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A survey of the instructional use of microcomputers in special education programs in Michigan

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A SURVEY OF THE INSTRUCTIONAL USE OF MICROCOMPUTERS IN SPECIAL EDUCATION PROGRAMS IN MICHIGAN

By

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A DISSERTATION

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ABSTRACT

A SURVEY OF THE INSTRUCTIONAL USE OF MICROCOMPUTERS IN SPECIAL EDUCATION PROGRAMS IN MICHIGAN

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The purpose of this study was to determine the status of the instructional uses of microcomputers in special education programs in public schools throughout Michigan. The study sought to provide information about developed district polices and practices that appear to promote the growth of microcomputer technology.

The survey instrument was mailed to 236 special education administrators in Michigan; of that number, 59 were Intermediate School District (ISD) special education directors and 177 were Local Educational Agency (LEA) special education directors. One hundred eighty-nine usable surveys were returned for an 80% response rate.

The major findings from this study were as follows:

A majority of respondents reported that both special and general education teachers used microcomputers in their classrooms.

About 58% of the respondents indicated that their districts had already developed long-range technology plans for general education programs. Also, 34% of the respondents indicated that their districts had special education technology plans for special education programs.

School districts with a special education technology plan had a higher percentage of teachers using microcomputers in special education classrooms than did districts without such a plan. Also, school districts with a technology plan had a higher percentage of teachers using microcomputers in general education classrooms.

Special education administrators perceived that microcomputers were used primarily to support instruction. Other uses, in descending order of agreement, included tutoring students on specific skills, implementation of IEP goals, and rewarding students for good behavior.

The percentage of special education teachers who had been trained to use microcomputers ranged from 0% to 100% with a mean of 69.05%.

The administrators' highest concern with regard to inservice training was computer-assisted instruction. The next highest concern was with selection and evaluation of software and introduction to computer application/computer literacy.

Dedicated to My Mother Whom I Love and Miss,

Chang Hee Lee

and

My son Whom I Love and am proud of,

Wesley McLaughlin, as I look to the future.

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CHAPTER I

BACKGROUND

Introduction

During the last decade there has been unprecedented growth in the amount of technology that is available in schools. In fall 1988, it was estimated that approximately 1.7 million computers were being used in public schools (U.S. Congress, 1988). The greater availability and sophistication of new technology, combined with decreasing costs, has provided the potential for increased effectiveness and efficiency in the delivery of special education services (Bennett, 1982). The Authors of Power On! New Tools for Teaching and Learning (U.S. Congress, 1988) suggested that the dramatic increase in technology "shows a widespread willingness on the part of school districts, schools, teachers and parents to explore the possibilities of new learning technology" (p. 4).

Under Part G of the Education of the Handicapped Amendments of 1986, the Office of Special Education Programs (OSEP) in the U.S. Department of Education is authorized to support the development and appropriate use of technology in special education. Part G

specifically authorizes four areas in which the OSEP actively supports projects (a) determining how technology is currently used in educating students with handicaps and how it can be used more effectively, (b) designing and adapting new technology to improve the education of these students, (c) stimulating the public and private sectors in the development and marketing of new technologies, and (d) disseminating information on the availability and use of technologies (Burnette, 1990).

Passage of the Technology-Related Assistance for Individuals with Disabilities Act of 1988 indicated an increased public awareness of the benefits of technology to educate handicapped students. However, use of microcomputers in special education raises a number of new issues for program administrators in terms of the development of policies and practices for the instructional use of microcomputers, software selection, and inservice teacher training.

In 1987, Goldman, Semmel, Cosden, Gerber, and Semmel (1987) investigated the reactions of special education administrators to microcomputer technology in terms of the development of policies and practices governing the adoption and use of microcomputers. They discovered that school district administrators of both regular and special education programs faced economic and instructional policy issues regarding the adoption

of microcomputers. It appears that relatively little information is available to guide the policy-making processes toward optimal learning outcomes for children with special needs. Effective administration of special education services at all levels depends upon the availability of accurate and timely program information. There is a great need for well-informed planning and decision making. Decisions that are made will likely have important long-term consequences.

Policy analysis, according to Gray (1984), helps planners focus on problems, issues, and needs. He wrote:

> Policy analysis is a vehicle by which district administrators can gain knowledge for decision making relative to an innovation like computer use. Through policy analysis they can come to understand the problems-issues-needs surrounding computer use in their own districts. As a result, they can be a position to set the direction and content of such a change. (p. 76)

Therefore, a prerequisite to policy and decision making is to determine the appropriate use of microcomputers by analyzing how microcomputers are currently being used with children who have special needs.

Recently, school staffs have come to rely on field-based research to guide their school-improvement efforts (Justiz & Mason, 1984). When Johnson (1983) studied how schools acquired their instructional-computing agenda of action, he reported that a certain cycle of activity was common to all sites. He indicated that the cycle of

activity was (a) awareness, (b) identification, (c) approval and commitment, and (d) implementation. Cory (1983) also reported that schools go through identifiable stages when adding microcomputer instruction to the curriculum. Specifically, she found that, before school systems can fully use computers, they go through four invariant stages: (a) getting on the bandwagon, (b) entering a stage of confusion, (c) pulling it all together, and (c) beginning full implementation. In addition, Cory suggested that six factors -- hardware, software, staff development, computer-assisted learning, computer literacy, and attitude -- must be considered at each stage. Dershimer (1982) recommended that the following be considered when planning strategies to implement microcomputer use in public education: training, funding, choosing software, communicating with other users, matching goals with the technology, selecting from diverse applications, selecting hardware, and using microcomputers equitably.

The researchers cited above corroborated a commonality of implementation strategies across school sites as schools work individually through the innovation-adoption process. Such findings have reinforced the premise that a school's implementation process can be facilitated by knowledge of the documented practices and progress evaluations of schools

that are similar demographically (Hall, 1981).

Becker (1982) corroborated the need for further research as a basis for more reliable decision making by local schools:

> For each of the problems that may result when microcomputers are introduced into the school's ongoing educational structure, systematic research could help discover their incidence and severity and the conditions under which the problem is minimized.
>
> We need to develop an unbiased and representative body of information about how schools decide to obtain and use microcomputers and other technological tools, how they use them, and the effects their use has on students and the social organization of the school.
>
> However, in the absence of research, those who implement various uses of microcomputers in an educational environment should share with other educators how they deal with them. (P. 56)

The absence of such in-depth analyses is particularly critical because the use of microcomputers in special education will continue to grow. Therefore, it is necessary to know more about microcomputer use with special needs students in order to develop coherent policies and practices with regard to (a) planning for technology, (b) instructional uses of microcomputer, (c) selection of software; and (d) inservice teacher training and support.

Statement of the Problem and Need for the Study

Despite the continued rapid increase in the instructional use of microcomputers in special education, at present there is relatively little information to guide the planning efforts related to the

educational computing needs of special education students in Michigan. To accelerate the realization of the promise of technology, a much greater investment in determining such needs is required.

According to the literature reviewed for this study, microcomputer technology is useful in the education of special needs students, and individualized instruction can be enhanced through the use of microcomputers (Hanaford, 1983). However, more information is needed about the usefulness of microcomputers in special education.

National surveys (Hanley & Yin 1984, Market Data Retrieval, 1984) have been conducted to identify the administrative and instructional uses of microcomputers in the United States. These Surveys indicated that microcomputers were being used in special education for administrative and instructional purposes, but that school personnel had difficulty selecting appropriate software. School districts also lacked information concerning funding and staff development in relation to microcomputer use. In addition, Hanley (1983) found that the initial planning for and adoption of microcomputers often occurred without much involvement of district-level staff.

The need to determine the present level of the integration of instructional computing activities in

Michigan schools was verified by the Michigan State Board of Education (1984) in its Blueprint for Action:

> The Michigan State Board of Education, based on the recommendation of the referent technology group, shall... acquire existing school district plans in order to develop and provide planning models for school district and intermediate district use. (pp. 21-22)

Becker (1982) corroborated the need for further research as a basis for more reliable decision making by both local schools and product developers:

> For each of the problems that may result when microcomputers are introduced into the school's ongoing educational structure, systematic research could help discover their incidence and severity and the conditions under which the problem is minimized.
>
> We need to develop an unbiased and representative body of information about how schools decide to obtain and use microcomputers and other technological tools, how they use them, and the effects their use has on students and the social organization of the school.
>
> However, in the absence of research, those who implement various uses of microcomputers in educational environments should share with other educators how they deal with them. (p. 56)

At present, relatively little is known about the status of the instructional use of microcomputers, inservice training of teachers on microcomputers, and software selection in special education programs in Michigan. By reviewing current research and by contacting those involved with educational computing at the Michigan Department of Education, Special Education Services, the researcher determined that there is a need for this type of study so that special education educators can improve their present microcomputing

programs and plan for future educational computing in special education.

Purpose of the Study

The researcher's overall purpose in this study was to determine the status of the instructional use of microcomputers in special education programs in public schools throughout Michigan. Areas of interest were (a) the degree to which microcomputers are used for instructional purposes in public schools, (b) the existence of policies concerning the instructional use of microcomputers in terms of a technology plan and a microcomputer committee, (c) the nature of personnel involvement in decisions to acquire hardware and software, (d) guidelines for purchasing software, (e) inservice teacher training and support, (f) special education administrators' perceptions regarding the goals of instructional technology in special education classrooms, and (g) special education administrators' concerns regarding the inservice training needs of special education teachers.

This study was undertaken in an attempt to provide information for educational planners that might serve as an indicator of present progress toward the integration of microcomputers into special education programs in Michigan.

Research Objectives

Specific objectives in conducting this study were to:

1. Determine the degree to which microcomputers are used for instructional purposes in special and general education programs throughout Michigan.

2. Determine the availability of technology plans in school districts and the nature of school personnel's involvement in decisions to acquire hardware and software.

3. Determine what considerations school districts have given to purchasing instructional software.

4. Determine the status of inservice training on microcomputers for special education teachers.

5. Determine special education administrators' perceptions regarding the use of microcomputers in special education classrooms.

6. Determine special education administrators' concerns regarding inservice training in microcomputer technology for special education teachers.

7. Develop recommendations, based on the finding of this study, for educational planning and microcomputer use in special education programs.

Research Questions

This study was designed to answer the following research questions with regard to the instructional use of microcomputers in public school in Michigan:

1. To what degree are microcomputers used for instructional purposes in special and general education programs in Michigan and do the two programs differ in their use of microcomputers?

2. What policy decisions have been made or are being developed to ensure the instructional use of microcomputer technology?

3. Is there a difference in the instructional uses of microcomputers between school districts that have a technology plan and those that do not have such a plan?

4. What considerations have school districts given to purchasing instructional software?

5. What are special education administrators' perceptions concerning microcomputer use in special education classrooms?

6. To what extent is inservice training on microcomputers provided to special education teachers and how is it funded?

7. What are administrators' concerns with regard to inservice training in microcomputer technology for special education teachers?

Limitations of the Study

1. The study was limited by available funds to include intermediate school district (ISD) and local education agency (LEA) special education directors in Michigan.

2. The study was limited to self-report survey questionnaires mailed to ISD and LEA special education directors. Generalization from such self-reported surveys lacks the validity of generalization from a controlled study.

3. Although it was field tested, the survey instrument might have had built-in ambiguity that would inhibit the collection of data pertinent to the study.

Definitions of Key Terms

The following terms are defined in the context in which they are used in this dissertation.

Adaptive device. Any input or output device or interface that allows an individual to use a computer by some means other than with the standard equipment.

BASIC (Beginners' All-purpose Symbolic Instructional Code). A computer-programming language that often is used as an introduction to programming for students.

Computer-assisted instruction (CAI). A teaching process in which a computer is directly involved in the presentation of instructional materials in an interactive mode to provide and control the individualized learning environment for each student.

Computer-managed instruction (CMI). A teaching process in which instruction is systematically controlled by the computer.

Computer literacy. A term that is widely used, but whose meaning has rarely been agreed upon. Lockheed, Hunter, Anderson, Beazley, and Etsy (1983) described computer literacy as:

> Whatever a person needs to know and do with computers in order to function competently in our information-based society. It includes three kinds of competence: knowledge, skills and understanding: (1) the ability to use and instruct computers to aid in learning, solving problems, and managing information; (2) knowledge of functions, applications, capabilities, limitations, and social implications of computers and related technology;

and (3) understanding needed to learn and evaluate new applications and social issues as they arise.

Computer programming. Designing, organizing, and writing a series of instructions in a computer code (programming language) to direct the computer to complete a series of tasks.

Decision making. A process of formal or informal procedures that may be followed to arrive at a final choice.

Electronic information service. A service linking computers and/or databases for information retrieval or interactive communication.

Electronic mail. A computer-based electronic message system that enables one person to compose a message, address it to another person, and ship it electronically to that person's computer "mailbox." The message waits in the recipient's mailbox until that person requests his or her computer to check the mailbox for any mail that has been received. Electronic message systems are used widely in business, government, and institutions of higher education.

Hardware. The components of the computer, including the display monitor, the keyboard, disk drives, printers, and so on.

Individualized education program (IEP). A written document required by federal law to detail the year's plan for every handicapped child; includes statements of

present performance, annual goals, short-term instructional objectives, specific educational services needed, relevant date, regular education program participation, and evaluation procedures; must be signed by parents as well as educational personnel.

Intermediate school district (ISD). A regional educational agency that serves as a link between the local school districts and the state education authority.

Local School District (LSD). A basic independent educational unit of government, which has a superintendent and a board of education.

LOGO. A sophisticated programming language whose creators have developed special programs whereby children may have computer experiences that enhance such skills as problem solving, procedural thinking, debugging, and graphing.

Microcomputer. A small, stand-alone computer that historically was distinguishable from mini-computers and mainframes by its relatively limited powers in terms of processing speed and available memory.

Perception. "The interpretation of received stimuli in light of past experiences and knowledge" (Hopkins 1976, p. 90). In this study, perception was assessed by respondents' degree of agreement or disagreement, as measured by their answers on a forced-choice Likert-type scale, with statements about the

instructional use of microcomputers and teacher inservice training.

Software. The instructions and programs that are used in the computer.

SpecialNet. (National Association of State Directors of Special Education) offers a Comprehensive System of Personnel Development (CSPD) Bulletin Board, a potpourri of information about personnel development efforts, practices, and resources around the nation.

Word processing program. An computer application program that facilitates the process of writing, editing, and printing any textual material.

Organization of the Study

This dissertation is organized into five chapters. Chapter I includes an introduction to the study, a statement of the problem and need for the study, purpose of the study and research objectives, limitations, and definition of key terms.

Chapter II contains a review of literature on issues and concerns in four areas related to computer education. These areas are Planning for Technology, Selected Topics Related to the Instructional Use of Microcomputers, Selection of Software, and Teacher Training and Support.

The methods and procedures used in this descriptive study are described in Chapter III.

The findings of the study are presented in Chapter IV.

Chapter V contains a summary of the research, discussion and conclusions drawn from the major findings, and recommendations for educational practice and for further study.

CHAPTER II

REVIEW OF RELATED LITERATURE

The literature review focuses on selected issues and concerns related to computer education. The discussion is focused on the following four subjects: Planning for Technology, Selected Topics Related to the Instructional Use of Microcomputers, Selection of Software, and Teacher Training and Support.

Planning for Technology

Current writers have supported the value of using computers with special needs students (Becker, 1982; Maddux, 1984; MacArthur, Haynes, & Malouf, 1986). Applications are varied, depending on the specific disabilities of each student. Meeting students' unique needs has always been a major focus of special education, and the microcomputer can help meet many of those needs if its introduction is carefully planned. To accomplish this, administrators must develop both expertise in special education and technology and skill in determining how this new instructional tool can best complement and improve the educational process. A well-developed implementation plan, employing the expertise of many educators in various disciplines, must

be developed in each school system (White, 1987).

Bailey (1991b) noted that "if administrators are to infuse technology into their school and district, long-range planning must become the highest priority" (p. 12). Cory (1983) pointed out that if a district has made a commitment to the implementation of instructional computing, its policy decision will be evidenced in its long-range plans.

In Principals' Planning Guide for Microcomputers (1983), developed by the Michigan Council of Teachers of Mathematics and the Michigan Intermediate Media Association, using a cyclical process and involving the school principal in planning for microcomputers are recommended. The planning process involves answering the following questions: (a) Which curriculum goals and objectives are to be enhanced by microcomputers?; (b) What outcomes are expected, and how will their achievement be measured?; (c) What software and/or process will be used?; (d) What considerations have been made for purchasing hardware?; (e) What staff inservice has been planned?; (f) Were the intended outcomes achieved?; (g) What additional applications should be considered?; and (h) What modifications to curriculum goals should be considered?

Basic considerations with regard to planning include: involving a staff committee in developing the

plan; reflecting school goals, needs, and limitations; joining with others to develop a district-level plan; remembering that the plan is more temporary than permanent; and making the budget realistic (Neill, 1983). That is, planning requires experience and expertise in both technology and education, as well as an awareness of political and financial reality.

Researchers have indicated that the most successful school districts have a comprehensive and long range plan (Foster, 1988; Mageau 1991; Witthuhn, 1985). Neill (1983) suggests that this long range planning should be a fluid process. The Michigan State Board of Education (1987), in Essential Goals and Objectives for Computer Education, noted that "effective computer education can only be accomplished when a district planning process is adopted" (p. 3). In other words, planning for technological implementation within the context of an overall school district's strategic plan is the key to a successful technology program. Technology will continue to shape the processes and systems of schooling.

Selected Topics Related to Instructional Uses of Microcomputers

The literature offers considerable support for the use of computer assisted instruction (CAI) with special needs students (Becker, 1982; Maddux, 1984; MacArthur, Haynes, & Malouf, 1986). One of the greatest potential

benefits of CAI to persons with disabilities lies in the individualized nature of such instruction (Hanaford, 1983). In addition to the advantages of individualization, that is, immediate feedback and reinforcement, and monitoring of progress, CAI frees the teacher to devote more time to the students' educational needs (Forman, 1983). For special needs children who have experienced a prolonged history of academic failure, the computer may be especially useful. In a nonthreatening manner, the computer program can ensure the child failure-free mastery of new skills and knowledge, or it can reinforce and support previous attainments. The child's sense of increased competence is thus supported. When the child's sense of competence lags, a return to the computer program should be positively reinforcing (Budoff & Hutten, 1982).

Hofmeister (1984) stressed the instructional applications of computers and discussed them in relation to (a) computer-assisted instruction (CAI), which puts the learner in direct contact with the computer; (b) computer-managed instruction (CMI), which concerns the diagnosis of pupils' strengths and needs and prescriptive instructional interventions; and (c) computer literacy, which entails learners becoming aware of the applications of computers in society, acquiring technical operational skills related to the computer as a machine, and acquiring knowledge of the

computer's logical process and formal programming languages. Each of these areas is discussed more fully in the following paragraphs.

Computer-Assisted Instruction (CAI)

Computer-assisted instruction (CAI) is a teaching process in which a computer is directly involved in the presentation of instructional materials in an interactive mode to provide and control the individualized learning environment for each student. The interactive mode usually is subdivided into drill and practice, tutorial, simulation, game, and problem solving (Burke, 1982).

Vinsonhaler and Bass (1972) reviewed ten studies on the use of CAI at the elementary school level. These studies were published between 1966 and 1970. All ten studies involved CAI drill and practice in mathematics or language arts in grades 1 to 6. CAI was used as a supplement to traditional instruction, with standardized achievement tests as the outcome measures. These authors found CAI to be superior to traditional methods of instruction. Also, in meta-analytic reviews of the research literature, CAI has been found to enhance learning, engender more positive attitudes toward course work, and reduce the time needed for learning (Kulik, Bangert, & Williams, 1983). In addition, findings from studies reviewed by the U.S. Congress, Office of

Technology Assessment (1988) led to the conclusion that CAI is superior to conventional methods of instruction.

Drill and Practice. The primary application of microcomputers in CAI in special education is drill and practice (Becker, 1982; Maddux, 1984). Drill and practice is designed to integrate and consolidate previously learned material through practice on the computer. It serves as a supplement to other forms of instruction (Burke, 1982).

Drill and practice CAI has been shown to have a positive effect on the achievement of elementary school children (Kulik, Kulik, & Bangert-Drowns, 1985). MacArthur, Haynes, and Malouf (1986) found that subjects with learning disabilities who engaged in drill and practice CAI spent significantly more time attending to academic content and less time off task than did subjects who engaged in workbook activities.

Tutorial Programs. Tutorial programs contain a description or an explanation of the concepts being taught. Basically, a tutorial is intended to provide some instruction, ask questions to determine whether the student understands, and, on the basis of the student's performance, provide further instruction if necessary.

The research on tutorial software is sparse and the effectiveness of tutorial software has not yet been determined. However, the PLATO tutorial system,

developed by Control Data Corporation, was the subject of a research study by Slattow (1977). Slattow concentrated on studying the effectiveness of computerized tutorials in language arts and mathematics instruction. Results indicated that only tutorials involving fractions effected any significant improvement in student learning.

Simulation Programs. Simulations may be useful in teaching students with handicaps skills that normally would be difficult to teach because of the practical considerations involved in placing the student in the actual environment represented by the simulation (Moore, Yin, & Lahm, 1986). Also Strickland and Poe (1989) noted that a simulation is a powerful teaching technique that models a particular event by imitating or replicating it. In addition, simulations enable learners to make low-risk decisions and receive informative feedback in simulated consequences (Doerr, 1979), to speed up or slow down the time frame to fit instructional goals, and to make abstract subjects more concrete (Hunter, 1984; Roberts, 1984).

Lindsay (1986) suggested that good educational simulations should include a number of features. One of these features is realism. A second is the presentation of an active, responsive learning environment that motivates students to explore. The third and most important feature, from a pedagogical point of view, is

that the simulation should provide an opportunity for students to arrive at an understanding of the system through a cycle of hypothesis proposing and testing, and then deciding which hypothesis to try next on the basis of feedback received.

Educational Games. Educational games are designed to develop general problem-solving methods and strategies while maintaining students' interest and motivation (Budoff, Thormann, & Gras, 1984). Budoff et al. noted that students who were mentally retarded, learning disabled, and emotionally disturbed could improve specific skills, including fine-motor coordination, through the use of games.

Malone (1981) studied the effects of various aspects of arcade games on students' game preferences as indicated by ratings and time spent playing. Although they were not conclusive, his results suggested that students' preferences for particular games were affected by the amount of challenge, fantasy, and sensory curiosity (visual and auditory effects) in the games. Also, Malone suggested other possible motivating aspects of video games, such as: (a) a goal hierarchy with goals that are difficult, but within reach, and with a ceiling that is seemingly unlimited; (b) high response rates that demand students' undivided attention; and (c) immediate response-by-response feedback, allowing

improvement as indicated by more global feedback.

Problem Solving. Computers can be used to teach problem-solving skills and to help students apply those skills to solving actual problems. Papert (1980) proposed using microcomputers to allow children to become generative problem developers and problem solvers. Also he noted that in the LOGO environment, the child is in control. The child programs the computer. In teaching the computer how to think, children embark on an exploration about how they themselves think. This approach has considerable potential for many special needs children. A major problem of many children with specific and global learning disabilities is their disordered approach to problem solving (Budoff & Hutten, 1982).

Leher and deBernard (1987) investigated the effects of programs using LOGO compared with those using commercially available software and no treatment on the perceptual-language skills of preschoolers with language impairments. They found that children instructed in LOGO achieved greater overall gains in perceptual-language skills than did those who were not instructed in LOGO.

In summary, special education and CAI share the common objective of catering to individual differences by providing effective and efficient instruction that is matched to the characteristics of learners. Both are

purported to provide carefully sequenced content, appropriate feedback, and consistent and accurate monitoring of students' performance. Both are designed to offer appropriate pacing of instruction and efficient, extrinsically motivating formats, as well as provide for data-based instructional decisions. Also each is directed at providing individualized educational planning and instruction within a restrictive environment (Semmel, Cosden, Semmel, Kelemen, 1984).

Computer Managed Instruction (CMI)

Recently, much has been written about the potential of computers for increasing the quality of Individualized Education Programs (IEPs) and decreasing the cost and time of preparing IEPs, particularly in light of computers' data-management capabilities (Wilson, 1981).

Burke (1982) defined computer managed instruction (CMI) as the systematic control of instruction by the computer. This instructional approach is characterized by testing, diagnosis, learning prescriptions, and thorough record-keeping.

Public Law 94-142 (the Education for All Handicapped Children Act, 1975) mandates that all handicapped children who need special education services must be provided with free, appropriate public education designed to meet their unique needs. A cornerstone of

this provision is the development and implementation of the IEP, the goals and objectives of which serve as a blueprint of the child's instructional program (Turnbull, Strickland, & Hammer, 1978).

However, some teachers have complained that the IEP is "irrelevantly exaggerated paperwork" (Sabatino, 1981) and that they are expending time and effort on a process that has little relevance to classroom instruction (Goldberg, 1981). Price and Goodman (1980) examined the costs associated with developing an IEP and found that writing the document and gathering supportive diagnostic data, in that order, account for the major time expenditure in the overall document-development process. Developing an IEP is time consuming because the program must contain much information gathered from a variety of sources. In addition, questions have been raised concerning teachers' ability to do in-depth curriculum planning (Turnbull et al., 1978) and to write the sequential and technically adequate goals and objectives that are required if the IEP is to be a useful instructional tool (Tymitz, 1980).

Ryan and Rucker (1986) investigated the difference between school districts using computerized IEPs and those using noncomputerized IEPs with regard to the attitudes of teachers toward IEPs, the time teachers spent writing and preparing IEPs, and the cost per IEP.

The study findings indicated that teachers in districts using computerized IEPs systems spent less time writing IEPs and had a more favorable attitude toward IEP instructional planning than did those in districts using noncomputerized IEPs. In addition, the cost per IEP for computerized districts was less than the cost per IEP for noncomputerized districts.

In another study, Davis (1985) examined the use of computerized IEP management systems. He found that the advantages of the computerized approach are decreased preparation time and increased teacher efficiency and proficiency. However, IEP-development programs can be misused, resulting in IEPs that are neither individualized nor appropriate to the needs of children with disabilities. Therefore, teachers, and parents should be involved in selecting, developing, and implementing computerized IEP management systems.

Finally, Budoff, Thormann, and Gras (1984) noted that a computerized IEP system provides easily read information that is specific to the student and saves teachers many tedious hours formulating or transcribing objectives. Another major benefit of standardizing objectives on a computer is that the objectives can more easily be shared among concerned staff members.

Selection of Software

The advent of microcomputers on the educational scene has brought a great deal of confusion to teachers and administrators. That is, as information emerges on the function of microcomputers in the schools, educators are expressing concern about the integration of CAI into the curriculum and about the quality and quantity of software available for students served by regular and special education (Budoff et al., 1984; Grady, 1983).

In assessing the current and projected uses of CAI in public schools, Chambers and Bork (1980) noted that the need for additional and improved CAI modules is a major impediment to usage. Among the major critical issues identified as confronting the school were the acquisition of quality CAI, and the lack of guidelines for integrating CAI into the curriculum.

Malouf, Morariu, Coulson, and Maiden (1989) noted that the successful use of microcomputers in special education depends on the selection and use of appropriate instructional software. The number of instructional software products is rapidly increasing, whereas the quality of this software and its appropriateness for special education continue to be in doubt. Also, Preece (1984) remarked that many educators decry the gap between the rapid increase in the amount of hardware in schools and the painfully slow increase in the amount of easily available, nontrivial,

educationally legitimate CAI material.

Blum (1982) and Malouf, Morariu, Coulson, and Maiden (1989) found that it was difficult to achieve acceptable levels of consistency and reliability, even when software evaluation procedures were controlled and the evaluators were trained. Further, Malouf et al. (1989) found that special education teachers preferred trying out or examining software and talking with other educators rather than looking at written evaluations of software.

Currently, guidelines and sources of knowledge about selecting quality software packages are limited. Thus, many educators experience frustration after purchasing poorly designed software packages that fail to help students achieve the desired learning outcomes.

Although educators have acknowledged the effectiveness of CAI software in an educational setting, they have criticized much of the software that exists. Careful development of software and thorough evaluation of its merits are, therefore, important. Also needed are improvements in teacher training in the use of this software as well as research that defines the choices which educators should consider in the course of planning CAI (Brinker, 1984).

In summary, the small amount of outcome-evaluation research that currently is available on educational

software is not plentiful enough. Educators need to interpret published recommendations with caution. Ratings from different sources may not agree with each other, and there is no evidence that subjective judgments of effectiveness are predictive of the actual effectiveness of programs. Therefore, identifying quality software and planning for the acquisition of enough copies of selected software and its integration into the curriculum must be completed before implementation.

Each school system should design its own method of evaluation, based on its specific needs assessment. Software evaluation is an ongoing process, whether it is carried out as part of the decision-making process in the initial purchase of the microcomputer or in the yearly purchase of software. Therefore, an organized method for cataloging information is necessary (Taber, 1984).

Teacher Training and Support

To make the technology work in schools, it is critical that staff members support the concept of instruction with computers and use them constructively with students. For this to happen, school districts must develop ways to help staff become familiar with how microcomputers work and how they can be used for instruction. (Budoff et al., 1984). A staff-

development program serves two basic purpose: (a) to allay staff members' fears and change their attitudes about computer technology and (b) to encourage and assist staff members in acquiring the necessary knowledge and skills for integrating computer technology effectively into the curriculum (Bakke, 1984).

According to Power On! New Tools for Teaching and Learning (U.S. Congress, 1988) despite the desire of most teachers to use computers and other interactive technologies in their teaching, most educators have not received sufficient or appropriate instruction and training to enable them to use technology effectively. Also, the authors of Power On! suggested that states, the federal government, schools of education, and the private sector all have roles to play in improving teachers' preparation in the use of technology. Especially crucial is state support; such support is a significant factor in both teacher training and school use of technology.

In addition, Time for Results: The Governors' 1991 Report on Education, the National Governors' Association task force recommends that at least 10-20 percent of State funds allocated for acquisition of various machines should be designated for training programs. The task force strongly believes that the State must make a greater commitment to support staff training programs.

Bork (1984) believed that, in general, "United States' teachers are poorly trained to use computers effectively" (p. 179). Teachers who are district-trained in computer uses through occasional inservice activities gain little lasting understanding of educational applications, he reported. Ragsdale (1982) suggested that inservice education is likely to become more important with time because of increased needs, more resources, added student demands, and different and greater pressures on teachers.

The promise of microcomputer technology is vast, but the need for administrative leadership and support cannot be emphasized enough. The special education administrator must lead the staff in the use of computer technology or encourage and support leadership by interested teachers (Budoff et al., 1984).

Moursund (1981) said that a major problem schools have in implementing computer technology is "training teachers so they have the knowledge, skills, and attitudes to effectively use computers with students" (p. 8). He suggested that principals might expedite staff development by (a) choosing an in-house expert who is enthusiastic about educational computing, (b) overseeing an individualized teacher-made plan for keeping up in the field and relating that to the teacher's instructional area, (c) encouraging and

implementing additional training opportunities, (d) creating an awareness of courseware evaluation and location sources to help teachers select proper courseware, and (e) making the most use of the equipment provided.

In summary, it was apparent throughout the literature that there is a concurrent need for staff support and development at any juncture where an innovation infiltrates a school or is formally adopted by a school system. Bell and Elmquist (1992) said that technology must now move to center stage in education and be used to replace, not just supplement, past practices. Unless teachers have full access to technological tools and learn to use them to teach effectively, these tools will remain only a powerful means of transforming the education process.

Effective staff training and support are essential to ensure successful implementation of the special education plan for using computers in instruction. Educators must be well versed in the specialized knowledge, skills, and processes relevant to using computers and adaptive devices to deliver, support, and manage instruction. Administrators must support teachers in this endeavor by making equipment, training, and time available. Finally, the need for inservice will continue because computer technology and the uses of that technology will continue to change. Inservice

training is critical. Without proper support and adequate funding, technology in education will be just another fad (Bailey, 1991a).

CHAPTER III

DESIGN OF THE STUDY

Introduction

The specific procedures and methods used in carrying out this descriptive study are presented in this chapter.

The study was designed to determine the status of the instructional use of microcomputers in special education programs in public schools throughout Michigan. The researcher also sought microcomputer information about school district policies and practices that have been developed which appear to promote the growth of an emerging microcomputer technology in special education in Michigan. The study was undertaken to provide information about the current direction and extent of policies and practices related to the instructional uses of microcomputers in special education programs in Michigan public schools.

The purpose of descriptive research is to portray current conditions accurately and objectively. Good and Skates (1957) described the nature and value of descriptive research in the following way:

> Much of the significance and importance of the descriptive study lies in the possibility of

> investigating the status of conditions at any given time and of repeating the survey at a later date, thus providing descriptions of cross-sections at different times, in order that comparisons may be made, the direction of change noted and evaluated and future growth or development predicted. Such guidance is of relatively great importance in our complex and rapidly changing modern society. (p. 550)

Sax (1979) also reported that descriptive research often is of greatest value at the beginning stages of an investigation. It can be surmised that the advent of instructional computing in special education presents such a beginning stage, and that the present researcher's attempt to describe the status of this development was appropriately served by using the descriptive research method.

The Study Population

The population for this study comprised all 59 intermediate school district (ISD) special education directors and all 177 local education agency (LEA) special education directors in Michigan. The ISD serves as a link between the local school districts and the state education authority. In many cases, ISDs may provide services to special needs students that LEAs cannot offer because they do not have adequate funds or enough students to implement such programs. The ISDs may also provide inservice training to staff members. ISD special education directors were included in this study as it was believed they would have broad

perspectives on how special education programs operate within their districts and how teachers are kept abreast of current trends in special education and computer technology.

The LEA operates independent education programs within its own boundaries. Mayer (1982) described the responsibilities of the LEA special education director as including curriculum supervision, placement of students, budget development and monitoring, working with parents, staff inservice education, program evaluation, and supervising educational programs and services located at schools in the community. The researcher believed that performance of these responsibilities would provide LEA directors with the knowledge of, or access to, the information called for in response to the survey questions.

This survey is considered to be cross-sectional in that standardized information was collected from a predetermined population (Borg & Gall, 1973). Guidance in selecting the study participants was provided by staff of the Michigan Department of Education, Special Education Services.

Instrumentation

Development of the Survey Instrument

A survey was designed to collect information pertinent to district-level special education program practices and polices with regard to microcomputers. Questions were structured to elicit the following information (a) the degree to which microcomputers are used for instructional purposes, (b) the existence of policies concerning the instructional use of microcomputers in terms of a technology plan and a microcomputer committee, (c) the nature of personnel involvement in decisions to acquire hardware and software, (d) guidelines for purchasing software, (e) inservice teacher training and support, (f) special education administrators' perceptions regarding the goals of instructional technology in special education classrooms, and (g) special education administrators' concerns regarding the inservice training needs of special education teachers.

The survey items were based on input from computer experts in the Special Education Services Division of the Michigan Department of Education, the ACCESS Project (a state-initiated project on microcomputers awarded by the Michigan Board of Education to Oakland Schools under Title VI-B), and a statistical advisor. In addition to summary articles on educational computing practices in

professional journals, a number of current research studies and recently developed educational computing assessment instruments influenced the content of survey questions in all categories of interest.

A preliminary version of the survey was field tested to estimate response time, to verify the completeness and content of the questions and the readability of the survey, and to seek comments on any deficiencies in the instrument and suggestions for its improvement. Seven respondents, special education coordinators and special education supervisors who had experience in the administration and supervision of special education, were selected for the field test. On the basis of responses to this field test, the survey instrument was revised and refined to incorporate appropriate recommendations.

Following these refinements, the survey was reviewed and approved by members of the researcher's doctoral committee. A version of the survey instrument was developed and submitted to the Michigan Department of Education to ensure the appropriateness of all items in the survey (see Appendix D). The final version of the survey contained 33 questions.

Relationship of Survey Items to the Research Questions

Seven research questions were posed in this study. The research questions and the survey items related to each question are listed below.

Research Question 1

> To what degree are microcomputers used for instructional purposes in special and general education programs in Michigan and do the two programs differ in their use of microcomputers?

Survey Items:

I-1. What percentage of your special education teachers use computers in their classroom?

I-2. What percentage of the general education classrooms in your school district use microcomputers?

Research Question 2

> What policy decisions have been made or are being developed to ensure the instructional use of microcomputer technology?

Survey Items:

I-3. Does your district have a full time technology coordinator?

I-4. Does anyone have this responsibility in your district?

I-5. What percentage of time is the above person assigned to this responsibility?

I-6. Does your district have a technology plan?

I-7. Does your district have a special education technology plan?

I-8. Do you use the special education technology plan when special education instructional staff make a request to purchase instructional software?

I-9. Do you use the special education technology plan when special education instructional staff make a request to purchase hardware?

I-10. Does your district have a committee for purchasing hardware?

I-11. Who is involved on your district's committee?

I-12. Who is involved in your district's decision to purchase hardware?

Research Question 3

Is there a difference in the instructional uses of microcomputers between school districts that have a technology plan and those that do not have such a plan?

Survey Items:

I-1. What percentage of your special education teachers use computers in their classroom?

I-2. Approximately what percentage of the general education classrooms in your school district use microcomputers?

I-6. Does your district have a technology plan?

I-7. Does your district have a special education technology plan?

Research Question 4

What considerations have school districts given to purchasing instructional software?

Survey Items:

II-1. Does special education software have to relate to the CORE curriculum used in the district?

II-2. Does special education software have to relate to an IEP (Individualized Education Plan) goal?

II-3. Does special education software have to be reviewed by the teacher prior to purchase?

II-4. What is the budget that you allow for each special education teacher to purchase instructional software over the school year?

Research Question 5

What are special education administrator's perceptions concerning microcomputer use in special education classrooms?

Survey Items:

Please indicate your level of agreement with the following comments concerning the use of instructional technology in special education classrooms (Strongly, Disagree, Disagree, Undecided, Agree, Strongly Agree)

II-5. Tutor student on specific skills
II-6. Implement the IEP
II-7. Supplement instruction
II-8. Reward students for good behavior

Research Question 6

To what extent is inservice training on microcomputers provided to special education teachers and how is it funded?

Survey Items:

III-1. Does your special education teacher(s) use any of the following electronic information services?

III-2. Indicate the percentage of your special education teacher(s) who have been trained to use microcomputers.

III-3. Indicate, by percentage, how your special education teachers have been trained to use microcomputers.

Inservice training within your district
Inservice training within your intermediate district
Inservice training at higher education institution
Outside private consultants
Special computer conferences

III-4. What percentage of the school's budget for staff training on microcomputers falls into the following categories?

General education budget
Special education budget

Research Question 7

What are administrators' concern with regard to inservice training in microcomputer technology for special education teachers?

Survey Items:

III-5. Introduction to computer application/computer literacy
III-6. Computer-assisted instruction
III-7. Computer-managed instruction
III-8. Selection and evaluation of software
III-9. Word processing
III-10. Graphics
III-11. Computer programming (e.g., BASIC, LOGO, etc.)
III-12. Adaptive devices
III-13. Electronic Information Services

Data Collection Procedures

The survey was mailed to 236 special education administrators in Michigan including all 59 ISD special education directors and 177 LEA special education directors. The Special Education Services Division of the Michigan Department of Education assisted by providing mailing labels.

A cover letter was included in the survey packet explaining the purpose of the survey, emphasizing its importance and significance, and stating how the resultant information would be used (see Appendix D). A

stamped envelope addressed to the researcher was enclosed to facilitate return of the surveys. In the cover letter, the researcher asked that the survey be returned by May 24, 1991. Respondents were assured of the confidentiality of their answers and they did not have to identify themselves or their school system on the survey. The surveys were stamped with an identification number to help in tracking nonrespondents. A letter of support signed by the chairperson of the researcher's doctoral committee was also included in the survey mailing (see Appendix C).

On May 21, 1991, a reminder letter was sent to nonrespondents (see Appendix E), asking them to return their completed surveys. They were asked to call the researcher if they had misplaced the survey or had not received one; in such case, a replacement survey would be mailed to them.

As surveys were received, the researcher checked them for completeness to determine whether they should be included in the study. Four of the 193 surveys that were returned were not used because they were incomplete. Hence, 189 surveys were judged to be usable, yielding a response rate of 80%. Although the survey was sent to 59 ISD special education directors and 177 LEA directors, not all of the surveys were completed by these individuals. Thirty-four surveys were filled out by other individuals who were

knowledgeable about and responsible for the computing programs in their district. The positions of the survey respondents are shown in Table 3.1. This breakdown of respondents by position provides a way to view the survey data in light of the respondents' access and participation.

Table 3.1 -- Distribution of Respondents' Positions

	N
ISD Directors	39
LEA Directors	116
Others	34
Total	189

Data Analysis Procedures

After the survey responses were compiled, the researcher screened the data to ensure that they were appropriate for use in the statistical analysis. The data were then coded and keyed for the computer analysis. A printout of the data file was retrieved and compared with the original raw data to check for accuracy. Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS). Because the researcher's purpose was to describe the use of computer technology in special education programs, the primary statistical procedures employed were frequency distributions, percentages, mean scores, standard deviations, t-tests, and summary forms of

descriptive statistics. The conventional .05 level was set as the criterion for significance for the t-test.

Summary

This chapter contained a description of the study population, the instrument used to collect data for the study, and the data-collection and data-analysis procedures used in carrying out the research. The results of the data analyses are presented in Chapter IV.

CHAPTER IV

RESULTS OF DATA ANALYSES

Introduction

The researcher's overall purpose in conducting this study was to determine the status of the instructional use of microcomputers in special education programs in public schools throughout Michigan. The researcher also sought to provide information about district policies and practices concerning the instructional use of microcomputer technology in special education programs in Michigan. Special education administrators' perceptions regarding the goals of instructional technology in special education classrooms also were investigated, as were these administrators' concerns regarding inservice training needs of special education teachers.

The survey instrument was mailed to 236 special education administrators in Michigan; of that number, 59 were ISD special education directors and 177 were LEA special education directors. One hundred eighty-nine usable surveys were returned, resulting in an 80% response rate.

Results of the Statistical Analyses

In this section, each research question is restated, followed by the results of the statistical analysis for that question. Although 189 surveys were returned, not every respondent answered every question. Therefore, figures shown in the tables might not always equal 189.

Research Question 1

> To what degree are microcomputers used for instructional purposes in special and general education programs in Michigan and do the two programs differ in their use of microcomputers?

Respondents were asked what percentage of their special education teachers used microcomputers in their classrooms. As shown in Table 4.1, about one-third (31.7%) of the respondents said that all special education classes in the school district used computers in their classrooms. Thirty-seven percent of the respondents said that 51% to 75% of their special education classes used microcomputers. Fifteen percent of the respondents reported that 26% to 50% of their special education classes used microcomputers, and another 15% said that 1% to 25% of their special education classes used microcomputers. Just one (0.5%) of the respondents said that none of the special education classes in the district used computers in their classrooms. These data indicate a high use of

microcomputers in special education programs throughout Michigan.

Table 4.1. -- Percentage of Special Education Teachers Using Microcomputers in their classrooms

Percentage of Classes Using Microcomputer	N	%
None	1	.5
1-25% of Classes	29	15.3
26-50% of Classes	29	15.3
51-75% of Classes	70	37.0
All Classes	60	31.7
Total	189	100.0

To determine the degree to which microcomputers are used for instructional purposes in general education classrooms, respondents were asked what percentage of the general education classrooms in their school districts used microcomputers. As shown in Table 4.2, 16.7% of the respondents said that all classes used microcomputers. Thirty percent of the respondents reported that 51% to 75% of classes used microcomputers, another 30% indicated that 26% to 50% of classes used microcomputers, and 20.4% stated that 1% to 25% of classes used microcomputers. Only 3% of the respondents said that no classes in their districts used microcomputers. However, 15% of the respondents did not answer the question, or said they were "not sure." ISD and LEA special education directors sometimes qualified their answers by writing in such comments as

"Kindergartners do not use computers, which reduces the ratio" or "I am not sure." In addition, it was not clear whether the reported use of microcomputers in the classroom included or excluded factors of use-time and access to microcomputers. However, the data in Table 4.2 indicate that, in general education, the instructional use of microcomputers is prevalent.

Table 4.2. -- Percentage of General Education Classes Using Microcomputers in their classrooms.

Percent of Class used	N	%
None	6	3.7
1-25% of Classes	33	20.4
26-50% of Classes	48	29.6
51-75% of Classes	48	29.6
All Classes	27	16.7
No responses	27	-
Total	189	100.0

Concerning the instructional use of microcomputers in general education and special education, it was assumed that microcomputers would be used less in special education programs than in general education programs. However, the respondents indicated that approximately equal proportions of general education and special education programs used computers for instruction. In summary, the findings suggest that most special and general education teachers in Michigan use microcomputers for instructional purposes in their classrooms.

Research Question 2

What policy decisions have been made or are being developed to ensure the instructional use of microcomputer technology?

The survey contained several items related to this research question. To find out about the technical or resource assistance available in the district, the respondents were asked: "Does your district have a full-time technology coordinator?" A technology coordinator would be responsible for the overall organization and direction of the school district's computers in the educational program. According to the survey responses, one-third (34.6%) of the school districts employed a full-time technology coordinator, whereas two thirds (65.4%) of the school districts did not (see Table 4.3).

Table 4.3. -- Number and Percentage of Districts that Employ Full-time Technology Coordinator

	N	%
No Full-time Technology Coordinator	123	65.4
Full-time Technology Coordinator	65	34.6
Total	188	100.0

Another question concerned the district's outreach to help and/or receive help with the instructional uses of microcomputers when a full-time technology coordinator was not employed. Thirty-eight percent of the respondents indicated that their

districts received assistance from a part-time technology coordinator, data center personnel, Regional Educational Media Center (REMC) staff, a media specialist, the coordinator of special education, or teachers. Twenty-seven percent of the respondents said that their districts did not have anyone who was responsible for coordinating technological aids.

Table 4.4. -- Number and Percentage of Districts Employing Anyone Who Shares the Responsibility as a Technology Coordinator

	N	%
No	51	27.0
Yes	72	38.1
No Response	66	34.9
Total	189	100.0

Bailey (1991) noted that "if administrators are to infuse technology into their school and district, long-range planning must become the highest priority (p. 12)." Also, Cory (1983) pointed out that if a district has made a commitment to the implementation of instructional computing, its policy decision will be evidenced in its long-range plans.

To ascertain whether a technology plan had been or was being developed in the respondents' districts, two questions were asked: "Does the district have a technology plan in general education?" and "Does the district have a special education technology plan in

special education?". As shown in Table 4.5, 58% of the respondents said that their school district had a technology plan. In addition, several respondents commented that "A technology plan is in development stage," or "The district has a technology plan; however, it is outdated and needs revision."

Table 4.5. -- Number and Percentage of Districts that have a Technology Plan

	N	%
Technology Plan	109	57.7
No Technology Plan	75	39.7
No response	5	2.6
Total	189	100.0

In terms of special education technology plans, about one-third (34.4%) of the respondents said that their district had such a plan, whereas two-thirds (64%) of respondents indicated their district did not have a special education technology plan (see Table 4.6). Several LEA special education directors reported that "The plan was included in part of ISD district master plan, and no need for separation," "In process," "Not specific to special education but will soon be included in district plan," "We did have a special education technology plan years ago," or "Because the school district is so small and communication is informal; but we will get our plan in writing."

In summary, the findings indicated that as technology is emerging, technology plans have evolved more in general education than in special education. Also, many special education technology plans have been included in the technology plans in general education.

Table 4.6 -- Number and Percentage of Districts that Have a Special Education Technology Plan

	N	%
Special Ed. Technology Plan	65	34.4
No Special Ed. Technology Plan	121	64.0
No Response	3	1.6
Total	189	100.0

When a school district commits to long-range planning for the instructional use of microcomputers, their policies would be directed toward the acquisition of hardware, maintenance of technological equipment, procurement of software, and formulation of ongoing plans for teacher training and technological updating (Cory, 1983). To determine whether the districts' special education technology plans were followed when purchasing instructional software and hardware, respondents were asked: "Do you use the special education technology plan when special education instructional staff make a request to purchase instructional software and hardware?" As shown in Table 4.7, a majority of respondents (89%) followed the special education technology plan when purchasing

instructional hardware. About 10% of the respondents did not follow that plan when purchasing instructional hardware. However, 72.3% of the respondents reported that the special education technology plan was followed when purchasing instructional software, and 27.7% of respondents reported that the plan was not followed. The data in Table 4.7 suggest that policy and practice were related.

Table 4.7. -- Number and Percentage of Districts that Follow the Special Education Plan When Purchasing Software/hardware

	Yes		No	
	N	%	N	%
Software	47	72.3	19	27.7
Hardware	58	89.2	7	10.8

To determine the nature of district personnel involvement in the acquisition of computer hardware, respondents were asked whether their district had a committee for purchasing hardware. White (1987) noted that determining who will make hardware decisions is critical. Teachers who have computer expertise and who use the microcomputer as an instructional tool should have an opportunity to review the hardware choices and provide input as to which keyboard, monitor, and other hardware components would be best for their students. In this study, better than half of the respondents (50.8%) said that their districts had a committee for

purchasing microcomputer hardware, whereas the other half (48.2%) reported that their districts did not have such a committee (see Table 4.8).

Table 4.8. -- Number and Percentage of Districts that have a Committee for Purchasing Hardware

Item Statement	N	%
Committee for Purchasing Hardware	92	48.2
Committee for Purchasing Hardware	95	50.8

In addition, respondents were asked to indicate who was involved in the district's decision to purchase hardware. They could cite more than one person. Responses to this item are shown in Table 4.9. Most frequently (46%), teachers were involved in decisions to purchase computer hardware. In addition, 38% of the respondents indicated principals were involved, 32% said a coordinator was involved, 30% mentioned a librarian or media specialist, 27% cited special education administrators, and 10% mentioned other personnel. These included media personnel, the superintendent, the curriculum director, and central office staff.

The push for microcomputer acquisition has moved away from the single-person, usually a teacher pattern, toward groups of teachers and/or school and district-level administrators. Becker (1985) indicated that this shift has been accompanied by increases in the range of

students who have access to and are using microcomputers and the instructional uses for which microcomputers are employed.

Table 4.9. -- Personnel Involved on School District's Microcomputer Committee (N=189)

Personnel	N	%
Teachers	88	46.0
Principal	73	38.6
Coordinator	62	32.8
Librarian or Media specialist	57	30.2
Special education administrators	51	27.0
Others (specify)	19	10.0

Note: Respondents could circle more than one answer.

In addition, participants were asked, "If the district does not have a microcomputer committee, who is involved in your district's decision to purchase hardware?" Respondents could circle more than one answer. They indicated that the decision to purchase microcomputer hardware tended to be made by more than one individual or a group (see Table 4.10). In most cases (73%), teachers were involved in this decision. About 71% of the respondents also indicated that special education administrators and/or principals were involved, about 47% mentioned a coordinator, and 41% a librarian or media specialist. Also, 34% of the respondents specified the involvement of a curriculum coordinator, superintendent, central office personnel, parents, director of special services, and secretary.

In general, the acquisition of hardware was characterized by collaboration across educational programs and across personnel categories in the district. That is, the acquisition of hardware was an interactive process, involving both central office administrators and site-level personnel.

Table 4.10. -- Personnel Involved in Decisions to Acquire Microcomputer Hardware (N=189)

Personnel	N	%
Teachers	138	73.0
Special Ed. Administrator	134	70.9
Principal	125	66.1
Coordinator	88	46.6
Librarian or Media Specialist	77	40.7
Others (specify)	64	33.9

Note: Respondents could circle more than one answer.

Research Question 3

> Is there a difference in the instructional uses of microcomputers between school districts that have a technology plan and those that do not have such a plan?

Planning for technology, within the context of school district strategic planning, is the key to a successful technology program. Researchers have indicated that the most successful districts have a comprehensive and long-range plan (Foster, 1988; Mageau, 1991; Witthuhn, 1985). Using a five-point scale, the respondents were asked to indicate the percentage of special education teachers using microcomputers in their

classrooms (1 = None, 2 = 1%-25% of classes use computers, 3 = 26%-50% of classes use computers, 4 = 51%-75% of classes use computers, 5 = all classes use computers). Based on the responses to this survey question, districts that had no special education technology plan had a mean score of 3.69, whereas districts with a special education technology plan had a mean of 4.10. A T-test was performed on these data and the difference in the means of districts with and without special education technology plans was found to be significant at the .05 level (see Table 4.11). That is, a higher percentage of teachers in districts with a special education technology plan were using microcomputers in their classrooms as compared to teachers in districts without such a plan.

Table 4.11 -- Results of T-test on the Use of Microcomputers in Special Education Classrooms

	(n)	Mean	SD	Standard Error	t-value	df	Prob.
No Sp. Ed. Tech. Plan	(121)	3.694	1.079	.098	2.58	184	.011*
Sp. Ed. Tech. Plan	(65)	4.107	.970	.120			

*Significant at the .05 level.

Using the same five-point scale described above, respondents were asked to indicate the percentage of general education classrooms that used microcomputers. Based on their responses to this item, districts with no

technology plan had a mean of 2.96, whereas those with a technology plan had a mean of 3.57. As shown Table 4.12, the difference between mean was statistically significant at the .05 level. In other words, more teachers were using microcomputers in their classrooms in school districts with a technology plan than districts without such a plan.

Table 4.12. -- Results of T-test on the Use of Microcomputers in General Education Classrooms

	(n)	Mean	SD	Standard Error	t-value	df	Prob.
No Technology Plan	(62)	2.967	1.008	.128	3.56	155	.00*
Technology Plan	(95)	3.528	1.078	.111			

*Significant at the .05 level.

Research Question 4

What considerations have school districts given to purchasing instructional software?

The successful use of microcomputers in special education depends on the selection and use of appropriate instructional software. The quantity of software products is rapidly increasing, whereas the quality and appropriateness of this software for special education may be questioned.

To ascertain the guidelines that were being used to purchase software for special education programs in Michigan, survey respondents were first asked whether special education software had to relate to the CORE

curriculum used in the district. Only about one-fifth of the respondents (19.6%) said that such software had to relate to the CORE curriculum. Conversely, almost 80% of the respondents said that special education software did not have be to related to the CORE curriculum. Several respondents indicated that software usually related to the CORE curriculum, although this was not necessary. The responses to this item are shown in Table 4.13.

Table 4.13. -- Relation of Special Education Software to the CORE Curriculum

	N	%
No relation to CORE Curriculum	148	78.8
Relation to CORE Curriculum	37	19.6
No response	4	1.6
Total	189	100.0

Next, respondents were asked whether the special education software had to relate to an Individualized Education Plan (IEP) goal. As shown in Table 4.14, two-thirds of the respondents (64.6%) said that special education software did not have to relate to an IEP goal. However, 34.9% of the respondents indicated that such software did have to relate to an IEP goal.

Table 4.14. -- Relation of Special Education Software to an IEP goal

	N	%
No Relation to IEP Goal	122	64.6
Relation to IEP Goal	66	34.9
No response	1	.5
Total	189	100.0

Respondents also were asked whether special education software had to be reviewed by the teacher placing the order before the purchase. About half of the respondents (53%) said that special education software did have to be reviewed by the teacher before the purchase, but about 47% of respondents indicated that the teacher did not have to review the software before the purchase (see Table 4.15).

Table 4.15. -- Special Education Software Review by the Teacher before the Purchase

	N	%
No	88	46.5
Yes	100	52.9
No response	1	.5
Total	189	100.0

Finally, respondents were asked to indicate the yearly budget allowed for each special education teacher to purchase instructional software. The majority of respondents reported that the special education teacher had a specific budget for purchasing software.

Interestingly enough, though, 22.8% of the respondents said there was no budget limit for purchasing instructional software. However, the respondents specified that, even without budgetary limitations, purchasing depended on need, funding resources, and past purchases. Nineteen respondents mentioned that they had a supply budget, based on per-pupil allocation, for purchasing what teachers thought was most needed for the classroom. The responses to this survey item are presented in Table 4.16.

Table 4.16.-- Special Education Teachers' Annual Budget for Instructional Software

Value	N	%
$ 1.00 - $ 49.99	21	11.1
$ 50.00 - $ 99.99	34	18.0
$100.00 - $199.99	30	15.9
$200.00 - $500.00	42	22.2
No limitation	43	22.8
Others (specify)	19	10.0
Total	189	100.0

Research Question 5

> What are special education administrators' perceptions concerning microcomputer use in special education classrooms?

The respondents were asked to indicate their level of agreement with four goals of instructional technology in the special education classroom. They responded to each item using a five point Likert-type scale on which 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided,

4 = Agree, and 5 = Strongly Agree. A mean and standard deviation were calculated for each item (see Table 4.17). The means ranged from 4.57 for item 3 (supplement instruction) to 3.76 for item 5 (reward students for good behavior).

Supplement to instruction received the highest agreement rating. Next was the use of microcomputers for tutoring students on specific skills. Implementation of the IEP had the next highest degree of agreement. Rewarding students for good behavior had only a moderate degree of agreement. In summary, the special education administrators who participated in this study were highly supportive of the instructional use of microcomputer technology in special education classrooms.

Table 4.17. -- Respondents' Agreement with Four Goals of Instructional Technology in Special Education Classrooms.

Item Statements	Mean	S.D.
Supplement Instruction	4.57	.51
Tutor student on specific skills	4.46	.62
Implement the IEP	4.03	.86
Reward students for good behavior	3.76	.97

1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

Research Question 6

To what extent is inservice training on microcomputers provided to special education teachers and how is it funded?

The respondents were asked whether special education teacher(s) in their districts used any of the following electronic information services: ACCESS, SpecialNet, Compuserve, DIALOG, Dialcom, BRS, PRODIGY or others. They were to check all that applied. The majority of the respondents indicated that their districts used ACCESS. SpecialNet was used second most frequently. However, several respondents said, "To my knowledge, any current accessing of electronic information services is done privately by individual staff initiative," or "Probably a few utilize this, but being done with private equipment and funds! The district is not currently providing access to these services". The responses are presented in Table 4.18.

Table 4.18. -- Electronic Information Services Used by Special Education Teachers.

	Number of responses
ACCESS	104
SpecialNet	39
PRODIGY	13
Compuserve	5
DIALOG	1
Dialcom	1
BRS	1
Other	14

With the advent of microcomputers in the classroom, the training needs of educators have become a central issue of many school systems across the country. Authors of Power On! New Tools for Teaching and Learning (U.S Congress, 1988) found that "the vast majority of those now teaching or planning to teach have had little or no computer education or training" (p. 19). Training gives teachers the necessary skills to work the technology, and education provides a vision of how to work with it (Fulton, 1989). Glenn and Carrier (1988) also emphasized that technology education, and the training that teachers need are not static but continue as technology evolves.

District involvement in the support of inservice training is an important indicator because it places the emphasis on student learning through teacher preparation. Stasz and Winkler (1985) claimed that teachers need incentives to stimulate and sustain their motivation and interest in staff development. Bailey (1991a) also noted that effective training programs must be planned by the staff, focused on actual classroom or administrative uses of technology, sensitive to staff members' personal needs and motivation, supported with tangible incentives for teachers, and offered as an ongoing process rather than a single event.

To determine the degree of teacher inservice training on the use of microcomputers provided by school

districts in Michigan, respondents were asked to indicate the percentage of special education teacher(s) who had been trained to use microcomputers. The percentage of special education teachers who had been given such training ranged from 0% to 100%, with a mean of 69.05%. Thus, a majority of districts had made a commitment to training special education teachers to implement microcomputer instruction. In fact, one respondent indicated, "In my district, professional staff who spend their own time taking 50 hours of computer instruction, provided by the district, earn an IBM computer with a printer. Ninety-five percent of the staff have responded favorably." Hence, it appears that incentive programs are effective in encouraging teachers to attend inservice programs on the use of microcomputers for instructional purposes.

In a third question concerning staff development, respondents were asked to indicate, by percentage, how special education teachers had been trained in the use of microcomputers. Various types of training sources were listed. The mean percentage for each training source is shown in Table 4.19. Each of the five training sources was used to some extent, but the most frequently used (60.6%) was inservice training within the school district. Next was inservice training within the ISD (46%), followed by inservice training at higher

education institutions (21%), training through private consultants (18%), and training at special computer conferences (16%). The majority of respondents reported that teachers had received training through multiple activities. For example, a respondent might have responded by indicating that 30% of inservice training was through the district, 15% of training was through computer conferences, higher education institutions, and private companies involved in technology training.

Table 4.19. -- Special Education Teachers Training in the Use of Microcomputers

Training Sources	Mean Percentage
Inservice training with your district	60.60
Inservice training within your ISD district	45.99
Inservice training at higher ed. inst.	20.50
Outside private consultants	17.97
Special computer conferences	16.34

A single survey item dealt with funding for staff training on microcomputers. According to Toong and Gupta (1982), the future of microcomputers in schools may "critically depend" on the availability of funds, but the current major constraints on public school budgets are well known. These constraints may be a function of insufficient funding for most school activities or a priority system for special education that is not favorable to inservice training. In this study, respondents indicated that general education budget allocations were the most important source of

funding for staff inservice training on microcomputers. Training activities for special education teachers also were funded in part by the special education budget. Thus, there appears to be a high degree of collaboration between the two educational programs. This finding is consistent with data reported by Hanley (1983), Cosden, Gerber, Goldman, Semmel, & Semmel (1984), and Goldman et al. (1987).

Table 4.20 -- Percentage of School's Budget for Staff from Two Sources

	Mean Percentage
General education budget	51.22
Special education budget	35.03

Research Question 7

What are administrators' concerns with regard to inservice training in microcomputer technology for special education teachers?

Policy considerations also include administrative decisions to update teacher inservice training in microcomputer applications. The actual staff-development activities are critical. Effective training programs must be planned by the staff and focused on actual classroom applications. To provide useful information regarding staff-development activities, respondents were asked what topics they thought should be considered in providing inservice training for

special education teachers. Nine applications were listed, and respondents were asked to rate the usefulness of each one, using a Likert-type scale ranging from 1 = minimally useful to 4 = essential. The mean rating for each item represented respondents' concerns for inservice training on that application. The mean and standard deviation for each application are shown in Table 4.21.

Table 4.21 -- Special Education Administrator Concerns for Inservice Training on Microcomputer Applications

Training Activities	Mean	SD
Computer Assisted Instruction (CAI)	3.35	.64
Selection and evaluation of software	3.17	.79
Introduction to computer application/ computer literacy	3.00	1.04
Computer Managed Instruction (CMI)	2.96	.78
Word processing	2.89	.89
Adaptive devices	2.81	.93
Graphics	2.37	.84
Electronic Information Services	2.12	.89
Computer Programming (e.g. Basic, LOGO)	1.79	.91

Using the mean ratings shown in Table 4.21, it was possible to group the applications into high-range concerns, moderate-range concerns, and low-range concerns. High-range concerns included computer assisted instruction (CAI), selection and evaluation of software, and introduction to computer application/computer literacy. Moderate-range concerns included computer managed instruction (CMI), word processing, and adaptive devices for teacher training.

Low-range concerns included microcomputer uses related to graphics, electronic information services, and computer programming.

Summary

This chapter contained the results of the data analyses. The source of data was survey questionnaires completed by 189 special education administrators in Michigan. In the preceding pages, each research question was restated, followed by a presentation of the data related to that question. A summary of the study, including the major findings, is presented in Chapter V, along with a discussion, and recommendations for practice and for further study.

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Chapter V is contains a summary of the study, a discussion based on the study findings, and recommendations for practice and future research.

Summary

Despite the continued rapid increase in the instructional use of microcomputers in special education, at present, there is relatively little information to guide planning efforts related to the educational computing needs of special education students in Michigan. To accelerate the realization of the promise of technology, a much greater investment in determining such needs is required.

The researcher's purpose in conducting this study was to determine the status of the instructional uses of microcomputers in special education programs in public schools throughout Michigan. Areas of interest were (a) the degree to which microcomputers are used for instructional purposes in public schools, (b) the existence of policies concerning the instructional use of microcomputers in terms of a technology plan and a microcomputer committee, (c) the nature of personnel

involvement in decisions to acquire hardware and software, (d) guidelines for purchasing software, (e) inservice teacher training and support, (f) special education administrators' perceptions regarding the goals of instructional technology in special education classrooms, and (g) special education administrators' concerns regarding the inservice training needs of special education teachers.

Seven research questions were posed in the study, and the researcher designed a survey to gather the necessary data to answer these questions. The survey consisted of 33 items related to various aspects of microcomputer use in special education programs in Michigan.

The population for this study included the 59 ISD special education directors and 177 LEA special education directors in Michigan during school year 1990-91. The survey was distributed to all 236 of these special education directors. One hundred eighty-nine usable survey were returned for an 80% response rate.

Because the researcher's overall purpose was to describe the use of microcomputers in special education programs, the primary statistical procedures employed were frequency distributions, percentages, mean scores, standard deviations, t-tests and summary forms of descriptive statistics. The conventional .05 level of

significance was set for the t-test.

The major findings from this study were as follows:

A majority of respondents reported that both special and general education teachers used microcomputers in their classrooms.

About one-third of the respondents reported that their school districts had a full-time microcomputer coordinator. However, the districts with no technology coordinator received assistance from a part-time technology coordinator, data center personnel, REMC staff, or a media specialist.

With regard to a technology plan, about 58% of the respondents indicated that their districts had already developed long-range technology plans for general education programs. Also, 34% of the respondents indicated that their districts had special education technology plans for special education programs.

A majority (89%) of the respondents reported that a special education technology plan was followed when purchasing hardware. However, 72% of the respondents reported that the special education technology plan was followed when purchasing instructional software.

Half of the respondents indicated that their districts had a microcomputer committee to assist in making decisions about purchasing hardware. Various categories of personnel were reported to be involved on these microcomputer committees; teachers were most

frequently involved. However, the respondents also reported that principals, coordinators, librarians, media specialists, special education administrators, central office staff, and superintendents were involved on the microcomputer committee.

School districts with a special education technology plan had a higher percentage of teachers using microcomputers in special education classrooms than did districts without such a plan. Also, school districts with a technology plan had a higher percentage of teachers using microcomputers in general education classrooms.

About one-fifth of the respondents reported that software purchases had to relate to the CORE curriculum used in the district. About one-third of the respondents said that special education software purchases had to relate to an IEP goal. About one-half of the respondents said that special education software had to be reviewed by the teacher before it was purchased. Finally, the majority of respondents reported that special education teachers had a specific budget for purchasing software.

Special education administrators perceived that microcomputers were used primarily to support instruction. Other uses, in descending order of agreement, included tutoring students on specific

skills, implementation of IEP goals, and rewarding students for good behavior.

The percentage of special education teachers who had been trained to use microcomputers ranged from 0% to 100% with a mean of 69.05%.

With regard to teacher training sources, the findings indicated that inservice training within the school district was the most common source employed. ISDs, higher education institutions, and private consultants also were involved in providing technology training.

General education budget allocations were the most important funding sources for inservice training. Training activities for special education teachers also were funded in part through the special education budget.

The administrators' highest concern with regard to inservice training was computer-assisted instruction. The next highest concern was with selection and evaluation of software and introduction to computer application/computer literacy.

Discussion

This study focused on reported instructional uses of microcomputers in special education programs. The major findings provide important information for policy makers and practitioners in special education.

An analysis of the findings indicates that the instructional use of microcomputers is perceived to be prevalent in special and general education programs in Michigan. That is, the instructional use of microcomputers in special and general education programs is reported to be as widespread as anticipated by the authors of Power On! New Tools for Teaching and Learning (U.S. Congress, 1988).

Although this study is limited to self-reporting survey questionnaire when compared with other research designs, such as, experimental or survey that use observation and/or interview, it is believed that the availability and sophistication of computer technology in society in general is impacting education and will continue to do so.

With regard to technology plans, about 58% districts had already developed long-range technology plans for general education programs, Whereas 34% had technology plans specific to special education. Also, the special education technology plans were generally included as part of a technology plan in general education.

In school districts with a technology plan, a higher percentage of teachers in special education and general education classrooms were using microcomputers than in districts without such a plan. Although no attempt was made to determine the actual use of

computers by students, or subject areas in which they are used, or the amount of time students had access to microcomputers, this finding corroborates the work of Witthuhn (1985), Foster (1988), and Megeau (1991) that the most successful districts have a comprehensive and formal technology plan. It is apparent that the most important decision a school district can make with regard to the instructional use of microcomputers is to develop a district technology plan.

Both special and general education personnel were involved in decision making with regard to the purchase of hardware. In general, the acquisition of hardware was characterized by collaboration across educational programs and across personnel categories in the district. Further, training activities for special education teachers were partially funded through special education budgets but were also being conducted as part of general district inservice programs. Thus, there appeared to be a high degree of collaboration between the two educational programs, consistent with the data reported by Hanley (1983), Cosden, Gerber, Goldman, Semmel, & Semmel (1984), and Glodman et al. (1987).

It is apparent that general and special education professionals can establish useful collaborations on important educational matters.

Power On! New Tools for Teaching and Learning (U.S. Congress, 1988), a U.S. government document, indicated that, despite the desire of many teachers to use computers and other interactive technologies in their teaching, most educators have not received sufficient or appropriate training to enable them to use technology effectively. Training gives teachers the necessary skills to work the technology, and education provides a vision of how to work with it (Fulton, 1989). Also, Glenn and Carrier (1987) emphasized that technology education and the training of teachers are not static but should continue as technology evolves. Thus, training for teachers should be seen as an ongoing requirement for professional growth.

Policy related considerations include administrative decisions implemented to update the teacher inservice training in microcomputer application. Effective training programs should include input by the staff and should be focused on actual classroom applications (Church & Bender, 1989). There is little agreement among proponents of teacher inservice training as to what computer applications should be addressed in inservice training programs (Fellmy & Nicholson, 1985; Hoth, 1985). For many years, computer-literacy programs have focused on teaching technical computer programming. Many questions have been raised regarding this emphasis on computer programming rather than on instructional

applications of computers (Diem, 1984). Researchers have indicated a need for inservice instruction that supports teachers who want to teach about computers (Moore, 1984) and those who want to use the technology for instructional purposes (Rogers, Moursand, & Ence, 1984).

Few surveys of special education administrators have been conducted to determine in what types of applications teacher inservice training is needed within the special education context. The findings from such research would provide important insights regarding teacher inservice needs in special education. Data from this survey indicated that the administrators' concerns for inservice training needs included computer-assisted instruction, selection and evaluation of software, introduction to computer application/computer literacy, computer managed Instruction, word processing and adaptive devices. It is apparent from the findings of this study that the special education administrators are aware of the potential of CAI. Also, regardless of the type of program, much research remains to be done to determine the most effective ways to promote teachers' skill and interest in using computers. More intensive and specific types of training would appear to be necessary to provide teachers with the basic skills required for using of microcomputers in instruction, as

well as the confidence derived from hands-on experience (Church et al. 1989). It is apparent from the findings of this study that the inservice of teachers on uses of microcomputers must be on-going, fully supported by local and intermediate school districts, and focused on practical applications for teachers.

Recommendations

The researchers's overall purpose in conducting this study was to determine the status of the instructional use of microcomputers in special education programs in public schools throughout Michigan. With the previously stated findings and discussion in mind, the researcher makes the following recommendations for practice and further research.

Recommendations for Practice

1. The Michigan State Board of Education needs to evaluate the present policies and practices of ISDs and LEAs, especially in relation to the delivery of educational computing.

2. ISDs and LEAs need to develop plans for implementing microcomputer technology so that microcomputers can be used most efficiently in education.

3. ISD and LEA central administrators should appoint a computer resource person whose responsibility would be to coordinate the implementation of computer programs throughout the district. The computer resource person would provide or organize microcomputer training for the school district staff and provide the staff with suggestions regarding hardware and software. This would be the liaison among central administrators, principals, teachers, and outside computing resources. He or she also would keep these educational personnel informed of the status of microcomputer education in the school district.

4. Central administrators can best encourage microcomputer education by providing an adequate budget for microcomputer technology and professional computer support staff.

5. ISDs and LEAs need to offer teachers a variety of inservice classes in various applications and at all levels of computing expertise. Also, the ISD should provide microcomputing consulting services to its local school districts.

In their capacity, ISDs would be able to advise school districts of successful microcomputer programs. They should coordinate the microcomputer efforts of local school districts and with other ISDs, establish a centralized microcomputer courseware review system, develop a software library, offer microcomputer and

software laboratory services to school districts, and give schools an opportunity to purchase microcomputers at a low cost through a bid process.

LEAs also need to offer inservice teacher training on microcomputers. They should seek creative approaches to such training, along with practical applications of microcomputers in both general and special education classrooms. The need for such inservice activities is great and will remain so in the future.

6. A staff-development training committee should gather information about microcomputer technology and its effect on student achievement and attitudes, teacher performance, and long term student performance.

Recommendation for Further Study

The recommendations in this section focus on some of the current needs for better use of existing research and for the initiation of collaborative efforts to extend research into needed areas.

1. A study should be conducted to determine what is the actual practice in the schools concerning instructional use of microcomputers changes that have occurred in microcomputer use since the present study was completed. Future investigations should focus on the actual use of computers by students, including the frequency of time microcomputers are used by individual students, the subject areas in which they are used, and

the availability of microcomputers to individual students.

2. A statewide research network should be established to document and disseminate information on current effective practices being used by school districts in implementing microcomputers into the classroom. Schools need to be informed and updated about effective instructional uses of microcomputers.

3. Research is needed to determine the kind of microcomputer training necessary to help teachers become effective users of instructional computing.

4. ISDs, colleges, and universities should investigate additional methods of providing inservice training in instructional microcomputing to meet the increasing demand for such training; they should also cooperate in developing in services activities. Consideration should be given to inservice activities involving a variety of microcomputers and topics of varying complexities.

5. Research should be conducted to develop a microcomputer software evaluation system.

6. Research is needed on the roles of various school professionals related to computer technology. For example, school leaders, as well as teachers, computing consultants, school boards, and governmental agency computing personnel need to know their role and

responsibilities with regard to computer technology.

7. A computer research center needs to be established, perhaps at the higher education institution level, that will coordinate and disseminate microcomputer research, software, and information about successful microcomputer programs that will work in specific educational situations.

8. The special education administrators in this study rated inservice training in CAI as very useful. Thus, in future research, it would be desirable to explore the attitudes of special education administrator toward the use of CAI in special education classrooms.

9. Further research should be conducted to determine the actual amount of time microcomputers are used in general and special education classrooms, students' access to microcomputers, the content areas in which microcomputers are used, and other related topics.

APPENDICES

APPENDIX A

LETTER OF HUMAN SUBJECT APPROVAL

MICHIGAN STATE UNIVERSITY

OFFICE OF VICE PRESIDENT FOR RESEARCH
AND DEAN OF THE GRADUATE SCHOOL

EAST LANSING • MICHIGAN • 48824-1046

May 20, 1991

Yeon Hong Min
674 Wayland
East Lansing, MI 48823

RE: A SURVEY OF THE INSTRUCTIONAL USE OF MICROCOMPUTER TECHNOLOGY IN SPECIAL EDUCATION CLASSROOMS IN MICHIGAN, IRB#91-237

Dear Ms. Min:

The above project is exempt from full UCRIHS review. The proposed research protocol has been reviewed by another committee member. The rights and welfare of human subjects appear to be protected and you have approval to conduct the research.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval one month prior to May 15, 1992.

Any changes in procedures involving human subjects must be reviewed by UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to my attention. If I can be of any future help, please do not hesitate to let me know.

Sincerely,

David E. Wright

David E. Wright, Ph.D., Chair
University Committee on Research Involving
Human Subjects (UCRIHS)

DEW/deo

cc: Dr. Donald Burke

APPENDIX B

FIELD-TEST LETTER

MICHIGAN STATE UNIVERSITY

COLLEGE OF EDUCATION · DEPARTMENT OF COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION

EAST LANSING · MICHIGAN · 48824-1034

(Date)

(Name and Title)
(Address)

Dear _____:

I am in the process of constructing a survey instrument for my dissertation. The topic I have chosen is "A Study of the Instructional Use of Microcomputer Technology in Special Education Classrooms." This study is supported and conducted with the cooperation of the Michigan Department of Education, Special Education Service.

As part of this study, you have been selected as one potential candidate to judge my instrument. I am confident that your input will be crucial in shaping the final instrument.

I sincerely need your help in completing this stage of my doctoral program at Michigan State University. Would you please take a few minutes to fill out this draft copy? Please note on the survey any comments that you have. At the end of the survey note how long it took you to complete the instrument.

_____, your assistance in this important inquiry will be most valuable and greatly appreciated. Please use the enclosed self-addressed stamped envelope to return the draft survey and your comments by April 26. If you need to reach me, you may call me Collect at (517) 337-3889.

Thanks again for your assistance!

Sincerely yours,

Yeon Min

Yeon Hong Min

APPENDIX C

SUPPORT LETTER

DISABILITY RESEARCH SYSTEMS, INC.

evaluation, research and training services

Dear Colleague:

The purpose of this letter is to indicate my support of the research conducted by my advisee, Yeon Hong Min. Her research proposal is entitled " A Survey of The Instructional Use of Microcomputer Technology in Special Education Classrooms in Michigan".

This study is supported and conducted with the cooperation of the Michigan Department of Education, Special Education Service. The purpose of this study is to gather research-based data that might provide guidance to decision makers in the field of special education in Michigan. Thus, the enclosed study can make an important contribution to this fields.

As chair of Ms. Min's doctoral advisory committee, I seek your cooperation in her research efforts. The few minutes necessary for your participation will be most helpful, appreciated and essential for completion of Ms. Min's research.

If you have any questions concerning this research project, please contact me at 517-351-3484.

Thank you in advance for your cooperation.

Sincerely yours,

Donald Burke, Professor

APPENDIX D

THE SURVEY INSTRUMENT AND COVER LETTER

MICHIGAN STATE UNIVERSITY

COLLEGE OF EDUCATION · DEPARTMENT OF COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION

EAST LANSING · MICHIGAN · 48824-1034

Date

Name and Title
Address

Dear _____:

I would appreciate your participation in a study entitled, "A Survey of The Instructional Use of Microcomputer Technology in Special Education Classrooms in Michigan." This study is supported and conducted with the cooperation of the Michigan Department of Education, Special Education Service. The attached questionnaire was developed to study the instructional use of microcomputer technology in special education classrooms.

Would you please assist me by taking approximately five minutes to complete the attached questionnaire and return it in the self-addressed, stamped envelope by May 24, 1991. The information you provide will be held in strict confidence. Your responses will not be seen by anyone except the researcher. The identification number on the survey is to identify whether the survey was returned, therefore eliminating the need for a follow-up letter.

A summary of the results of this study will be available upon completion. If you would like a copy of the results, please indicate this by checking "Yes" on last page of the survey. If you have any questions, you may reach me at 800-292-1606.

Your prompt response will be greatly appreciated.

Sincerely,

Yeon Min

Yeon Hong Min
Doctoral Candidate Michigan State University

Survey Instrument

PART I: INSTRUCTIONAL USE OF MICROCOMPUTERS

1. What percentage of your special education teachers use microcomputers in their classroom? (Circle number)

   1 NONE
   2 1 - 25% OF CLASSES USE COMPUTER
   3 26 - 50% OF CLASSES USE COMPUTER
   4 51 - 75% OF CLASSES USE COMPUTER
   5 ALL CLASSES USE COMPUTERS

2. What percentage of the general education classrooms in your school district use microcomputers? (Circle number)

   1 NONE
   2 1 - 25% OF CLASSES USE COMPUTERS
   3 26 - 50% OF CLASSES USE COMPUTERS
   4 51 - 75% OF CLASSES USE COMPUTERS
   5 ALL CLASSES USE COMPUTERS

3. Does your district have a full time technology coordinator? (Circle number)

   1 No-----PROCEED TO #4 2 YES-----PROCEED TO #6

4. Does anyone have this responsibility in your district? (Circle number)

   1 NO 2 YES (SPECIFY): _____

5. What percentage of time is the above person assigned to this responsibility? _____%

6. Does your district have a technology plan? (Circle number)

   1 NO 2 YES

7. Does your district have a special education technology plan? (Circle number)

   1 NO ----- PROCEED TO #10 2 YES ------ PROCEED TO #8

8. Do you use the special education technology plan when special education instructional staff make a request to purchase instructional software? (Circle number)

   1 NO 2 YES

9. Do you use the special education technology plan when special education instructional staff make a request to purchase hardware? (Circle number)

   1 NO 2 YES

10. Does your district have a committee for purchasing hardware? (Circle number)

    1 NO -------PROCEED TO #12 2 YES ------PROCEED TO #11

11. Who is involved on your district's committee? (Circle all that apply)

    1 PRINCIPAL
    2 TEACHERS
    3 COORDINATOR
    4 LIBRARIAN OR MEDIA SPECIALIST
    5 SPECIAL EDUCATION ADMINISTRATOR
    6 OTHERS (SPECIFY): _____

12. Who is involved in your district's decision to purchase hardware? (Circle all that apply)

    1 PRINCIPAL
    2 TEACHERS
    3 COORDINATOR
    4 LIBRARIAN OR MEDIA SPECIALIST
    5 SPECIAL EDUCATION ADMINISTRATOR
    6 OTHERS (SPECIFY): _____

PART II: PURCHASING INSTRUCTIONAL SOFTWARE

1. Does special education software have to relate to the CORE curriculum used in the district? (Circle number)

    1 NO 2 YES

2. Does special education software have to relate to an IEP (Individualized Education Plan) goal? (Circle number)

    1 NO 2 YES

3. Does special education software have to be reviewed by the teacher prior to purchase? (Circle number)

    1 NO 2 YES

4. What is the budget that you allow for each special education teacher to purchase instructional software over the school year? (Circle number)

    1 $ 0.00 - $49.99
    2 $ 50.00 - $99.99
    3 $100.00 - $199.99
    4 $200.00 - $500.00
    5 NO LIMITATION

Please indicate your level of agreement with the following comments concerning the use of instructional technology in special education classroom.

In your view, what should be the goals of instructional technology in your special education classroom: (Circle you response)

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5.	Tutor students on specific skills	SD	D	?	A	SA
6.	Implement the IEP	SD	D	?	A	SA
7.	Supplement instruction	SD	D	?	A	SA
8.	Reward students for good behavior	SD	D	?	A	SA

PART III: TEACHER SUPPORT AND INSERVICE TEACHER TRAINING

1. Does your special education teacher(s) use any of the following electronic information services? (Circle all that apply)

   1 ACCESS
   2 SpecialNet
   3 Compuserve
   4 DIALOG
   5 Dialcom
   6 BRS
   7 PRODIGY
   8 Other electronic bulletin board/Mail system:(Specify) _____

2. Indicate the percentage of your special education teacher(s) that have been trained to use microcomputers. _____%

3. Indicate, by percentage, how your special education teachers have been trained to use microcomputers.

   _____% Inservice training within your district
   _____% Inservice training within your intermediate district
   _____% Inservice training at higher education institution
   _____% Outside private consultants
   _____% Special computer conferences

4. What percentage of the school's budget for staff training on microcomputers falls into the following categories?

   _____% general education budget
   _____% special education budget

Using the categories below, what should be considered when inservice training is provided for your special education teachers? (Circle your response)

		Minimally useful	Moderately useful	Very useful	Essential
5.	Introduction to computer application/ Computer literacy	1	2	3	4
6.	Computer Assisted Instruction	1	2	3	4
7.	Computer Managed Instruction	1	2	3	4
8.	Selection and evaluation of software	1	2	3	4
9.	Word processing	1	2	3	4
10.	Graphics	1	2	3	4
11.	Computer Programming (e.g., Basic, LOGO, etc.)	1	2	3	4
12.	Adaptive devices	1	2	3	4
13.	Electronic Information Services	1	2	3	4

PART IV: GENERAL INFORMATION

1. Title of your current position: (Circle number)

   1 ISD DIRECTOR 2 LEA DIRECTOR 3 OTHER_____

2. What is your gender? (Circle number)

   1 FEMALE 2 MALE

3. How many total years of experience do you have as a special education administrator? (Circle number)

   1 0 - 5 YEARS
   2 6 - 10 YEARS
   3 11 - 15 YEARS
   4 16 - 20 YEARS
   5 OVER 20 YEARS

4. How many special education students are enrolled in your school district? _____

5. How many full time special education teachers are in your district? _____

6. What is your school district classification? (i.e. Class A, Class B, etc.) _____

If you would like a summary of this study results please indicate below:

____ *Yes, I want the results of this study sent back to me*
____ *No, I do not want the results sent back to me.*

Thank you for completing the survey

APPENDIX E

FOLLOW-UP LETTER

MICHIGAN STATE UNIVERSITY

COLLEGE OF EDUCATION · DEPARTMENT OF COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION

EAST LANSING · MICHIGAN · 48824-1034

(Date)

(Name and Title)
(Address)

Dear _____:

Last week a survey questionnaire was mailed to you concerning the Instructional Use of Microcomputers in Special Education Classrooms. If you have already completed and returned the survey, please accept my sincere thanks. If not, and you still have the questionnaire, may I ask for your kind cooperation by taking a few minutes from your valuable time to complete and return it to me in the envelope provided by May 28, 1991.

If by some chance you did not receive the questionnaire, or it has become misplaced, please call me at 800-292-1606 and I will put another one in the mail to you immediately.

Thank you!

Sincerely yours,

Yeon Min

Yeon Hong Min

BIBLIOGRAPHY

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Bailey, G. D. (1991). Making staff development work. Electronic Learning, 11(2), 12. (a)

Bailey, G. D. (1991). Districtwide technology integration. Electronic Learning, 10(8), 16-24. (b)

Bakke, T. W. (1984). Optimal approaches to microcomputer implementation in the schools. American Institutes for Research in the Behavioral sciences, Palo Alto, California, 37

Bancroft, B. (1985). A child's present in a futures-oriented society: how selected Michigan public elementary schools provide instructional computing opportunities for their pupils. (Doctoral Dissertation).

Bass, G., & Perkins, H. W. (1984). Teaching critical thinking skills with CAI. Electronic Learning. 4(2), 32-34, 96.

Becker, H. J. (1982). Microcomputers in the Classroom: Dreams and Realities. Baltimore, MD: Center for Social Organization of Schools, Johns Hopkins University.

Becker, H. J. (1985, July). The Second National Survey of Instructional Use of School Computers: A Preliminary Report. Paper presented at the World Conference on Computers in Education, Norfolk VA.

Becker, H., & Schur, S. (1986). The advantages of using microcomputer-based assessment with moderately and severely handicapped individuals. Journal of Special Education Technology, 8(2), 53-57.

Bell, T. H.; & Elmquist, D. (1992). Technology: A catalyst for restructuring schools. Electronic Learning, 11(5), February, 10-11.

Bennett, R. (1982). Applications of microcomputer technology to Special Education. Exceptional Children, 49(2), 106-113.

Bennett, R. (1986). A framework for studying the use of computers in special education. Journal of Special Education Technology, 8(2), 44-52.

Bennett, R. (In press). Planning and Evaluating Computer Education Programs. Columbus, OH: Charles E. Merrill.

Blackhurst, A. & MacArthur (1986). Microcomputer use in special education personnel preparation programs. Teacher Education and Special Education, 9(1), 27-36.

Blaschke, C. (1986). Technology for special education: A national strategy. T.H.E. Journal, 77-82.

Blum, V. (1982). Evaluation of Educational Software for Microcomputers: An Analytical Approach. Paper presented at the annual meeting of the American Educational Research Association, New York.

Bjoum, W. (1982). A plan for introducing microcomputers into instruction. The Computing Teacher, 9(7), 52-53.

Borg, W., & Gall, M. D. (1973). Educational Research. New York: David McKay Company.

Bork, A. (1984). "Computer futures for education." Creative Computing, November, 178-180.

Brinker, P. (1984). The microcomputer as perceptual tool: search for systematic learning strategies with handicapped infants. Special Services in the School. 1, 21-26.

Bruder, I. (1989, October). Ninth annual survey of the States. Electronic Learning, 9(2), 22-28.

Budoff, M., & Hutten, L. R. (1982). Microcomputers in special education: promises and pitfalls. Exceptional Children, 49(2), 123-128.

Budoff, M., Thormann, J., & Gras, A. (1984). Microcomputers in Special Education. Cambridge, MA: Brookline Books.

Burke, R. L. (1982). CAI sourcebook. Englewood Cliffs, NJ: Prentice-Hall.

Burmbaugh, K. E. (1983). MECC: A statewide model for educational computing. In M. Grady, & M. Grady & J. Gawronski (Eds.), Computers in Curriculum and Instruction (pp. 64-73). Alexandria, VA: Association for Supervision of Curriculum Development.

Burnette, J. (1990). Assistive Technology Design in Special Education. Issue Brief 2. The ERIC/OSEP Special Projection on Interagency Information Dissemination. Published by The Council of Exceptional Children.

Campbell, D., Peck D., Horn, C., & Leigh, R. (1987). Comparison of computer-assisted instruction and print drill performance: A research note, ECTJ, 95-103

Chambers, J, & Bork, A. (1980). Computer Assisted Learning in U.S. Secondary/Elementary Schools. New York, NY: Association for Computing machinery. (ERIC Document Reproduction Service No. ED202461)

Chang, L. & Osguthorpe, R. (1987). An evaluation system for educational software: a self-instructional approach. Educational Technology, June 15-19.

Church, G., & Bender, M. (1989). Teaching with Computers: A Curriculum for Special Educators. College-Hill Press, A Division of Little, Brown and Company Inc.

Computer literacy: A survey of initiatives for teachers and students across the States. (1984). Education Week. October 24 p. 11

Connors, F., Caruso, D., & Detterman, D. (1986). Computer-assisted instruction for the mentally retarded. In N. Ellis (Ed.). International Review of Research in Mental Retardation. (Vol. 14). New York: Academic Press

Cosden. M., Gerber, M. M., Goldman, S. R., Semmel, D., Semmel, M. I. (1984). Survey of microcomputer access and use by mildly handicapped students in Southern California (Tech. Rep. No. 4). Santa Barbara, CA: University of California, Santa Barbara.

Cory, S. (1983, November). 4-State model of development for full implementation of computers for instruction in a school system. The Computing Teacher, 1-4.

Davidove, E. (1987, July). Evaluation and selection of courseware development software. Educational Technology, 34-37.

Davis, B. (1985). IEP Management Programs. Northwest Regional Educational Lab., Portland. (ERIC documents code ED 266 610)

Diem, R. A. (1984). Preparing for the technological classroom: Will we meet the challenge? Educational Technology, 24(1), 13-15.

Doerr, C. (1979). Microcomputers and the 3R's. Rochelle Park, NJ: Hayden Book Company, Inc.

Dugan, S. (1986, November). Education of the Handicapped Amendments of 1986. Education of the Handicapped: Special Supplement. Capitol Publication, Inc. Arlington, VA.

Fellmy, W. R., & Nicholson, E. W. (1985). School priorities in the information society. Educational Technology, 25(11), 48-50.

Foreman, K., & Steinhoff, C. (1983). Networking for microcomputer management. In D. Bonnette (Ed.)., Proceedings of NECC/5 National Educational Computing Conference (pp. 4-6). Baltimore, MD: Computer Society Press.

Foster, D. (1984). Computers simulation in tomorrow's school. Computers in the Schools, 1(3), 81-89.

Foster, D. (1988, April). Technology: implications for long-Range planning. Educational Technology, 7-14.

Friedman, S., & Hoffmeister, A. (1984). Matching technology to content and learners: A Case Study. Exceptional Children, 51, 130-134

Fulton, K. (1989, March). Technology training for teachers: A federal perspective. Educational Technology, March, 12-17

Gay, L. R. (1981). Educational Research. Charles E. Merrill Publishing Co. Columbus, OH.

Glenn, A, & Carrier, C. (1989, March). A perspective on teacher technology Training. Educational Technology, 7-11.

Glenn, A., & Carrier, C. (1988). A Review of the Status of Technology Training for Teachers. NTIS Order No. PB 88-194 766/AS

Goldman, S. R., Semmel, D. S., Cosden, M. A., Gerber, M. M., & Semmel M. I. (1987). Special education administrators' policies and practices on microcomputer acquisition, allocation, and access for mildly handicapped children: interfaces with regular education. Exceptional Children, 53(4), 330-339.

Goldberg, M. P. (1981). Perceptions of resourceroom teachers of the hearing impaired and parents with respect to the individualized program conference (Doctoral dissertation, Columbia University Teachers College, 1980). Dissertation Abstract International, 41, 42882A.

Good, C. V. (1954). The Methodology of Educational Research. Edited by A. S. Varr and De. Skates. New York: Appleton-Century-Crofts.

Gray, P. J. (1984, October). The use of policy analysis in setting district policy on microcomputers. Educational Leadership, 42, 72.

Grady, M. (1983). Issues and implications. In M. Grady & J. D. Gawronski (Eds.), Computers in Curriculum and Instruction (PP. 22-27). Alexandria, VA: Association for Supervision and Curriculum Development.

Hall, G. (1981, Winter). Issues related to the implementation of computers in classrooms." Journal of Computers in Mathematics and Science Teaching. 14-19.

Hanley, T. V. (1983). Microcomputers in Special Education: Organizational Issues. Mountain View, CA.: SRA Technologies and Cosmos Cooperation.

Hanley, V. T., & Yin, K. R. (1984, February). Microcomputers in Special Education: Finding and Recommendations from a Current Study. Paper presented at Technology and Special Education Conference, Reno, Nevada.

Hanley, T. V., Appell, L. S., & Harris, C. D. (1988). Technological innovation in the context of special education systems: A qualitative and structured research approach. Journal of Special Education Technology, 9(2) 98-108.

Hannnaford, A. E. & Taber, F. M. (1982). Microcomputer software for the handicapped: Development and evaluation. Exceptional Children, 42(2), 137-142.

Hannaford, A. E. (1983). Microcomputers in special education: some new opportunities, some old problems. The Computing Teacher, 10, 11-17.

Hofmeister, A.M. (1982). Microcomputers in perspective. Exceptional Children, 49(2), 115-121.

Hofmeister, A. M. (1984). Microcomputer Applications in the Classroom. New York: Holt, Rinehart and Winston.

Hofmeister, A. M, Engelmann, S., & Carnie, D. (1986). Observations form the development and field testing of an instructional videodisc program. Journal of Special Education Technology, 7(3) 42-46.

Hopkins, C. D. (1976). Educational Research: A Structure for Inquiry. Columbus, OH: Charles E. Merrill Publishing Co.

Hoth, E. (1985). Debunking myths about computer literacy for teachers. Educational Technology, 25(1) 37-39.

Hunter, B. (1984, February). Modeling education on the real world. Educational Computer Magazine, 26-27.

Jenkins, M. W. (1987). Effect of a computerized individual education program (IEP) writer on time savings and quality. Journal of Special Education Technology, 8(3), 55-66.

Johnson, R. (1983). An Educator's Guide to Microcomputers. Pontiac, MI: Oakland Schools.

Justiz, M. J.; & Mason, W. S. (1984). A changing NIE: Facilitating new partnerships. Phi Delta Kappa, December 277-80.

Kehrberg, K. T. (1987). Microcomputer software development: New strategies for a new technology. AEDS Journal, 13(1), 102-110.

Keresztenyi, S. B. (1986). Uses of computer technology in education programs for mentally retarded, learning disabled, and emotionally disturbed students in New York. (Doctoral Dissertation, Teachers College, Columbia university, 1986).

Kolich, E. (1985). Microcomputer teaching with the learning disabled: A review of the literature. Journal of Learning Disabilities, 18(7), 428-431.

Krivacska, J. (1987). Computerized IEP management systems. Paper presented at the annual meeting of the national association of school psychologist, New Orleans. (ED289325).

Kulik, J. A., Kulik, C. C. & Cohen, P. A. (1980). Effectiveness of computer-based college teaching: A meta-analysis of findings. Review of Educational Research, 50, 525-544.

Kulik, J., Bangert, R. L., & Williams, G. W. (1983). Synthesis of research on computer-based instruction. Educational Leadership, 41, September, 19-21.

Kulik, J. A., Kulik, C. C. & Bangert-Drowns, R. E. (1985). Effectiveness of computer-based education in elementary schools. Computers in Human Behavior, 1(1), 59-74.

Lee, W. (1987). Microcomputer courseware production and evaluation guidelines for students with learning disabilities. Journal of Learning Disabilities, 20(7), 436-438.

Lehrer, R., & deBernard A. (1987). Language of learning and language of computing: The perceptual-language model. Journal of Educational Psychology, 79(1), 41-48.

Lehrer, R. (1986). Logo as a strategy for developing thinking? Educational Psychologist, 21(1 & 2), 121-137.

Lepper, M. (1985). Microcomputers in education. American Psychologist, 40, 1-18.

Lipman, D. (1986). A look at computer managed IEPs. Closing the Gap. 5(3), P. 15

Lindsay, P. (1986). Computers in Special Education: Using Technology to make up the Difference. In: The proceedings of the Canadian Symposium special education. 27P.

Lockheed, M.; Hunter, B.; Anderson, R.; Beazley, R.; & Etsy, E. (1983). Computer Literacy: Definitions and Survey Items for Assessment in Schools.

MacArthur, C., Haynes, J., & Malouf, D. (1986). Learning disabled students' engaged time and classroom interaction: The impact of computer assisted instruction. Journal of Educational Computing Research, 2, 189-198.

Maddux, D.C. (1984). Educational microcomputing: The need for research. Computers in the Schools, 1, 35-42.

Mageau, T. (1991). Backbone networks: The heart of the technology plan. Electronic Learning, October, 16-21.

Mageau, T. (1992). Integrating an ILS: Two teaching models that work. Electronic Learning, 11(4), 16-22.

Maher, C. A., & Bennett, R. E. (1984). Planning and Evaluating Special Education Services. Englewood Cliffs, NJ: Prentice-Hall.

Malone, T. W. (1981). What Makes Things Fun to Learn: A Study of Intrinsically Motivating Computer Games. Palo Alto CA: Xerox Palo Alto Research.

Malouf, D., Morariu, J., Coulson, D., & Maiden, V. (1989). Special education teachers' preferences for sources of software evaluation information, Journal of Special Education Technology, 6(3), 144-155.

Margalit, M., & Shulman, S. (1986). Microcomputers in special education: Renewed expectations for solutions to chronic difficulties. Exceptional Child, 33(3) 99-205.

Market Data Retrieval, Inc. (1984). Microcomputers in Schools, 1983-84. Westport, CT: Author.

Mayer, C. L. (1982). Educational Administration and Special Education: A handbook for School Administrators. Allyn and Bacon, Boston, Massachusetts.

McCarthy, R. (1992, February). Decisions, decisions what computers should you buy? Electronic Learning, 11(5), 18-24.

Michigan Department of Education, & Michigan Council of Teachers of Mathematics. (1983). Principals' Planning Guide for Microcomputers. Printed by Birmingham, Michigan, Public School.

Michigan State Board of Education. (1984). Better Education for Michigan Citizens: A Blueprint for Action.

Michigan State Board of Education. (1987). Essential Goals and Objectives for Computer Education.

Moore, G., Yin, R., & Lahm, E. (1986). Robotics, artificial intelligence, computer simulation: Future application in special education. T.H.E Journal, 14(1), 74-76.

Moore, M. L. (1984). Preparing teachers to teach about computers and computing. The Monitor, 23(5,6), 19-21.

Moursund, D. (1981). School administrator's introduction to instructional use of computers. The Computing Teacher, 8, 8-11.

National Governors' Association Center for Policy Research and Analysis (1986). Time for Results: The Governors' 1991 Report on Education. Washington, D.C:

Neill, S. B. (1983). How To Plan for Effective Instructional Use of Microcomputers. Tips for Principals from NASSP. National Association of Secondary School Principals, Reston, VA.

Papert, S. (1980). Mindstorms: Children, Computers and Powerful Ideas. New York: Basic Books.

P.L. 91-142 (1975). Education for All Handicapped Children Act, Sec. 4(a), (19).

Preece, J. (1984). Selecting CAL packages: Helping teachers to recognize quality software. Computer Education, February, 20-21.

Price, M., & Goodman, l. (1980). Individualized education programs: A cost study. Exceptional Children, 46 446-454.

Ragsdale, R. G. (1982). Computers in the Schools: A Guide to Planning. Toronto: The Ontario Institute for Studies in Education.

Rhodes, A. E. (1963). Better Education Through Effective Intermediate Units. Washington, D.C.: National Education Association, Department of Rural Education. pp. 3-4.

Roberts, N. (1984). Testing the world with simulations. Educational Computer Magazine, 6, 28-29.

Rogers, J., Moursand, D, & Ence, G. (1984). Preparing precollege teachers for the computer age. Communications of the ACM, 195-200.

Rosenberg, S. D. (1986). Special and individual: Computers meet the needs of the handicapped. TechTrends, November-December, 19-24.

Ryan, L. B., & Rucker, C. N. (1986). Computerized vs. noncomputerized individualized education programs: Teachers' attitudes, time, and cost. Journal of Special Education Technology, 8(1), 5-12.

Sabatino, D. A. (1981). Are appropriate educational programs operationally achievable under mandated promises of P.L. 94-142? Journal of Special Education, 15, 9-18.

Sax, G. (1979). Principles of Educational and Psychological Measurement and Evaluation. Wadsworth Publishing Company, Belmont, CA.

Semmel, I., Cosden, A., Semmel, S., & Kelemen, E. (1984). Training special education personnel for effective use of microcomputer technology: Critical needs and directions. Special Services in the School, 1, 63-82.

Sheingold, K., Kane, J., Endreweit, M., & Billings, K. (1981). Study of Issue Related Implementation of Computer Technology in Schools. Cambridge: Bank Street College of Education.

Sheinglod, K., Kane, J., & Endreweit, M. (1983, November). Microcomputer use in schools: Developing a research agenda. Harvard Education Review, 53, November, 412-58.