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Identifying Characteristics To Use As Descriptors of Educators' Potential for Acquiring Computer Literacy

Leota W. Coffey
East Tennessee State University

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Coffey, Leota Wise

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IDENTIFYING CHARACTERISTICS TO USE AS DESCRIPTORS OF EDUCATORS' POTENTIAL FOR ACQUIRING COMPUTER LITERACY

A Dissertation

Presented to

the Faculty of the Department of Supervision and Administration

East Tennessee State University

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

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by

Leota Wise Coffey

August, 1984

APPROVAL

This is to certify that the Advanced Graduate Committee of

LEOTA WISE COFFEY

met on the

25th day of June, 1984.

The committee read and examined her dissertation, supervised her defense of it in an oral examination, and decided to recommend that her study be submitted to the Graduate Council and the Dean of the School of Graduate Studies in partial fulfillment of the requirements for the degree Doctor of Education.

Chairman, Advanced Graduate Committee

Signed on behalf of the Graduate Council

Dean, School of Graduate Studies

ABSTRACT

IDENTIFYING CHARACTERISTICS TO USE AS DESCRIPTORS OF EDUCATORS' POTENTIAL FOR ACQUIRING COMPUTER LITERACY

by

Leota Wise Coffey

Purpose: The purpose of this study was to determine whether certain characteristics of public school administrators are present which can be used as descriptors for other educators' potential for acquiring computer literacy from a specific staff development model.

Procedure: Participants in the study were 44 public school administrators from the Northwest Education Region of North Carolina. The study was quasi-experimental, using a pretest, treatment, and posttest design. The treatment of the subjects consisted of six three-hour sessions of computer literacy training. It was administered over a 12-week period of time.

A model for staff development of computer literacy was designed to include the basic and most important concepts of computer literacy, as identified by a search of the literature and examination of available models. Two instruments were used to obtain the data necessary for the study; a personal data sheet was developed to collect the demographic data required to determine the independent variables and The Minnesota Computer Literacy and Awareness Assessment was used to measure attitudes toward computers and computer knowledge.

Data were analyzed by the Statistical Package for the Social Sciences Extended (SPSSX) which computed the Pearson Product-moment or *t* tests as deemed appropriate for each of 12 hypotheses. The minimum acceptable level for determining significance was at the .05 level.

Findings. Data analysis indicated that:

1. Attitudes toward computers have an effect on the attainment of computer knowledge.

2. The staff development model designed was effective in promoting computer literacy.

3. The attainment of computer literacy results in a more positive attitude toward computers.

4. The variables of age, gender, position in school system, or length of time in the educational profession do not significantly influence attitudes toward computers.

5. The attainment of computer knowledge was significantly higher for females than for males.

6. The attainment of computer knowledge was not influenced by the area of initial certification or position in the school system.

7. Assignment as principal of an elementary school or a secondary school did not influence attitudes toward computers or the attainment of computer knowledge.

Conclusions. Conclusions of the study and recommendations for future research were given.

Institutional Review Board

This is to certify that the following study has been filed and approved by the Institutional Review Board of East Tennessee State University.

Title of Grant or Project Identifying Characteristics to Use as Descriptors of Educators' Potential for Acquiring Computer Literacy

Principal Investigator Leota Wise Coffey

Department Supervision and Administration

Date Submitted June 27, 1983

Principal Investigator Leota W. Coffey

Institutional Review Board Approval, Chairman

Armand O. Lefrancois MD
Chairman IRB

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Chapter 1

INTRODUCTION

A constant challenge to educators is to provide opportunities for students to acquire the skills necessary to function successfully in their society. This challenge to educators becomes even more dramatic in a time of rapid societal change.

Alvin Toffler (1980) has portrayed the present time as a period of such change as civilization enters a new era. According to Toffler, the first era was agricultural with land representing the most important measure of power. During this time, the basic social unit was the clan or tribe, held together by the need to survive. The agricultural era lasted about 10,000 years.

The second era of civilization was the industrial age with the measure of power shifting from land to energy and resources. The social unit changed from the clan to the family. Civilization remained in the industrial era for approximately 300 years.

Civilization is now moving into the third era, identified by Toffler as the era of information. The basic social unit has changed from the family to the individual.

The power center of the information era is computer technology.

The transition from the industrial era to the information era has been in progress for approximately 30 years but the advancements made in computer technology have been phenomenal, exceeding the advancements made in both the agricultural and industrial eras (Mayhew, 1982). In addition to the discrepancy in the rate of advancement during these eras, there was also a difference in the type of implements used.

> It is interesting to note that while the tools of the agricultural and industrial ages were physical implements or extensions of the body, the primary tool of the information age--the computer--is an intellectual or mental tool that represents an extension of the human mind. (Mayhew, 1982, p. 14)

At a time when computers have come to be an everyday tool of many adults working in business, government, and industry, students are graduating from the public schools with technological skills that are already obsolete (Naisbitt, 1982). There are strong educational implications for curriculum change that will create a computer-literate learning environment which will allow students in public schools to acquire the skills necessary for a modern, high-quality education in the information era. Traditionally, a person who did not have command of the basic skills--reading, writing, and counting--was considered illiterate. A conclusion from the research seems to be that, increasingly, a test of literacy will include command of the computer. Thus, the computer, previously considered an expensive, complicated instrument of science, has become a necessary component of the educational program.

With the increased emphasis on the importance of computer literacy coming from state departments of education, the investigator utilized the North Carolina State Department of Public Instruction to conduct this study. Through consultation with the Director of the Northwest Education Regional Center, the investigator secured permission to use the staff development network of the Northwest Education Region to select the sample, gather data, and administer the treatment to the participants in the study. Developing plans for the staff development model, scheduling activities, securing equipment, identifying consultants and implementing the training sessions were accomplished through the cooperative efforts of the Regional Center staff and the investigator.

The Problem

The problem of this study was to determine whether certain characteristics of public school administrators are present which can be used as descriptors for other educators' potential for acquiring computer literacy from a specific staff development model.

Significance of the Study

Microcomputers are inundating the public schools and the demand for schools to provide a program of computer literacy is continually increasing (Moursund, 1982). The national Education Department (ED) has launched a project to define computer literacy as a first step toward measuring the computer abilities and knowledge of educators and students nationwide.

> ED has awarded a $134,224 contract to the Educational Testing Service and the Human Resources Research Organization to work with the panel in defining computer literacy and to prepare questions that measure computer literacy and can be used in a national survey of superintendents, principals, teachers, and students (Report on Educational Research, 1983, p. 5).

In the report, A Nation at Risk (National Commission on Excellence in Education, 1983), computer literacy was identified as one of the "Five New Basics." This study recommended that one-half year of computer science be required for graduation from secondary school.

Public school administrators must consider many factors as they strive to meet the demands of parents, students, and the community to provide computer-literate students (Gawronski & West, 1982). Public school administrators must themselves develop a degree of computer literacy that will enable them to make knowledgeable decisions that are vital to implementing computer programs in the schools. Moreover, they need access to information to improve the quality of administrative decision-making and to assist in the performance of routine tasks (North Carolina State Department of Public Instruction, 1983). As instructional leaders, administrators need to be knowledgeable of computers to a degree that they can assist teachers in making decisions about the use of hardware and the selection of software that will enhance the learning opportunities of students.

The findings of this study should be beneficial to public school administrators as they prepare to implement computer programs in the schools. In addition to providing an opportunity for participants to acquire computer literacy, the study will demonstrate a staff development model that could be used, with slight modifications, for faculty inservice. From this model, current educators could acquire needed skills for using the computer both as an instructional and a management tool.

The study delineates characteristics which could serve as descriptors to identify educators who might be successful in acquiring computer literacy. Thus, the findings of the study would simplify personnel selection and increase the possibility of establishing successful computer literacy programs in the schools.

Hypotheses

The following hypotheses, stated in the research format, were formulated for this study:

1. There will be a significant difference between the participants' pretest and posttest scores of computer knowledge.

2. There will be a significant positive correlation between attitudes of public school administrators toward computers in education and the attainment of computer literacy as determined by the pretest attitude scale and posttest of computer knowledge.

3. There will be a significant change of attitudes of public school administrators toward computers in education resulting from an increase in awareness of the capabilities of computers as measured by the pre- and posttest of attitudes paired with the pre- and posttest of knowledge.

4. There will be a significant difference in the pretest scores of attitudes toward computers in education between public school administrators aged 25 - 45 and those aged 46 - 65.

5. There will be a significant difference in the amount of change of attitudes toward computers in education between public school administrators aged 25 - 45 and those

aged 46 - 65 as measured by the difference between the pre- and posttest of attitudes for the two groups.

6. There will be a significant difference in pretest scores of attitudes toward computers in education between female public school administrators and male public school administrators.

7. There will be a significant difference in the attainment of computer literacy between female public school administrators and male public school administrators as demonstrated by the difference between pre- and posttest scores of computer knowledge.

8. There will be a significant difference in the attainment of computer literacy between public school administrators with initial certification in mathematics or science and those with initial certification in other disciplines as measured by the posttest scores of computer knowledge.

9. There will be a significant difference in attitudes toward computers in education between public school administrators who have been in education from 1 to 10 years and those who have been in education over 10 years.

10. There will be a significant difference in the posttest scores of attitudes between elementary school principals and secondary school principals.

11. There will be a significant difference in the attainment of computer literacy between elementary school principals and secondary school principals as measured by

posttest scores of computer knowledge.

12. There will be a significant difference in the attainment of computer literacy between principals and central office staff as measured by the pre- and posttest scores of computer knowledge.

Assumptions

The following assumptions were considered pertinent to the study:

1. The school systems could benefit from this study in identifying persons receptive to computer literacy training.

2. Various levels of intelligence were represented among the participating public school administrators; therefore, intelligence had no influence on the outcome of the study.

3. The instruments utilized in gathering data for the study were valid for the purpose stated.

4. The participants in the study had received no previous training in a computer literacy program.

5. The participants in the study responded to the instrument honestly and seriously.

6. The characteristics identified would serve as valid descriptors of school personnel's potential for computer literacy.

Limitations

The following limitations were placed on the study:

1. The review of the literature was limited to materials available in the libraries of East Tennessee State University, Johnson City, Tennessee, Appalachian State University, Boone, North Carolina, the ERIC Search Indicators and materials obtainable through the Inter-Library Loan Service at East Tennessee State University.

2. The amount of time for the treatment was limited to six three-hour sessions.

3. The physical facilities for use during the treatment were limited to those provided by the North Carolina State Department of Public Instruction.

4. The computers used in the treatment were limited to 25 Apple IIe computers.

5. Participants were limited to 44 public school administrators from the Northwest Education Region of North Carolina who agreed to participate in the computer training program.

6. Participation in the study was limited to public school administrators who had received no previous computer training (see Appendix A).

7. The activities of the treatment were limited to those included in the Staff Development Model selected for this study.

8. The measurement of attitudes toward and knowledge of computers in education was limited to those items measured by the Minnesota Computer Literacy and Awareness Assessment.

9. The time for the study was limited to spring, 1983 through spring, 1984.

Definition of Terms

Central Office Staff Members

Central Office Staff members are certificated professional educators employed by the school system to work in leadership roles, including superintendents, supervisors, and program directors or coordinators.

Computer Assisted Instruction (CAI)

Computer Assisted Instruction refers to using the computer to help present instructional programs to students. Programs may include such teaching methods as drill, tutorial, demonstration, simulation, or instructional games (Moursund, 1982).

Computer Hardware

Computer Hardware is the collection of physical devices which make up a computer system.

Computer Literacy

Computer Literacy is "the general range of skills and understanding needed to function effectively in a society increasingly dependent on computer and information technology" (Coburn, Kelman, Roberts, Snyder, Watts, & Weiner, 1982, p. 253).

Computer Managed Instruction

Computer Managed Instruction refers to using the computer as a record keeper, diagnostic tester, prescriber of what to study next, or any of the various activities that help to organize and manage instruction (Moursund, 1982).

Computer Software

Computer Software is the computer program that contains the list of instructions that tell a computer to perform a given task or tasks (Coburn et al., 1982).

Integrated Circuit

An Integrated Circuit is a unit containing a number of transistors and other electronic components (Moursund, 1982).

Logo

Logo is "a computer programming language developed by Seymour Papert specifically for children" (Moursund, 1982, p. 45).

Microcomputer

A microcomputer is a small computer "whose central processing unit consists of one or a few large-scale integrated circuits" (Moursund, 1982, p. 45).

Minnesota Educational Computing Consortium (MECC)

The Minnesota Educational Computing Consortium (MECC) is a statewide organization that coordinates computing activities; it is the world's largest single developer and producer of educational software (Gawronski & West, 1982).

Northwest Education Region

The Northwest Education Region is one of eight areas in North Carolina identified for administrative purposes as an educational region by the North Carolina State Department of Public Instruction, and comprising 19 local administrative units.

Peripherals

Peripherals include any devices used to communicate with the central processing unit of a computer or used to store data, e.g., keyboard, printer, disk drive (Coburn et al., 1982).

Programming

Programming is the writing of a list of instructions that tells a computer to perform a given task or tasks.

Public School Administrators

Public School Administrators are certificated professionals employed by a school system to serve in educational leadership positions, including superintendents, supervisors, program directors or coordinators, and principals.

Silicone Chip

A Silicone Chip is "a small (e.g., 1/4" x 1/4"), flat piece of silicone on which electronic circuits are etched" (Coburn et al., 1982, p. 253).

Organization of the Study

The study was organized into five chapters:

Chapter 1 contains an introduction to the study, statement of the problem, significance of the study, research hypotheses, assumptions of the study, and limitations of the study. Definitions of terms and organization of the study are also included.

Chapter 2 presents a review of the related literature.

Procedures by which the study was conducted are contained in Chapter 3.

An analysis of the findings of the study is included in Chapter 4.

Chapter 5 includes the summary, conclusions, and recommendations of the study.

Chapter 2

REVIEW OF RELEVANT LITERATURE

The urgency for computer literacy was expressed repeatedly in a review of the literature.

> At a recent national conference, a U.S. Department of Labor official predicted that by 1985, 80% of all jobs will require some knowledge of computers. An EDUCATION USA special issue on Technology (Jan. 4, 1982) said, "By the year 2000, as many as 65% of the work force may be employed in jobs involving the processing and communication of information. Like today's functional illiterate, times for those not trained to use technology will be tough indeed". (Computers in Education, 1982, p. 1)

The extensive use of computers is no longer a futuristic idea but a reality.

A brief historical overview of computer technology development provides an insight into the process that has made technological equipment, which less than 40 years ago was tremendously expensive, cumbersome, and complicated, become easily accessible to educational settings. Moursund

(1982) traced this rapid development from 1945 to the present. The first general-purpose electronic digital computer was introduced in December 1945. It contained 18,000 vacuum tubes, weighed 30 tons, required a large room for installation, used an enormous amount of electricity, and demanded air conditioning. Operation of this computer was limited to computer specialists who had received extensive training. During the 1950's computers became available commercially but were still huge and extremely expensive. Transistorized computers first became common in 1960. They were smaller, more reliable, and less difficult to operate. The development of the integrated circuit during the 1960's revolutionized computers by allowing hundreds of transistors to be manufactured on a small piece of silicone called a "chip." The use of these chips reduced both the size of computers and the expense of producing them. With the progress of chip technology, microcomputers requiring only a very small number of chips became operational by the mid-1970's.

These microcomputers are within the financial reach of schools, require a small area for installation, and are designed so that even kindergarten children can operate them. Improved technology has made a $3,000 microcomputer system of today comparable to a $200,000 computer system of 20 years ago; a computer that requires only the space of a desk top is capable of performance superior to a computer that filled a large room at that time; a computer that can be operated by a five-year-old is as sophisticated as the one that required a specially trained operator only two decades ago. As the computer has become cheaper, more mobile, and less complicated, it has proliferated almost all facets of society. It has been readily accepted as a necessity in the business world (Moursund, 1982).

In March 1980, the Association for Computing Machinery's Sub-Committee on Computing in the Secondary/Elementary Schools appointed a Task Force on Computer Assisted Learning to conduct a study assessing the current and projected use of the computer in U.S. public secondary and elementary schools (Diem, 1981). According to Diem, 974 school districts were selected for the study; each system selected was requested to answer a 34-item questionnaire. Of those systems selected for the study, 62.3% responded, revealing the following relevant findings:

1. 90% used computers for either instructional or administrative purposes. This number was expected to rise to 95% by 1985.
2. 74% of the districts included the use of computers among their instructional strategies. It is anticipated that this will increase to 87% by 1985.
3. 54% currently use computer-assisted instruction (CAI) in one form or another. CAI encompasses learner-computer interaction.

4. Most computer-assisted learning is heavily concentrated at the secondary level. Mathematics, natural sciences, business, and language arts use computers most often.
5. Computer-assisted learning is expected to expand to other high school fields, including the social studies, while extensive use at the elementary level is also foreseen.
6. Major obstacles to wider use of the computer as a learning tool appear to be limited financial resources, lack of knowledge about computers on the part of administrators and faculty, unfavorable attitudes about technology, and inadequate computer-learning packages. (Diem, 1981, p. 1)

School officials are exploring different possibilities in an effort to acquire computers to meet the needs of their students. A congressional bill, known as the Technology Education Act of 1982, or the Stark Bill, was introduced to allow computer companies to donate equipment to schools in exchange for the tax deduction for the computer companies (North Carolina State Department of Public Instruction, 1982). Although the legislation to allow this was approved in the House of Representatives by quite a wide margin, the Senate did not consider it in the 1982 fall session. However, Apple Computers, Inc., "will be donating computers in California . . . as Governor Brown has signed a similar bill to allow contributions to schools here starting early in 1983" (Jobs, personal communication, Dec. 20, 1982). Many states, school systems, or individual schools are entering competitive funding proposals to computer companies in order to obtain computers for educational purposes. School systems are stretching budgets to include computer equipment and materials (Coburn et al., 1982).

Some states have introduced legislation which would mandate that instruction in computer literacy be provided through the public schools. Florida already has the mandate in effect ("EL's Survey of the States, 1982"). An annual survey in 1982, conducted by Electronic Learning, found that 33 states have established computer educator-user groups "all of which have the general aim of promoting the effective use of computers in the classroom. In those states where no statewide groups were identified, most often a special arm within the state department of education (DOE) was filling that role" ("EL's Survey of the States," p. 62). Martin and Heller (1982) reported that eight states--Alaska, California, Delaware, Florida, Minnesota, North Carolina, Pennsylvania, and Texas--have developed policies concerning educational computing.

This proliferation of interest in computer literacy and the availability of microcomputers have placed great pressures on public school administrators. The question was no longer whether or not to place computers in the schools; instead, the question was how to implement computer programs. The main concern as schools began implementing these programs was the lack of teachers prepared to teach computer literacy (Coburn et al., 1982). According to a 1982 survey of the 20 largest schools of education in the United States, only one (Illinois State University) had a computer literacy requirement for graduation ("EL's Survey of Schools of Education," 1982). This report indicates a lack of preparation in computer literacy at the undergraduate level for student teachers so that teachers have entered the profession unprepared in this area. In a survey conducted in 1980, it was revealed that 94.4% of 227 student teachers surveyed felt unqualified to teach computer literacy (Stevens, 1980). The public is demanding that school administrators examine curricula and create computer-literate learning environments for students at a time when educators themselves are not yet computer-literate (Coburn et al., 1982).

Further compounding the dilemma for school administrators, this compulsion to provide computer literacy for all students inundated the public schools at a time when educational funding was being reduced at the federal, state, and local levels (Coburn et al., 1982). A study of the financial condition of urban school districts, conducted by the American Federation of Teachers (AFT) and released in Education Week (March 23, 1983), showed the nation's urban school districts to be in far worse financial condition in 1983 than they were five years before (Foster, 1983). State and local educational budgets have not had adequate resources to compensate for the reduction in federal aid to education.

Another factor that complicated the implementation of computer literacy in existing curricula was the consistent decline in public school enrollment. According to the 27th Annual Survey by the National Center for Educational Statistics, the total decline of public school membership was 4.8 million from 1972 until 1980, with 41 states reporting a smaller enrollment in 1980 than in 1970 (The Size and Shape of Public School Systems, 1983). With the decrease in membership precluding the hiring of new teachers in most school systems, computer literacy programs had to be implemented by existing staff members.

The recent report, A Nation At Risk (National Commission on Excellence in Education, 1983) emphatically addressed the urgency for curriculum changes to include computer literacy programs that will prepare highly skilled workers in the new fields of technology. It stated that:

> Computers and computer-controlled equipment are penetrating every aspect of our lives--homes, factories, and offices.
>
> One estimate indicated that by the turn of the century millions of jobs will involve laser technology and robotics.
>
> Technology is radically transforming a host of other occupations. They include health care, medical science, energy production, food processing, construction, and the building, repair, and maintenance of sophisticated scientific, educational, military, and industrial equipment. (p. 10)

With the strong emphasis on integrating the new technology into the schools, the plight of educators was described succinctly by C. Edward Scebold (1983), as he wrote in CALICO Journal,

> As in the past, educators find themselves reacting to conditions in the society which they must serve. The pressure is intense, for we are called upon to utilize a technology which we did not devise and for which we are not prepared. It calls for time to think, to plan, and to reeducate ourselves (p. 13).

Computers and Curriculum Change

The basic issue of the necessity for curriculum change to accommodate the influence exerted by the recent developments in computer technology is of major importance to school administrators. As reported by Naisbitt (1982), the National Council of Teachers of Mathematics has concluded that

> computer literacy is an essential outcome of contemporary education. Each student should acquire an understanding of the versatility and limitations of the computer through first-hand experience in a variety of fields. (p. 33)

Gawronski and West (1982) saw the information explosion and ready access to computer power posing many challenges to our total concept of schooling. Coon (1982) addressed a need for significant change if our schools are to survive; she described those changes as follows:

(1) The transmission model of educating children must go. With the accumulated knowledge in all technical fields doubling every 5-10 years, there is no way teachers can store all the knowledge that a child might want to access. Even so, current educational research shows that the transmission model (teacher as lecturer) is still the most prevalent, though the least effective of teaching methods. Helping children access information via computer with the teacher serving as facilitator is a far more reasonable method of helping children learn.

(2) Helping children take charge of their own learning must become a fact and not a platitude. Children who exercise power and who achieve in the school setting are children who have enough confidence to expose themselves to the consequences of failure and to consider difficult tasks as challenges. Computers in the educational setting can provide consequences that are safe to accept. It . . . gives children another chance to correct entered data as a step toward improvement.

(3) Individualized educational programs must become the norm for all children, not just those in special programs. . . . Students must be allowed to acquire knowledge in a way that suits them. The computer allows for these differences. (pp. 15-16)

In Mindstorms, Papert (1980) expressed concern for students' ability to succeed if they continue to learn only what is being taught in the present school curricula. He emphasized that learning is not something that is "done" to people; instead, it is something they do that gives them a sense of power and mastery. Thus, Papert developed the Logo computer language to enable students to develop a sense of power and mastery by making the computer do what they want it to do instead of responding to programs developed by others. John Naisbitt (1982), in Megatrends, approached the necessity for implementation of computers into the curriculum in a less idealistic way and discussed the practical and financial advantages of this change.

> First, computers offer a cost-effective albeit capital-intensive way of individualizing education. Second, computers simplify the extensive record-keeping required for individualized instruction. Third, familiarity with computers is now considered a strong vocational advantage, a salable skill (Naisbitt, 1982, p. 33).

Reinforcing this idea of computer knowledge being a salable skill, Luehrman (1981b) estimated that 50 hours of hands-on experience in computer use for a student is a $1,000 advantage in first-year income for that student, with the $1,000 being compounded annually.

Moursund (1982) viewed computer literacy as a basic element of the school curriculum, ranking in importance with the subjects of reading, writing, and mathematics. He saw a need to reexamine every aspect of the current curriculum "because a computer is a powerful addition to solving the same types of problems as one solves using the three R's, we can predict that eventually all students will be expected to learn to use a computer" (p. 17). He went on to express two points that he considered fundamental in future curriculum development:

(1) Paper and pencil remain essential tools--it is merely routine, rote paper and pencil manipulation that is decreasing in importance.

(2) There is an increased need for accurate and rapid mental skills such as knowing the basic number facts and knowing how to spell and punctuate. In emphasizing these skills we are preparing students to work with the computer rather than compete with it. (p. 23)

Since the computer is a machine that can help solve a wide variety of problems, Moursund interpreted its integration into the curriculum as decreasing the emphasis on routine and rote skills and increasing the emphasis on higher level skills of understanding, problem solving, and application of results when problems are solved. Basic skills are not replaced but enhanced by adding computer literacy to the existing curricula.

Computer Literacy in the Curriculum

At the present time, research that is relevant to computer literacy is characterized by diversity. Some of the foremost writers in the discipline did not agree on a definition for computer literacy or the required components of a computer literacy program. The Education Department of the United States awarded a contract to the Educational Testing Service in the amount of $134,224 for the purpose of defining computer literacy and preparing questions that measure computer literacy (Report on Educational Research, 1983). Initially, computer literacy had a limited definition and was generally described as what students should know about the use of computers and the capabilities of computers (Forman, 1982). Similarly, "one school of thought holds that computer literacy means mastering the skills needed to operate a computer successfully" (Zakariya, 1982, p. 19). However, recent literature suggests that these definitions are no longer adequate to reflect goals and objectives for a computer literacy program. Zakariya stated,

> Another and possibly more widely accepted definition [of computer literacy] includes some knowledge of the history of computing devices; a practical understanding of how a computer operates; familiarity with present and potential uses of computers; and an understanding of the social and educational impact of the computer. (p. 19)

Another encompassing concept of computer literacy was that "a computer-literate person is one who has the skills, knowledge, and attitudes necessary to survive in an information-based, computer-dependent society" (Montgomery County Public Schools, 1982, p. 4). Bell (1982) summarized the meaning of computer literacy more frequently accepted in current literature by stating,

> General computer literacy encompasses areas such as history of computers, the nature of computers, communicating with computers, types of computers, and peripheral hardware, capabilities and limitations of computers, computer uses and programming skills. (p. 171)

As public school administrators begin implementing computer literacy programs into curricula, agreement must be reached on the meaning of computer literacy. This will determine the scope and sequence of the program and the learning outcomes for students in the program.

Computer Programming

Computer programming, as well as computer applications, seems to be viewed as a necessary component of computer literacy. Zakariya (1982) asserted that a student develops personal and intellectual skills through working with a computer, and that computer programming is an exercise in procedural thinking developed by dividing a complex problem into small, sequential steps. Computer programming enhances students' general intellectual abilities and prepares them to develop high-level thinking skills that prepare them for citizenship in a computer-based society (Coburn et al., 1982). Luehrmann (1981b) was one of the most forceful advocates of computer programming as a component of computer literacy. He contended that

> the student learns how to analyze problems in terms of procedures (sets of small steps) that operate on data; how to write that analysis of the problem in the form of a computer program; and how to enter the program into a computer, run the program, revise it, and solve the problem. Such a student is learning a new problem-solving skill. (Luehrmann, 1981b, p. 64)

Luehrmann compared computer literacy to literacy in language by stating that to be literate a person must be able to do something with language, not just to be aware of it and its various components--letters and words--and the role of language in society. Computer literacy must include the ability to do computing, not just to recognize and identify the components of a computer system or to be aware of the capabilities of a computer (Luehrmann, 1981a). This analogy emphasized his contention that computer programming is an important part of computer literacy.

Seymour Papert, author of Mindstorms and developer of the computer language Logo, saw the computer as an object to think with if children could easily communicate and interact with it in a natural way. This belief was his motivation in developing Logo language which combines computer programming and a learning philosophy that enable students to learn subjects like English and math by interacting with a computer (Lough, 1983). Through field tests conducted over a 14-year period (1968-1982), indications were that Logo was having a significant effect on learning by enabling students to

(a) develop logical thinking and problem-solving skills,

(b) learn to develop and test their own ideas and theories, and

(c) become familiar with concepts such as variables, symmetry, angles and geometric forms.

Papert (1980) saw computer programming as a means for children to gain control over the computer instead of being controlled by it through prepared programs and games.

Applications of Computers in Education

It appears that technological innovations have a significant role in education, both for the instructional program and for the administration of schools. Robert Judd (1983) expressed this when he stated,

> Recent developments in the microcomputer field have come tumbling out one on top of another; the number of innovations that apply to school administration has been growing and shows no sign of slackening. (p. 13)

Public school administrators must be knowledgeable of the capabilities of computers to enhance the total educational program. Most studies identified three broad categories of utilization of computers in education: Computer Assisted Instruction (CAI), Computer Managed Instruction (CMI), and Administrative Uses of Computers. For the purpose of organizing the applications of computers in education, this study has used these categories.

Computer Assisted Instruction (CAI)

Computer Assisted Instruction (CAI) was described by Splittgerber (1979) as

> a teaching process directly involving the computer in the presentation of instructional materials in an interactive mode to provide and control the individualized learning environment for each individualized student. (p. 20)

At its simplest level, CAI is drill and practice, while at its most sophisticated level, a dialogue system allows the computer and student to interact in high-level problem-solving activities (Moursund, 1982). An advantage of using CAI, as described by Gawronski and West (1982) is that it

> may also be used to stimulate real or imaginary situations that are too technical, expensive, dangerous, or time consuming to perform in the usual classroom setting. Physical science experiments, water polution studies, and political and economic scenarios are examples of computer simulations presently available. (p. 1)

Due to the lack of high-quality software and the extreme difficulty of controlling the number of variables in any learning situation, the success of CAI is largely dependent upon the individual situation. However, there are definite advantages of CAI when used with other appropriate teaching methodology (Gleason, 1981). A study of the research on Computer Assisted Instruction (CAI) during the past 20 years was conducted by James Kulik and his colleagues at the University of Michigan and reported in "Computers in Education: What the Research Shows" by Gerald W. Bracey (1982). The initial study examined 301 studies, eliminating 250 due to methodological flaws and retaining 51 research studies for analysis. These studies examined the effect of CAI on students in grades 6 - 12 and reported findings in three categories: achievement, affective/motivational, and social. The following conclusions were drawn from the study:

(1) Effects of CAI on achievement outcomes

- students who received computer-assisted instruction scored better on objective tests than students who received traditional instruction only (63rd percentile, 50th percentile, respectively)
- students' retention was increased by CAI
- CAI improved the speed at which students learn a given amount of material

(2) Effects of CAI on Affective/Motivational Outcomes

- students expressed positive attitudes about computers because they could move at their own pace and work in a non-threatening atmosphere
- they felt more in control of their learning

(3) Effects of CAI on social outcomes

- encouraged collaborative, cooperative problem-solving
- lessened competition

A set of recently conducted studies by the Educational Testing Service (ETS), in collaboration with the Los Angeles Unified School District, showed CAI to be even more effective with younger students (Bracey, 1982). This four-year study, involving students in grades 1 - 6, revealed the following findings:

(1) CAI was found to be an effective learning aid over the long-term (at least one year) as well as the short-term.

(2) It was shown that CAI could easily be replicated, "unlike many other approaches to compensatory education" - such as individual tutorial.

(3) The study found that while CAI costs were within typical compensatory education budgets, they were not proved to be more or less cost-

> effective than other methods of helping disadvantaged students. (p. 52)

ETS found that students who had access to computers for only 10 minutes per day scored significantly higher in mathematics than those students who had no access to computers. Twenty minutes of computer access doubled the gain. Smaller but consistently positive gains were made in reading and language by students with access to computers and were maintained throughout the four-year study (Bracey, 1982).

Most studies divide CAI into five basic categories. Summarized from Coburn et al. (1982), these five categories are the following:

Drill and practice. These are the most common applications of CAI. They use the computer to practice a particular set of skills in math, reading, spelling, or other basic skills areas.

> They are criticized by many educators for being narrow in their pedagogy (stimulus-response), unnecessarily boring, and even at times for reinforcing incorrect learning. (Coburn et al., p. 21)

Tutorial programs. These programs instruct the student in an identified area, one-on-one, instead of the teacher instructing the student.

Demonstrations. These programs are particularly appropriate for mathematics and science instruction, or in any area where complicated or dangerous demonstrations are used in instruction. They can often be much more effectively presented by the computer through the use of color, graphics, and sound than by a teacher.

Simulation. This is a powerful capability of the computer. It can simulate events that could not be presented by a teacher due to danger, expense, or lack of time.

Instructional games. These games range from a motivational activity to a rich and complex learning environment. They can be used in any area of instruction for motivation, instruction, reinforcement, or reward.

Computer Managed Instruction (CMI)

Computer Managed Instruction (CMI) was described by Splittgerber (1979) as:

> an instructional management system utilizing the computer to direct the entire instructional process. . . . CMI has some or all of the following characteristics: organizing, curricula and student data, monitoring student progress, diagnosing and prescribing, evaluating outcomes, and providing planning information for teachers. (p. 20)

One sophisticated CMI program available can provide 20 different analyses of student, classroom, school, or district progress (Geisert, 1982). Functions this program can perform, according to Geisert, include projecting class profiles, grouping by established objectives, generating individual progress charts, listing resources available to teach a particular skill, and reporting to parents. By using the computer to manage the time-consuming record-keeping involved in teaching, teachers have more time to personalize instruction, promote group process work, and help students learn problem-solving skills (Gawronski & West, 1982).

Moursund (1982) suggested using the computer to free teachers of time-consuming tasks such as scoring objective tests. Computer programs are available that can perform an item analysis on the questions, keep records on students, and print out reports for school personnel and parents. They also have the capability of analyzing diagnostic tests and identifying areas that need reinforcement. Nobel (1982) saw the computer being used in test preparation as well as in scoring and analysis of data. He described a programmed master list of questions that would generate tests on appropriate instructional areas and instructional levels as requested by the teacher. When designed properly, the tests could be scored, results analyzed, and individualized feedback provided by the computer. This method of computerized testing resulted in more effective teaching through more frequent evaluation designed to meet specific needs. The rapid return of test results provided timely feedback to the students and promoted learning through frequent review.

Wallace Judd (1983) saw a different advantage to using computers in testing. He called it computerized adaptive testing and saw it as a means of individualizing and humanizing tests. In this method of testing, the computer adjusts the selection of test items so that if a student gets the first item wrong, the next one will be slightly easier with the process continuing until the student answers one correctly.

Administrative Uses of Computers

Computers have many capabilities that enhance the effectiveness and efficiency of public school administrators. They are powerful tools for gathering, organizing, analyzing, processing, and evaluating information (Gawronski & West, 1982). In a study conducted by the schools in Montgomery County, Maryland, the financial advantages of using computers in school administration were analyzed. Through that study, it was reported that a staff of 23 people, using one computer, performed duties that would normally require 400 payroll clerks (Montgomery County Public Schools, 1982). The same study reported reducing the cost of scoring standardized tests from $1.50 per student to $.30 per student. The school system realized an annual saving of a million dollars due to computerized school food-purchasing procedures. Other administrative uses of the computer listed in the study included scheduling of students, calculating grade point averages, determining class rankings, generating students' college transcripts, printing report cards, and monitoring inventories.

Dealing with a different aspect of school administration, Marshall (1982) proposed that computers will impact on the decision-making process of school administrators. This, he asserted, will evolve due to the increased volume of information available to the decision maker. Concurrently, the simplicity of dispersing the information to a greater number of people will encourage decentralization of the decision-making process. This decentralization of decision-making was described by David K. Mosow (1983) as a "Percolate Up" model of information flow, made possible by the capabilities of the microcomputer in contrast to the traditional "Trickle Down" flow of information in educational organizations. Mosow distinguished between the two models by examining patterns of collecting, disseminating, and using information of importance to an organization. With the Trickle Down model,

> information is collected near the top of the administrative structure and the results flow down to the end users. . . . There is one major flaw in this model--processed information is slow to return to the end user. (p. 21)

The Percolate Up model of information flow, as explained by Mosow, allows information to be collected and processed at the source with only the pertinent summarizations passed to other administrators for appropriate processing at each level. This enables the users to have access to information commensurate to their needs without delay. It also relieves the higher levels of administration of processing extraneous data and superfluous paperwork. The microcomputer enables each school to add, delete, and change information as it is collected, to print special reports as needed, and to disseminate them appropriately.

Recent developments in the microcomputer field and advancements in software production have provided report capabilities for almost every administrative need in a school system (R. Judd, 1983). School administrations do not need a programmer, system analyst, or even a data-processing manager with the cost-effective microcomputers and the new software systems that enable administrative services to accomplish computer-assisted information control and generation of reports (Poirot, 1980). Chase Crawford of the Florida Department of Education reported on a project that involved the cataloguing of computer programs of microcomputer software for use in school administration. In this report, Crawford (1983) analyzed the types of computer software on the market that are available to assist in performing administrative functions in education and prepared a listing for each category. The categories identified and the number of software programs for each were the following:

7 - athletics

24 - attendance accounting

27 - budgeting, accounting, and other business management (district level)

11 - budgeting, accounting, and other business management (school level)

21 - grade analysis and reporting

8 - guidance personnel use

19 - instructional management

12 - inventory and property records

8 - media center personnel use

3 - planning

17 - scheduling

6 - staff personnel record keeping

25 - student record keeping

Crawford agreed with other writers in the categorizing of computer programs for school administrators into three basic types: data management systems, electronic spread sheet systems, and word processing systems. He described them as follows:

Data management systems. These programs use the computer to store information, retrieve it, and report it in a format determined by the need of the user. Information can be stored by various categories which can be recalled, changed, or analyzed. These electronic filing systems use a field as a unit of information, a record as a meaningful collection of fields, and a file represents a meaningful collection of records. Data management programs have a great potential for reducing paperwork for school administrators since they can substitute for maintaining records and files and generating reports from those files in such areas as attendance accounting, instructional management, personnel and student records, inventory and property records, and scheduling.

Electronic spread sheet system. The electronic spread sheet programs enable the computer to operate as a calculator. An electronic spread sheet is a matrix of columns and rows, the intersections of which define about 16,000 positions into which one can enter a number, an alphabetic title, or a formula to be calculated (Crawford, 1983, p. A3). It has the capability of duplicating a printed form such as an attendance register, book report, budget, or various other forms required of school systems. Calculation and manipulation of figures are instantaneous with an electronic spread sheet system, providing feedback with a minimum of effort and time. The advantages of using a spread sheet system over the conventional paper, pencil, and calculator are speed, accuracy, storage of data, and ease of duplicating a desired format. The fiscal impact of a proposed change in the school budget can easily and quickly be determined with an electronic spread sheet since changing a single value in the table will instantly change all related values. The use of these programs free school administrators from routine tasks and allow them to spend their time more productively.

Word processing systems. The word processing programs convert the computer into an intelligent typewriter. "Word processing is the writing of new text or the recalling of a previously written text from memory, editing it, and producing it in a final form on paper" (Crawford, 1983, p. A4). Written text can be stored in computer memory or on a diskette until it is corrected, edited, or modified; then the final document can be printed on paper. Word processing programs can minimize laborious, time-consuming writing tasks for school administrators through preparation of proposals, contracts, forms, reports, and letters. Documents that involve a great deal of standardized text can be customized by making minor changes where only a small portion of the text needs to be changed in each case. The word processor allows words, phrases, sentences or paragraphs to be deleted, changed, or moved, usually by only a computer command. Special capabilities include tabulating and indenting, justifying margins, subscripting, underlining, and bold printing. Capabilities are almost unlimited with automatic pagination and dating, automatic formatting of lists and tables, and centering of text being common.

> In larger microcomputers entire lexicons of words can be stored in order that the entire text can be checked for spelling, hyphenation of words at the end of lines, and capitalization of proper nouns. (Crawford, 1983, p. A5)

The data management systems, electronic spread sheet systems, and word processing systems have worked well for administrative tasks because of the large amount of information to be processed and the kinds of repetitive operations needed to do so (Poirot, 1980). Crawford (1983) identified three situations in which microcomputers can simplify and enhance the role of the school administrator:

> (1) When massive amounts of data are processed through well-defined operations
>
> (2) When processing is highly repetitive
>
> (3) When speed of processing is of great importance (p. 3)

Scebold (1983) summarized the effects of the computers for school administrators when he stated,

> The computer offers a new perspective on how we can manage all facets of our lives; indeed, it has already caused a revolution in how we live, in how we interact with each other, and how we relate to the information on which we depend. (p. 13)

Social and Ethical Issues to be Resolved

Two principle issues to be addressed by public school administrators as computers proliferate the schools are social and ethical issues. The social issue is that of equity; the ethical issue deals with the development of a code of ethics that will protect the computer industry from illegal copying of commercially marketed software. The rapid pace of the transition into the technological age has caught educators unprepared to deal effectively with these problems and has allowed insufficient time to devise strategies to alleviate them.

Computer Equity

One concern of school administrators as computer literacy becomes a basic in the curriculum is the problem of assuring computer equity to all students. In a review of articles and studies on this topic, equity was addressed in two areas--equity between male and female students and equity among socioeconomic levels of students.

Equity between the sexes. For undetermined reasons, more boys than girls are attracted to microcomputer use in the public schools (Boss, 1982). In a program for middle school students in Lebanon, Oregon, media specialist Jacqueline A. Boss noted that more boys than girls enrolled in the summer school microcomputer class and spent more time using computers during the regular school term. She reported that in weekly computer programming contests, designed to encourage elementary programming among middle school students, over a nine-week period eight winners were male--leaving only one female winner. She discussed the inconsistencies existing between school programs and the work world; microcomputer courses at the secondary school level are dominated by males while the majority of microcomputer operators in the work force are female. Boss observed in her work with students "that left to their own inclinations, very few girls will take the time or energy to get involved with computers or microcomputers available to them in schools" (p. 56). Yet, on the adult level, Boss cited examples of women filling the role of key punch operators, data processors, and operators of office computers more frequently than men. Therefore, she perceived a need for schools to prepare female students for assuming these roles.

Mathews and Winkle (1982) asserted that female students merit special attention if computer equity is to be achieved. They contend that "female students inherit a handicap (for the most part culturally derived) in the form of anxiety about computers and related technology" (p. 315). Girls often limit their career options by neglecting to take advantage of the opportunity to acquire technological skills as a result of these self-inhibiting attitudes. Early intervention is necessary since studies of mathematics attitude, aptitude, and achievement revealed that students as early as third grade begin viewing mathematics as a subject for boys (Mathews & Winkler, 1982).

A summary of the findings of a national study of 17-year-old students revealed that twice as many boys as girls took computer programming courses; twice as many boys as girls had computers at home; and there was a 3:1 ratio of boys to girls in coeducational computer camps ("Computer Learning," 1984). The same report indicated that the discrepancy was even greater at the college level, citing that less than one-fourth of the undergraduate computer science majors at the University of California were female while at MIT there was a 10:1 ratio of male to female computer science graduate students. According to Children's Computer Workshop, this inequity based on gender seems to be a matter of inclination. Boys volunteer for computer work more often than girls, experiment more, and seem less afraid of making mistakes. There seems to be a subtle pressure in our culture that discourages girls from becoming involved with computers and is often reinforced by counselors or teachers who steer girls away from computer courses or have lower expectations for girls than boys enrolled in the courses ("Computer Learning," 1984). Computer software was found to be designed to have more appeal to boys than to girls. A survey of computer software found that packaging, titles, concepts, and rewards were more frequently designed for boys. A three-year study based on thousands of hours of observation of children ages 3 to 13 concluded that girls are more likely to cooperate during computer sessions while boys are more likely to experiment. Girls are more systematic and work through a program the way the designer intended it, while boys make up their own game, trying the wrong answers to see what happens. Girls prefer games with less violence than do boys ("Computer Learning," 1984).

Even between male and female teachers, there seems to be an attitudinal difference toward computers. In a study of teacher attitudes toward computers, Beauregard (1975) found

> a significant difference in the attitudes of teachers toward computers does exist between male and female teachers. . . . Male teachers tend to have more positive attitudes toward computers than do their female counterparts. (p. 124)

<u>Equity among socioeconomic levels</u>. Predictions have been made that computers will augment the division between affluent students and economically disadvantaged students. Concern has been expressed that in the future anyone who is not familiar with computers will be as economically disadvantaged as those who presently cannot read and write (Benderson, 1983). This point was stressed by Ernest J. Anastasio, vice president for research management at Educational Testing Service, when he stated,

> A segment of our society may be denied these options (for employment) because they will have

> had no contact and no familiarity with high technology. These are likely to be the children who grow up in major urban areas. On the other hand, children in the more affluent suburban communities will have more familiarity with the technology, and they will be the ones who have access to better jobs, better education, and the like. (Benderson, 1983, p. 13)

The social-equity issue of computer education was perceived by Walker (1980) to be one of the major problems to be resolved by school systems. With private schools and wealthier public school districts getting the more sophisticated computer systems first, the more economically deprived areas will be less able to prepare students to compete in a society that demands high technological skills. Steve Hallmark, an educational consultant in Washington, D.C. warned that computers may lead to the development of a permanent economic underclass because of inequity in making them accessible to all students (Walker, 1980). The same students who cannot afford personal computers in the home are attending schools that cannot absorb the additional expense of providing computer programs for the students. There does not seem to be enough federal money to bridge the gap since, even though federal funds from the Elementary and Secondary Act may be used for computers, "most schools are so locked into using that money for reading and math tutoring that using it on computers seems frivolous" (Walker, 1980, p. 6). A survey conducted by Market Data Retrieval, a market research firm in Westport, Connecticut, dealt with the use of microcomputers in the schools. One aspect of this study analyzed the relationship between school district size and the use of microcomputers. Findings from the study showed that in larger school districts with over 5,000 students, two of three had microcomputer facilities; in the smaller school districts with under 1,200 students, fewer than one of three had microcomputer facilities (Baker, 1982). Based on these data, students attending schools in smaller school districts are less likely to have the opportunity to work with computers than are students attending schools in larger districts.

Another conclusion from the survey by Market Data Retrieval was that low-income school districts lag behind their wealthier counterparts in providing computers for their students to use. This survey showed a positive correlation between the amount of money spent for instructional supplies per student and the number of computers in the schools. In school districts which spent less than $30.00 per student, only 22 percent had microcomputers while in school districts that spent more than $60.00 per student, 40 percent had computers (Aeppel, 1982). There was also a difference in the way computers were used in wealthier school systems. According to Aeppel, the more affluent systems used computers to teach advanced skills such as programming while the low-income systems used them more often for drill and practice, since the computers were often purchased with federal funds earmarked for remedial programs. A national survey, conducted by the Center for Social Organization of Schools, Johns Hopkins University, confirmed the findings of the survey by Market Data Retrieval. This study found that public schools in districts with a high percentage of poor families were much less likely to own computers; only 41 percent of these schools had computers while 66 percent of the wealthier schools owned them (Johns Hopkins University, 1983). The secondary schools least likely to have computers fall into three categories--low socioeconomic schools, predominantly minority schools, and Southern rural schools (Johns Hopkins University, 1983). This survey reported that enrollment is a major factor in school ownership of microcomputers. Only 33 percent of elementary schools with an enrollment of less than 200 students had computers compared to 55 percent of the schools with more than 700 students which had computers.

Wallace Judd (1983) warned school administrators of the possibility of legal ramifications if they do not solve the equity problem in an effective manner. He said,

> Administrators who claim that their schools cannot afford computers might find themselves with

> their school districts the defendants in a suit brought under the laws mandating equality of educational opportunity. (p. 122)

As the effects of computers and computer literacy become more widely recognized and the public becomes more aware of their importance in the educational process, the equity issue will be increasingly serious for school administrators.

Ethics Involved in Microcomputers in Schools

The ethical issue of whether or not to copy commercially marketed software will be faced by all computer educators as they become involved in computer programs in the schools. This ethical, and even legal, issue was discussed in "MICROgram: The Copying Problem" (1983), and its implications for educators were examined. If educators decide to copy computer software and courseware, then by example, they are giving approval for students to copy data from copyrighted materials.

> Disallowing the issue of whether the software and courseware industry understands the needs of the educational community (and the educational community's responsibility to the companies it does business with) administrators and teachers should take a very careful look at how their attitude regarding software piracy may influence their student's [sic] behavior. (p. 35)

Educators have the responsibility to discuss this issue openly with students, other teachers, administrators, and parents, and to emphasize that, even though software piracy may be a common practice, it is ethically and legally unacceptable.

Paul C. Hardin (1983) saw the development of a fair, legal, and practical standard of ethics for application to computers and software as the most critical social and economic issue for the courts, industry, and education to confront in the present decade. He identified four major issues involved in computer ethics:

> (1) Theft of money, goods or property using the computer as a "tool" to such ends
>
> (2) Taking information from computer memory, which information is then used in detriment to the parent entity and/or the benefit of the thief
>
> (3) Utilization of computer time without authorization
>
> (4) Utilization of hardware, software or courseware designs which are identical or nearly identical to those of another person or entity, and from which person or entity those designs originated (p. 58)

Since the first three issues are presently considered crimes punishable under existing laws, the fourth issue is the one of major concern to educators. Some measures have been taken in the marketplace to help resolve the problem of software copying in the schools. Backup copies must be provided, either as a part of the purchase price or at a nominal cost. A multiple machine license may be purchased by a school principal permitting duplication of materials to be used in that particular school. A local network license may be purchased to allow educators to use one piece of software to service many students in schools where several microcomputers are networked to a central processing unit. In addition, commercial distributors of software grant multiple sale discounts and offer generous discounts to school systems that have developed written policy discouraging copying of computer materials ("MICROgram," 1983).

Summary

The literature related to computers in education is characterized by diversity, making it difficult to summarize. There was an obvious need for further study to determine the long-range impact of computers in the schools, the advantages they offer, and the problems they create.

However, the general conclusion may be drawn that the technology is more advanced and accessible at this point than the schools are prepared to use to its fullest potential. There is a need for extensive inservice programs to help prepare educators to implement computer programs that are needed by students. Computer programs are available that can assist school administrators in more efficient and effective operation of almost any phase of the educational program, freeing administrators of much of the drudgery of repetitive tasks so that more of their time can be spent as educational leaders of the schools and school systems.

The public and society are demanding skills that will prepare students to function more successfully in this technological era. These demands dictate the need for curriculum change. Curriculum review, evaluation, and planning that will effectuate curriculum change are imperative and emerge as a major responsibility of educators.

Chapter 3

METHODS AND PROCEDURES

This chapter contains a description of the study, the selection of the sample, treatment of the subjects, statement of null hypotheses, description of the instruments, data collection, and a summary of the statistical analysis of the data.

Description of the Study

The study was quasi-experimental in design, using a pretest, treatment, and posttest with a selected group of participants, as depicted below:

N = 44	Selection/ Assignment	Pretest	Treatment	Posttest

Quasi-experimental research involves applied settings where it is not possible to control all the relevant variables but only some of them (Isaac & Michael, 1981). In educational research, particularly in field studies, this design is often used because it is impractical or impossible to make random selection or assignment of the sample (Borg & Gall, 1979).

To conduct this study, it was necessary to secure the support of the North Carolina State Department of Public Instruction. This was accomplished through consultation and planning with the Director of the Northwest Education Regional Center, who gave his approval and support for the study to be conducted using the resources available to the Regional Center. With this approval secured, the investigator, in collaboration with the coordinators of staff development and research for the Northwest Education Region, devised plans to conduct the study. These plans included determining the sample, scheduling activities, and notifying the subjects of the scheduled activities. In addition, the staff development model to be used in the treatment of the subjects was determined and a plan was developed for each training session.

It was determined that the Northwest Regional Center in North Wilkesboro was the most convenient site for the training sessions, so arrangements were made to use that facility. Computer hardware required to conduct the training was secured by scheduling the mobile educational laboratory from the Apple Computer Company. Consultants with expertise in specific areas were identified and scheduled to participate in the appropriate sessions.

The Sample

Participants in the study were 44 public school administrators from the Northwest Education Region of North Carolina. The state of North Carolina is divided into eight education regions with the Northwest Education Region being Region 7 (see Appendix B) and consisting of 19 local administrative units. The Northwest Regional Education Center acts as a broker for the educational services of the state education agency, providing services for administrators and teachers.

The 19 local education agencies (LEA's) in Region 7 include both rural and urban school systems representing a wide range of school enrollments and organizations. The schools in the region serve small, isolated mountainous areas with sparse populations as well as cities with populations of over 20,000. The school systems range in size from 1,788 students to 13,479 students (Appendix B).

All public school administrators in Region 7 were apprised of the opportunity to participate in the computer literacy workshop. Although participation was not mandated, the North Carolina State Department of Public Instruction has placed strong emphasis upon school administrators' acquiring of computer skills. This emphasis is reflected in the State Plan for Computer Utilization in North Carolina Public Schools, which recommends:

> that, for administrative purposes, school and school systems: . . . require administrators to gain at least a minimal understanding of both the instructional and administrative uses of computers to enable them to make informed decisions, cope with problems and provide leadership in this new area of technology. (North Carolina State Department of Public Instruction, 1983)

The subjects in the study were public school administrators, consisting of superintendents, principals, supervisors, and directors or coordinators of programs, who agreed to participate in a computer literacy training program. These school administrators represented diverse levels of preparation, experiences, and backgrounds. A collection of demographic information revealed that the participants had formerly lived and worked in many geographic regions (see Appendix C), and their work experience included a wide range of educational assignments with varying levels of formal preparation (see Appendix D).

The Treatment of the Subjects

The study was undertaken to delineate characteristics or descriptors that would help identify educators who might be most receptive to computer training, as presented by a selected staff development model. In order to manage and administer the treatment efficiently, the 44 participants were randomly subdivided into two equal groups. Each subgroup received the same instruction under the same conditions. The data collected from the subgroups were combined for analysis.

To maximize the hands-on experience with computers that is vital to the training model, each participant had access to a computer system during the training sessions. Each system consisted of an Apple IIe computer, a monitor, and one disk drive. Each participant had a diskette of any software program used during the training. A listing of the software used is included in Appendix E.

The treatment of the subjects consisted of six three-hour sessions of computer literacy training. It was administered over a 12-week period of time.

A model for staff development of computer literacy was designed to include the basic and most important concepts of computer literacy, as identified by a search of the literature and examination of available models. This model was developed by David Craig, Research and Evaluation Specialist for the State Department of Public Instruction in North Carolina, and the researcher responsible for the study.

Major concepts of computer literacy incorporated in the training sessions are listed below with a complete plan for each training session included in Appendix F.

- Historical overview of computers and their impact on society

- Understanding of the major components of a microcomputer

- Operation of a microcomputer through hands-on experience

- Definitions and understanding of computer terminology

- Meaning of key commands and introduction to basic programming (BASIC and LOGO)

- Determining hardware needs and criteria for selection

- Methods of critiquing software and sources for purchasing

- Software with applicability to educational administration

Printed materials used during the training session were developed by the Minnesota Educational Computer Consortium. Appendix G contains duplicates of this material.

Null Hypotheses

Null Hypothesis 1. There will be no significant difference between the participants' pretest and posttest scores of computer knowledge.

Null Hypothesis 2. There will be no significant positive correlation between attitudes of public school administrators toward computers in education and the attainment of computer literacy as determined by the pretest attitude scale and posttest of computer knowledge.

Null Hypothesis 3. There will be no significant change of attitudes of public school administrators toward computers in education resulting from an increase in awareness of the capabilities of computers as measured by the pre- and posttest of attitudes paired with the pre- and posttest of knowledge.

Null Hypothesis 4. There will be no significant difference in the pretest scores of attitudes toward computers in education between public school administrators aged 25 - 45 and those aged 46 - 65.

Null Hypothesis 5. There will be no significant difference in the amount of change of attitudes toward computers in education between public school administrators aged 25 - 45 and those aged 46 - 65 as measured by the difference between the pre- and posttest of attitudes for the two groups.

Null Hypothesis 6. There will be no significant difference in attitudes toward computers in education between female public school administrators and male public school administrators.

Null Hypothesis 7. There will be no significant difference in the attainment of computer literacy between female public school administrators and male public school administrators as demonstrated by the difference between pre- and posttest scores of computer knowledge.

Null Hypothesis 8. There will be no significant difference in the attainment of computer literacy between public school administrators with initial certification in mathematics or science and those with initial certification in other disciplines as measured by the posttest scores of computer knowledge.

Null Hypothesis 9. There will be no significant difference in attitudes toward computers in education between public school administrators who have been in education from 1 to 10 years and those who have been in education over 10 years.

Null Hypothesis 10. There will be no significant difference in the posttest scores of attitudes between elementary school principals and secondary school principals.

Null Hypothesis 11. There will be no significant difference in the attainment of computer literacy between elementary school principals and secondary school principals as measured by posttest scores of computer knowledge.

Null Hypothesis 12. There will be no significant difference in the attainment of computer literacy between principals and central office staff as measured by the pre- and posttest scores of computer knowledge.

Instruments Used in the Study

Two instruments were used to obtain the data necessary for the study. One instrument, a personal data sheet, was developed by the investigator while the other instrument, the Minnesota Computer Literacy and Awareness Assessment, was purchased from the Minnesota Educational Computing Consortium. Permission was requested by the investigator to use the Minnesota Computer Literacy and Awareness Assessment in the study (Appendix H). This permission was granted by Richard A. Pollak, Director of Special Projects for MECC (Appendix I).

Personal Data Sheet

The personal data sheet was designed to collect the demographic data required for the background variables of participants identified as important to the study. It included personal data, educational data, and geographic data for each subject in the study (see Appendix J).

The Minnesota Computer Literacy and Awareness Assessment

The Minnesota Computer Literacy and Awareness Assessment is an instrument developed to reflect a broad conception of computer literacy so that various cognitive and affective domains could be assessed (see Appendix K). To assist in understanding the instrument and interpreting the results, the investigator purchased a copy of the User Guide for the Minnesota Computer Literacy and Awareness

Assessment prepared by Ronald E. Anderson, Karl Krohn, and Richard Sandman. The following information and explanations were derived from studying the User Guide for the instrument.

Development of the instrument. The instrument was developed to assess both cognitive and affective domains of computer literacy. In order to determine content, data were collected on a variety of computer courses. "Course descriptions, course objectives, learning materials, and evaluation instruments were received from numerous schools throughout the country" (Anderson, Krohn, & Sandman, 1980, p. 1). Through this process, over 2,000 test items and objectives relating to computers were collected. This material was used to identify six dimensions of computer literacy, five in the cognitive area and one in the affective area.

> After several revisions, the list of objectives was circulated to a national panel of specialists representing professional computer societies, industry, and education. On the basis of their recommendations, a final revision of the list was made. (Anderson et al., 1980, p. 2).

Structure of the instrument. The instrument contains 120 items, divided into three different dimensions. Part one is an affective assessment including items 1 - 30; part two is a cognitive test including items 31 - 83; and part three is a survey of background variables including items 84 - 120. For this study, only parts one and two of the instrument were used, with the personal data sheet designed to acquire the appropriate background variables necessary for the study replacing part three of the instrument.

The affective section of the instrument is subdivided into two parts. Items 1 - 20 were designed to measure four attitudinal dimensions, as follows:

(1) enjoyment or the degree to which a person enjoys computers or learning about computers

(2) anxiety or the amount of stress that is associated with using computers

(3) efficacy or the extent of confidence one has in his or her ability to work with computers

(4) educational computing support or the degree to which a person feels positive toward integrating computers into the educational system (Anderson et al., 1980).

Items 21 - 30 are a set of value ratings not specifically related to computers; they were not analyzed for use in this study.

The cognitive test consists of 53 items that measure five different content domains of computer literacy, as described below:

(1) Hardware (H) (10 items). The hardware domain consists, in large part, of computer hardware

definitions and related concepts. The basic components of a computer and their functional interdependence are also included.

(2) Software and Data Processing (S) (8 items). This domain includes such things as knowledge of how data is organized and processed by computers; the fact that computers are controlled by people who write instructions in a specific programming language; a realization that computers store both instructions (program) and data within memory; and recognition that computers process data by searching, sorting, deleting, updating, summarizing, etc.

(3) Applications (A) (15 items). Computers are used in every sector of society: in work, in government, in people's homes, and in school. Questions in this domain concern when and where computers are being used and whether or not their use is appropriate.

(4) Impact (I) (13 items). This category differs from the applications domain in that it deals with social and psychological effects of applying computers. Issues of primary concern in this domain include privacy, crime, careers, and employment.

(5) Programming and Algorithms (P) (7 items). This domain includes the ability to follow, modify, correct, and develop algorithms expressed both as a

> set of English language instructions and in the form of a computer program. (Anderson et al., 1980, pp. 3-4)

The items used to measure each cognitive dimension are considered a subtest. The composite test made up of all 53 items can be considered a global assessment of the cognitive domain of computer literacy (Anderson et al., 1980).

Validation of the instrument. Content validation of objectives and their related test items was obtained from a random sample of computer courses across the state of Minnesota. The objective adoption rate for the cognitive domain by the sample was 74 percent or greater, except for the social impact area, in which adoption of objectives was 55 percent. In the affective domain, there was an 86 percent rate of adoption of objectives by two samples (Anderson et al., 1980).

Data Collection

A personal data sheet was designed to collect the demographic information required for completion of the study. This sheet was completed by each participant in the study.

Prior to beginning the treatment at the orientation session, a pretest was administered to each participant for the purpose of measuring attitudes toward computers in education and determining the level of computer knowledge. Following the final session of the treatment, a posttest was administered to each participant for the purpose of measuring attitudes toward computers in education and determining the level of computer knowledge. Both pre- and posttests were administered, collected, and scored by the investigator.

Analysis of Data

For the purpose of statistical analysis, the null form of each hypothesis was tested. Since hypothesis #2 was a correlation study, the Pearson product-moment correlation coefficient was used to analyze the data. In statistical analysis, correlation refers to a quantifiable relationship between two variables (Popham, 1967). The Pearson product-moment coefficient correlation is one of the most widely used measures of statistical correlation, with the formula being:

$$\frac{N\Sigma XY-(\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2-(\Sigma X)^2][N\Sigma Y^2-(\Sigma Y)^2]}} \qquad (1)$$

The value of the correlation coefficient can range from -1.0 to +1.0; "the sign of the coefficient indicates the direction of the relationship; the absolute value of the coefficient indicates the magnitude of the relationship" (Hinkle, Jurs, & Wiersma, 1979, p. 73).

For hypotheses #4 through 12, the t test for independent samples was employed for statistical analysis of the data. The t test enables the researcher to determine if the difference between two sample means is significant (Isaac & Michael, 1981) and is computed by the following formula:

$$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}} \qquad (2)$$

The t test for nonindependent samples, or paired t test, was used to test hypotheses #1 and 3 since correlated means were used. The measure analyzed was the difference between the paired scores for attitudes toward computers and computer knowledge, for both the pre- and posttest, using the following formula:

$$\frac{\overline{D}}{\sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{N}}{N(N-1)}}} \qquad (3)$$

One assumption of the t test is that the samples come from two populations with equal means and equal variances (Isaac & Michael, 1981). To assure nonviolation of this assumption, pretest scores were analyzed and revealed no significant differences between the grouping variables and pretest. According to Blalock (1972) there is no point in adjusting for the pretest unless there are some variations between the means of the grouping. Since this variation was not present, the t test was an appropriate statistical measure to use in analyzing the data for these hypotheses.

The minimum acceptable level for determining significant difference was at the .05 level.

The Statistical Package for Social Sciences (SPSSX) was used to facilitate statistical analysis.

Chapter 4

PRESENTATION OF DATA AND ANALYSIS OF FINDINGS

The purpose of this study was to determine whether certain characteristics of public school administrators were present which could be used as descriptors for other educators' potential for acquiring computer literacy from a specific staff development model.

A group of 44 public school administrators from the Northwest Education Region of North Carolina participated in the study. For the purpose of this study, public school administrators were categorized into four subgroups: superintendents, supervisors, program directors or coordinators, and principals. The composition of the group is shown in Table 1.

Each subject in the sample participated in training sessions described in the specified staff development model (see Appendix F). Prior to the initial training session, a pretest was administered to each participant and a posttest was administered at the conclusion of the final training session. These pre- and posttest scores provided the basic data for this study. The instrument used for the pre- and posttest, The Minnesota Computer

Table 1

Composition of Sample

Position in System	Frequency	Percentage
Superintendent	1	2.3
Supervisors	4	9.1
Director/Coordinators	6	13.6
Principals[a]	33	75.0
Total	44	100.0

[a]Includes assistant principals

Literary and Awareness Assessment, was designed to assess both attitudes toward and knowledge of computers. Items 1 - 20 measured attitude and were scored on a Likert-type scale. For all items, "strongly agree" was scored as a 5; "agree was scored as a 4; the neutral point "undecided" was scored as a 3; "disagree" was scored as a 2; and "strongly disagree" was scored as a 1, with a score range from 20 to 100. Since some of the items were worded negatively to avoid response set, it was necessary to reverse-score several items at the analysis stage. Item analysis indicated that items 2, 3, 4, 8, 9, 12, 15, and 20 needed to be reverse scored before final attitude scales could be computed. Items 31 - 83 measured computer knowledge with raw scores consisting of the number of correct responses to 22 true - false statements and 31 multiple-choice questions, with a score range from 0 to 53. The raw scores of the pre- and posttests are arrayed in Appendix L.

These data were keypunched into IBM 80-column cards and read into the IBM 4341 Model II operating under the OVSV1 system at the East Tennessee State University Computer Center. They were analyzed by the Statistical Package for the Social Sciences Extended (SPSSX) which computed the Pearson Product-moment or t tests as deemed appropriate for each hypothesis.

Several independent variables were proposed in the hypotheses as being relevant to the study. To gather the necessary information needed to test whether these variables were significant in the acquisition of computer knowledge, a Personal Data Sheet was completed by each participant in the study, identifying the following characteristics:

(1) the age of the participant

(2) the gender of the participant

(3) the position held in the school system

(4) the area of initial certification

(5) the level of academic preparation

(6) the number of years in the educational profession

Presentation and Analysis of Data

Twelve null hypotheses were tested in the study. Each null hypothesis was tested for significant difference at the .05 level using a two-tailed test.

Null Hypothesis 1. There will be no significant difference between participants' pretest and posttest scores of computer knowledge. A comparison of means of the pre- and posttest scores was made through use of the paired *t* test with the results shown in Table 2.

Table 2

Paired Scores for Pre- and Posttests of Computer Knowledge

Paired Scores	N	Mean	Mean Difference	*t*	*p*
Pretest	44	35.40			
			9.81	11.02	.000*
Posttest	44	45.22			

df=43
*Significant

This analysis indicated that the identified staff development model was effective in that participants' posttest scores of computer knowledge were significant even beyond the .001 level. The investigator rejected the null hypothesis and accepted the research hypothesis.

Null Hypothesis 2. There will be no significant positive correlation between attitudes of public school administrators toward computers in education and the attainment of computer literacy as determined by the pretest attitude scale and posttest of computer knowledge.

The Pearson product-moment correlation coefficient was used to determine the relationship between the pretest score of attitude toward computers in education and the posttest score of computer knowledge of the participants. The results of this correlation are reported in Table 3. An examination of the test scores revealed there was a correlation coefficient of +.36 between the pretest attitude scores and the posttest knowledge scores at a .008 level of significance. With a .05 level of significance established for retaining or rejecting the null hypothesis, the null hypothesis was rejected and the research hypothesis was accepted that there was a significant positive relationship between attitudes of public school administrators toward computers in education and the attainment of computer literacy.

Null Hypothesis 3. There will be no significant change of attitudes of public school administrators toward computers in education resulting from an increase in awareness of the capabilities of computers as measured by the pre- and posttests of attitudes paired with the pre- and posttests of knowledge.

Table 3

Correlation of Pre- and Posttest Scores for Attitudes Toward Computers and Computer Knowledge

	Posttest Knowledge
Pretest Attitude	.3606 (44) p = .008*

*Significant

Since this hypothesis required an analysis of correlated means for attitudes toward computers and means of computer knowledge for both the pre- and posttests, the <u>t</u> test for nonindependent variables was used for statistical analysis. This measure analyzed the difference between the paired scores, with the results displayed in Table 4.

As revealed by this analysis, there was a significant difference between the paired scores of attitudes toward computers and computer knowledge for the pre- and posttests. The difference was significant beyond the .001 level; therefore, the null hypothesis that there would be no significant change of attitude toward computers resulting from an increase in knowledge of computers was rejected and the research hypothesis accepted.

Table 4

Difference Between the Means of Paired Scores for Pre- and Posttests of Attitudes Toward Computers and Computer Knowledge

Paired Scores	N	Mean	SD	t	p
Pretest	44	70.45	10.32		
Posttest	44	83.02	7.98		
Difference	44	12.56	9.89	8.43	.000 *

df=43
*Significant

Null Hypothesis 4. There will be no significant difference in the pretest scores of attitudes toward computers in education between public school administrators aged 24- 45 and those aged 46 - 65.

Age was identified as a variable of importance to the study. The age range of 25 to 65 was determined to include all public school administrators and was verified as inclusive by the personal data gathered from the sample. Further, 25 - 45 years and 46 - 65 years were established as subgroups for age, with 52 percent and 48 percent of the participants in the subgroups, respectively, as is shown in Table M-1 in Appendix M.

Examination of the pretest scores of attitudes toward computers in education revealed that the mean score for public school administrators aged 25 - 45 was 72.52 compared to a mean score of 68.19 on the pretest of the public school administrators aged 46 - 65, as shown in Table 5.

Table 5

Means of Pretest Scores of Attitudes Toward Computers by Age Groups

Years	N	Mean	SD	t	p
25 - 45	23	72.52	7.12		
				1.37	.180*
46 - 65	21	68.19	12.77		

df=42
*Not significant

With a t value of 1.37 significant at the .18 level, it was concluded that the identified age variables did not influence attitudes toward computers. Consequently, the investigator failed to reject the null hypothesis.

Null Hypothesis 5. There will be no significant difference in the amount of change of attitudes toward computers in education between public school administrators aged 25 - 45 and those aged 46 - 65 as measured by the difference between the pre- and posttest of attitudes for the two groups.

The means for pre- and posttest scores of attitudes toward computers and the difference between these means for the age groups 25 - 45 years and 46 - 65 years are reported in Table 6. Although there was a difference in the amount of change between the two identified age groups, the difference was not significant at the .05 level of probability. Therefore, the investigator failed to reject the null hypothesis. The age variable for groups 25 - 45 years and 46 - 65 years was not significant in the change of attitudes toward computers of public school administrators in the study.

Null Hypothesis 6. There will be no significant difference in pretest scores of attitudes toward computers in education between female public school administrators and male public school administrators.

The gender of the participants was a variable identified to be important to the study. The means of pretest scores of attitudes toward computers were examined to determine if there was a significant difference between attitudes of male and female participants. The results of the statistical analysis for this variable are shown in Table 7.

This analysis reflects a slight difference in the means of pretest attitudes of males and females but the level of significance is less than .05. Therefore, the investigator failed to reject the null hypothesis.

Table 6

Comparison of Change of Attitudes Toward

Computers by Age Groups

		Pretest		Posttest		Difference Between Pre- and Posttest			
Years	N	Mean	SD	Mean	SD	Mean	SD	*t*	*p*
25 - 45	23	72.52	7.12	83.73	6.39	11.21	5.48	-.09	.36*
46 - 65	21	68.19	12.77	82.23	9.52	14.04	13.15		

df=42

*Not significant

Table 7

Means of Pretest Scores of Attitudes Toward Computers by Gender of Participants

Gender	N	Mean	SD	t	p
Male	30	69.86	11.21		
				-0.55	.586 *
Female	14	71.71	8.35		

df=42
*Not significant

Null Hypothesis 7. There will be no significant difference in the attainment of computer literacy between female public school administrators and male public school administrators as demonstrated by the difference between pre- and posttest scores of computer knowledge.

The difference in the attainment of computer literacy by males and females was determined by comparing the means of the pre- and posttest scores of computer knowledge for the two identified groups and determining the means of the difference between the two test means. This comparison is displayed in Table 8. Although the pretest means scores of computer knowledge were 36.00 and 34.14 for males and females, respectively, an analysis of this comparison shows a difference in means of 8.70 and 12.21 for males and females, in that order. This indicates that there was a

Table 8

Comparison of the Attainment of Computer Literacy by Gender of Participants

		Pretest		Posttest		Difference Between Pre- and Posttest			
Gender	N	Mean	SD	Mean	SD	Mean	SD	*t*	*p*
Male	30	36.00	6.73	44.70	5.96	8.70	6.58		
								-2.40	.021*
Female	14	34.14	5.70	46.35	4.46	12.21	3.14		

*Significant

significant difference at the level of .021. Therefore, the investigator rejected the null hypothesis and accepted the research hypothesis.

Null Hypothesis 8. There will be no significant difference in the attainment of computer literacy between public school administrators with initial certification in mathematics or science and those with initial certification in other disciplines as measured by the posttest scores of computer knowledge.

The area of initial certification of the participants was identified as a variable to examine for possible significance to the attainment of computer literacy. Areas of initial certification of the public school administrators who participated in the study are shown in Table 9.

The literature seemed to indicate that computers have had greater acceptance and more usage in mathematics and science than in other academic disciplines. For this reason, participants with initial certification in mathematics or science were grouped together and participants with initial certification in other disciplines were grouped together. Means of the pre- and posttest scores on computer knowledge were compared for the two groups and are shown in Table 10.

This analysis showed that the mean pretest score for participants with initial certification in mathematics or science was higher than the mean pretest score for parti-

Table 9

Areas of Initial Certification of Participants

Area of Certification	Frequency	Percent
Art	1	2.3
Business Education	1	2.3
Early Childhood	2	4.5
Elementary Education	10	22.7
English	1	2.3
Exceptional Children	4	9.1
Guidance	1	2.3
Home Economics	2	4.5
Mathematics/Science	12	27.3
Social Studies	10	22.7
Total	44	100.0

cipants with initial certification in other disciplines. However, mean posttest scores were slightly higher for the participants with initial certification in other disciplines than for the participants with initial certification in mathematics or science. There was a significant difference between the mean pre- and posttest scores for participants with initial certification in mathematics or science and participants

Table 10

Mean Scores for Computer Knowledge for Participants with Initial Certification in Mathematics or Science and Other Disciplines

Area of Certification	N	Pretest		Posttest		Difference Between Pre- and Posttest			
		Mean	SD	Mean	SD	Mean	SD	*t*	*p*
Mathematics/ Science	12	38.16	8.35	44.58	6.20	6.41	6.50		
								-2.47	.018*
Other Disciplines	32	34.37	5.32	45.46	5.35	11.09	5.22		

*Significant

with initial certification in other disciplines, being 6.41 and 11.09, respectively. With an achieved t value of -2.47, this was significant at the .018 level. Therefore, the null hypothesis of no significant difference between initial certification in mathematics or science and other disciplines was rejected and the research hypothesis was accepted.

Null Hypothesis 9. There will be no significant difference in attitudes toward computers in education between public school administrators who have been in education from 1 to 10 years and those who have been in education over 10 years.

The number of years the subjects in the study had been in the educational profession was analyzed to determine if it was a variable significant to attitudes toward computers in education. For this analysis, two groups were established; one group was composed of subjects who had been in the educational profession from 1 to 10 years while the other group was composed of subjects who had been in the profession for more than 10 years. The results of this analysis are reported in Table 11. The mean scores of the pretest of attitudes toward computers showed a difference at the insignificant level of .692.

Although a comparison of the pre- and posttest scores showed a significant change of attitudes of public school administrators, an analysis of the scores showed the

Table 11

Mean Scores of Pre- and Posttests for Participants with 1 - 10 Years and More Than 10 Years in the Educational Profession

Years in Education	N	Pretest Mean	Pretest SD	Pretest *t*	Pretest *p*	Posttest Mean	Posttest SD	Posttest *t*	Posttest *p*
				Attitudes					
1 - 10	28	70.92	11.66			83.78	7.83		
				0.40	.692			0.84	.408*
More Than 10	16	69.62	7.73			81.68	8.31		
				Knowledge					
1 - 10	28	35.85	6.70			46.03	5.54		
				0.61	.546			1.29	.204*
More Than 10	16	34.62	5.99			43.81	5.39		

*Not Significant

amount of change to be similar between the two identified groups with a mean difference of 12.86 for the 1 - 10 years subjects and a mean difference of 12.06 for the more than 10 years subjects. Further, the pre- and posttest scores for attainment of computer knowledge reflect no significant difference between the two identified groups, as is reported in Table 11.

The investigator failed to reject the null hypothesis that there is no significant difference of attitudes toward computers between public school administrators who have been in the education profession 1 - 10 years and those who have been in the profession for more than 10 years.

Null Hypothesis 10. There will be no significant difference in the posttest scores of attitudes between elementary school principals and secondary school principals.

The principals in the sample were subgrouped into elementary and secondary principals to form the variable to be analyzed for significance of this hypothesis. Due to the variance in application of computers at these school levels, this was determined a variable of possible significance to the study. The results of statistical analysis of the data as reported in Table 12 indicated that, while there was some difference, it was not significant at the .05 level as was established for the study. As a result, the investigator failed to reject the null hypothesis.

Table 12

Mean Posttest Scores of Attitudes Toward Computers of Principals

Principals	n	Mean	SD	t	p
Elementary	25	81.92	8.03		
				1.85	.073*
Secondary[a]	8	88.00	8.33		

[a]Secondary principals include assistant principals
*Not significant

Null Hypothesis 11. There will be no significant difference in the attainment of computer literacy between elementary school principals and secondary school principals as measured by posttest scores of computer knowledge.

The attainment of computer literacy was measured for elementary and secondary principals by comparing the mean pre- and posttest scores of computer knowledge for the two groups and determining the difference between them. This comparison is shown in Table 13.

Although both groups showed a significant gain between pre- and posttest scores for computer knowledge, the mean differences were 9.36 and 8.75 for elementary and secondary principals, respectively. These mean differences were not significant at the .05 level. Consequently, the investigator failed to reject the null hypothesis.

Table 13

Mean Scores of Computer Knowledge for Elementary and Secondary Principals

		Pretest		Posttest		Difference Between Pre- and Posttest			
Principals	N	Mean	SD	Mean	SD	Mean	SD	*t*	*p*
Elementary	25	34.32	7.34	43.68	6.12	9.36	7.01		
								0.23	.820*
Secondary[a]	8	36.12	4.67	44.87	4.19	8.75	4.65		

[a]Secondary principals include assistant principals.

*Not significant

Null Hypothesis 12. There will be no significant difference in the attainment of computer literacy between principals and central office staff as measured by the difference between pre- and posttest scores of computer knowledge.

The pre- and posttest scores for the attainment of computer knowledge for principals and central office staff members in the sample are reported in Table 14. The mean pretest scores for principals and central office staff are 34.75 and 37.36, respectively, with no significant difference between the two means. A mean posttest score of 43.96 was calculated for principals and a mean of 49.00 was calculated for central office staff members. With a *t* value of -3.87 there was a significant difference between the posttest means beyond the .001 level of probability. However, the difference between the pre- and posttest means for principals and central office staff are 9.21 and 11.63, with a probability level of .124. Therefore, the researcher failed to reject the null hypothesis of no significant difference in the attainment of computer literacy between principals and central office staff members.

Table 14

A Comparison of Pre- and Posttest Scores of Principals and Central Office Staff Members

Group	N	Mean	SD	t	p
		Pretest			
Principals	33	34.75	6.76	-1.17	.24*
Central Office Staff	11	37.36	4.98		
		Posttest			
Principals	33	43.96	5.67	-3.87	.000**
Central Office Staff	11	49.00	2.79		
		Difference			
Principals	33	9.21	6.45	-1.58	.124*
Central Office Staff	11	11.63	3.47		

*Not significant **Significant

Summary

The purpose of this chapter was to report the analyses of data. The results reported were based on information gathered from the personal data sheet, the pre- and posttest scores of the instrument selected for the study, and the statistical analysis of these scores. In seven of the null hypotheses, being numbers 4, 5, 6, 9, 10, 11, and 12, the investigator failed to reject them. Hypotheses 1, 2, 3, 7, and 8 were rejected at a significance of .05 level of probability, and the research hypotheses were accepted.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains a summary, conclusions, and recommendations based on the review of the literature and the analysis of data.

Summary

One of the most revolutionary technical developments to affect the educational system in recent years is the computer, particularly the microcomputer. The economic availability of the microcomputer to schools has preceded the preparedness of school personnel to use this development to its full capabilities. Educators often feel threatened by computers because of their lack of knowledge of them.

The intent of this study was to determine whether certain characteristics of public school administrators are present which can be used as descriptors for other educators' potential for acquiring computer literacy from a specific staff development model. A sample of 44 public school administrators who had received no previous training with computers participated in the study.

A staff development model was designed in an effort to provide the basic components of computer literacy for the subjects in the study. These components included the following:

- Historical overview of computers and their impact on society

- Understanding of the major components of a microcomputer

- Operation of a microcomputer through hands-on experience

- Definitions and understanding of computer terminology

- Meaning of key commands and introduction to basic programming

- Determining hardware needs and criteria for selection of hardware

- Methods of critiquing software and sources for purchasing software

- Software with applicability to educational administration

The activities included in the staff development model (see Appendix F) served as the treatment for the 44 public school administrators constituting the sample. The treatment was administered to the subjects in six 3-hour sessions over a 12-week period.

A pretest and a posttest administered prior to and at the conclusion of the treatment provided the basic data for the study. The instrument selected to be used for this purpose measured both attitudes toward computers and computer knowledge (Appendix K). A personal data sheet was designed to determine variables among the participants, with the following variables considered of importance to the study:

(1) attitude toward computers

(2) age

(3) gender

(4) area of initial certification

(5) years in the educational profession

(6) position in the school system

(7) principal assignment - elementary or secondary

Data gathered from these two instruments were analyzed by the Statistical Package for Social Sciences (SPSSX). The proper statistical analysis was determined by the needs of the study, being either the Pearson Product-moment, Paired *t* test, or the *t* test for independent samples.

Twelve null hypotheses were constructed for the study to determine whether the identified variables were significant in the attainment of computer literacy. They were tested at the .05 level of significance.

Conclusions

A review of the literature and an analysis of the data in Chapter IV led the investigator to the following conclusions:

1. The impact of computers on society and especially education is infinite in its ramifications and cannot be accurately measured.

2. Attitudes toward computers have an effect on the attainment of computer knowledge. There was a positive correlation between the pretest score of attitude toward computers and the posttest score of computer knowledge.

3. The staff development model designed is effective in promoting computer literacy. It is possible to design inservice activities that will assist educators who are lacking in computer skills to attain those skills.

4. The attainment of computer literacy results in a more positive attitude toward computers. Posttest scores for attitude toward computers were increased as the participants became more aware of operations and capabilities of computers.

5. The variable of age does not significantly influence attitudes toward computers nor the attainment of computer knowledge.

6. The gender of the participant does not influence attitudes toward computers. However, there was a significant difference in the attainment of computer knowledge

between male and female participants. Female participants had lower pretest scores for computer knowledge and higher posttest scores than did males. This was significant at .021 level of probability.

7. The area of initial certification is not a significant factor in the attainment of computer literacy. Although participants with initial certification in mathematics or science had higher pretest scores, their posttest scores were lower than participants with certification in other areas. In fact, participants with other areas of certification scored significantly higher (.018) than did math and science certified people.

8. The length of time involved in the educational profession does not influence attitudes toward computers.

9. Assignment as principal of an elementary or a secondary school did not influence attitudes toward computers or the attainment of computer knowledge.

10. The assigned position in the school system was not a significant variable as evidenced by achieved scores in attaining computer literacy. However, conjecture into the composition of the groups (principals and central office staff members) is not inappropriate in order to explain discrepancies in the posttest scores of computer knowledge. This finding correlates with the rejection of null hypothesis 7 which hypothesized no significant difference between the attainment of computer literacy between male and female subjects. Most of the principals

in the sample (28 of 33) were male, while most of the central office staff members in the sample (9 of 11) were female. Another factor in this result might be the greater availability of computers in central offices than in individual school offices, and thus more motivation for central office staff members to attain computer literacy.

Recommendations

As a result of this study, the following recommendations are proposed:

1. Additional studies with greater sample sizes should be made to determine the long-range advantages and disadvantages of computers in education.

2. Computer literacy programs should be made available to educators through inservice education.

3. Professionals charged with the responsibility of training teachers should be cognizant of the need for including computer literacy in the program of studies.

4. Research to define and articulate expectations of computer literacy should continue.

5. Research should continue to design the most effective staff development model of computer literacy to be used in varying school organizations for both students and teachers.

6. Continuous effort should be made to determine technological skill needs of students entering the workforce.

7. Opportunities for providing computer equity, regardless of gender or socioeconomic level, should be provided.

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APPENDICES

APPENDIX A

MEMORANDUM FROM

NORTH CAROLINA DEPARTMENT OF

PUBLIC INSTRUCTION

DEPARTMENT OF PUBLIC INSTRUCTION

STATE OF NORTH CAROLINA
NORTHWEST REGIONAL EDUCATION CENTER
303 E STREET
NORTH WILKESBORO, NORTH CAROLINA 28659
AREA 919 - 667-2191

A. CRAIG PHILLIPS
STATE SUPERINTENDENT

CHARLES P. BENTLEY
DIRECTOR

October 20, 1983

MEMORANDUM

TO: SUPERINTENDENTS, REGION VII

FROM: DAVID CRAIG, DIVISION OF RESEARCH
EMERY PARTEE, DIVISION OF MATHEMATICS

RE: MICROCOMPUTER WORKSHOP

There will be two Administrative Microcomputer workshops conducted at the Regional Center. These workshops are specifically designed for Administrative Personnel to develop beginning skills in using microcomputers in their work.

Please distribute the enclosed information to your staff. Space will be limited to twenty-five (25) participants in each workshop. Enrollment will be on a first come first served basis.

Thank you for your support!

DC/EP/id

APPENDIX B

COMPOSITION OF EDUCATION REGION 7

OF NORTH CAROLINA

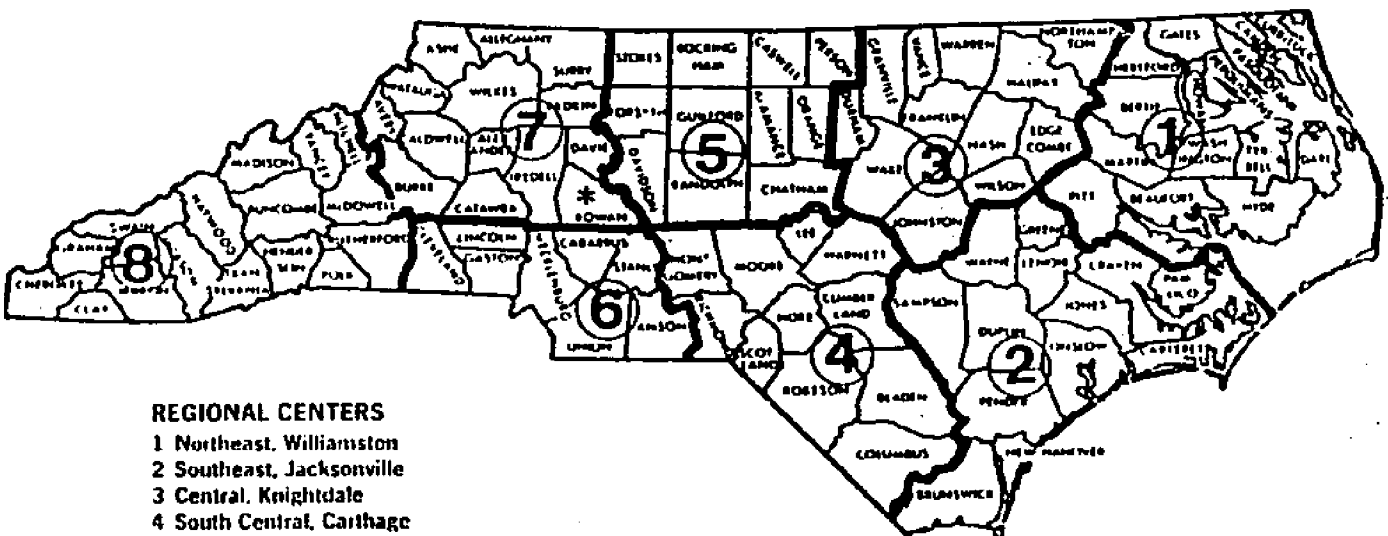
School Systems and Enrollments in Education

Region 7 of North Carolina

School System	Enrollment*
Alexander	5,168
Alleghany	1,788
Ashe	4,166
Avery	3,095
Burke	13,303
Caldwell	13,479
Catawba	13,279
Hickory	4,779
Newton/Conover	3,067
Davie	5,039
Iredell	10,235
Mooresville	2,472
Statesville	3,802
Elkin	1,075
Mount Airy	2,153
Watauga	4,878
Wilkes	11,504
Yadkin	5,347
Surry	8,618

*Based on Data from North Carolina Education Directory, 1983-84.

North Carolina Education Districts



REGIONAL CENTERS

1 Northeast, Williamston
2 Southeast, Jacksonville
3 Central, Knightdale
4 South Central, Carthage
5 North Central, Greensboro
6 Southwest, Albemarle
7 Northwest, North Wilkesboro
8 Western, Canton

*Rowan County, although in Education District 7, is served by the Southwest Regional Education Center in Albemarle.

APPENDIX C

GEOGRAPHIC REGIONS REPRESENTED BY SAMPLE

Geographical Regions of Previous Work Experience

Represented by the Participants in the Sample

Countries	States	Cities
England	Georgia	Asheville, N.C.
	Indiana	Charlotte, N.C.
	New York	Columbia, S.C.
	South Carolina	Durham, N.C.
	Tennessee	Greensboro, N.C.
	Virginia	Greenville, N.C.
	Wisconsin	Greenville, S.C.
		Lenoir, N.C.
		Lexington, N.C.
		Madison, Wis.
		Morganton, N.C.
		Mount Airy, N.C.
		New York, N.Y.
		Raleigh, N.C.
		Rock Hill, S.C.
		Statesville, N.C.
		Wilmington, N.C.
		Winston-Salem, N.C.

Participants in group had educational experience representative of the eight education regions of North Carolina.

APPENDIX D

WORK EXPERIENCE AND FORMAL PREPARATION REPRESENTED BY SAMPLE

Work Experience Represented by

Participants in the Sample

Position	Frequency
Teacher's Aide	1
Teacher	34
Assistant Principal	6
Principal	28
Headmaster	1
Supervisor	5
Director/Coordinator	7
Assistant Superintendent	1
Superintendent	1
Professor/Department Chairperson	1
Regional Center Consultant	2
Dean of Students	1

Level of Formal Preparation

Degree	Frequency	Percent
B.S.	3	6.8
M.A.	23	52.3
Ed.S.	17	38.6
Ed.D.	1	2.3
	44	100.0

APPENDIX E

COMPUTER SOFTWARE USED IN TRAINING PROGRAM

Appendix E

Software Used in Training Program

DOS 3.3

Apple Presents Apple

Personal Filing System (PFS)

Visicalc

Bank Street Writer

Snoop II

Logo

APPENDIX F

STAFF DEVELOPMENT MODEL

SESSION ONE

COMPONENTS	CONCEPTS AND ACTIVITIES
1.1. Orientation	A. Overview of training session B. Schedules, facilities C. Introduction of staff
1.2. Completion of instrument	A. Data sheet: personal data, educational data, geographic data B. Pre-test: The Minnesota Computer Literacy and Awareness Assessment
1.3. Historical background of computers	A. 1940's: first computer (ENIAC) vacuum tubes, huge, expensive, complicated B. 1950's: computers became available commercially; remained extremely expensive and massive C. 1960: transistorized computers became common; smaller, more reliable, easier to operate D. Mid-1960's: integrated circuit revolutionized computers; allowed hundreds of transistors to be manufactured on a small piece of silicone "chip" E. 1970's: microcomputers available; within financial reach of schools, required small area for installation, easy to operate

COMPONENTS	CONCEPTS AND ACTIVITIES
1.4. Getting acquainted with the computer	A. Computer system 1. Computer circuit board (a) Central processing unit (CPU): Performs basic operation; the "brains" of the computer (b) Memory chips: (1) ROM - Read Only Memory: Intelligence that resides in the computer; activated when computer is turned on and is not lost when turned off (non-volatile) (2) RAM - Random Access Memory: Data can be moved from any RAM address to the CPU; allows the computer user to write to the memory; lost when computer is turned off (volatile) (c) Motherboard: Contains 8 slots, numbered 0-7, that are designed to allow printed circuit cards to be plugged in for specific purposes; e.g., language cards, disk drives, printer, card reader (d) Power supply: Houses necessary electrical wiring for operation of computer

COMPONENTS	CONCEPTS AND ACTIVITIES
	2. Input device (keyboard): Allows user to communicate with computer; flashing cursor means the computer is ready to take information - "It's your turn"; similar to a typewriter keyboard but certain keys perform special functions: (a) Return: Press this key when you have finished typing a response; in many programs it allows you to continue (b) CTRL (Control) key: Depressing this key while pressing another key allows the computer to perform special functions; characters pressed simultaneously with the CONTROL key do not appear on the screen (c) Arrows: Allow error correction; left arrow backs cursor up, right arrow moves cursor forward (d) REPT (Repeat) key: Will repeat any key as long as it is depressed (e) Space bar: Spaces when depressed or, in some programs, allows you to continue (f) RESET: To be used if something goes wrong or if you want to work with a different diskette (g) POWER: A lighted key that shows the system is on; not a switch

COMPONENTS	CONCEPTS AND ACTIVITIES
	controlling power, but a safety feature (h) SHIFT: Capitalizes or prints symbol on top half of key (i) ESC (Escape): Depress to exit program (j) CTRL RESET: Emergency exit only when other methods will not work; can damage diskette NOTE: The keyboard differs from the typewriter in that the O and Ø are not interchangeable, nor are the 1 and l. Letters and numerals serve different functions on the computer keyboard. 3. Output devices (a) Monitor: Displays output on screen (b) Printer: Provides hard-copy of output (c) Speaker: Limited sound output 4. Storage device or Disk Drive: Hinged door activates the read-write head automatically; red light indicates disk drive is processing diskette - do not interrupt while light is on; handle disk drive with care as it has moving parts and can easily be damaged

SESSION TWO

COMPONENTS	CONCEPTS AND ACTIVITIES
2.1. Operation of the computer	A. Starting-up the computer system 1. Turn on monitor 2. Insert diskette in disk drive; hold by label, with labeled side turned up 3. Close the disk drive door 4. Turn on computer B. Running programs 1. PR#6 activates disk drive a 2. Menu will allow you to choose from various programs on the diskette 3. Follow the directions given in the program 4. Press the return key after each response you type in 5. Continue by pressing space bar or key designated in program C. Steps to take when program does not work 1. Check typing 2. Lock the CAPS LOCK key down 3. Check manual 4. Ask someone who has computer expertise
2.2. Operating computer without disk drive	A. Press CTRL RESET to exit program B. Type HOME to clear screen and bring cursor to upper left corner of screen C. Type LIST to display program as written

COMPONENTS	CONCEPTS AND ACTIVITIES
	D. Type RUN to execute program
	E. "Syntax Error" means computer cannot process your input
2.3. Selection and care of diskettes	A. Always buy double density diskettes to allow use of both sides by cutting a notch opposite the one already cut
	B. Notch allows disk to be written to and read from
	C. To write protect a diskette (so important data will not be written over) place tab over notch
	D. Keep diskette in dust cover when not in use
	E. Magnetic field will erase diskette; never place on monitor
	F. Do not touch exposed shiny part where oval is cut
	G. Label with felt-tip pen - not ballpoint or pencil
	H. Avoid excessive heat
	I. Store in box or storage case, standing upright

COMPONENTS	CONCEPTS AND ACTIVITIES
2.4. Initializing a diskette	A new disk can be used with any microcomputer; it must be initialized using the Disk Operating System (DOS) to reserve the first three sectors for the "hello" program To Initialize: INIT HELLO Save
2.5. Saving a program	To save a program to a diskette, type SAVE plus the name of the program.
2.6. Copying a diskette	A. Insert the DOS 3.3 System Master diskette in the disk drive B. Type LOAD COPYA C. Remove System Master D. Replace with disk to be copied E. Insert blank disk in Drive 2 F. Type RUN COPYA G. Press Return to copy

SESSION THREE

COMPONENTS	CONCEPTS AND ACTIVITIES
Hands-on experience with programs that are helpful to school administrators (Data Management Systems, Electronic Spread-Sheets, Word Processors).	
3.1. Data-base Management Program	Data Management programs use the computer to store information by various categories which can then be easily recalled, changed, and analyzed by the user. Reports can be generated with the information printed in a format determined by the user. Examples of available data management systems useful to school administrators include programs designed for scheduling, inventories, attendance accounting, media and textbook recording, instructional management, and student record-keeping. The Data-base Management Program selected for use in the training session was Personal Filing System (PFS) and PFS Report. This program is versatile yet easy to use. Each participant was provided a diskette containing the PFS program to permit a hands-on experience with the program. The following procedure (based on the PFS User's Manual) was used for working through the program:

COMPONENTS	CONCEPTS AND ACTIVITIES
	1. Designing a file on PFS This function allows you to provide a place to store information. [ESC] to return to menu To select the DESIGN FILE function, type 1 following SELECTION NUMBER. Each file must have a name. Type the name of your choice in the space following FILE NAME: (8 characters, maximum) Press [CTRL] [C] to continue. The screen gives you two choices: Design File Menu 1. CREATE FILE 2. CHANGE DESIGN Type 1 for SELECTION NUMBER [CTRL] [C] continue Insert a blank data diskette in the disk drive. Now you are ready to design the form. Type each item you want on the form and terminate it with a colon. Design a form that would be useful in your particular job assignment.

COMPONENTS	CONCEPTS AND ACTIVITIES
	• The following keys allow you to position the cursor on the screen: [CTRL] [F] - move the cursor left (one character) [CTRL] [G] - move the cursor right (one character) [CTRL] [T] - move the cursor up (one line) [CTRL] [V] - move the cursor down (one line) [RETURN] - move the cursor to the beginning of the next line Other control keys: [CTRL] [N] - bring up the next page [CTRL] [P] - bring up the previous page [CTRL] [E] - erase the current page [CTRL] [C] - stores blank form on the diskette [ESC] - returns to PFS menu 2. Storing information (ADD) This function allows you to store information in the file you have created. From the menu, type 2 for SELECTION NUMBER. Type the name you gave the file for FILE NAME. [CTRL] [C] - to continue

COMPONENTS	CONCEPTS AND ACTIVITIES
	The form you designed should appear on the screen. To enter data, you fill in the blank form you created.
	The following keys allow you to move the cursor so you can enter the information where you want:
	[→] Moves the cursor to the next item on the form
	[←] Moves the cursor left one character (to current typing errors)
	[CTRL][G] Moves the cursor right one character (to space over a character without erasing it)
	Other control keys:
	[CTRL][E] Erases all the information entered on the current page ___ leaves item names
	[CTRL][C] Stores the information on the diskette
	[ESC] Returns to PFS Menu

COMPONENTS	CONCEPTS AND ACTIVITIES
	3. Search/Update This function allows you to search by any item and to make desired changes in the information stored on any form. To choose this option, type 4 in SELECTION NAME and the file name you choose. Type the retrieval specifications for any item exactly as they were typed on the form. The use of .. before or after a partial specification will search for all forms with the partial specification. The information on any form can be changed by typing over the information presently on the form. [CTRL] [C] will save the corrected information to the diskette.
3.2. Electronic spread sheet	With an electronic spread sheet program, the computer is used as a calculator, working with data in a grid format of columns and rows. Data can be entered, changed, and used in a variety of calculations, all done on the screen before it is printed on paper. Most problems that can be solved with a calculator, pencil, and paper can be solved with an electronic spread sheet system on a microcomputer. The advantages

COMPONENTS	CONCEPTS AND ACTIVITIES
	of using the spread sheet system over the conventional tools are speed, accuracy, storage of data, and ease of duplicating a desired format. These systems allow you to speculate and enter changes in a program that give you instant feedback with a minimum of effort. The recalculation ability and the memory of formulas by the program and computer simplify the most complex calculations and manipulations of numbers. The electronic spread sheet program selected for use with the participants in the training session was the Visicalc program. In this program, the worksheet is organized as a grid of columns and rows, defining thousands of entry positions. The commands allow the user to design the worksheet in any format needed for the data being used. Each participant loaded the Visicalc Tutorial program into the computer. Basic commands and cursor movements were explained, based on information from the Visicalc User's Guide, as follows: Cursor Control Typing in data L - labels (words) V - values (numbers) (R) means press RETURN ESC - to backspace over mistakes Formulas Functions

COMPONENTS	CONCEPTS AND ACTIVITIES
	A simple applications problem, related to public school administration, was given to each participant to solve using the Visicalc program. Consultants were available to give individual assistance as needed.
3.3. Word processor	The computer is used as an intelligent typewriter. Text is typed in and the computer allows the user to make corrections and changes on the screen instead of on paper, and to format the document automatically. Written text can be stored in computer memory or on a diskette until it is corrected, edited, or modified; then the final form can be printed on paper. Bank Street Writer was the word processor program chosen to use with the participants in the study. This program was chosen because it has the capabilities required by public school administrators in preparing proposals, reports, or communications. In addition, it is easy to use with commands that make it practical for students to use in the classroom. Participants were provided a diskette containing the Bank Street Writer Tutorial program to assist them in learning how to use it. Directions for the use of the tutorial appear automatically on the screen.

COMPONENTS	CONCEPTS AND ACTIVITIES

The Bank Street Writer has three modes, shown on three different screens. They are explained in the user's manual as follows:

1. The WRITE MODE is used to compose a document. The following screen indicates the write mode:

   ENTER TEXT ESC FOR MENU

   TYPE IN TEXT AT CURSOR ^ TO CAPITALIZE

   ⇦ ERASES

   (a) The cursor tells the location of the next character to be typed.

   Cursor movement

   right - space bar
   left - ⟵ left arrow
   down - return

   (b) Menu selection: To select a function, press open and solid apple keys
   (c) CAPS - LOCK key: Capitalizes text if in down position
   (d) Delete one character, press left arrow key
   (e) Keys with second symbol: Press SHIFT and the desired key
   (f) Repeat keys: Repeat automatically when held down
   (g) TAB key: Indents eight spaces at a time, up to four times
   (h) Center text - at beginning of new paragraph

   CTRL C

COMPONENTS	CONCEPTS AND ACTIVITIES

the first option is already highlighted. To select a different operation, use the open and solid apple keys to move the highlighter vertically; use the SPACEBAR to move the highlighter vertically. When your option is highlighted, press RETURN.

Options in the EDIT MODE are:

(1) ERASE
(2) UNERASE
(3) MOVE
(4) MOVE BACK
(5) FIND
(6) REPLACE
(7) TRANSFER MENU

(d) Press ESC to go back to the EDIT menu
(e) Press ESC to go back into the WRITE MODE

3. The TRANSFER MODE is used to transfer operations such as saving to disk, renaming, deleting, printing a document, or initializing a new diskette

⇦ OR ⇨, RETURN ESC TO MAIN MENU
RETRIEVE DELETE PRINT-DRAFT QUIT
SAVE INIT RENAME PRINT-FINAL CLEAR

Options in this mode:

(a) INIT AND SAVE: Initializes a new diskette and saves a document to it

COMPONENTS	CONCEPTS AND ACTIVITIES
	(b) RETRIEVE: Loads a document that has been saved to a diskette into the computer (c) RENAME: Permits the name of a document to be altered (d) CLEAR AND DELETE: Removes a document from the screen and the computer (e) QUIT: Leaves the text processing operation and enters regular programming operation Participants were allowed time to work through the Bank Street Writer Program with the assistance of the Tutorial program, User's Manual, and consultants. Each participant produced a document, using the word processor.

SESSION FOUR

COMPONENTS	CONCEPTS AND ACTIVITIES
4.1. Selection of hardware	A. Before the selection of any computer hardware is finalized, the functions of the hardware should be determined. The functions to be performed by the computer plus the availability of software should be the determining factors in hardware selection. Other factors to consider include 1. cost 2. ease of use 3. amount of memory 4. speed of processing 5. documentation 6. expansion of system 7. peripherals available 8. service after purchase 9. personal preference B. Public school administrators should be aware of: 1. educational prices for hardware 2. state contract prices 3. starter package specials C. Before buying hardware, check company policies on: 1. warranty 2. service contract 3. follow-up service 4. loaners while being serviced

COMPONENTS	CONCEPTS AND ACTIVITIES
	D. Printer selection should be based on need: 1. dot matrix 2. letter quality 3. speed 4. noise level 5. space required 6. type of ribbon (cost) 7. type of paper feed E. Preventive measures to protect hardware: 1. ground with proper plugs 2. avoid extreme temperatures 3. avoid excessive movement 4. handle disk drives with care 5. use power bar to prevent power surge 6. protect from static electricity 7. prohibit food and drinks in computer area 8. practice routine maintenance

COMPONENTS	CONCEPTS AND ACTIVITIES
4.2 Selection of software	Before selecting software, decide what the program is to accomplish. Each program is designed for a specific purpose so choose the one that most nearly meets a particular need. There are two main categories of software that educators will use. A. Management/Utility Programs These programs range from word processor and data base programs to administrative and instructional management applications. Types: 1. Data Base and Program Generators allow you to write your own program without programming knowledge. Some program generators allow elementary students to write their own materials. 2. Administrative duties such as scheduling, attendance, grade averaging, etc., are prepared to serve a dedicated task and will vary considerably in range and scope. 3. Instructional Management: Saves time for the educator, e.g., writing of IEP's, scoring tests, retrieval system for instructional materials, etc.

COMPONENTS	CONCEPTS AND ACTIVITIES
	B. Computer Assisted Instruction These programs are used by the student as a part of the instructional program: 1. Drill and practice: Give immediate reinforcement to a particular skill 2. Tutorial: Introduces new concepts and provides explanations; individualizes instruction and provides immediate feedback 3. Simulations: Can be used to approximate real events that are impossible to experience in the classroom; compresses time 4. Education games: Present basic facts in a different, interesting way; motivational and entertaining; combine other instructional methods The same general evaluation factors apply to computer programs as apply to other educational materials, such as: 1. correct information 2. clear instructions 3. attractive layout 4. appropriate instructional level 5. motivation and interest 6. freedom from bias 7. effective cost

COMPONENTS	CONCEPTS AND ACTIVITIES
	Additional factors to consider in selecting and evaluating computer programs include: 1. user friendly approach 2. clear options 3. sufficient directions 4. proper feedback 5. appropriate use of graphics 6. appropriate use of color

SESSION 5

COMPONENTS	CONCEPTS AND ACTIVITIES
5.1. Computer Programming	A. Programming Statement: Becoming proficient in computer programming usually requires lengthy instruction and many hours of hands-on experience with the computer. Due to time limitations, the training sessions will provide only an introduction to computer programming for participants. Two programming languages--BASIC and LOGO--will be presented due to their applications to educational settings. The purpose of the sessions is not to produce computer programmers, but to develop awareness, expose school administrators to the capabilities and limitations of the two languages, and initiate interest in or determine need for the individual to pursue computer programming. Only the most basic commands will be presented. B. Computer programming allows the user, through input devices, to give the computer a list of instructions that directs the computer to perform a given task or tasks.
5.2. Programming with BASIC	A. What is BASIC? Basic is an acronym for Beginners All-Purpose Sequential Instruction Code. It is a computer language that is available, in some form, on most microcomputers manufactured today and is designed for computer novices. It is the

COMPONENTS	CONCEPTS AND ACTIVITIES
	computer language most often used by educators.
	B. Commands and effects
	If someone important told you to RUN, you probably would move both legs very quickly. If you told a computer to RUN, it would not move at all. Why? It's not because computers aren't smart or because you are not important. It's because the computer speaks a different language. It speaks BASIC. To talk with a computer, you need to learn some important vocabulary words. Here they are:
	PR#6 — When you type this, the computer will greet you and/or tell you what is on the disk.
	RETURN — After you type something, you need to hit this button to put the information into the computer.
	CURSOR — The blinking square on the screen.
	CATALOG — This command tells you what is on the disk.
	This key moves the cursor backwards. It erases what you have written. Use it to correct mistakes.
	This key moves the cursor forward.

COMPONENTS	CONCEPTS AND ACTIVITIES
	10 Print "How old are you" 20 Input A 30 End Run (5) Computers can calculate: Addition + Subtraction - Multiplication * Division / 10 Print 893 + 264 20 Print 4267 - 592 30 Print 4267 * 3.92 40 Print 1000/33 50 Print 24 * 23/71/33 60 End Run (6) Hands-on time with computer; writing programs devised by individuals and consultants

SESSION 6

COMPONENTS	CONCEPTS AND ACTIVITIES
6.1 Programming with Logo	A. What is Logo Logo is a computer programming language designed by Seymour Papert to enable students, even preschoolers, to control the computer. It is a powerful, easy-to-use language that incorporates graphics, text, and sound into its programs. B. Special Keys deletes to the left of the cursor. RETURN lets the computer know you are finished typing your command C. Logo Commands CONTROL G interrupts LOGO and waits your command CONTROL L graphic screen CONTROL S split screen CONTROL T text screen ERALL erases all procedures D. Some Capabilities of Logo 1. Text - Like BASIC, Logo executes instructions entered from a keyboard. PRINT [ ] results in the words enclosed in the brackets being printed on the screen. PRINT [What is your name]

COMPONENTS	CONCEPTS AND ACTIVITIES
	2. Graphics - To make graphics, Logo changes the cursor into the "turtle" which is a small triangle on the screen that responds to commands of directions and numbers TURTLE GRAPHIC COMMANDS Full Name Short Name SHOWTURTLE............ST FORWARD..............FD BACK.................BK RIGHT................RT LEFT.................LT CLEARSCREEN...........CS PENUP................PU PENDOWN..............PD SETBG (sets background color) SETPC (sets pencolor) To draw a square DRAW FORWARD (or RD) 10 RIGHT (or RT) 90 FD 10 RT 90 FD 10 RT 90 FD 10 RD 90

COMPONENTS	CONCEPTS AND ACTIVITIES
	THE REPEAT COMMAND Will repeat a specified number of times what is contained in brackets. Examples: ?REPEAT 4 [FD 40 RT 90] ?REPEAT 5 [FD 60 LT 144] 3. Procedures - Logo does not use line numbers in programming; it uses procedures. You can teach the computer a set of instructions. In LOGO this is called a procedure. To define a procedure you must begin with the word "TO" followed by the name you choose for it. You will notice that a " " symbol appears instead of a "?". This lets you know that the computer is 'listening'. The word "END" lets the computer know you are finished. Example: ?TO SQUARE REPEAT 4 [FD 40 RT 90] END SQUARE DEFINED (will appear) After you have defined SQUARE you can use it to build other things.

COMPONENTS	CONCEPTS AND ACTIVITIES
	Example: ?REPEAT 4 [SQUARE RT 90] ?CS ?TO SPIN REPEAT 36 [SQUARE RT 10] END SPIN DEFINED ?SPIN 4. The Editor The LOGO editor allows you to create, modify or correct procedures. Example: ?EDIT "SPIN [don't forget the quotation mark] You are now in the editor and your computer should have at the bottom of your screen -LOGO EDITOR- . MOVING THE CURSOR WITHIN THE EDITOR While holding the key marked CONTROL or CTRL: CONTROL N: next line CONTROL P: previous line CONTROL F: forward CONTROL B: backward ← :deletes to the left of the cursor Newly inserted text appears to the left of the cursor. CONTROL C: exits and leaves the editor.

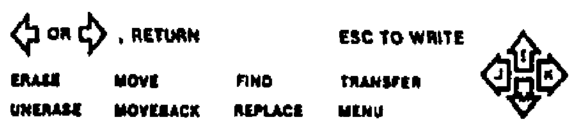
COMPONENTS	CONCEPTS AND ACTIVITIES
	5. Hands-on time with Logo, using Logo program and Apple Logo Mini-Reference.
6.2. Completion of instruments	A. Posttest - the Minnesota Computer Literacy and Awareness Assessment.
	B. Evaluation of sessions.

COMPONENTS	CONCEPTS AND ACTIVITIES
	RUN — Type this and then type the program title to make a program work. BRUN — If a program on the catalog has a B in front of it, type BRUN and then the title to make it work. RESET — This key should never be hit when the red light is on. Typing this key starts everything over. TEXT — After writing a program in graphics, type this to get back to regular BASIC. LIST — This command will list all of the lines in your program in order. [CTRL] [C] — Stops any program. HOME — Clears the screen. C. Writing a program (1) Programs are written on lines with each line being numbered 10 20 30 (2) Print: Commands the computer to print whatever follows on that line (3) Input: Allows you to assign values that a program must have to solve a given problem (4) End: Ends program

COMPONENTS	CONCEPTS AND ACTIVITIES
	7. appropriate use of sound 8. control of rate and sequence 9. availability of support materials Criteria for software evaluation will be included in the handout. An exhibit of educational software was arranged so participants could examine and evaluate a variety of programs.

COMPONENTS	CONCEPTS AND ACTIVITIES

2. The EDIT MODE is used when you want to make alterations in a document either by making a correction or by adding, replacing, deleting, or moving material. The following screen indicates the edit mode:



(a) Cursor movement

↑ = The cursor moves up 1 line
← = The cursor moves 1 space to the left
→ = The cursor moves 1 space to the right
↓ = The cursor moves down 1 line
B = The cursor moves to the beginning of the document
E = The cursor moves to the end of the document
U = The cursor moves up 12 lines
D = The cursor moves down 12 lines

(b) Press ESC to get to write mode

(c) Select any of the seven operations listed at the top of the screen by highlighting the option of your choice. When you press ESC in the Write Mode

COMPONENTS	CONCEPTS AND ACTIVITIES
	Step 1. Turn on monitor Step 2. Insert PFS program diskette in the disk drive Step 3. Turn on computer PFS Menu appears on the screen. The options on the menu include: (1) design file (2) add (3) copy (4) search/update (5) print (6) remove Selection number: Selection name: Step 4. Remove PFS program Important keys when using PFS [CTRL] - Used to control the PFS program when used in conjunction with other keys. [CTRL] [C] - Allows the program to continue. [ESC] - When pressed, allows you to escape back to the menu. [RESET] - Should never be used with the PFS program, or it may erase the information you have entered.

APPENDIX G

PRINTED MATERIAL PROVIDED EACH PARTICIPANT

COMPUTER WORKSHOP for SCHOOL ADMINISTRATORS

David Craig

Leota Coffey

Northwest Regional Education Center

Fall 1983

HISTORICAL BACKGROUND OF COMPUTERS

1940's - First computer (ENIAC)
Vacuum tubes, huge, expensive, complicated

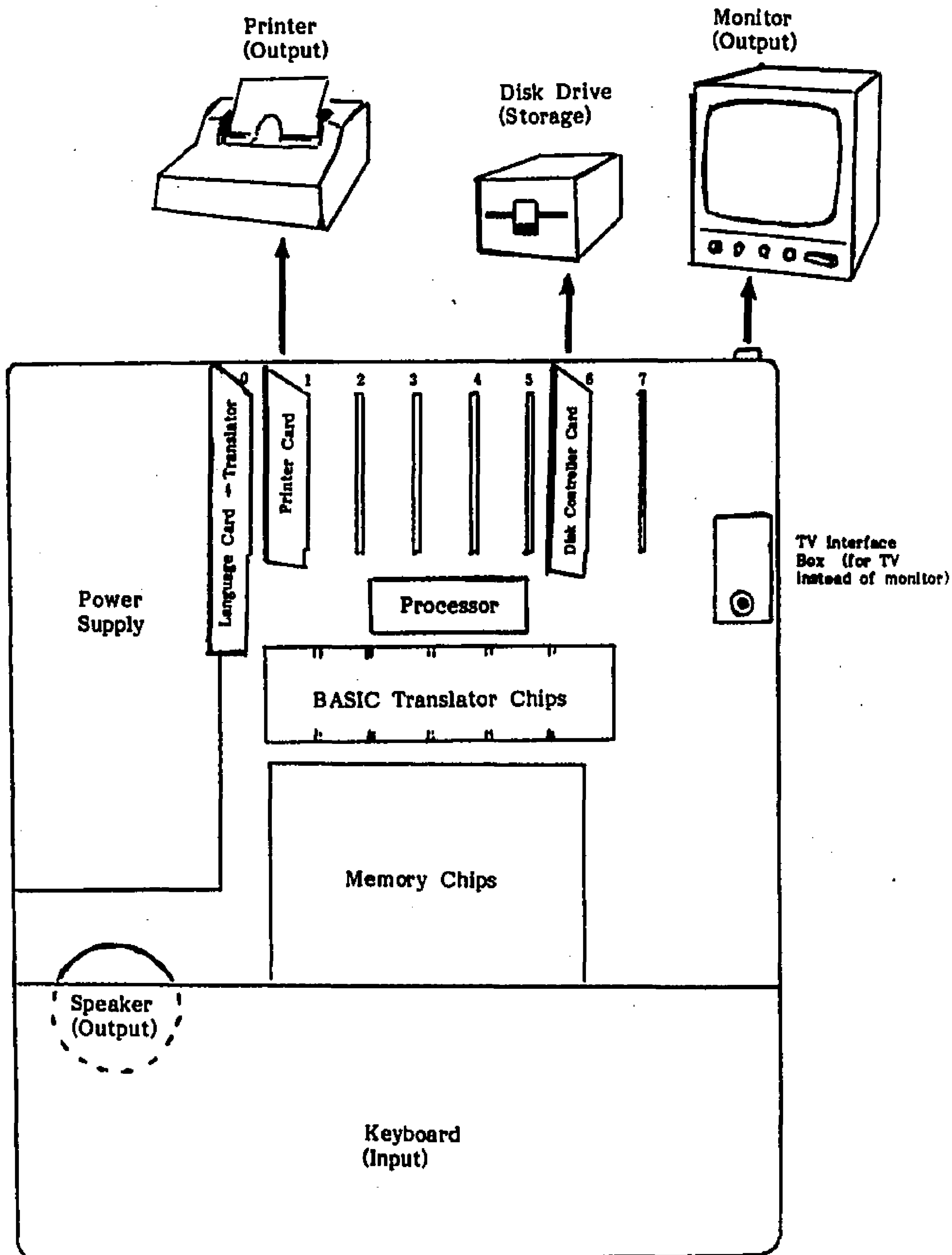
1950's - Computers became available commercially - remained extremely expensive and massive

1960's - Transistorized computers became common - smaller, more reliable, easier to operate

- Integrated circuit revolutionized computers - allowed hundreds of transistors to be manufactured on a small piece of silicone "chip"

1970's - Microcomputers available - within financial reach of schools, required small area for installation, easy to operate

APPLE PARTS: THE ANATOMY



INITIALIZING A DISKETTE

A new disk can be used with any microcomputer. It must be initialized using the Disk Operating System (DOS). This reserves the first three sectors for the "Hello" program.

To initialize:

INIT HELLO

Save

BUYING DISKETTES

Always buy double density diskettes. Both sides can be used by cutting knotch opposite the one already on disk.

INSTRUCTIONAL COMPUTING APPLICATIONS

Computer As An Object Of Instruction

This approach is useful in science, business and math where computers are an integral part of the modern business and technological world. Word processing, accounting, and payroll are all real-life business applications which are computerized. This area will become increasingly important as computing impacts other areas of society, computer art and music for example.

APPENDIX H

LETTER OF REQUEST FOR PERMISSION TO USE MECC INSTRUMENT AND MATERIALS

AVERY COUNTY SCHOOLS

PO Box 397, Newland, NC 28657
Telephone 704/733-6006

January 9, 1984

MECC
2520 Broadway Drive
Lauderdale, Minnesota 55113

Dear Sir:

Pursuant to our telephone conversation, I am conducting a study involving microcomputers and public school administrators. On your recommendation, I purchased a sample copy of the Minnesota Computer Literacy and Awareness Assessment and examined it as an instrument that might be appropriate to use to measure both attitudes toward and knowledge of computers.

After considering various instruments, I believe, as you do, that this instrument will be most satisfactory to use with the participants in my study. Therefore, I have ordered 60 copies of the instrument and the User's Guide for this purpose.

I have also ordered your training material "Using the Computer in the Classroom." I am requesting written permission, as verbalized in our telephone conversation, to use both the assessment instrument and the training material with the participants in the study.

I appreciate your efforts to provide quality materials that facilitate implementing computer literacy in educational programs.

Sincerely,

Leota W. Coffey

Leota W. Coffey
Director of Personnel

LWC/jb

APPENDIX I

RESPONSE TO REQUEST TO USE

MECC INSTRUMENT AND MATERIALS

MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM

2520 Broadway Drive • Saint Paul, Minnesota 55113

January 20, 1984

Ms. Leota W. Coffey
Avery County Schools
P.O. Box 397
Newland, North Carolina 28657

Dear Ms. Coffey:

This is to give you permission to use Form 8 of the Minnesota Educational Computer Literacy and Awareness Assessment. A copy of our publications list is enclosed should you need more copies of the instrument.

We ask that:

1) If you prepare any written papers or oral reports, that you cite it as follows: Anderson, R. E., Hansen, T. P., Johnson, D. C., and Klassen, D. L. Minnesota Computer Literacy and Awareness Assessment, Form 8. St. Paul, MN: Special Projects, Minnesota Educational Computing Consortium, 1979.

2) You send to Special Projects of MECC, reports or papers generated from your use of this test.

Sincerely,

Richard A. Pollak, Ph.D.
Director
Special Projects Division
(612/638-0651)

RAP:rh

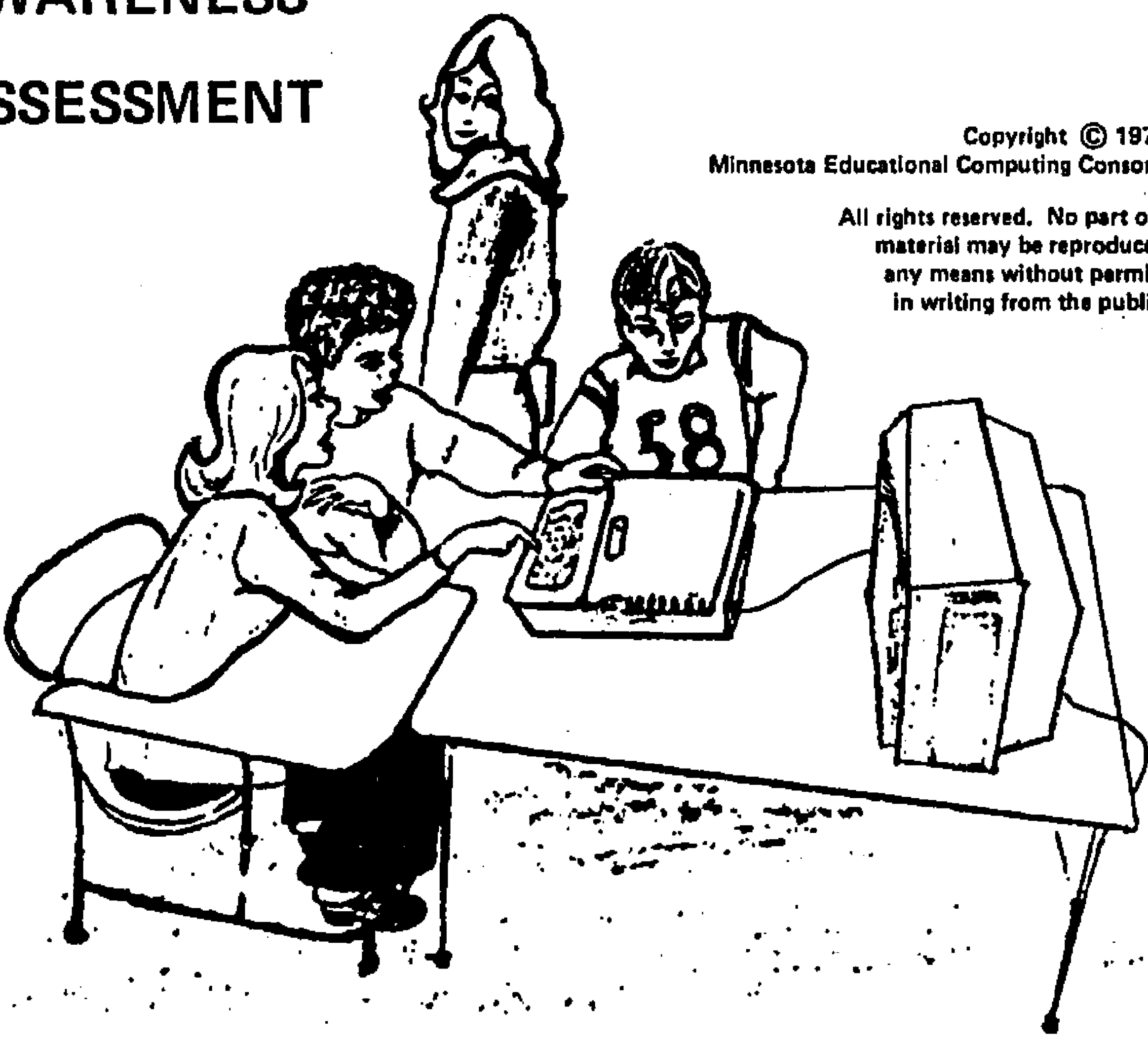
enclosure

APPENDIX J

MINNESOTA COMPUTER LITERACY AND

AWARENESS ASSESSMENT

MINNESOTA COMPUTER LITERACY and AWARENESS ASSESSMENT



MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM
2520 Broadway Drive
St. Paul, MN 55113

APPENDIX K

PERSONAL DATA SHEET FOR PARTICIPANTS

Personal Data

NAME: ____
Last First Middle

ADDRESS: ______________________________________

____

TELEPHONE: ( ) ________________________________

BIRTHDATE: ___________________________________
Year Month Day

SEX: Female _____ Male _____

Professional Experience

LEA _______________

POSITION: ______________________________________

If Principal: Elementary _____

Secondary _____

AREA OF INITIAL CERTIFICATION ___________________________

LEVEL OF FORMAL PREPARATION: B.S. _____
M.A. _____
Ed.S. _____
Doctorate _____

YEARS IN EDUCATIONAL PROFESSION: 1 - 10 _____
11 - 20 _____
21 - 30 _____
Over 30 _____

YEARS IN PRESENT POSITION: 1 - 10 _____
11 - 20 _____
21 - 30 _____
Over 30 _____

YEARS SINCE LAST ENROLLED IN COLLEGE COURSE: 1 - 5 _____
6 - 10 _____
11 - 15 _____
16 - 20 _____
21 - 25 _____

Educational Data

1. Have you held a position in education in other countries or states? ______________

   If yes, please list countries:

   states:

2. Have you held a position in education in another region (other than region 7) of North Carolin? ______

   If Yes, please list region:

3. Have you held a position in education in an urban area (population over 13,000)? __________

   If yes, please list city (cities):

4. Please check the positions in education in which you have served:

   Teacher ______

   Principal ______

   Supervisor ______

   Program director/coordinator ______

   Assistant Superintendent ______

   Superintendent ______

   Other (please list) ___________________________

APPENDIX L

PRE- AND POSTTEST SCORES FOR PARTICIPANTS

TABLE L-1

PRETEST SCORES FOR ATTITUDES TOWARD COMPUTERS

Value	Frequency	Percent	Cum Percent
28.00	1	2.3	2.3
54.00	1	2.3	4.5
57.00	2	4.5	9.1
59.00	2	4.5	13.6
60.00	1	2.3	15.9
61.00	1	2.3	18.2
62.00	1	2.3	20.5
63.00	1	2.3	22.7
65.00	1	2.3	25.0
66.00	1	2.3	27.3
67.00	2	4.5	31.8
68.00	2	4.5	36.4
69.00	2	4.5	40.9
70.00	1	2.3	43.2
71.00	1	2.3	45.5
73.00	2	4.5	50.0
74.00	3	6.8	56.8
75.00	3	6.8	63.6
76.00	3	6.8	70.5
77.00	3	6.8	77.3
78.00	3	6.8	84.1
79.00	2	4.5	88.6
81.00	1	2.3	90.9
82.00	1	2.3	93.2
84.00	2	4.5	97.7
85.00	1	2.3	100.0
TOTAL	44	100.0	

Valid Cases: 44 Missing Cases: 0

TABLE L-2

PRETEST SCORES FOR COMPUTER KNOWLEDGE

Value	Frequency	Percent	Cum Percent
23.00	2	4.5	4.5
24.00	1	2.3	6.8
25.00	1	2.3	9.1
27.00	2	4.5	13.6
28.00	1	2.3	15.9
30.00	4	9.1	25.0
31.00	1	2.3	27.3
32.00	1	2.3	29.5
33.00	3	6.8	36.4
34.00	3	6.8	43.2
35.00	3	6.8	50.0
36.00	4	9.1	59.1
37.00	1	2.3	61.4
38.00	1	2.3	63.6
39.00	3	6.8	70.5
40.00	4	9.1	79.5
41.00	1	2.3	81.8
42.00	3	6.8	88.6
43.00	1	2.3	90.9
44.00	1	2.3	93.2
46.00	1	2.3	95.5
48.00	2	4.5	100.0
TOTAL	44	100.00	

TABLE L-3

POSTTEST SCORES FOR ATTITUDES TOWARD COMPUTERS

Value	Frequency	Percent	Cum Percent
66.00	2	4.5	4.5
67.00	1	2.3	6.8
70.00	1	2.3	9.1
72.00	1	2.3	11.4
75.00	2	4.5	15.9
76.00	1	2.3	18.2
77.00	1	2.3	20.5
78.00	2	4.5	25.0
79.00	3	6.8	31.8
80.00	3	6.8	38.6
81.00	1	2.3	40.9
82.00	1	2.3	43.2
83.00	1	2.3	45.5
84.00	5	11.4	56.8
85.00	3	6.8	63.6
86.00	3	6.8	70.5
87.00	1	2.3	72.7
88.00	2	4.5	77.3
89.00	2	4.5	81.8
90.00	1	2.3	84.1
93.00	1	2.3	86.4
94.00	1	2.3	88.6
95.00	2	4.5	93.2
96.00	2	4.5	97.7
97.00	1	2.3	100.0
TOTAL	44	100.0	

TABLE L-4

POSTTEST SCORES FOR COMPUTER KNOWLEDGE

Value	Frequency	Percent	Cum Percent
32.00	1	2.3	2.3
35.00	2	4.5	6.8
36.00	2	4.5	11.4
39.00	2	4.5	15.9
40.00	2	4.5	20.5
42.00	2	4.5	25.0
43.00	1	2.3	27.3
44.00	6	13.6	40.9
45.00	3	6.8	47.7
46.00	2	4.5	52.3
47.00	3	6.8	59.1
48.00	4	9.1	68.2
49.00	2	4.5	72.7
50.00	5	11.4	84.1
51.00	3	6.8	90.9
52.00	2	4.5	95.5
53.00	2	4.5	100.0
TOTAL	44	100.0	

APPENDIX M

AGE OF PARTICIPANTS IN STUDY

Table M-1

AGE OF PARTICIPANTS IN STUDY

Value	Frequency	Percent	Cum Percent
29	1	2.3	2.3
31	1	2.3	4.5
32	1	2.3	6.8
33	4	9.1	15.9
34	1	2.3	18.2
35	1	2.3	20.5
36	3	6.8	27.3
37	1	2.3	29.5
38	1	2.3	31.8
39	2	4.5	36.4
40	4	9.1	45.5
41	1	2.3	47.7
43	1	2.3	50.0
45	1	2.3	52.3
46	2	4.5	56.8
47	1	2.3	59.1
48	1	2.3	61.4
49	2	4.5	65.9
50	1	2.3	68.2
52	2	4.5	72.7
53	1	2.3	75.0
54	4	9.1	84.1
55	1	2.3	86.4
56	1	2.3	88.6
58	3	6.8	95.5
60	1	2.3	97.7
61	1	2.3	100.0
Total	44	100.0	

VITA

LEOTA WISE COFFEY

Personal Data:	Date of Birth: June 14, 1937 Place of Birth: Newland, North Carolina Marital Status: Married
Education:	Diploma, Newland High School, Newland, North Carolina, 1954. Berea College, Berea, Kentucky; elementary education, B.S., 1958. Appalachian State University, Boone, North Carolina, early childhood, M.A., 1979. East Tennessee State University, Johnson City, Tennessee; supervision, Ed.D., 1984.
Professional Experience:	Teacher, Crossnore Elementary School; Crossnore, North Carolina, 1958-1981. Federal Programs Director, Avery County Board of Education; Newland, North Carolina, 1981-83. Director of Personnel and Instruction, Avery County Board of Education; Newland, North Carolina, 1983.
Professional Associations:	American Association of University Women Phi Delta Kappa North Carolina Association of School Administrators North Carolina Association of Supervision and Curriculum Development