pre-authored software. Students who were already experienced with the various software packages were given instructions on program development.

Students, taught to program, learned that there are several program languages. BASIC, however, was introduced as the language they would use. They were instructed as to the various commands, statements, and rules involved in the use of this language.

The students began their experience at program development through the inspection of a problem to be solved. The student then listed the steps involved in its solution. The solution was then compared with a program and each program line was correlated with each step in the solution.

The student read several programs, predicted the outcome of each, and entered them into the computer for comparison before they developed any programs. The first experience the student received in writing a program was to complete a program that had several essential components left blank. A form of the cloze procedure was used to develop the student's ability to recognize the importance of each aspect of a computer program.

Following practice of this nature, the student was prepared to begin the development of simple linear programs. The initial programs were short, five to ten lines, and contained only REM and PRINT statements. The concept taught the logical order of a computer program.

Once the students were proficient at this level of program development, they were introduced to advanced program techniques. Instruction at this level included the use of loops, alpha-numeric variables, input statements arrays, and the use of graphics. The primary intent of the instruction was the student's awareness of the value of a computer program. Students, at this level, were able to write a single program that was applicable to many problems. The students recognized that the same program could be used many times over to solve similar problems.

Within the study of program development, the students were taught the types of computer errors that exist. Examples were given of computer-detected errors and logical errors. The instruction also included the necessary steps to follow when either error was encountered.

In conclusion, all students in grades two through six participated at some level with the computer. Obviously, the level of the student dictated the type of instruction received. Due to a variety of factors, only certain students received a higher degree of instruction in both strands. The selection of those students is described in another portion of this paper. The chart that follows illustrates the scope and sequence of instruction.

Scope and Sequence

Skill \ Grade	2nd	3rd	4th	5th	6th
Literacy					
Operation	■	■	■	■	■
History			■	■	■
Uses			■	■	■
Programming					
Inputting Programs			■	■	■
Completing Programs				■	■
Writing Linear Programs				■	■
Writing Advanced Programs					■

Selection of Pupils

The philosophy at Southeast Fountain was to give all students hands-on experience with the computer. It was recognized that the phrase computer literacy implied many concepts. Ideally all students should have the opportunity to become as computer literate as their abilities would permit. However, due to limited equipment and time within the school's schedule, the ideal could not be achieved. A method was created to select certain students for a greater degree of instruction.

Southeast Fountain had an enrollment of 620 students in grades one through six. The school owned nine computers available for student use. A plan was developed that provided the maximum efficiency of machine usage and at the same time provided meaningful experience for the student.

The computer curriculum committee decided not to involve the first grade students. They were excluded because of several factors. It was believed that students at this level were already bombarded with a significant amount of information. First grade students often have great difficulty in their adjustment to school. Further, a priority existed that placed the ability to read, write, and do mathematical computations above all else in the curriculum. Finally, first grade students will have ample opportunity to have contact with the computer during the remainder of their elementary school experience.

The second point of the plan was that all students in grades two through six need some level of computer literacy. It was the responsibility of the administrative and teaching staff to integrate the use of computers into the curriculum. This was achieved through the use of drill and practice, simulation, and tutorial software. The literacy level attained was the ability to manipulate the keyboard, operate loaded programs, and gain confidence in computer operation. These skills were all in addition to the knowledge gained from the content of the programs the student operated. This method was chosen so that every time the student worked with the computer, the activity would be relevant and meaningful.

It was the decision of the principal to select students in the fourth, fifth, and sixth grades to receive additional instruction on computer literacy and program development. The students were selected through the use of two criteria. The first criteria was achievement based on the results of the testing program that was maintained at Southeast Fountain. A student, to be selected, needed to score at or above the 90th percentile on the total reading test. The second criteria was the student's placement in reading class. Southeast Fountain maintains ten reading classes in each grade. Each teacher is assigned two classes.

The selected student needed to be placed in one of the two highest classes.

There were several reasons for this selective procedure. Reading scores were used because it was perceived that the reading scores were a more accurate preditor of student success. Achievement was used as a criteria; therefore, the students with the greatest mental potential would be assured the opportunity to gain additional knowledge. Reading placement was a criteria because it was an indicator that those students with the ability also displayed task commitment.

The administrators and teachers at Southeast Fountain agreed that great potential existed for errors in this selective process. The attitude existed that any process contained potential error. A vehicle was needed to correct any error in the selection of the students. Teachers were to be alert for any student that may have been missed in the process. Upon the recommendation of a teacher, any student that was otherwise eliminated may be included in the computer program. The computer teacher may remove a student from the program if he or she could not achieve in the class. Great care, however, was exercised in the latter.

In conclusion, the need to select students was derived from the desire to offer a computer course. This course was to be placed in the total curriculum. The school day had already been consumed by state mandated subject areas; therefore, the computer course had to be created without any available time slot in the schedule. The reading class at Southeast Fountain was one hour and twenty minutes in length. This made it possible for one group of students to meet for computer instruction one day per week without a violation of the mandated time for reading instruction. Obviously, it was not appropriate to shorten, by one fifth, the amount of reading all students were to receive. Reading maintains a higher priority for all students than does computer instruction. However, the process provided a means for the identification of students that had demonstrated their ability to learn additional subject matter.

Computer Literacy: All Students Grades 2 - 6

The term computer literacy has been a phrase used to encompass many concepts. Literacy was the catch-word in much of the literature that was researched. Unfortunately, a clear, consistent definition was not found. The development of a definition for computer literacy was like an attempt to aim at an unsteady target (Levin, 1983).

A majority of the experts that have written articles and have done research, related to computer instruction, agreed on the need for programs that achieved a certain level of literacy. Consistency existed relevant to the reason for the necessity of literacy programs. The basic concept was that society has become very technical in its methods to process information. Individuals must become computer literate in order to maximize their abilities to solve problems (Brumbaugh and Rawitsch, 1982).

If one were to use a broad definition of literacy, then any activity that has brought the student into contact with the computer has increased the literacy of that person. Any computer related activity has the potential to be included in the study of computer literacy.

Curricula and educators need direction. An acceptable definition must be constructed. Three elements of literacy were identified and included in the definition. Computer literacy is a general understanding of electronic computing; an area of knowledge that includes (1) an understanding of the technology used when processing information, (2) an understanding of the effects that computers have had and will have on society, and (3) an understanding of how computers are problem-solving tools (Horn and Poirot, 1981). This definition implied that the student should gain some knowledge of the component parts, specialized vocabulary, and various acronyms used in computer terminology (Watt, 1980). A further implication was that the student be exposed to the history and development of the computer (Inskeep, 1982).

Educators have long recognized that after the introduction of a skill it must be followed by constant reinforcement. Teaching computer literacy may be compared in a similar fashion to any other skill. Students cannot become literate unless the instruction be presented in a continuous manner. A valid computer program must be integrated with each of the other curricula (Brumbaugh and Rawitsch, 1982). Integration was accomplished through the application of the computer and appropriate software into the subjects of language, social studies, science, mathematics, and spelling. The instructional methods were limited to drill and practice, tutorial, and simulation. The ability to read and write computer programs was an additional method; however, it was not introduced or reinforced by the classroom teacher. Program development was taught only by the computer science teacher to a selected group of students. The following charts depict each method that was used in each of the five selected subject areas by grade level:

2nd, 3rd, and 4th Grades

Method \ Subject Area	Language	Social Studies	Science	Math	Spelling
Drill and Practice	X			X	X
Simulation		X	X		
Tutorial	X	X	X	X	X

5th and 6th Grades

Method \ Subject Area	Language	Social Studies	Science	Math	Spelling
Drill and Practice	X	X	X	X	X
Simulation		X	X		
Tutorial	X	X	X	X	X

The classroom teacher selected the desired software and hardware from the library. An example may have been a need for drill and practice with basic subtraction facts. The math teacher would have selected the appropriate program, checked the necessary computers out for math class, and assigned the pupils in need of the practice to a programmed computer. The activity took place in the math room under that particular teacher's supervision. The management of the software and hardware was under the supervision of the computer coordinator.

This aspect of the computer was applied to all the students in grades two through six. Specific instruction related to the computer was not given. The only goals were to expose the students to the computer, reduce any fear the students may have had, give the students the confidence and knowledge that they control the computer's operation, and to make the teacher more efficient in the operation of a particular class. Not all the elements of the definition of literacy were met with all students. Students, who were to receive more detailed instruction, were selected for a special computer science class as described in the next portion of this project.

Special Class for Literacy

This researcher felt that a study of computer literacy as a specific subject area required special circumstances. Such qualities as the mature ability of the student to understand and appreciate the material presented and the necessity of a competently trained teacher were factors of consideration. For those reasons a class was created for computer literacy at Southeast Fountain.

The students selected for this class were in the fourth grade. They were selected by using two criteria: (1) past record of achievement; and (2) placement in one of the two highest reading groups. The reasons for selection based on this criteria were that the students involved have the ability for relatively technical material to be meaningful. Placement in the highest reading group indicated that the students have demonstrated a level of maturity that enabled them to make use of this ability. It was this researcher's contention that selection on ability would not insure the students would commit themselves to the task at hand.

The recognition was made that using such limited criteria for selection may create a degree of error. Students may be selected that were not ready to accept the material presented and students may be excluded that would otherwise have performed at a very high level. Students were moved into and out of this class to eliminate this problem. An environment was desired that was absent of threat. Provisions were made for students that were or were not ready for the type of instruction offered, regardless of any pre-determined criteria.

This special class was arranged to be offered one day per week. The period length was one hour and twenty minutes. Due to the current full schedule, the class was held at the same time as the scheduled reading class. Special provisions were made at Southeast Fountain so each teacher has two reading groups. The reading teacher with a designated computer group also had a reading group of low ability students. This gave that teacher the opportunity to have one day per week to concentrate only on children that had experienced difficulty with reading.

The length of time was considered to be minimal. The retention of material was expected to be a factor that would impede instruction. This method of scheduling was considered to be a compromise between providing computer literacy instruction and maintaining the remainder of the curriculum.

Five goals were adopted for this class. The recognition was made that students needed to know how computers affect society. Students should recognize the potential problems associated with the use of computer technology and participate in the solution of these problems. Literacy required some knowledge of how computers were instructed. The students must recognize that people control computers. An elementary concept of how a computer works was desired in order for students to become unintimidated by the notion that the computers were too complex to be used and understood by most people. Students were taught how computers were used in society to give the course a measure of relevance. Finally, students were taught how computers are operated so they will be self-sufficient in the use of computer technology (Brumbaugh and Rawitsch, 1982).

This researcher believed that exposure to the computer was perhaps the best ingredient in the instruction of computer literacy. The more time each student was able to operate the computer, the more confidence that student gained in his ability. Game-type activities with the computer may be appropriate to introduce the student to the computer. Computer games can assist the student to learn, however, informed and directed teaching must follow to fully develop the students grasp of the computer's potential (Inskeep, 1982). The need for organized instruction lead to the development of the following objectives for the fourth grade computer literacy class:

(1) The student will learn to power-up the computer.

(2) The student will learn to place random input into the computer in order to become familiar with the keyboard.

(3) The student will do simple mathematical calculations on the keyboard using the PRINT statement.

(4) The student will input their name and address into the computer, with and without proper punctuation and the PRINT statement.

(5) The student will demonstrate a knowledge of the PRINT, RUN, NEW, and LIST statements both meanings as related to computers and function.

(6) The student will define the difference between a micro, mini, and main frame computer.

(7) The student will become aware of some of the many applications of a computer.

(8) The student will load a program from cassette tape using the tape player as an input device.

(9) The student will RUN a program that has been loaded into the computer.

(10) After viewing selected audio-visual presentations, the student will list some of the many capabilities of the computer.

(11) The student will research and list the areas where computers are in use.

(12) The student will participate in at least one field trip to see the applications of a computer.

Each stated objective was written specifically for the fourth grade, however, they cannot be considered mutually exclusive. Once a solid foundation had been made, the same objectives were reinforced in computer classes at the fifth and sixth grade level. Computer literacy is a continued process, it was not introduced at one level and never reinforced at later levels.

The development of a plan of instruction with regards to computer literacy included various factors. The numerous terms were considered that were used in computerized instruction. Methodologies were developed to assess the effectiveness of the project. Provision was made for a variety of software. Finally, the various aspects of implementation which may contribute to the student's fear of the computer were considered (Lawton and Gerschner, 1982).

Programming

The ability to program a computer was a skill that was to be an essential part of the computer curriculum at Southeast Fountain. Program development was viewed as an intricate aspect of computer literacy and needed to be included in the school's overall computer educational effort. The concept was that the ability to tell the computer what to do required a basic knowledge of a computer programming language (Levin, 1983).

There were four benefits noted for the inclusion of instruction on programming. Obviously, the primary goal was to teach the elementary skills necessary to write a computer program. The research completed on this topic indicated the existence of several secondary benefits. One such secondary affect was the potential improvement of the student's thinking skills. The research stated the very nature of the activities related to programming assisted the improvement of sequential thinking (Brumbaugh and Rawitsch, 1982). The precise type of skills that indicated improvement were solving problems and the improved ability of the student to think logically (Inskeep, 1982).

The recognition was made that certain factors existed that limited the number of students to receive instruction on computer programming. The limitations were: (1) available time within the schedule; (2) an insufficient number of computers to instruct large numbers efficiently; and (3) a lack of the mature ability of all students to receive instruction of a relatively technical nature.

Certain limitations existed at Southeast Fountain to necessitate the creation of a course for computer programming.

The students selected for this course were in the fifth and sixth grade. They were all members of one of the two highest reading groups in their respective grades. The class met one day per week for each group in the computer lab. The size of each group varied from twelve to eighteen.

The selection of the students actually began when they entered fourth grade. Fourth grade students were taught topics related to computer literacy. The same students with previous experience were placed in the programming class when they entered the fifth grade. Students in the programming class, therefore, did not begin without a knowledge of the operation of a computer.

There were exceptions made with respect to the selection of the students. Students new to the school were included if they demonstrated they had the ability. Students not otherwise selected were included if any teacher recommended they be in the class. A student was excluded if the computer science teacher determined the student either did not exhibit the maturity necessary for instruction of this nature, or if the student was observed to be frustrated by the class activities.

Consideration was given to the degree at which students should be taught to program. The notion that students were to be highly competent programmers was thought an inappropriate goal for the elementary level. The desire was to build the foundation that would permit the students to enhance their knowledge at the secondary and post-secondary levels. The major fault with the attempt to teach a high degree of programming was such instruction would be inconsistent with the purpose of an elementary school and the needs of the student. In addition, a significant likelihood existed that by the time students currently in the fifth or sixth grade graduate from high school, the technology will have undergone so much change that the level of knowledge taught would be obsolete.

The initial step in the creation of the course for the development of computer programs was to establish goals. A total of nine goals were written to be accomplished over a two year period. The goals for the computer programming class were as follows:

(1) To know the components of a computer and their function.

(2) To use BASIC as a programming language.

(3) To learn how various statements and commmands function in the computer.

(4) To learn the parts of a computer program line.

(5) To learn how a computer follows a program in its execution.

(6) To write a computer program in BASIC.

(7) To use a cassette recorder as both an input and output device.

(8) To be able to locate and program possible errors in a program.

(9) To learn how to create graphics with the computer.

After the course goals were established, student directed objectives were written to support the goals. Since the philosophy at Southeast Fountain was to plan through behaviorally stated objectives, the same method was followed when the objectives were written for computer programming. The list of objectives was as follows:

(1) The student will identify the basic parts of a computer and relate them to the block diagram of a computer.

(2) The student will define BASIC, BIT, BYTE, k, RAM, and ROM.

(3) The student will enter and run a BASIC program.

(4) The student will define the process needed in order to communicate with the microcomputer.

(5) The student will define the purpose and describe the use of the BASIC statements PRINT, LET, and REM.

(6) The student will define the use of the BASIC commands RUN, LIST, and NEW.

(7) The student will list the names of the three parts of a line of BASIC programming as the line number, statement, and argument.

(8) The student will perform arithmetic operations on the microcomputer.

(9) The student will describe the process a computer follows in executing a program.

(10) The student will list the steps to follow in developing a computer program.

(11) The student will list the two types of programming errors as computer detected and logical errors then define each.

(12) The student will describe how to correct computer detected errors.

(13) The student will use the tape player as an input-output device.

(14) The student will describe unconditional and conditional branching.

(15) The student will explain the functions of and give examples for the BASIC statements GOTO and IF-THEN.

(16) The student will write and run programs, one using an unconditional branch, and the other a conditional branch.

(17) The student will define a loop as related to a computer program.

(18) The student will define and illustrate a FOR-NEXT-STEP statement.

(19) The student will define and illustrate the INPUT statement using alpha-numeric variables.

(20) The student will define and write programs with the four statements used in graphics, which are SET, RESET, POINT, and CLS.

In summary, the course for computer programming caused the establishment of goals and objectives. They were to be achieved over a two-year period with selected students. The course was viewed as a continuation of the literacy class developed for selected fourth grade students. The combination of the computer literacy program designed for all students in grades two through six, the fourth grade literacy class, and the class for computer programming constituted the total computer curriculum at Southeast Fountain Elementary School.

Keyboarding Skills

The ability to manipulate the keyboard was an essential part of computer literacy. An excessive amount of valuable class time can be lost if the student must spend a great amount of time in search of specific keys. In addition, the computer keyboard contained keys that were special to a computer keyboard.

This curriculum proposed that keyboard skills be gained through simulation. Two software packages were used for this purpose, Alpha-Key, published by Radio Shack and Typing Tutor, published by MECC. The programs operated in a similar fashion. The student selected a difficulty level: slow, medium, or fast, and the computer flashes a key on the monitor. The student responded by typing the same key within a given length of time. The programs included an advanced level. The computer flashed nonsense phrases, and the student response was to type the same phrase. Upon the termination of the program, the computer reported the correct responses and the number of errors.

The emphasis was placed on the student's ability to locate specific keys within a reasonable amount of time. Emphasis was not placed on correct typing procedures, although that may have validity. The priority remained with computer literacy and the activities necessary for its acquisition.

Teacher Literacy

Teacher involvement was viewed crucial in order to have a successful curriculum. Each teacher must also have met certain literacy requirements. The fear of computers seemed to have no age limit and often the level of fear increased proportionately with age. The teacher must be as confident about using the computer as an instructional tool as he would with any piece of educational equipment (Uhlig, 1982).

The teacher must be trained to operate the computer effectively. The knowledge of powering-up the computer, loading programs, and the language requirements to run the program is required. Beyond this ability, the teacher need not possess a great amount of computer knowledge. The teacher need not be able to author programs or interpret the intracacies of computer logic. The teacher, however, must have the ability to evaluate computer software. Since the teacher would use the computer for drill and practice, tutorial, or simulation exercises, they possessed the necessary expertise in the selection materials to be purchased by the school. Computers and teachers are not mutually exclusive. The sooner teachers realize the powerful instructional ally they have in the computer, the sooner its benefits will be passed on to learners in the classroom (Inskeep, 1982).

Staff Development

A school curriculum will not succeed without the involvement and support of the teaching staff. Their opposition guarantees failure of even the best programs. One would be wise to postpone a project until the staff has been properly educated in the philosophy and implementation procedures. No proposed project should be adopted until the teachers who it will affect have been trained to the point where they can contribute largely to the planning and implementation of the project (Lawton and Gerschner, 1982).

This problem can be solved through appropriate planning. Many people, teachers included, have a basic fear of computers. Teachers must first be reassured that the computer does not pose a threat to their job security. When computers were first introduced into business, the accountants and office workers worried about their possible replacement by a machine. Today there are more accountants and office workers than ever before (Henderson, 1982). The instructional staff must learn the value of the machine. Any fear that pre-existed within each teacher must be removed so that the computer will not be thought of as a strange intervention in their orderly existence (Birmingham, 1982).

Administrators, as the implementors of curriculum, must have the foresight to help the staff become involved in the use of computers (McDonald and Gibson, 1982). The most efficient way to satisfy this important need is through in-service programs. Teachers must be given the opportunity to become familiar with the computer, learn the advantages it can provide for them and their students, and become as comfortable with its use as they are with other instructional aides. The only reason that many teachers do nothing with computers is because no one has taken the initiative to instruct them as to the use of the computer (Elliott, 1982).

There are two benefits of an appropriately trained staff. If the goal of computer literate students is to be achieved, the computer must be used throughout the curriculum by all the staff. The teachers must provide the opportunity for the students to have frequent contact with the computer. The second benefit is the necessity of staff involvement with the evaluation and selection of software. Today's teachers should know how to evaluate computer courseware as effectively as they do textbooks or filmstrips (Inskeep, 1982). The two benefits are dependent on one another and it is impossible to consider them separately.

Each school will find it necessary to determine the degree of need each teacher has for computer education. If one would develop an analogy with the film projector, it may be said the teacher can be very competent with its use without little knowledge of how it functions. The same comparison could be made with the computer. The teacher does not need extensive knowledge of programs or computer languages if the teacher's primary interest was computer-assisted instruction. It is important, however, the teacher have a sufficient level of computer knowledge for the effective use of the microcomputer in the classroom (Bunch, 1982).

Each teacher must have a minimum level of knowledge in order to insure thorough use of the computer in the classroom. The staff will need the knowledge of basic operations and terminology associated with computers. The various commands and troubleshooting techniques should be taught. Teachers must become familiar with the available software in their area of interest. Software packages often have operational commands that will vary from publisher to publisher. The techniques in their use are similar, and the teacher should have the ability to master their use. The teacher is the best source person, when judging content, for selection and evaluation of software in each subject area. If the computer becomes a mode of instruction within each classroom, the teacher will need to plan for computer use within the normal routine of the classroom. The teacher may have the additional need for knowledge of an authoring language if that teacher desires computer generated instructional materials. Finally, some of the staff may have either the need or the desire to learn the principles of computer programming (T. Grady, 1983).

This researcher accepted the responsibility of staff development at Southeast Fountain. A plan was developed for seventeen of the twenty-five classroom teachers in grades two through six to receive in-service instruction prior to the implementation of computers in the curriculum. Seven teachers and this researcher were trained during the spring of 1983 by a computer consultant from Radio Shack, Inc. Ten teachers received training during the summer of 1983 through a voluntary program offered by the school corporation.

The training of teachers at Southeast Fountain has been strictly on a volunteer basis. The administrative philosophy at Southeast Fountain has been to not force computer training upon teachers that do not desire it. The teachers not trained will, hopefully, recognize the benefits computers have provided in other classrooms thus volunteer for training at a later date. This philosophy has resulted in training 77 percent of the staff in computer usage. This plan represented a sufficient number for successful implementation of computers into the curriculum.

Future in-service programs will be offered on a need basis. There will be changes develop within the staff and new teachers will come to Southeast Fountain. They will need training. Staff members not previously trained will make requests for additional in-service programs. New equipment and software packages will require additional in-service programs. Finally, the expectation has been that previously trained teachers will desire additional training in order to enhance what they have already learned.

The present staff development plan at Southeast Fountain consists of eight levels of instruction. Each and every level equals one two hour workshop and two workshops have the potential to be combined into one session. The staff was given three choices which were four-hour classes on Saturday mornings, two-hour classes at the end of the school day, or summer classes. Each workshop required two hours of instructional time, therefore, the total program required sixteen hours. The Staff Development Plan diagram illustrates the workshop objectives.

Staff Development Plan

Work-Shop	Summer	Saturday	After School	Title	Objective
1	4 hrs.	4 hrs.	2 hrs.	Introduction to Microcomputers	Learn operation and terminology
2			2 hrs.	Advanced User Topics	Learn commands and troubleshooting
3	4 hrs.	4 hrs.	2 hrs.	Subject Area Software	Become familiar with available software in subject area
4			2 hrs.	Computer-Assisted Instruction	Learn to use CAI packages
5	4 hrs.	4 hrs.	2 hrs.	Software Evaluation	Learn software evaluation techniques
6			2 hrs.	Curriculum Integration	Learn to plan for computer use in the classroom
7	4 hrs.	4 hrs.	2 hrs.	Authoring Languages	Learn to use an authoring language
8			2 hrs.	Programming	Learn principles of computer programming

In summary, staff development was an essential component of the computer curriculum at Southeast Fountain. The intent of the plan was for assurance that the computer was integrated into the total elementary curriculum. This researcher has strived for the creation of a non-threatening environment that allows teachers an integral role in the introduction of computers into the total elementary experience (Hughes, 1983).

Environment

The physical environment for computers was an important consideration in the development of the curriculum. The placement of the equipment was an important factor that influenced the acceptance of the computer (Brumbaugh and Rawitsch, 1982). The organizational plan at Southeast Fountain was developed so that the computer did not become the domain of a single person or department.

Several organizational patterns were examined. A centralized plan was considered for a possible environment. This plan would have created a computer lab with the computers stationed in one location. This plan would make it necessary for the students to come to the room where the computers were located. The advantages of this plan were that individualized or small group instruction would be convenient and connecting the computers into a network was possible. The major disadvantage was this plan limited the use of the computers to one teacher at a given time period.

Another pattern for consideration was the decentralized plan. It would be created by the placement of computer stations at various locations throughout the school building. This plan would make the computers extremely accessible and compatible with both large and small group instruction. The primary disadvantage of this organizational pattern was the requirement for significant number of computers. There are five sections of each grade level at Southeast Fountain. The minimum equipment requirement for the decentralized plan would be three units for each grade or fifteen total units. The use of the decentralized plan eliminates the network capabilities of the computers.

An organizational pattern was adopted at Southeast Fountain. This plan was a combination of the other two patterns. A centralized computer lab design was necessary for classes on computer literacy and program development. Such classes, however, only consumed a maximum of two hours and forty minutes of the school day. The remainder of time left the nine computers available for classroom use (Brumbaugh and Rawitsch, 1982). Mobile carts were purchased for each computer, so that they could be moved from classroom to classroom.

A check-out system was developed that allowed each teacher to request a computer for use in the classroom. Check-out procedures and records were maintained by the computer coordinator. The teachers were requested to indicate their need for a computer twenty-four hours in advance. No teacher was permitted to check-out a computer for a time period that conflicted with the literacy or program development classes. This procedure, however, did not create a problem because those classes were held during the reading portion of the schedule and computer-assisted instruction was not recommended at that time. Finally, the adopted organizational pattern did not restrict the entire computer lab from staff use.

The type of hardware was a factor for consideration when the organizational pattern was adopted. Southeast Fountain had purchased the necessary hardware prior to the adoption of a pattern. The hardware was nine, 16k TRS-80 Model III units for student stations and one, 48k Model III for a host computer. This alignment of hardware enabled the installation of the TRS-80 Network II System. The network system, which hooked the student stations into the host unit, permitted the teacher to program or save work from each student station. The network system was a device that saved time. The time to program or save information on each individual computer is considerable and can only be considered a loss of instructional time. The Model III computer was designed with a self-contained monitor for convenience of transportation to different class areas.

Future plans have been conceived to make computers more accessible by all students. The desired result was computer availability for student use during free time. Concrete plans have not been completely formulated, but two alternatives have been considered. The library is located to provide maximum accessibility; therefore, it has been considered for a possible location of a computer. The library, through the presence of a librarian, can provide the necessary security and supervision for the computer. Under this concept, use of the computer would be restricted through the use of a teacher-signed permission slip. There were three perceived disadvantages of the library as a location for the computer. The computer could become a distraction for other students present. The library would make one computer accessible to over 600 students; thus an overload on equipment would be created. Finally, this plan would require the purchase of another computer, because the units previously purchased could not be spared for this purpose.

The second plan opened the computer lab at various times in the day. The daily schedule created an overlap of recess, lunch, and activity time when the computers would not be in use either in the lab or by a teacher. The lab could be opened for students at those points of overlap. A teacher-signed permission slip would be necessary and the number of students in the lab at one given time was limited to fifteen. The duty of supervision, if this plan was adopted, would be assigned to the library aide. The proximity of the library to the computer lab would permit this arrangement.

The premise has been perceived that computers generate an excitement among children. Computers that remain locked in a laboratory stifle the potential excitement and creativity within the children. Computer education must be broad in base and accessible to the students. A computer program that maintains accessibility by the students has the potential of channeling a student's creativity into meaningful learning experiences.

Selection of Software

Computer-assisted instruction will only be as good as the software available for instruction. Therefore, a careful process and the use of well-designed criteria for the selection of software will be critically important (Kansky and Heck, 1981). Software selection will have the greatest affect on the learner. The producers of commercial software have enjoyed a fantastic growth rate over the past five years. Unfortunately, those that publish educational software have often shown little concern for the educational value or validity of their product. The result has been to literally flood the market with thousands of software packages, some of which have been educationally sound and some have not. Most research has found that there are less than one hundred good programs currently available to schools (Bell, 1982).

Schools must have a variety of methods available for evaluation of software packages. The method must insure the quality of the software and provide for the needs of the pupils before the computer can viably assist instruction (Stevens and Sybouts, 1982).

The selection of software should be done with much care and detail. Some general considerations can be made throughout the selection process. The method of operation should be clear to the user at each step and the user should be able to easily recover from potential errors. The software must be comprehensive. The evaluator must determine if the instructional package covers the appropriate content. The degree a software package can extend the capabilities of previously purchased packages must, also, be considered within the evaluation process. Well-devised packages will provide essential documentation. The software package will provide manuals for set-up and usage of the program. A consideration, unrelated to the content of the package, was the support provided by the vendor. A reliable vendor will provide the technical support should problems with the program exist. The final consideration was the cost of the package. Every school has certain budgetary restraints. The cost of a software package refers to more than the required initial investment. The evaluator should investigate the possibility of back-up copies. Some vendors have developed sophisticated security systems to prevent the piracy of software thus requiring the purchase of a back-up. Other vendors permit the user to make their own back-up copies (Deck, 1982).

The software selection process at Southeast Fountain employed the use of two criteria. Southeast Fountain was inundated by third class mail advertisements and each company had the best, newest, and most advanced software available. To avoid costly errors in time and money due to judgements based on advertisements, Southeast Fountain subscribed to Robert Purser's Software Directory. This directory is published four times each year and it provides a review of educational software. The subscription rate was twelve dollars per year. When the cost and time it saved were considered, the directory was a bargain. Purser's directory was consulted before any software package was evaluated for classroom use.

The second step of software evaluation was the employment of a checklist (see appendix A). The checklist employed had five categories for evaluation. The categories were adequacy of documentation, ease of use, hazard protection, educational relevance, and inherent adventure. The evaluation form used a scale of one to twenty-five and each category was divided into the bahavioral descriptions of limited, adequate, and outstanding. The evaluator would rate each category, record the rate on a summary sheet and multiply the rate by a given weight to achieve the score for that category. The sum of all the scores in each category represented the total score for the software package.

Weights specified the relative importance of the criteria. The assigned weights were actually proportions; the sum of the weights must equal 1.00. These weights were totally independent of the rest of the evaluation process and could be changed with no affect on the other procedures. Since the weights were independent of the evaluation process, they could be modified to fit various situations (Metzcus, 1983).

The evaluation system employed at Southeast Fountain also had the capability to provide a price-performance ratio. The relative value, when calculated, was used as a comparative index of value. This index was a cumulative result of the entire evaluation process. The index focused the decision process on applications software that was comparable in terms of grade level, subject area, and classification.

A simple and direct method was used for the calculation of the price-performance ratio. The price of the software was divided by the total score of the package. The quotient was interpreted as a measure of cost per point on the evaluation scale. The price-performance ratio was only meaningful in a comparative sense; it was not a measure of cost-effectiveness (Metzcus, 1983).

The evaluation of software was completed by the teacher in each particular subject. The completed evaluation form was returned to the computer coordinator. The computer coordinator filed the necessary requisition forms for the purchase of the package. The centralized purchase procedure alleviated the possiblility of duplicate purchases and made one person responsible for management of the budget.

After the software arrived it was cataloged and stored. The software was placed in the library for easy accessibility. An index system was created, therefore, software was readily located by subject area and grade level. A documentation sheet was filed with each software package. The documentation sheet gave a detailed description of the package. The documentation sheet saved the teacher the time it would ordinarily take to preview courseware.

Computer Coordinator

The responsibility of curriculum maintenance must be assumed by a person on the staff. A healthy school computer curriculum will require attention beyond the initial implementation stage (Brumbaugh and Rawitsch, 1982). This role could be filled by various staff people; the principal, assistant principal, a teacher, or the librarian. This researcher, who was also the assistant principal, was selected because of his prior knowledge of computers; therefore, time was not lost due to training a staff member. Further, the position of this person provided the opportunity for easy supervision of the computer curriculum. The coordinator who provided the guidance for the computer curriculum was the key person in the project's success (Gring, 1982).

The computer coordinator had six major duties. This person had the responsibility of hardware maintenance. Periodic equipment malfunctions must be promptly repaired. Once malfunctions were reported to the computer coordinator, he filed a work order with the central office and the downed unit was shipped to the Indianapolis computer center for repairs. The school corporation investigated the possibility of a maintenance agreement. The cost was too great to bring maintenance personnel to the school due to the corporation's rural location.

Software maintenance was another responsibility given the computer coordinator. Software required the creation of a storage area safe from the elements that harm such materials. Other duties included the maintenance of an inventory of all software materials, and when permitted by the publisher, the production of back-up copies of the software. Back-up copies insure the safety of expensive software from damage or accidental erasures.

The computer coordinator had the responsibility for the schedule of all computer hardware and software. This duty required the coordinator to maintain records for the location of each piece of equipment. Without specific records, danger will always exist that equipment will either be lost or dominated by an individual. The maintenance of check-out records provided a degree of accountability for the user.

A person who had expertise in the area of software usage was responsible for its selection and evaluation. The acquisition of selected software materials was the duty of the computer coordinator. The coordinator provided the staff with information related to available materials. The staff was given instruction and an instrument to evaluate the software. The selection of specific packages were made by the staff and the coordinator who had the responsibility to requisition the desired software packages. This procedure provided purchase centralization which made it possible to monitor the portion of the budget designated for the acquisition of software.

The computer coordinator had the responsibility for in-service workshops on the most efficient operational techniques. The need for workshops always existed in order that the curriculum be dynamic. Typical workshops discussed the use of new equipment, the orientation of new staff members, the access to various manuals, and software documentation.

The final duty of the computer coordinator was a curriculum troubleshooter. When the curriculum was implemented, a list of the future needs of the program was impossible. When unknown problems with the equipment, software, or operation of the curriculum developed, the coordinator was consulted (Eisele, 1982).

The role of computer coordinator was an essential factor in the development, implementation, and maintenance of the curriculum. The school needed someone for leadership and efficient operation of the computer curriculum. Without someone to fill this capacity, the failure of the curriculum was perceived (Fisher, 1983).

Program Evaluation

One can easily become infatuated with new technology. Addition or modification of a curriculum should include some method, formal or informal, of program evaluation. The result of the evaluation process should give the evaluator an indication of the affect the curriculum change created on the school program as a whole and the students for whom the curriculum was intended.

The evaluation process at Southeast Fountain could best be described as informal. A committee of teachers was established, one from each grade two through six. The committee was chaired by the computer coordinator and he reported directly to the building principal.

The committee observed the use of the computers in each respective grade and reported the quantity and quality of the usage at monthly evaluation meetings. This procedure provided a continuous evaluation process. The desired outcome was the early identification of problems within the computer curriculum, therefore, the available time could be spent in search of viable solutions.

This procedure, though of an informal nature, was perceived as better than a year-end evaluation process. The primary advantage was that this method solved problems as they occured, rather than being a detriment to the curriculum throughout the school year. A secondary advantage was the perception that the administrators and teachers were likely to do a better job of evaluation if it did not occur at the end of the year. The approach of summer vacation and the pressures of the end of a school term have the potential to distract one from a thoughtful evaluation process.

The evaluation process at Southeast Fountain consisted of three points of concern. The first item was the amount of time the computers were idle. Documentation of this item was easily achieved through inspection of the computer check-out log. Computer usage was the second item. If students spend too much time with game activities on the computer, changes would be needed in the method the computer-assisted instruction program had been implemented.

The final item of evaluation was the relevance of the courseware for the instructional activities in the classroom. The utilization of computers in the classroom was meant to compliment instruction and not become an independent insertion.

The procedure for evaluation did consider student achievement as important. Certain questions related to achievement were raised throughout the evaluation process Such questions were: (1) Are the students progressing rapidly through their assigned objectives? (2) Have students met the objectives by the end of the instructional unit? (3) Is test performance at least comparable to what it would have been without assistance from the computer?

The use of student achievement as criteria for evaluation contained two disadvantages. First, when student achievement was used, greater time was needed before necessary information was available. Evaluation, on occasion, could not begin until the conclusion of an instructional unit. The second disadvantage was the lack of an adequate statistical base for comparison.

The committee on evaluation perceived all the criteria needed reconsideration. Each committee member realized the elusive nature of objective evaluation for the program. However, this procedure eliminated many potential problems and contributed largely to the success of the computer curriculum.

Future Equipment Needs

Southeast Fountain had the advantage to establish a curriculum with the necessary financial support. The hardware inventory included nine TRS-80, 16k student computers, one TRS-80, 48k host computer with dual disk drives, and the TRS-80 Network II System. This equipment inventory level was within the adequate range to sustain the desired program.

No curriculum, however, should be considered a one-time investment. The initial investment must be protected by the insurance that the program will continue to be relevant. Obsolescence must be considered particularly in a program of high level technology. Computer hardware purchased this year will probably have a wear life of five to seven years and will be technologically obsolete within three (T. Grady, 1983).

Few schools, Southeast Fountain included, have the luxury of a curriculum with all materials and equipment the curricular implementors desired. A "shopping list" for the future has been developed at Southeast Fountain. A dot mattrix printer is on the list for the 1984-85 school year. Other items desired for program enlargement are additional student computers, a color computer with programs in LOGO, and a telephone modem. Additional computers were desired to reduce the demand on the present hardware by the staff. More units would increase the availability of computers into the curriculum and would lessen the down-time of the units caused by a high rate of usage. LOGO was under consideration as a method for the younger students. Should LOGO become an addition to the computer curriculum, the purchase of a compatible color computer would be necessary. The addition of a telephone modem would give the present system the capability to tap outside sources. Services from The Source, Compu-Serve, and Compu-Store could be utilized by the staff and students. The ability to link a school like Southeast Fountain with the most recent knowledge and information available was deemed an exciting possibility.

CHAPTER IV

Summary

The key point for any school corporation seeking to initiate computer education should be: What are the ultimate goals of the program? The motives for the establishment of a curriculum must have a solid foundation built on the needs of the corporation and the desired outcome of the curriculum. School personnel should not be tempted to institute poorly devised curricula because of a desire to "keep-up" with neighboring school corporations. The best curriculum begins with detailed plans not with implementation (Brumbaugh and Rawitsch, 1982).

Once a commitment for computer education has been made by the school corporation, the personnel can be selected for the program. One person should be selected as the coordinator. He will organize the activities in all the stages of development prior to implementation. The selection of this person can be critical. The coordinator should have the ability to solve a broad spectrum of problems. Further, the coordinator must have the ability to involve many people.

After a committee has been established for the purpose of program development, the work of the establishment of program goals and objectives will begin. First, the curriculum committee would be wise to develop a list of program goals. This list of goals should be supported by specific learning objectives that indicate the manner each goal will be accomplished. This researcher felt it most important that a curriculum for computer education be interdisciplinary; therefore, the curriculum committee must devise a vehicle for the accomplishment of that goal.

After it has a detailed plan of goals and objectives, the curriculum committee must decide the most approporate methods for each objective. Decisions will be made on whether such computer assisted instructional methods as simulation, tutorial, or drill and practice will be used. All three methods are appropriate for certain objectives. A certain amount of software will be required regardless of the method. The committee will then be confronted with the evaluation of the abundance of software packages. The committee should prepare an instrument for software selection. Then the individuals with the expertise in course content should apply the instrument within their particular discipline.

Software selection should always preceed hardware selection. Once the committee has selected a software source, they must consider the equipment necessary. Important details of memory size, cassette or disk based, and essential peripherals must be considered. The variety of hardware is so extensive that confusion is likely. The committee should employ an instrument for hardware evaluation.

The curriculum committee may desire the assistance of a computer consortium. Many consortiums have recently been formed. The two well-known and oldest consortiums are the Minnesota Educational Computing Consortium and the Michigan Computer Consortium. Computer consortiums charge a membership fee, however, if their guidance can prevent errors on behalf of the school corporation, the savings may well exceed the membership fee.

The final decision of the curriculum committee will be the manner for curriculum implementation. The committee may decide to pilot a plan on a limited scale. A pilot project has two advantages. This plan provides an indication of error and the time for correction. The other alternative would be to begin the project on a full scale with the confidence that any error would be minor and the integrity of the total curriculum would not be endangered. This researcher preferred the pilot concept. The initial program at Southeast Fountain began with three computers. The curriculum was piloted for one year. After the first year the program was increased to nine computers and a network system. The one-year pilot project, if nothing else, gave this researcher, the administration, and the teaching staff confidence that the curriculum was well-designed.

Recommendations and Conclusions

Computers have been established in most segments of society. The knowledge one has of the various uses and applications of the computer will increase that individual's ability to cope in the society.

Many predictions can be made concerning the significance of the computer in the future. Only time will prove or disprove those predictions. However, one only needs to review the past thirty years to make the assumption that computers are an ever-increasing force in society. The influence of computers on each person's daily life will likely not decrease or become stagnant.

The school, in its role to prepare students for the future, must recognize the importance of computer education. Those in the decision-making positions of each school need the wisdom to guide them to construct a curricula that is broad. Each segment of the curriculum that together represents the total school experience should be involved.

This researcher arrived at several conclusions. They are offered as recommendations for the development of a plan for the implementation of computer education at the elementary level. Each recommendation was made specifically for Southeast Fountain Elementary School. The researcher arrived at the recommendations from reading current research and other literature, and the advice of others in the field of computer education.

Recommendations:

(1) A philosophical and financial commitment from the local board of education should be the initial step. The board must be convinced of the importance of such a program. Without either the philosophical commitment or the financial support the desired curriculum will fail in its first stage.

(2) The second step is to organize a committee whose make-up should include people from each subject area and grade level. In order to succeed, the committee must utilize the tremendous amount of expertise available. The initial task of the committee should be to conduct a needs assessment of the corporation. The survey of needs should reflect both student needs and non-academic needs. The survey of needs will provide a base for the establishment of goals and objectives.

(3) After the necessary goals and objectives have been established, the committee must consider the software and hardware requirements in order to accomplish the stated goals and objectives. This stage of decision-making will require choices of vendors, number of units, availability of service, and physical placement of equipment.

(4) Whether or not to begin the project with a small scale pilot plan must be decided. Should the pilot plan be selected, the term of the project should be established. A method to determine success or failure must also be created.

(5) After the goals of the curriculum have been established, the software can be selected. Decisions will be necessary regarding the type of software to purchase, the amount to purchase, and how the software is to be evaluated. Great care must be taken to be sure that value is received for each dollar spent.

(6) Following the selection of software, the next step of development is to determine the equipment needs of the program. The product name must be selected. Important considerations are: the number of units to be purchased, the level of capability of the units, and the availability of service for the units. Additional points to consider are peripherals to be added and the availability of software.

(7) The purchase of software should be centralized so that the budget can be preserved and to insure duplication of materials will not occur. Through the centralized purchase of software, a library and index of material can be created. The software library may be housed in the Instructional Media Center and the index of material should be provided for each staff member.

(8) The committee established for the creation of the computer curriculum should remain intact. The function of the committee will be to evolve into a role that provides the evaluation of the curriculum. The committee may be chaired by the computer coordinator and upon committee recommendations, he may implement changes or enlargements of the curriculum.

(9) The position of computer coordinator may be defined as the individual responsible for implementation and maintenance of the computer curriculum. The computer coordinator should be directly responsible to the principal followed by the superintendent and the board of education. The specific duties of the coordinator are as follows:

(a) To chair the committee for computer curriculum review.

(b) To make changes in the curriculum deemed necessary by the coordinator and the committee.

(c) To prepare periodic reports to the board of education.

(d) To supervise the purchase of all software and hardware.

(e) To remain abreast of technological changes in the computer industry as they relate to education.

(f) To provide in-service training for the staff on computer use and to provide the same service for staff members new to the corporation.

(g) To initiate the necessary steps to secure maintenance for equipment that has malfunctioned.

(h) To initiate and maintain a replacement schedule for equipment.

(i) To provide any related service as directed by the board of education or superintendent.

(10) A continual program designed for the in-service of staff must be established. The in-service should be created in a manner that make it possible for staff members with any level of computer knowledge to benefit. Although existing staff members may not

be required to receive the training, new members should be required unless proof of prior training can be provided by the staff member. The logic is that the staff must be informed on the use and application of computers, otherwise total implementation can never be achieved.

(11) It is recommended that the community be involved. The first activity that can be planned is to open the computer lab to parents during American Education Week. Each parent may be invited to participate with their child in the usage of the computers. Another activity is a computer fair to be held annually in the spring. Computer retailers from the area were invited to display their merchandise in the school multi-purpose room and all members of the community were invited to attend. The fair was scheduled to begin on a Friday evening and continue through Saturday. A two day event provided the maximum opportunity for attendance and was more desirable with the exhibitors.

(12) In order to achieve maximum utilization of equipment, the recommendation is made to provide adult education classes. The computer lab is required for student use during the normal school day. The result is idle equipment each evening, on Saturday, and throughout the summer. Classes can be offered at those times to anyone in the community. A fee may be charged to cover the cost of the instructor.

(13) Many styles of physical environment are possible. Each variation was explained in the previous portion of this project. The research indicates that the less confined the physical environment becomes, the greater advantage the computer is to the total curriculum. It is recommended that the physical environment include some capability to be mobile.

Limitations and Solutions

One of the greatest problems was the selection of appropriate software. Many programs were recommended for too wide an audience. The skill level of even more programs do not include higher levels of learning: comprehension, analysis, or application (Woodhouse, 1983). School persons should consider authoring at least a portion of the software locally. Certainly, it is not feasible to author all the software. With the availability of various authoring systems and word processing systems, some authoring can be done at the local level. Locally authored software will exceed the quality of purchased systems.

Since the market exists with educational software, schools will need to purchase a portion in order to meet their needs. The individuals charged with this responsibility should bear in mind that the expertise is educational computing (Lee, 1983). Those individuals must, therefore, be armed with the best evaluation techniques possible. Each teacher possesses the expertise in their content area. They must be shown how to apply that knowledge to the field of educational computing.

Each person in educational computing would be wise to consider the software needs before the purchase of hardware. School personnel often have made the mistake of expending large sums of money for hardware, then they search for appropriate software. The school must follow a plan: first, identify the goals; second, secure the appropriate software; and third, purchase the needed hardware.

The phrase, "the more the merrier," certainly applies to the implementation of a computer curriculum. The probability of success can be greatly increased by the involvement of individuals from as many parts of the school as possible. The assignment of this responsibility is unrealistic if a few are involved. One person or a small group of people cannot anticipate all the problems that will arise with the implementation of a new curriculum. Further, the more people that are involved, the more there exists hope that the project will succeed.

Many incorrect attitudes can be defeated, if a large percent of the staff is included in the process. The attitude that computers are the domain of the mathematics department or that computers can replace a teacher can be easily displaced with the attitude that computers have a multitude of applications and that no machine will replace the dynamics of a human being.

The hours of work required to design any curriculum is considerable. Any school interested in the establishment of a computer curriculum would be well advised to accomplish two goals. First, the curriculum should be designed unit-wide to encompass both elementary and secondary schools. Second, those persons in decision-making roles should consider the provision of release time or extra pay for the curriculum committee. Either plan will increase the expense incurred by the school district, however, the value of such a decision will be realized when the curriculum is implemented. Logic tells one that to ask people to tackle this task after school is unreasonable. Further, any school administrator desires the staff to concentrate on instruction during the school day.

The final limitation was the method by which students were selected for specialized computer instruction. The selection method has been previously described. This researcher remains uneasy that some students will be excluded that would otherwise find great success had they been in the class. Other selection procedures were examined and each represented this same basic fault. The other alternative plan would be to include all students. This course presented the potential interference with other subject areas as well as a tremendous increase in expense for hardware. Perhaps the solution employed was the best available at the time of implementation. This researcher will, however, continue to search for a method that will be more equitable in its application.

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APPENDIX A

Software Evaluation Form

APPENDIX A

Software Evaluation Form

Summary Sheet

Product Name ______________________ Author ________________

Price ____________________________ Grade Level ___________

Execution Time: Individual Lessons _____ Entire Package _____

Publisher _________________________ Date __________________

Contact Person ____

Address ____

City, State/Zip ____

Category

_____ Computer-Assisted Instruction

_____ Classroom Management

_____ Administrative Managment

Type

_____ Drill and Practice

_____ Tutorial

_____ Simulation

Other ________________

Configuration Requirements

Hardware _________________________ Operating System _______

Storage __________________________ Language _______________

Source Program Available ________

Features

__________ Graphics __________ Color __________ Sound

Summary Description ____

____

____

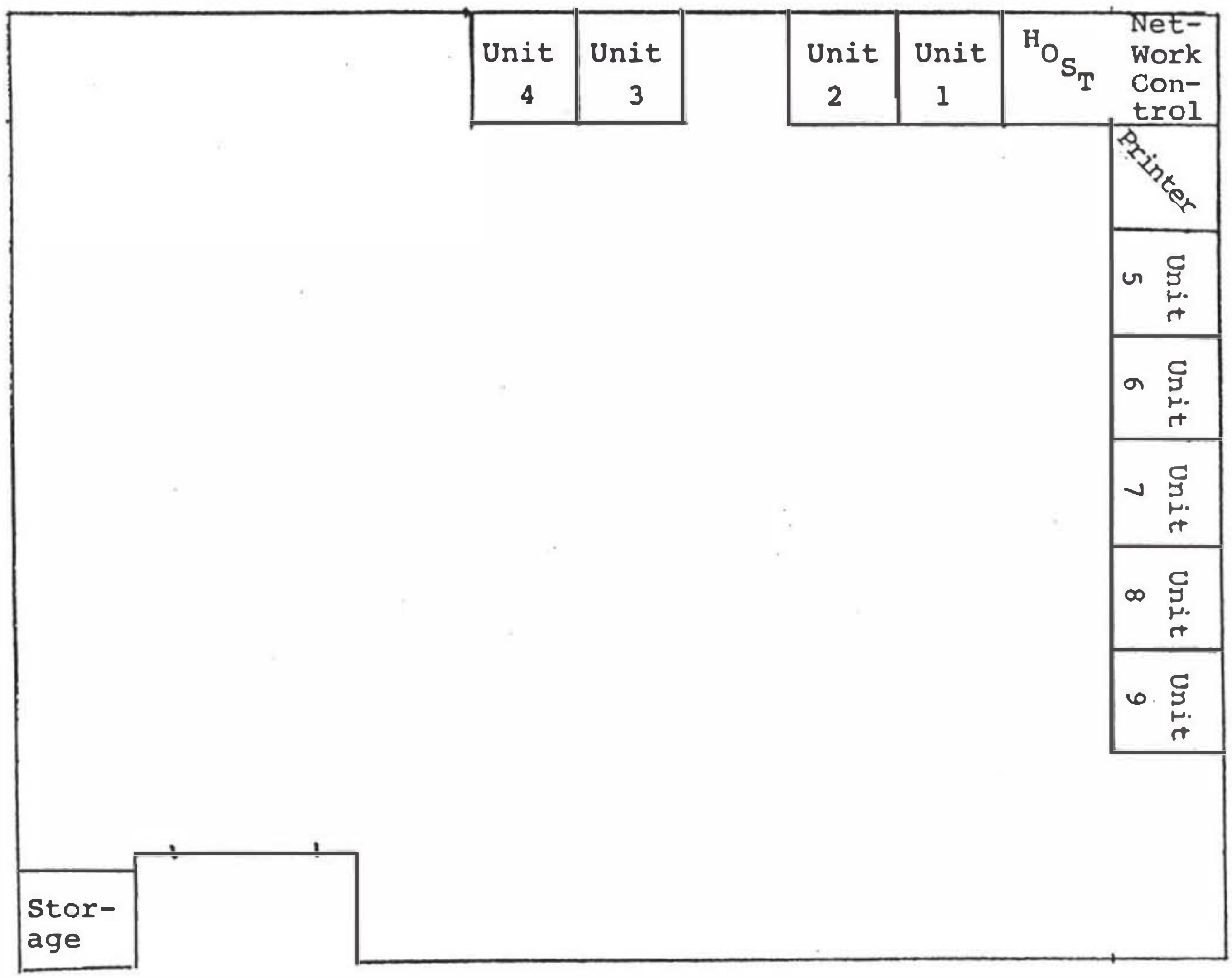
Scoring Summary

Category	Rating	x	Weight	=	Score
Adequacy of Documentation	_____	x	.35	=	_____
Ease of Use	_____	x	.25	=	_____
Hazard Protection	_____	x	.10	=	_____
Educational Relevance	_____	x	.15	=	_____
Inherent Adventure	_____	x	.15	=	_____
Total Score					_____

Rater ____________________________ Date __________________

APPENDIX B

Floor Plan of Computer Lab



Scale .5 cm. = 1 foot

APPENDIX C

Computer Check-Out Sheets

Computer Check-Out Sheets

MONDAY

TIME	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9
8:15									
8:30									
8:45									
9:00									
9:15									
9:30									
10:00									
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1:00									
1:15									
1:30									
1:45									
2:00									
2:15									
2:30									
2:45									
3:00									

TUESDAY

TIME	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9
8:15									
8:30									
8:45									
9:00									
9:15									
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1:30									
1:45									
2:00									
2:15									
2:30									
2:45									
3:00									

WEDNESDAY

TIME	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9
8:15									
8:30									
8:45									
9:00									
9:15									
9:30									
10:00									
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2:00									
2:15									
2:30									
2:45									
3:00									

FRIDAY

TIME	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9
8:15									
8:30									
8:45									
9:00									
9:15									
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2:30									
2:45									
3:00									

APPENDIX D

Building Floor Plan

APPENDIX D

Building Floor Plan