NEEDS OF IOWA INSTRUCTIONAL MICROCOMPUTER USERS

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by
Dennis M. Schrag
February 1982
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Dean of the School of Graduate Studies
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An abstract of a Dissertation by

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February 1982
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The problem. This study determined what Iowa instructional microcomputer users identified as their personal concerns, instructional design needs and technical assistance needs and the preferred mode and source of addressing those needs. By identifying the needs of the first generation of microcomputer users, support service providers may be better prepared to assist local district educators in better using microcomputer technology.

Procedures. Three typical instructional microcomputer users nominated by each of the fifteen area education agency directors of educational services, were interviewed using a structured interview instrument.

Findings. Personal concerns of instructional microcomputer users were focused on the amount of time that was demanded to learn how to use hardware and in preparation of instructional software. Users consistently reported a desire to train their fellow faculty members on the use of the micro. Instructional design needs of the users included the desire to learn how to adjust available software to better address local circumstances, the development of a model cataloging system and individual program documentation format, additional software in the basic skills disciplines, and model curriculum guides for computer literacy courses. The area education agencies were identified as the preferred source of addressing these needs. Technical assistance needs included: workshops on basic repair and maintenance of hardware, and courses in machine language and assembler language. The area education agencies and the institutes of higher education respectively were identified as the preferred source of addressing those needs.

Recommendations. Support service providers in the state including the Iowa Department of Public Instruction, area education agencies, professional organizations and local districts should develop a comprehensive plan to distribute available services and resources to address the needs of instructional microcomputer users and their students. Additional study on the appropriate use of the micro is needed.
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Chapter 1

INTRODUCTION

Microcomputers have become a familiar part of many Iowa students' school experience. More and more Iowa schools have purchased "micros" in the past two years. Experts predict that the microcomputer revolution in the classroom will continue. As with any educational innovation, certain barriers develop which may prevent the development from becoming an integral part of the instructional/curricular program.

The nature of this study was to determine what Iowa educators identified as the personal concerns, instructional design and technical assistance necessary to use microcomputers beyond the "toy" stage and into the "tool" stage. The identification of specific user needs and the identification of user concerns is the first step toward helping pre-service and in-service education providers develop meaningful and useful support services.

Microcomputers in Education

Recent developments in the solid state electronics industry have resulted in astonishing reductions in the
cost and size of computing equipment. Retail outlets for microcomputers number in the thousands; computers sold number in the hundreds of thousands. The micros used in homes and schools have the capacity of computer systems which just five years ago would have required specialized staff, extensive facilities, and expensive equipment.

It is difficult to define with precision what a microcomputer is. Perhaps the best distinguishing feature is price: $200 to $10,000. Basically, the microcomputer, using a "chip" microprocessor is structured the same as larger minicomputers. The stand-alone unit is physically smaller (a little larger than a typewriter), slower, and has less memory than larger machines. Memory capacity ranges from 12,000 to 128,000 bytes. A byte is defined as the basic unit of information. Usually one byte is equivalent to one symbol or one character of the alphabet.\(^1\) The basic central computer unit can be augmented to system stature with such peripherals as disk drives, printers and CRT monitors. Recent developments in microcomputer technology have provided voice activated control and expanded visuals with links to video-disks.

"Their use in educational settings will skyrocket in the next few years," predicts John F. Huntington, recognized

leader in the computer-assisted instruction discipline. ¹

The National Association of Secondary School Principals (NASSP) agrees with Huntington's predictions about micro-computer usage. The October 1979 issue of The Practitioner, the principals' national newsletter, anticipated that every high school in the country would own at least one microcomputer within two years.² Research by the National Science Foundation estimated that there were as many as 200,000 micros in K-12 schools. It projected upward of one million units by 1985.³

The increase in the number of micros in Iowa schools mirrors the national trend. A survey conducted by Earl Keyser of Northern Trails Area Education Agency in November, 1979, showed 134 school districts in the state owned 297 microcomputers.⁴ A conservative estimate from Dean Crocker, Iowa Department of Public Instruction Director of Statewide Data Processing Services, as of July 1, 1981,


²Stuart D. Milner and Carol Hargan, "Microcomputers ...the Future is Now," The Practitioner, VI, No. 1 (October, 1979), 1.


⁴Letter from Earl L. Keyser to John Bahum, Iowa Legislative Research Assistant, 1979.
placed the number of micros at over 645 spread among approximately 356 Iowa school districts.¹

The main advantages of microcomputers are affordability, transportability, and dedication. Instrumentally, the micros can allow the student to work at an individualized pace. Microcomputers can provide immediate feedback on the correctness of response and can monitor overall instructional progress. It is a highly motivational tool for some students.

Like other computer based learning techniques, the micro learning strategies include drill and practice, problem solving, tutorial programs, simulations, computer-assisted test generation, scoring and analysis and computer-managed instruction.

Some call it a revolution or a quantum leap or a major innovation in education. Others say it is just another fad; just wait and it will go away. There is considerable speculation as to the relative importance of the micro in the classroom. "There is no question that our lives will be intertwined with the microcomputer," said Dr. Winston Addis, superintendent of the Mount Vernon (Iowa) Community School District and immediate past national president of the Association of Educational Data Systems.

¹Telephone interview with Dean Crocker, Iowa Department of Public Instruction, Director of Statewide Data Processing Services, October 30, 1981.
In fact the technology is far beyond our ability to use it. Education is lagging far behind other fields such as medicine, industry and the military. Microcomputers are not a fad, they are here to stay and we as educators have an obligation to teach students how to deal with them. ¹

Ralph Van Dusseldorp and Dennis Spuck, editors of a special microcomputer edition of the AEDS Journal in the fall of 1979, consider the micro a very important technological advance.

No where is the potential and to some extent the realization of the capacity of microcomputing greater than in the field of education. Yet with all of the advances being made in microbased technology, few in the field of education understand these systems. Those of us in education need to be concerned that we are in control, that we have sufficient knowledge about this technology to insure that it will be used to the benefit of our educational mission. ²

The popularity of the microcomputer has prompted some educators to consider the machines a solution looking for a problem. Ernest L. Boyer, former U.S. Commissioner of Education, views the widespread dissemination of the micro with mixed feelings. In a speech delivered to the 1981 I/D/E/A/ Summer Fellows Program in Claremont, California, Dr. Boyer acknowledged the potential of the microcomputer


but questioned educational administrators on the rationale behind their purchase. Boyer chided some administrators for relegating an exciting tool to a fashionable toy.\(^1\)

Instructional integration of technology is much more complicated than buying a box and plugging it in.

The technological advances in hardware may have preceded the educational community's ability to design instructional units and software to use the machines to benefit students. Gerald Gleason, professor of educational psychology at the University of Wisconsin, notes; "Realistically, most knowledgeable people agree that hardware development is considerably ahead of software development and implementation."\(^2\)

Research on educational innovation and change at the University of Texas Research and Development Center for Teacher Education conducted by Gene Hall and Archie George indicated that as an innovation is introduced, adopters develop an aroused state of anxiety. Adopters develop a series of "concerns" on the value of the innovation and their

\(^1\) Ernest L. Boyer, "Quality Education in the 80s" (speech presented before the /I/D/E/A/ Summer Fellows Program at Claremont Men's College, Claremont, California, July 14, 1981).

\(^2\) Gleason, p. 7.
involvement with it. These concerns can be divided into three general categories: personal concerns, technical concerns and instructional design related concerns. As such these concerns are the educators' perceptions at any given moment in the process of adopting an innovation. The perception may be real or imagined, but it must be resolved before the change can be integrated into the mainstream of the curriculum. Indeed, the research of Hall and George indicated that adopters of innovations do move through a seven step developmental sequence from awareness to a state of total curricular integration.

The microcomputer can be viewed as a teaching tool and integrated into the curriculum when it can create new learning experiences or present a fresh and useful approach to learning. This type of integration into the learning process is the desired instructional design. Instructional design is defined as the appropriate mix of all factors which will increase student learning.

**Purpose of the Study**

The purpose of this study was to document and report the personal concerns, instructional design needs and technical needs of typical instructional microcomputer users in

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Iowa schools. Support services desired by the users to satisfy their needs were identified as were the preferred source and mode of the service. The descriptive study provides benchmark information concerning the degree to which microcomputers have been integrated into the curriculum.

Surveying the needs of users should be one of the first steps in providing quality support services. If microcomputers are to be used to their full capacity, adequate planning at the state, regional, and local level must be in place. Planning assumes that substantial information from the users is available. This study represents an initial effort at seeking user-based data on a statewide basis.

Rationale for the Study

User-based information on the personal, technical and instructional design needs would be helpful to Iowa's educational leaders. Given user-based data, administrators should be able to make better decisions about the use of microcomputers in the classroom. Because the hardware has been recently acquired, and because vendor support is notoriously slack, both technical and instructional design needs are present. Similarly, pre-service and in-service education providers which may have resources and responsibility to provide support services to educators may be in the
process of establishing their role vis-a-vis the appropriate use of microcomputers.

Minnesota, Florida, Vermont and Texas have initiated statewide studies on the role and function of micros in the classroom. These studies have included strong emphasis on implementation and curricular integration. Iowa has no such studies upon which to plan its microcomputer support services. NASSP's The Practitioner cautions its readership:

While the rewards for using microcomputers can be great, a certain amount of commitment on the part of administrators and teachers for planning, implementing, and evaluating computer use is vitally important. The complexity of the technology and relative inexperience of most educators in using the microcomputers make this imperative. Moreover, teachers and administrators must recognize how essential inservice training is for effective use of computers in instruction. While the amount of training may vary, some sophistication is necessary. Given the proliferation of microcomputers, unless serious attention is given to upgrading teachers' competencies, students may well become more computer literate than their teachers.

Adequate support services for the adopter of an innovation can assist in resolving adopter anxiety. Helping the adopter move through the developmental steps of user concerns outlined by Hall and George is critical if an innovation is to have long-term and successful use in the school setting. Studies by the Rand Corporation for the

1Gleason, p. 9.

2Milner and Hargan, p. 13.
National Diffusion Network, United States Department of Education, reported by David Marsh and Milbrey McLaughlin, note that the single most important aspect of staff support services is the capacity to provide "on the firing-line assistance" that is on-target to the needs of the teachers adopting the innovation. Frequency of assistance was much less important than the capacity to diagnose individual teacher concerns and resolve them. Initial training and good support services are second only to visible local school administrator commitment when considering innovation integration.¹ This study has documented what "on the firing line" needs current Iowa microcomputer users identify.

Reviewing the recent past and anticipated future of the instructional microcomputer in Iowa, the provision of adequate teacher training and support is crucial to the use of the micro as a real instructional tool.

It would be helpful to professional development providers to assess teachers' perceived instructional design, technical and personal concerns. Institutes of higher education, state and regional agencies, and professional organizations provide training to their constituents. These professional development providers realize that teacher training can make the difference between the microcomputer

¹Milbrey McLaughlin and David D. Marsh, "Staff Development and School Change," Teachers College Record, LXXX, No. 1 (September, 1978), 69-76.
as a tool and gimmick.

The United States House of Representatives (1978) Committee on Science and Technology discovered in its study of the impact of technology on schools, that the educational community lacks a "coherent, rational policy toward the use of computers for improving learning in our society." The study emphasized the urgent need to plan implementation strategies for taking full advantage of computing technology. A significant factor in the success or failure of instructional computing may be how adequately an implementation plan takes into account users' needs.

A study by the Minnesota Educational Computer Consortia (MECC) in 1980 involving 3800 secondary educators notes that only 39 percent believed they had training and preparation to make decisions about using computers in their teaching. (The number of secondary Minnesota educators who feel they have adequate training in computer utilization may appear high. One must consider, however, that for over ten years Minnesota has had a tax supported state agency which has had as its major objective instructional computer applications and associated teacher training.) These statistics


become magnified in Iowa's situation considering that unlike Minnesota, little financial or political support encouraging the use of computers in Iowa instruction has been present. We do not know what Iowa educators need to help blend the microcomputers they have into the curriculum.

Given better information on what current users need, preservice education programs may be able to establish experiences for the next generation of educators. Gerald Gleason, after a full year's sabbatical study of microcomputers in teacher education, reports on the status of preservice training:

I found only very few instances where education professors were providing experiences in CAI for prospective teachers. Occasionally, a unit in a media course focuses on use of computers. If one examines the various indexes of available CAI programs, it is obvious there are very few programs that are included in professional teacher education.

The lack of preparation and training of teachers is evident and acute. Historically, there is evidence of lessons learned from previous advances of technology in education. The growth of television and education's general neglect of its potential impact remains.¹

If teacher preparation institutions in Iowa decide to include training on the use of the micro in the classroom, knowledge of present user needs would provide a substantial springboard for preservice instructional development.

¹Gleason, p. 15.
The prospects of more computer equipment in the schools is considerable. Most experts in the field, noting that today's micros are the first generation of instructional machines, predict greater equipment capacity at lower costs. A 1980 study of all of Florida's superintendents noted that 90 percent anticipated greater expenditures of funds and student time for microcomputer related services and training.¹

If Iowa schools follow their Florida counterparts in the future, one can easily predict that additional user support services will be needed. But what services? What do Iowa educators need to better use the microcomputer capacity they have now and will have in the immediate future?

It may be appropriate for state and/or regional agencies to seriously explore proving software banks fashioned after the AEA's media collections. Planning and projecting is considerably enhanced by knowledge of users' needs. In the spring of 1980, Iowa legislators were asked to consider funding a statewide instructional microcomputer software clearinghouse. The proposal was included in the Iowa Department of Public Instruction's Legislative Recommendations. According to Dean Crocker, Iowa Department of Public Instruction, the measure did not progress due to two

¹Dickerson and Pritchard, p. 7.
factors: the sharp downturn in the state's economy and the lack of accurate user based information on the current state of the art in Iowa. This study has addressed the need for user based information by documenting their needs and concerns.

A similar proposal in Oregon supported by user based data resulted in a state appropriation and a contract with the Computer Technology Program of the Northwest Regional Educational Laboratory.¹ Securing federal or state financing to establish a microcomputer-user-assistance program is doubtful at this time. However, the possibility of establishing a coalition of existing support-service providers assisted with anticipated federal revenue sharing education dollars may result in some much needed coordination and leadership.

If the microcomputer is a "quantum jump" in the educational process, or, if it proves to be a small but important development in helping some students to learn some things easier or faster, a benchmark study of the present status of micros will assist later researchers in determining what impact, if any, efforts at the local, regional and state level may have had.

¹Donald C. Holznagel, "A Study of the Feasibility and Costs of Conducting a Proposed Clearinghouse for Microcomputer Information and Educational Software" (Computer Technology Program, Northwest Regional Educational Laboratory, Portland, Oregon, November, 1979). (Unpublished.)
What we do not know about the microcomputer users' needs is greater than what we do know. No studies are filed at this time exploring the grassroots desires of educators. This study has filled part of that gap.

Questions

Teachers integrating any educational innovation into the curriculum have personal, technical and instructional design concerns. Given a number of new microcomputer users in Iowa schools, this study will document:

1. What personal concerns do instructional microcomputer users have regarding the integration of the innovation into their curriculum?

2. What instructional design needs do instructional microcomputer users identify and what are the preferred source and mode of addressing those needs?

3. What technical assistance needs do instructional microcomputer users identify and what are the preferred source and mode of addressing those needs?

This study has documented what current users of the microcomputer identify as their needs. Examples of the assistance these educators might identify include:

Technical: How to learn machine language. How to create and adjust file systems. How to perform simple maintenance and repair functions.

Software: How to establish hard copy documentation
systems. Where to locate subject/grade specific software. How to adjust software to allow more time interval for student responses.

**Personal:** How to deal with other faculty members who may have machine anxiety in using a microcomputer. How to balance one's personal and professional responsibilities with the new micro interest. How to manage time more effectively to allow increased micro training.

**Instructional Design:** What impact does the speed and size of characters on a monitor have on elementary school students? Is the use of the micro appropriate for all students or should only the higher achieving students use it? Should all students progress through the same sequence of instructional software?

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**Definitions¹**

**BASIC:** An acronym for Beginners All-purpose Symbolic Instruction Code. A high level conservational interpretative programming language in wide use. Always written in capital letters, BASIC was invented by Kemeny and Kurtz at Dartmouth College in 1963.

**Byte:** The basic unit of information in a computer. Commonly consists of a sequence of eight binary bits usually

¹Douglas and Edwards, p. 57.
handled as a unit. One byte usually represents one character of the alphabet.

Chip: The heart of a microprocessor, a piece of silicon smaller than one's fingernail on which thousands of electronic elements are implanted.

Computer: A device that receives and then follows instructions to manipulate information. The set of instructions and the information on which the instructions operate are usually varied from one moment to another. If the instructions cannot be changed, the device is not a computer. The difference between a computer and a programmable calculator is that the computer can manipulate text and numbers.

Computer Language: A language used to communicate with a computer. All computer language instructions must be translated by a program in the computer into the machine's internal language in order for the instruction to be implemented.

CPU: Central Processing Unit. The heart of the computer, controlling what the computer does. It includes three main sections: arithmetic, control and logic elements. It performs computations and directs the functions of the system.

CRT: Cathode Ray Tube; video display unit.

Data: The information given to or received from a computer.

Disk: A record-like magnetic-coated piece of
material that can store programs, data, or tables of information. Floppy and hard disks are most common.

Graphics: Characters that can be used to form figures, shapes, and forms on the CRT or printer.

Hardware: Mechanical, magnetic, electrical and electronic devices which make up a computer. The physical equipment that goes into a computer system, consisting of the central processing unit plus all peripherals.

Input: Information going into the computer or into a peripheral.

Instructional Design: The appropriate mix of teacher, student, software, hardware, and curriculum to cause optimum learning.

Interactive: System capable of two-way communication with a user. Response time is quick, usually less than one second.

Language: A format by which a programmer can communicate more efficiently with a computer where predetermined commands will yield requested actions.

Memory: The integrated circuits of a computer which store information.

Microcomputer: A hardware configuration; a small computer system that includes the same features as larger units: input, memory, output, and CPU. Usually the system includes a keyboard for data entry, cassette tape or disk for storing programs and a TV like CRT for displaying results.
In contrast to larger machines, the micros usually cost between $200 and $10,000. An entire self-contained unit will usually fit on a desk top.

Peripheral Device: A device such as a printer, mass storage unit or keyboard which is an accessory to a microprocessor and which transfers information to and from the microprocessor.

Printer: The peripheral device which accepts output data from the microprocessor and prints characters on paper.

Program: A series of instructions to a computer which cause it to solve a problem or perform a task.

Software: Refers to programs and documentation which accompanies programs; the internal routine prepared to facilitate use of the hardware for a specific purpose; a set of instructions which controls the machine's ability to perform tasks.

Terminal: A peripheral device which facilitates human communication with a computer. It usually consists of a keyboard or CRT.

Delimitations

The study is limited to the perceptions of selected educators in Iowa.
Methodology

In an effort to identify what microcomputer users perceived as their support service needs, a structured interview was developed. Forty-five "typical" users were identified—three users from each of the fifteen areas of the state. Person-to-person interviews were conducted with forty-one of the teachers; four were conducted by telephone. The interview sought need information and the preferred source and mode of addressing those needs. The interview sought the users' advice in terms of technical assistance, software needs, instructional design matters and personal ramifications. The data from the interviews were compiled, tallied, and presented in terms of central tendencies.

Summary

There are many microcomputers in Iowa schools. Those educators using the micros for instructional purposes are the first generation of users. These first users, in the process of integrating the microcomputer technology into their courses of study, have encountered personal concerns and technical and instructional design problems. Identifying the needs and concerns of this first generation of micro users may provide information to support service providers as to assistance most desired to sustain the innovation as a useful educational tool.

Historically the use of the computer in education has
recorded the need for strong teacher training and effective support services. The following chapter will explore in greater detail the development of the center-based computer and microcomputer as an instructional tool from both a national and Iowa perspective. For the computer to serve as an aid in the instructional process, user needs must be identified and appropriate services provided. The purpose of this study is to identify the personal concerns and technical and instructional design needs of Iowa microcomputer users. Given this information, support service providers may further assist the first generation of users and help prepare the subsequent generation of users.
Chapter 2

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to place into a historical perspective the use of the computer as an instructional tool and the support services that accompanied that development. As noted in Chapter 1, this study documented the support service needs of instructional microcomputer users in Iowa. In an effort to distinguish between national and Iowa developments in both center-based and microcomputer environments, four sections of this chapter have been defined. While the chronology of the four sections overlap somewhat, the sections have been presented in a developmental sequence.

The computer as an instructional tool in the United States in K-12 school districts with emphasis on the period from 1960-1970 when computer-assisted instruction and computer-managed instruction saw widespread activity has been presented in the first section.

The history of the center-based computer as an instructional tool in Iowa's K-12 systems is charted in the second section of the chapter. The record of this development is focused, dating back to the 1960's when federal funds permitted a few Iowa instructional networks to be developed.
In the third section the literature has been reviewed and highlights the development of microcomputer applications in K-12 systems in this country. Because microcomputers have recently come into the marketplace, the literature in this area is largely oriented toward hardware.

Microcomputers as instructional tools in Iowa will be explored in the fourth section. A few unpublished works comprise the bulk of this literature.

Computers as Instructional Tools in America - Genesis

The development of the computer from the very earliest counting machines through the introduction of electronics and finally the development of the transistor has been recorded in a history by H. H. Goldstine entitled, The Computer: From Pascal to Von Neuman.¹ Goldstine reviewed the general development of the "thinking machines" with special emphasis on the wartime developments, including the initial computers. Specifically, he recounted the development of the ENIAC and the EDVAC machines. These early electronic machines, massive in nature and incredibly slow and ignorant by today's standards, nonetheless served as the prototype for later models. Goldstine summarized the

development of the computer:

...the importance of the computer to society lies not only in its superb ability to do very complex tasks of an obtuse mathematical nature, but also in its ability to alter profoundly the communications and transformation of all sorts of information. It is the latter capacity that has been so useful to the humanist.1

It is the educator's purpose to profoundly alter communication and transform all sorts of information. However, the use of the computer in the K-12 instructional setting was extremely sluggish in development. It was not until the launching of Sputnik in the mid-fifties and the development of the alphabet soup curricula (BSCS - Biological Sciences Curriculum Study, SMSG - School Mathematics Study Group, etc.) that one accounts for the growth of the computer as a functional teaching tool in the K-12 system. John I. Goodlad and associates described this development in The Changing School Curriculum. Not only was there a reform in the school curriculum content, but also the structure of the school was undergoing vast changes.2 "Teachers must now diagnose each student, determine the best possible class placement and subsequently relate student abilities and programs in a productive pattern."3 Suddenly

1Goldstine, p. 32.


3Goodlad and others, p. 7.
there was an urgent need for new student information not
days or weeks later, but immediately at the time and place
of decision-making affecting the student.

Goodlad, O'Toole and Tyler explored the dual need
for computer assistance in the schools, for curricular
relevance and student information in Computers and Information Systems in Education:

Prior to 1961, there were no professional associations primarily concerned with the special problems
of educational data processing. In November of
1961, a small group of educational data processing specialists in California...held a trial statewide
convention...of more than one hundred and thirty
people...Hence the California Educational Data Processing Association was formally founded in the
spring of 1962. It was the first such association
in the nation. The Council of Chief State School
Officers established a Commission on Educational Data Systems in 1963 for information processing
purposes. In 1958 only thirteen states took
advantage of Title X federal funds for statistical machines...a large number of states had plans to
take advantage of opportunities for developing EDP
programs for instruction under Title V of the
Elementary and Secondary Education Act of 1965.¹

At least three educational requirements made computer
assisted instruction/computer managed instruction (CAI/CMI)
inevitable: (a) the trend to individualize instruction,
(b) the growth of information to be acquired, and (c) the
shortage of qualified teachers in the early sixties.

In 1965, R. W. Gerard, Dean of Graduate Studies,

University of California at Irvine, listed these benefits CAI would bring to the student:

(1) better and faster learning since the student can spend his time learning at his convenience, go at his own pace, and catch up missed time; (2) better teaching at many levels and in many areas; (3) personalized tutoring; (4) automatic measurement of progress; and (5) the opportunity to work with vastly richer materials and more sophisticated problems. For the teacher, the system would (1) take away a great deal of drudgery and repetition; (2) allow the teacher to be updated effectively; (3) encourage frequent changes in the actual material used; and (4) make more time available for teacher-student contact.¹

Gerard saw wider social benefits: (1) the very best materials could be produced by master teachers, (2) these materials could be used widely and repeatedly, (3) individual modifications in the program could be made almost at will, (4) the great information systems could be tapped freely, and (5) the desperate shortage of teachers could be relieved. Gerard also called attention to the usefulness of CAI as a research tool in education.²

In 1965, Bolt described the potential of computer-assisted instruction. He noted that education was being extended by industry and commerce, and that a system which accommodates both computer-assisted instruction and


²Gerard, p. 9.
educational management could evolve into an information environment of extra-ordinary power. This environment would be made up of the computer-based systems and their peripherals together with all necessary educational information. This informational environment could foster the achievement of quality throughout the expanding and diffusing educational endeavor.¹

Gentile concluded in a 1967 review of the first generation of CAI systems by listing three residual problems: (1) technical—the technology of the computer and input-output devices, (2) semantic—the problem of writing instructional programs, and (3) effectiveness—the problem of learning and the effectiveness of learning. Gentile predicted that the first problem would be easily resolved by continued electronic refinements. It was the people and software difficulties which caused him greatest concern.²

Gentile's residual problems have remained. As will be demonstrated in later chapters of this study, educators continue to contend with rapid changes in hardware, inadequate software and unknown factors in using computers

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to effectively cause an increase in learning.

According to Molner et al., between the late 1950's and 1965 an estimated $13.3 million had been provided by the federal government for over one hundred research related projects dealing with educational uses of computers; 60 percent of those projects were still active in 1966. Most of the projects were funded through the Cooperative Research Act (amended by Title IV of the Elementary and Secondary Education Act of 1965), Title VII of the National Defense Education Act and the Vocational Education Act of 1963.¹ Training of teachers for the technical, instructional design, and personal ramifications of integrating the computer into the curriculum was then as it is now the critical factor of computer use in education. This study was concerned with those critical factors in microcomputer use.

By the mid-1960's many local districts were pilot testing their own instructional applications of the computer. In September, 1966, the School District of Philadelphia took its first steps in CAI at seven schools. A comprehensive Electronic Data Processing (EDP) system in the School District of Philadelphia envisioned computer

usage in the following areas: CAI, counseling and testing, basic skills development, vocational education, scheduling, and facilities.

Computers were used to assist in the teaching of biology and reading in two Philadelphia senior high schools (Germantown and Overbrook) and in two junior high schools (Roosevelt and Wanamaker). The effort, involving 464 students, was referred to as Project GROW, an acronym derived from the names of the four schools in the program. The Project GROW system was built around a central computer complex devised by Philco-Ford. There were eight terminals in each of the four schools. The thirty-two terminals accepted student responses by a sixty-five-character teletype keyboard.

The twenty teachers in the four schools involved with Project GROW attended a one-week orientation program in the summer of 1967 in order to become acquainted with CAI, review course material, become familiar with hardware, and plan their participation in the program. School district personnel prepared the curriculum materials, utilizing the services of learning-theory specialists, psychologists, and experts in the field of CAI. A long-range research

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1 "The Computer and Educational Progress in the School District of Philadelphia--Overview and Summary" (report of a study by the Brooks Foundation, Santa Barbara, California, contained in a published pamphlet through the Philadelphia Public Schools, 1967).
design was developed to help determine how CAI was to be used most effectively as part of the total educational process.¹

The appropriate training of teachers in the use of the computer was identified in Project GROW as a critical factor in adopting the computer into the educational process. So, too, teacher instructional and technical training regarding the use of the microcomputer remains a key factor to the integration of the innovation into the school operation. A later chapter of this study will chart what training needs current users identify as important to them.

Project LOCAL (Laboratory Program for Computer-Assisted Learning), successor to the Massachusetts Board of Education Project H212, was initiated in July, 1967, to improve secondary school instruction by use of the computer as a teaching aid.² It placed teletypes connected to a time-shared computer at Bolt, Beranek and Newman, Inc., Cambridge, in each of the member school systems: Westwood, Lexington, Natick, Needham, and private secondary schools,


to teach computer programming to children and adults, and to instruct mathematics and science teachers in the use of the computer. At the end of the third year the program accommodated more than 4,500 students per year. The project pilot-tested CAI software and various instructional modes of software including simulation, drill and practice and tutorial methods.

A digital computer was used as an aid in teaching via the problem-solving or algorithm method, as a tool for creating simulated and interactive learning situations, and as a vehicle for administering programmed instruction. This study has identified what instructional approaches microcomputer users use today. The use of the micro for teaching programming, just as with Project LOCAL is accompanied by using the technology as an academic content teaching tool.

Not all school districts were concerned solely with the system's applications. The Board of Cooperative Educational Services (BOCES) of Westchester County, New York, developed and evaluated computer assisted economics games as a method of individualizing instruction for sixth-grade students. Three games were developed: the Sumerian game, the Sierra Leone game, and the Free Enterprise game, all of which gave students simulated experience with economic problems. Subsequently, in an effort to determine how effective the simulated environment method could be in providing individualized instruction in other subjects, teachers from
northern Westchester County drafted materials in art, biology, chemistry, electronics, physics, French and music.\(^1\) This marked an initial effort in regional agency software development and distribution. It will be noted later in this study that Iowa's area education agencies have contributed to the software and teacher training aspects of microcomputer usage.

Charles Darby and others in *The Computer in Secondary Schools* in 1972 summarized the growth of CAI as follows:

> Of significance is the fact that computer technology has found its place in American secondary education. The question confronting secondary education today is not whether the computer belongs in secondary schools, but rather how can computer technology best be used by administrators and teachers to provide all students a more rewarding and challenging learning experience? The resolution of this question will ultimately determine the total impact of the computer on improving the quality of American secondary education.\(^2\)

Varying degrees of importance were placed on the use of the computer in education by state departments of education. Prompted by a strong computer industry, the State of

\(^1\)Roger Wing, "The Production and Evaluation of Three Computer-Based Economics Games for the Sixth Grade--Final Report" (Westchester County, New York: Board of Cooperative Educational Services, June, 1967).

Minnesota through a tax supported agency called the Minnesota Educational Computer Consortia embarked on an effort to provide computer related services (instructional) to the vast majority of the secondary students in the state. Of significant importance was MECC's emphasis on teacher training and software development. By 1977, at least 93 percent of the high school students in Minnesota had access to computer-assisted instruction. MECC's mission included hardware operations, communications, software development and evaluation and a strong network of implementation specialists to assist local district educators in using the resources that MECC could provide. This study was concerned with the support services available to micro users--the same type of support services Minnesota educators have had since the mid-1970's.

The Spring issue of the AEDS Journal carried an article by David Thomas of the University of Iowa entitled "The Effectiveness of Computer-Assisted Instruction--Secondary Schools." It was one of the most comprehensive studies on the topic. Using a study of studies method, Thomas concluded:

The studies reviewed paint a positive picture for computer-assisted instruction. In past years proponents hoped to see great achievement gains for CAI courses, spoke of very low costs and high retention, and did not mention time at all. Today,

CAI as a medium has "settled down." Achievement gains over other more traditional methods are the norm, but mere equivalence with very good instruction is also attained. Retention is equal to that obtained in traditional instruction. The technology fosters generally favorable attitudes toward computers and often toward the subject being taught. Perhaps the most valuable finding in the long run is that many CAI students gain mastery status in a shortened period of time. Finally, CAI cost appears to be approaching that of conventional instruction, but until standardization of cost algorithms occurs, comparisons are tentative. Given this data on the use of CAI, perhaps the most telling picture may be provided by Hunter, Kastner, Rubin, and Seidel (1975), who predicted that adoption of CAI by the majority of secondary schools will occur during the 1980's.1

In summary, the development of the instructional applications of the computer have progressed slowly compared to other disciplines. In education as in other applications, the critical factors in computer usage were not hardware, but software development and people-training to use the computing capacity fully. Federal projects provided model educational computing centers; however, the lack of a system of support services for hardware prevented the widespread application of the computer as an instructional tool. The continued need for properly trained computer users and appropriate software will be documented in later sections of this study, as the perennial problems involved in integrating the use of the computer in the curriculum.

1David B. Thomas, "The Effectiveness of Computer-Assisted Instruction--Secondary Schools," AEDS Journal, XII, No. 3 (Spring, 1979), 111.
Instruction and the Computer in Iowa

The Iowa Plan for the Use of the Computer for Education states:

A review of the development and use of the computer in education in Iowa shows accomplishments and problems, many of which parallel national trends. Iowa was one of the several states in the early sixties that was focusing on a systematized information flow for education.1

As computer centers were established to provide these growing administrative services, various operation, research and resource groups also came into being. Iowa legislators became increasingly aware of this computer-related education activity and were concerned with the unscheduled growth and concentration of computers in certain sections of the state. At the same time, other school systems had little or no access to computer services. The likelihood of expensive duplication of effort and uneven distribution of services and the resulting drain on public funds called for action.

Many Iowa students, teachers and administrators have been denied the benefits of computer services for several reasons: (a) computer potential has not been planned and coordinated for maximum benefits; (b) little has been accomplished toward standardizing computer utilization so programs developed by one center can be used by another; (c) computer accessibility varies greatly in the state;

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(d) cost for large-scale administrative or instructional applications is prohibitive except on a wide tax base; (e) many technicians and educators with technical skills are needed to operate and use such systems; and (f) lack of proper financing.¹

Many of these problems have been resolved by the widespread distribution of the microcomputer. As will be demonstrated in later sections of this study, user training and technical support remain critical factors in the educational use of the computer in Iowa.

Section 257.10 of the Iowa Code (1971) added subsection 14 by legislative amendment in February, 1972.² This subsection defined the intent of the law. It created a five-member committee to serve as the State Advisory Committee on Educational Data Processing to advise the State Board of Public Instruction in improving, coordinating and supervising the use of educational data processing computers in Iowa school systems.

The committee shall further inventory current practice and prepare and recommend a statewide plan for the use of electronic data processing computers in order to prevent the unnecessary proliferation of computers.³

By February, 1973, the State Advisory Committee and


²Iowa Code, Section 257.10, Subsection 14 (1972).

the Iowa Department of Public Instruction sent an Initial Report to the Iowa General Assembly.¹ The report inventory showed that nine computer centers were located in local school districts, joint county school systems, and Merged Area School Corporations. Budgeted items for staff, equipment, and miscellaneous expenditures for the nine centers totaled over two million dollars with a previous capital investment of about two and three-quarter million dollars. There were additional computers at the state universities, but those were not under the jurisdiction of the State Board.

The vast majority of the computer center operations in Iowa were for administrative functions. The initial report also explained the need for a Statewide Plan:

The State of Iowa needs a long-range plan for involving Iowa citizens in the development of a statewide system of making the combined computer power of all educational institutions available to every student, teacher, administrator, and policy maker (at the school board director level as well as for the members of the General Assembly).

A less obvious need is to better utilize the potential of computer technology for individualizing instruction for students.

For the proper application of technology to the educational programs, a third need is that of preparing people to: (1) develop and generate the instructional programs to be run on a computer; (2) build, maintain, and service the computer as

a machine; and (3) operate and control the entire system, its input and output.¹

On September 29, 1975, the Iowa State Advisory Committee on Educational Data Processing, chaired by the Superintendent of Public Instruction, reviewed procedures for developing and writing a statewide plan. Following the meeting, an ad hoc task force was formed composed of Iowa education administrators and computer specialists. The task force was charged with proposing a plan outlining a structure to coordinate the statewide development and use of electronic computers for education services in Iowa.

Concurrently with the changes in Section 273 of the Iowa Code dealing with the structure for delivery of educational services, changes were made in the Iowa Administrative Code. A new chapter, Chapter 55, was added to implement the authority of the State Board of Public Instruction to improve, coordinate, and supervise the use of the computer in education in Iowa (K through 14). The rules became effective January 19, 1976.²

Of special importance to this study was the legal definition of "instructional application" provided by Chapter 55.

¹Iowa Plan for the Statewide Use of the Computer for Education, p. 1.3.

²Iowa Administrative Code, State Board of Public Instruction, Chapter 55, January 19, 1976.
55.3(2)* "Instructional application" shall mean computer-based services which provide for use of the computer for instructional purposes in each particular educational unit in the state. These services may include, but are not to be limited to the following:

A. Computer-assisted instruction
B. Computer-managed instruction
C. Problem solving
D. Programming
E. Career and vocational education

A review of Title III and later Title IV-C records at the Iowa Department of Public Instruction revealed funding for two instructional computer centers in Iowa: Mason City Community Schools and Luther College Consortia.¹

Some "programming" instructional services were being provided by joint county school system computer centers in the late sixties notably from the centers located in Polk, Linn and Scott Counties. Most Iowa high schools with microcomputers are now able to offer programming courses. This study was concerned with the support needs that local district micro users perceived. Computer related services were no longer restricted to a few local schools in the state. The vast majority of Iowa's K-12 systems offered some level of computer related instruction to their students.

Title III Evaluation Reports (1973-1974) from Mason City Community Schools noted some 600 CAI programs

¹Iowa Department of Public Instruction, Curriculum and Instruction Division, Title III/Title IV Office, Final Reports 1960-1975, Grimes State Office Building, Des Moines, Iowa, 50319.
available to 3-12 grade students via twenty-six interactive terminals. A Title IV-C Evaluation Report (1976-1977) notes considerable effort toward the development of computer-managed instructional services using test item banking, test scoring and analysis services with pilot teachers in the district.

The 1977 and 1978 Annual Program Plans submitted by the newly formed Area Education Agencies included a specific chapter on computer services to be provided local school districts. At least five AEAs projected CAI/CMI services to their constituents (especially using C ISI-Career Information System of Iowa) in center-based operations or through mobile computer terminals tied to the Department of Public Instruction's Hewlitt-Packard computer.

About 40 percent of the local school districts in the state provided some level of interactive computer-related instruction. Projections for expansion of these services, contained in the annual reports of the area education agencies, showed that the new regional agencies were planning considerable activity in computer services. The

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2 Annual Program Plans 1977, 1978, submitted by fifteen Area Education Agencies of Iowa to the Iowa Department of Public Instruction, Director of Statewide Data Processing Service, Dean Crocker.
computer centers located at Mason City Schools and at Luther College were radically reorganized to include governance in part or in full by the AEA. AEA activity in computer applications was prompted by needs studies of local school districts in each AEA. Local schools wanted instructional and administrative computer services at a reasonable cost. Such services were ideally suited to regional governance and administration.

Subsequent to the governance redesign, the centers began expanding services to all local school districts in Areas 1 and 2 which had not had access to regular full-time on-line service. Mainframe equipment and communication acquisitions of AEAs 1, 2, 5, 10, 12 and 15 were planned for center-based CAI/CMI functions. Major efforts at expanding administrative services across the state, while politically caustic, did foster growth in the CAI applications.

In 1979-1980 422 microcomputers were reported to be in use in the state.¹ The failure of many local school districts to seek state board approval to purchase microcomputers and also the failure of many local districts to report their micro purchases formally to their area education agency made these statistics unrealistically low. The five-year projections contained in the AEA's annual reports

¹Telephone interview with Dean Crocker, Iowa Department of Public Instruction, Director of Statewide Data Processing Services, November 13, 1981. Permission to quote.
reflected a growing interest in and acceptance of the microcomputer. Micros were to be used in lieu of or in addition to the existing center-based services provided by the AEA service/delivery centers. Increases in telephone line costs, increases in rental of communication devices (multiplexers) and the rising costs of well-trained personnel seemed to be forcing some AEAs and local districts to seek alternative means of providing computer related instructional capacity to their students. The microcomputer appeared to be the answer.

In summary, school systems in Iowa have had very limited access computers for instructional applications. A statewide plan developed in the early 1970's was more concerned with preventing the proliferation of equipment than in providing Iowa students the opportunity to use the computer as an instructional tool. Computer-assisted instruction/computer-managed instruction capacity was provided to relatively few Iowa students in the period from 1960-1970 through federal grants and through the larger joint-county school agencies. The development of fifteen well-financed area education agencies whose major goal was to provide equalized educational opportunities to all Iowa students regardless of geographical location prompted a renewed interest in CAI/CMI services in the mid to late 1970's. Teacher training and software for these services was better provided by the broader based regional agencies.
than was possible through the previous local district efforts.

While the cost of hardware was falling, the cost of telephone communications and trained staff increased substantially in the period from 1975-1979 causing many center-based computer services in Iowa to re-examine their service delivery systems. The advent of the micro provided a clear alternative. Educators who desired instructional computing services could receive them without political harassment by purchasing a microcomputer.

This period did provide a clear mandate from Iowa educators that services for computer literacy as well as for instructional and administrative applications had a priority for both regional and state level agencies. The statewide plan identified that people-training and software development, acquisition and maintenance were critical factors that would need resolution before Iowa educators could use the full capacity of the technology available.

**The Microcomputer in Education**

*Time Magazine*'s February 20, 1978, cover story introduced millions of people to the microprocessor and the microcomputer. The role of the microcomputer in education was summarized in the article by California author Robert Albrecht:

In schools, computers will be more common than carousel slide projectors, movie projectors and
tape recorders. They'll be used from the moment schools open, through recess, through lunch period, and on as far into the day as the principal will keep the school open.¹

Larry R. Smith in "Microcomputers in Education," an article published in Monitor magazine (November, 1979), traced the development of the microprocessor chip. Growing from the initial Intel Corporation 4004 computer on a chip in 1971 with the capacity of only 46 instructions, the chip's capacity quickly doubled and then doubled again within a span of fifteen months. The Intel 8008 (used in the first Apple and TRS-80 Microcomputers) microprocessor continued to grow in functional utility and sophistication. More recent developments by Zilog, Inc. (Z-80 chip) and the Motorola MC6800 have expanded the byte capacity and instructional load of the initial Intel 4004 many times.²

It was not until January 1975 when Popular Electronics published an article that the microcomputer became a household reality. With a headline "The Most Powerful Minicomputer Project Ever Presented--Can Be Built for Under $400," the authors offered a build-it-yourself-kit using the Intel 8008 chip as the heart of the system. The authors hoped to sell several thousand kits over a


three-year period. The first month's orders tallied over three thousand and the demand grew. Indeed, the MITS Company in making its initial offer of the Altair 8800 began the microcomputer business. The price of the Altair's 8008 chip was just under $450 in January 1975. In less than three years, the price fell to under $10.¹

The relatively low cost and portability of the microcomputer made it well suited to educational applications. As documented in later sections of this study, one of the most used rationale in securing a micro for Iowa's schools was the ability to move the machine from classroom to classroom. Of course, the cost was very attractive also. Many Iowa schools purchased their own micro system for less than the annual cost of having a terminal tied to a center-based system.

"Cost reductions resulting in advancements made in the microprocessing technology have put CAI hardware within the reach of the public school budget. In addition, advancements in courseware development have made it possible for children to make significant gains in basic skills by using CAI," wrote Don Marston in a report prepared by the California State Department of Education in 1977 entitled "The Uses of Computer Assisted Instruction in California

¹Smith, p. 20.
Public Schools: Computers for Learning."¹

John F. Huntington in Educational Technology (May, 1979), published an exhaustive article, "Microcomputers and Computer Assisted Instruction" which provided a review of existing microcomputer hardware options. The article was a consumer's guide for shopping in the micro industry.² Iowa educators as elsewhere in the country were in the market for micros.

The October, 1979, edition of Educational Technology was a special issue dealing with microcomputers in education. It contained a "Glossary of Terms Useful in Dealing with Microcomputers" (the definitions in Chapter 1 of this study are taken largely from this work). The glossary was compiled by Charles H. Douglas and John S. Edwards.³ This "first" effort at providing educators with meaningful and understandable definitions of otherwise technical terms was reprinted widely. Training of educators was the essence of this study. A common vocabulary was and is basic to the training effort.

In the same issue, Charles L. Blaschke addressed the


²Huntington, p. 34.

³Douglas and Edwards, p. 57.
problem of software. In "Microcomputers Software Development for the Schools: What, Who, How?" Blaschke expressed his frustration with what he considered the "bottleneck" in the effective use of the micro in education—software development. Writing quality software for instruction was time consuming and requires both educational expertise and programming knowledge. Software prepared for one brand of hardware would not operate on any other brand of equipment. According to Blaschke, for every ten minutes of quality instructional software, at least ten hours of professional development has been invested. Because no one brand of microcomputer equipment had surfaced as a leader, commercial producers, especially textbook companies, were hesitant to risk substantial investment in software development. Hence, micro users were required to produce their own software or establish software exchange groups in order to broaden their micro software libraries. The lack of an effective marketing and distribution system further disrupted the flow of quality software to schools. Blaschke noted that some regional service agencies (AEA) had initiated software development and distribution on a small scale. He encouraged that activity. This study sought Iowa user information regarding software needs, including development and distribution.

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"Educational institutions generally are not actively planning a programmatic approach to microcomputers. Instead, there appears to be a 'hit and miss' approach to this new technology." With this statement, Laurel Dickinson and William Pritchard introduced "Microcomputers and Education: Planning for the Coming Revolution in the Classroom" contained in the same issue of Educational Technology. The authors contended that this first generation of micros will spawn even more, more powerful learning machines which will, to some degree, replace educators for purely economic reasons. Dickinson and Pritchard pleaded for sound reasoning and planning in adopting micros in a school setting. They reminded readers that hardware was the least expensive aspect of a computer operation, with teacher training and software the essential factors in making the machines work for learning. This study was designed to seek the perceived needs of Iowa micro users. Dickinson and Pritchard cited studies in the state of Florida which outlined the gaps between teacher training and proper utilization of the technology.

The entire October, 1979, edition of The Practitioner provided school administrators with microcomputer information. "Most secondary schools are likely to own at least one microcomputer within the next few years," predicted

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1 Dickerson and Pritchard, p. 5.
the editors. The article proceeded to define a micro, gave consumer tips and reviewed applications from CAI/CMI to attendance accounting. A comprehensive list of users groups and organizations was also provided, along with specific model sites where technology was being applied. The edition concluded:

Should a school have microcomputers? The authors believe the answer is "yes" for at least two reasons: (1) the potential for the use of computers in various aspects of education is now greater than ever with the microcomputer revolution and (2) educators must accept some responsibility to acquaint students and parents with the critical need for computer literacy in our contemporary world. Proliferation of microcomputers (and larger computers) will continue. Andrew Roman estimates that "by year-end 500,000 home-type computers will be in offices, laboratories, and classrooms." According to Richard Fowkes, industry sources predict that the education field alone will spend in excess of $400 million on microcomputer hardware and $200 million on software programs. Educators should not ignore the implications of the microcomputer revolution. Andrew Molnar of the National Science Foundation sees computer literacy as the next crisis in American education. Only a few years ago most educators felt that the role of computers in education would be defined sometime in the future. Microcomputers have changed all that--the future is now.¹

The editor of Educational Technology (November, 1979), in the "Technically Speaking" column, reflected on the people aspects of the micros in education:

One does not take on computers without first engaging in critical thinking about the possible long-term effects of such a move. One does not buy hardware without first thinking of software availability, and problems of scheduling, and

¹Milner and Hargan, p. 12.
questions of teacher retraining, and student evaluation, and guidance and counseling implications and teacher union problems, and fiscal accounting, etc.

What is being said here is that the initial cost of a microcomputer, while so small as to be trifling—in some instances, less than the cost of one week's salary for one teacher to buy a complete system which can last for many years—the fact is that hardware cost is but a mere fraction of the total real cost of moving into computers. Let us not fool ourselves about this. Software costs must be higher than the original hardware costs, if anyone is to get anything out of the hardware. And then we have the numerous other ancillary costs, as implied above.

Indeed, this study was aimed at identifying what teachers perceived as the critical factors in using micros as effective teaching tools.

The Association of Educational Data Systems, Fall 1979, AEDS Journal, included an article by Earl Keyser, CAI consultant with Northern Trails Area Education Agency in Clear Lake, Iowa, entitled "The Integration of Microcomputers into the Classroom or Now that I've Got it, What Do I Do With It?"

Integration of the microcomputer into the classroom is, or will soon become, a major problem for many teachers. Having had little or no input into the selection of the microcomputer, teachers will be forced to deal with the device in an instructional setting. This paper attempts to provide a few examples of the microcomputer in the classroom, emphasizing the advantages of the small machine. The paper further notes the availability of tools to create instructional materials on the

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microcomputer, such as author language, PILOT. It is noted that the principle limitation of microcomputers is the imagination of the user.¹

The 1980 national convention of the Association of Educational Data Systems held in St. Louis, Missouri, saw many presentations on the impact of the micro on education. Of the forty-five papers contained in the convention proceedings, over half concerned the use of the micro. Willis Jokela of the Minnesota Educational Computing Consortia noted in "Microcomputers in the Elementary School: What Experience has Taught Us So Far" the importance of teacher-user preparation and training. MECC used a building coordinator who then provided on-site training to other educators in a given school building. Outside consultant services were available for additional training upon call. Unlike the secondary counterparts, elementary teachers seem to have both greater anxiety prior to use of the machine and also greater flexibility after the anxiety had been conquered.²


¹Earl L. Keyser, "The Integration of Microcomputers in the Classroom or Now That I've Got It, What Do I Do With It?" AEDS Journal, XIII, No. 1 (Fall, 1979), 113.

²Willis Jokela, "Microcomputers in the Elementary School: What Experience has Taught us so Far" (paper presented to the AEDS National Convention, St. Louis, Missouri, April 13-16, 1980).
as he surveyed in person the micro in K-12 schools and teacher preparation institutions. Gleason cited the lack of teacher preparation, poor software with poor documentation and a general lack of computer literacy within the school community from the teacher education institutions to the local school administration to the teacher-user as the major obstacles to improved integration of the micro as a significant teaching tool. Gleason was optimistic on improved hardware capacity in the future. He was hopeful that additional support services and teacher training at the pre-service and in-service levels would help make the transition of the microcomputer as a real educational innovation.¹

Perhaps the most farsighted expert on the learning potentials of the micro is Seymour Papert. He suggested in *Mindstorms* that the act of programming the micro may be the process in which students can become more active and self-directed in the learning process. Students progressing through a simplified programming language (Logo) were identified as one method of increasing formal thinking patterns at a younger age. Such formal thinking is a goal of Piagetian philosophers. He was critical of educators who would regulate the use of the micro as a tool for content instruction, when in fact it might be used as the substance

¹Gleason, p. 7.
of both mathematical and literary training. Papert suggested that the micro is more than a tool for content, it is the very content itself. This potential exists, Papert believes if the standard use of BASIC language—a language of tradition—could be replaced by LOGO. When such a change in programming language and people's perspective is achieved, the "old mix" of traditional instructional methods with new technologies will give way to a radical change in education itself. That change would be toward a more inward, private act of self-education, producing creativity and expanded imagination.  

Much of the literature suggested that the present microcomputers are but a beginning in a new and exciting hardware development age. The Dallas Morning News, on May 3, 1981, reported extensively on Scott Instruments Corporation research in the development of a peripheral device called speech recognition. The new device would allow computers to hear and react to the spoken word. The device was expected to be on the market in early 1982.  

Micros in education are likely to increase in the coming years. Their impact is yet to be measured. By
documenting what the perceived needs of the first generation of users are and have been, the next generation of teachers may be more prepared to use the micros effectively. So, too, pre-service institutions may address the identified needs prior to placing teachers into local schools. This study has documented those needs.

In summary, the short six-year history of the microcomputer has had a considerable impact on education in the United States. Because of their relative low cost, portability and capacity to be dedicated to an instructional function, micros became a common feature of many K-12 school systems. Educators predict that in a few years every high school in the country will have at least one micro. With these predictions came advice that teacher training and software must be provided if schools were to gain optimal advantages from the technology. The essence of this study was to document the training needs of current users as well as their support service needs—the factors beyond hardware that allow the micro to be used as an effective teaching/computer literacy tool. The first generation of micro hardware and microcomputers in schools is just now in business. The following generations are yet to come.

The Microcomputer as an Instructional Tool in Iowa

The first instructional microcomputer probably was used in an Iowa classroom in the fall of 1976 according to
Earl Keyser, formerly CAI consultant with Northern Trails Area Education Agency.\(^1\) Instructional computing consultants from Iowa's Area Education Agencies, did not formally meet as a group until the fall of 1977. The first such meeting of support service providers was called by this author in October, 1978.\(^2\) Sixteen persons from institutes of higher education, area education agencies and local schools met on the campus of North Iowa Area Community College as the guests of Northern Trails Area Education Agency and the Area Two Educational Computer Center. The purpose of the meeting was to establish an informal sharing network among the instructional service providers of the state. While microcomputers were discussed briefly at the first meeting, center-based support services were the major agenda items. Quarterly meetings of the group increased the number of persons in attendance and the amount of time dedicated to the discussion of micros.\(^3\)

By October, 1979, the instructional computing group began discussing the need for a software clearinghouse for

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\(^2\)Letter from Dennis Schrag, Director, Educational Services, Northern Trails Area Education Agency, October 4, 1978.

\(^3\)Minutes of Council for Instructional Computing in Iowa, October, 1977 through December, 1980.
micros, the need to standardize equipment and methods of software documentation. Informal software exchanges among members of the group began, who in turn distributed this software to local users. The need for a formal software clearinghouse grew increasingly attractive.

On November 1, 1979, Dale Nimrod, Director of the Area One Computer Center sent a letter to Dr. Robert Benton, Iowa State Superintendent of Public Instruction, on behalf of the instructional computer consultants. The letter asked Dr. Benton to initiate discussions with the Minnesota State Superintendent to gain access to Apple Computer software developed by MECC. With such an agreement "...we could start our clearinghouse with the programs, resources and publications developed in Minnesota." An agreement was signed between the Council for Instructional Computing in Iowa and MECC in the fall of 1980. Distribution of the MECC software provided some 200 well-documented instructional programs for Iowa Apple computer users. The MECC software was jointly financed by local users and the AEA's.

In November of 1979, a telephone survey of AEA's, conducted by Earl Keyser, Northern Trails Area Education

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1 Letter from Dale Nimrod, Director, AEA 1 Instructional Computer Network to Robert Benton, Superintendent, Iowa Department of Public Instruction, November 1, 1979.

2 Minutes of (CI) Meeting, December 16, 1980.
Agency (NTAEA), found 298 microcomputers in Iowa's schools. Mr. Keyser's information is summarized in a letter dated November 21, 1979, sent to John Bahum, an Iowa Legislative Research Assistant. The survey was made at the request of the Council for Instructional Computing in Iowa as an initial step in collecting information on the need of a statewide microcomputer software clearinghouse.

In February, 1979, the Council for Instructional Computing in Iowa (CI)² adopted a formal status with a charter and bylaws. A major goal was to establish legislative support to finance a statewide software clearinghouse.²

Subsequently, a brochure distributed by (CI)² and developed by NTAEA noted that a clearinghouse would provide: (1) a center for collection and dissemination of existing computer programs; (2) a source of production for program documentation: manuals, course guides, instructional materials; (3) a method for distributing new instructional programs. A clearinghouse would affect 165,000 school children and 9,900 teachers in 134 districts using 297 microcomputers.

The brochure reprinted the (CI)² position paper:

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¹Earl L. Keyser, letter to John Bahum, Iowa Legislative Research Assistant, November 21, 1979.

²Minutes of (CI)² Meeting, February 4, 1980.
Students in Iowa classrooms are enthusiastic about computer-assisted instruction. This enthusiasm often leads them to work on computer-related lessons for extended periods of time, even beyond the school day. What is learned through such an experience, however, is dependent upon the quality of the computer materials used.

Educators in Iowa are acquiring computer materials in any way they can: writing programs, exchanging programs, and purchasing programs. But individual efforts are often duplicated with written materials describing the optimal use of most programs being totally unavailable. Quality control is non-existent. Teachers are making valiant efforts to resolve these problems, but the efforts are as individuals, the results are haphazard and inefficient.

Documentation of programs by objective and dissemination of catalogs of documentation is a prerequisite to efficient, successful use of computer materials in an instructional setting. Lack of this documentation is the largest problem in obtaining instructional computer programs. The problem increases manyfold with the advent of microcomputers.¹

Cooperative agreements among Area Education Agencies in the state helped local districts secure hardware for the best possible price. Noting that Minnesota through MECC established a state price for Apple Microcomputers, Northern Trails Area Education Agency through its cooperative purchasing program, sought bids for Apple Microcomputers and provided the structure for the first statewide purchase.

¹ "A Proposed Clearinghouse for Instructional Computing Materials" (brochure distributed by the Council for Instructional Computing in Iowa, February, 1980).
In the months following, Losses Hills Area Education Agency working with the Educational Service Units of Nebraska, secured prices for Apples and Pets and distributed that information statewide. Cooperative purchasing arrangements for hardware continues today.

The Iowa Department of Public Instruction Legislative Request for 1979 included a line item budget requisition for $134,000. The funds were to be used to contract a statewide clearinghouse for instructional microcomputer services. The request was contained in a larger request for funds for administrative data processing services and coordination. A downward slide in the state's economy, tense political in-fighting over the administrative services and poor information documenting the needs of micro users in the state halted the request in committee.

Based upon the 1980 Annual Data Processing Program Plans submitted to the Iowa Department of Public Instruction, Dean Crocker, Director of Statewide Data Processing Services, estimated that there were 645 micros in the state distributed among 356 local school districts. Other than the

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1 Records of Northern Trails Area Education Agency Cooperative Purchasing Program, Jenny Klune, Coordinator.

2 "Legislative Requests," Iowa Department of Public Instruction, 1979.

3 Telephone interview with Dean Crocker, Iowa Department of Public Instruction, Director of Statewide Data Processing Services, October 30, 1981.
cooperative efforts of the Council for Instructional Computing in Iowa with one another and with MECC for software sharing, little coordinated efforts at planning the role of the micro in Iowa's educational future was in place.

In summary, the use of the micro computer in Iowa's K-12 school systems has increased at a rapid rate over the past four years. Area education agency personnel have worked together to help provide some technical assistance, cooperative purchasing and software services to micro users. These services vary from one area to another due to the size and level of support services available from each regional agency. Iowa does not have an action plan for addressing the current needs of micro users in the state. Other than a hardware count, there was no formal statewide documentation on what the perceived needs of instructional micro users are.

It is safe to assume that support services to address the technical, instructional design and personal needs of instructional users will be the critical factor in delineating the success of existing computer use within Iowa schools as well as the expanded use of the computer within Iowa education. Such documentation is the essence of this study in subsequent chapters.
Chapter 3

METHODOLOGY

Population

The population of this study consisted of selected Iowa teachers using the microcomputer for instructional applications in K-12 settings. In May, 1981, each area education agency director of educational services was asked to identify three typical instructional microcomputer users in their region. No further descriptors were given other than the words "typical" and "instructional." Educational services divisions have legal responsibility for reporting annually to the Iowa Department of Public Instruction the school districts in their area which own computing equipment. Many of the educational services divisions provide some level of support service to their microcomputer users. Therefore, educational service directors have first-hand knowledge of instructional users. On a form provided (shown in Appendix A), the directors were asked to supply the name of the teacher-user, the user's school district, building, address and telephone number, and the name of that building's principal.

From the initial sample of forty-five "typical"
microcomputer users identified by the directors of educational services, thirty-seven agreed to participate in the study and were subsequently interviewed. Eight substitute users were identified, five of whom were nominated by their respective area education agency. Because of logistical problems, the remaining three interviewees were randomly selected from a composite list of schools in each respective area. Three users were interviewed from each of the fifteen areas of the state. The teaching assignments of those interviewed are presented in Table 1.

Table 1
Teaching Assignments of Interviewees

<table>
<thead>
<tr>
<th>Number of Interviewees</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Second Grade</td>
</tr>
<tr>
<td>1</td>
<td>Third Grade</td>
</tr>
<tr>
<td>1</td>
<td>Fifth Grade</td>
</tr>
<tr>
<td>1</td>
<td>Sixth-Eighth Grade Media</td>
</tr>
<tr>
<td></td>
<td>Specialist</td>
</tr>
<tr>
<td>4</td>
<td>Sixth-Eighth Grade Math</td>
</tr>
<tr>
<td>1</td>
<td>First-Eighth Learning Disabilities</td>
</tr>
<tr>
<td>1</td>
<td>High School Vocational Agriculture</td>
</tr>
<tr>
<td>2</td>
<td>High School Business Education</td>
</tr>
<tr>
<td>21</td>
<td>High School Math</td>
</tr>
<tr>
<td>11</td>
<td>High School Science</td>
</tr>
<tr>
<td>1</td>
<td>High School Social Science</td>
</tr>
</tbody>
</table>
Instruments

A structured interview was developed borrowing items from a film-users survey compiled by Dr. Clifford Ehlinger, Media Director, Grant Wood Area Education Agency, Cedar Rapids, Iowa. These items were adjusted so as to reflect microcomputer related instructional design factors. A copy of the Grant Wood Survey is shown in Appendix B.

Additional items were developed from materials originating from the Concerns-Based Adoption Model Project (C-BAM) of the University of Texas Educational Research and Development Center. C-BAM was initiated to aid educational facilitators responsible for guiding innovations (change) toward successful implementation and integration into a school's existing curriculum. The C-BAM materials were used as a guide for some items in the structured interview. C-BAM is a United States Department of Education Validated project and is contained in the National Diffusion Network. A copy of the C-BAM Instrument is shown in Appendix C.

The interview was divided into six sections: (1) Demographics, (2) Hardware, (3) Technical Assistance, (4) Software, (5) Instructional Design, and (6) Personal Considerations. Interview items addressing the user's preferred source and mode of support services were included with the specific request to identify needs in each of the sections except demographics.
A rough draft of the structured interview plan was reviewed and critiqued by two computer-assisted instruction consultants from two area education agencies. It was further reviewed by the members of the researcher's doctoral committee. A revised interview instrument was pilot tested with three teachers using both telephone and person-to-person administration. Pilot testing was used to determine the length of the interview, clarity of questions, suggestions and general reactions to the instrument. It was determined that valid information could be collected using either telephone or person-to-person administration. The preferred means of administration was person-to-person because of the expected length of the interview. In the pilot testing, teachers interviewed in person appeared to be more relaxed. These pilot interviewees also provided greater detail to the open-ended questions. A final draft of the interview plan was developed incorporating the word changes recommended by the pilot users.

The letter to the prospective interviewees and the response card format are shown in Appendices D and E respectively. A copy of the structured interview is shown at the end of this chapter and in Appendix F.

Data Collection

Each of the forty-five teacher-users was sent a personal letter on October 1, 1981, outlining the nature of the
study and the nature of the structured interview. The teachers were asked to return a postage-paid postcard containing the preferred time and day to be contacted by phone to establish an interview date and time. A copy of the structured interview instrument was sent so that each teacher-user in the sample could prepare for the interview. A carbon copy of the letter was sent to each prospective interviewee's building principal.

Interview dates were established via telephone. Interviews were conducted between October 15 and November 4, 1981. Permission to tape record each respondent's comments was secured at the time of the interview. All interviews were held in person with the exception of four telephone interviews held because of logistical conflicts. Respondents and the identification of their respective school districts were assured of anonymity.

Data Analysis/Presentation

Responses to the forty-five interviews were compiled and tallied according to each of the interview questions. Within each of the five sections of the interview, central tendencies were identified. Like responses were tallied and translated into percentages. In some cases individual responses were reported when they provided a unique point of view on a specific issue or question. Each section of the interview has been assigned a respective section in the
following chapter with demographics and hardware inventory data combined. Direct quotations from the interviews have been provided to selected questions or issues so as to provide a sample of the interviewees' intensity.

Two graphs were prepared to illustrate the following information:

1. Microcomputer Hardware Inventory by Brand.
2. School Year when First Micro was Available.

Some information has been presented in chart form. Some discrete information was organized in terms of percentage of the sample along with the actual number of users responding to each foil. For example, users were asked to identify the percent of their software which was documented. A table was prepared listing in descending order the percent of documented software identified by the users. Accompanying that data was the number of respondents listing each percentage of documentation and then the percentage of the sample of forty-five users, as shown in the example below.

<table>
<thead>
<tr>
<th>Percentage of Documentation</th>
<th>Number of Users Identifying Documentation Percentage</th>
<th>Percent of Sample</th>
</tr>
</thead>
</table>

During the structured interview, respondents were asked to provide their first and second preferences as to mode and source of addressing identified needs. The source or mode was listed and the corresponding percentage of users identifying each as a first choice and then as second choice was
organized as follows:

<table>
<thead>
<tr>
<th>Mode/Source</th>
<th>Percent-First Choice</th>
<th>Percent-Second Choice</th>
</tr>
</thead>
</table>

Several of the questions in the structured interview were open-ended allowing for multiple answers. Some data was presented in table form listing the various responses of the users and the corresponding number of users identifying that response. No percent of sample was given in these cases. For example, technical needs of users were identified. Some respondents had more than one need. All needs were reported and all user responses were listed with the corresponding need as follows:

<table>
<thead>
<tr>
<th>Identified Need</th>
<th>Number of Users Listing Need</th>
</tr>
</thead>
</table>

All other data was organized in terms of percentage rankings. Some of the data also include the number of users from the forty-five respondents, listed in parentheses to clarify or emphasize the percentage listings.

At the end of the five sections of Chapter 4, a summary of the data contained therein was arranged so as to present a profile of the "typical" user. These profiles, when combined, provide a state-of-the-art sketch of the typical instructional microcomputer user in Iowa as of November, 1981.
Dear Microcomputer User:

Thank you for agreeing to participate in this structured interview concerning your involvement with the microcomputer in education. The thrust of this interview is to determine what support services and needs selected instructional micro users in Iowa may identify. Results of the survey will reflect only statewide data. Individuals responding will NOT be identified in any way. There are no right or wrong answers—only your valued opinions. Before the interview I will ask your permission to audio tape record your responses. The interview will take about 15-20 minutes. Your direct and frank opinions are requested. Thank you for your help and time.

Dennis Schrag

Section 1: Demographics

User's Name ___________________________ Date ___________________________
School District ___________________________ AEA# ___________________________
Building ___________________________ Phone ___________________________
Address ___________________________ City ___________________________

Subject/Grade taught using micro ___________________________
Number of micros in building ___________________________
Number of students in building ___________________________
Where is the micro physically located in the building? ___________________________

How many of your students use a micro as part of their instruction?
Is the micro used for: Computer Literacy

Content Instruction

Section 2: Hardware

Brand of CPU ___________________________
Month/Year District Acquired ___________________________
Peripherals: ___________________________
Why did the district acquire the micro? ___________________________
Section 3: Technical Assistance

(The following questions seek your response to technical assistance—the help users might receive to assure that hardware and software is used as it should and can be.)

When did you receive initial technical training on use of the micro?
Who provided that training?
Was it satisfactory?
Month/Year began use with students
Since initial training, have you secured additional technical assistance?
What were your technical needs then?
Who provided that assistance?
If you were having technical problems, who would you contact first?
Can you identify any additional technical information/training you would like to receive now? Identify:

Please rank order the following modes of securing technical help:
____ Workshop
____ College credit course
____ Other users
____ Consultant/AEA
____ Vendor
____ Literature
____ Other: specify:

What advice would you offer other educators contemplating the purchase of a micro for instruction regarding the technical training aspects of the machine?

Section 4: Software

Have you written software for your own course objective(s)?

How often do you preview software prior to student use?
Always
Usually
Seldom
Never

Is there a uniform documentation library listing learning objective(s) for the software you have access to?

What percent of the software available to you is documented?
Approximate percent of all software you use by instructional approach:

- % Drill and Practice
- % Tutorial
- % Computer assisted test construction/scoring
- % CMI
- % Simulation
- % Problem Solving
- % Games
- % Guidance
- % Other: ____________________________

As students use the micro, is their work graded/evaluated as part of the course/unit grade?

What is the preferred language for instructional software?

What has been the primary source of the software you have now?

What is your preferred source of new software you may acquire?

- Other users
- Self produced
- Commercially produced
- Non-profit produced (MECC)
- Other: ____________________________

What are the three greatest needs you have regarding software:

What advice would you offer a new instructional computer user regarding software:

Section 5: Instructional Design

(Instructional design is defined as the appropriate mix of student, teacher, hardware, software and curriculum to cause optimum learning. The following questions have to do your instructional design needs and suggestions.)

What percent of your students have benefited by using the micro?

Has some one group of students benefited more? Which?

Does each of your students progress through the same sequence of assigned software?

Has your curriculum changed as a result of the micro? How?
In your opinion, is the micro a toy or a tool? Explain:____
To whom would you turn first if you had questions regarding
the micro and your own instructional design?____
What instructional design needs can you identify now?____

What would be your preferred mode of addressing instruc-
tional design needs you might have. Rank order:
   College class____
   Other users____
   Workshop____
   Publications____
   Consultant/AEA____
   Other: specify:____

What advice of an instructional design nature would you offer
a new microcomputer user?____

Section 6: Personal Considerations
(The following questions seek your opinion and
feelings on the impact the micro has had on you
and those you are involved with.)

What is your overall reaction to the micro?____

How has the micro affected you as a teacher?____

How has the micro affected you as a person?____

How has the micro affected those people you are involved with?
(friends, spouse, other teachers)____

What concerns you the most regarding the micro?____
On the following six questions, would you rate your situation on a scale from one to seven with one indicating the statement is TRUE of you now and seven indicating that the statement is not true or does not apply.

<table>
<thead>
<tr>
<th>Question</th>
<th>Very True</th>
<th>Not True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am concerned about revising my use of the microcomputer.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2. I am concerned about not having enough time to organize myself each day.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3. I would like to familiarize others with the progress of the micro.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>4. I feel good about my use of the micro and anticipate few changes in my current operations.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5. I have some good ideas that need to be tested to get better results from using the micro.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6. I am concerned about the conflict between my micro interest and my professional and family (friends) responsibilities.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

What personal advice would you offer a new instructional micro user? ____________________________________________________________________________

Thank you very much. I would be happy to send you a summary of my findings if you would be interested.

Yes        No

Dennis Schrag  
5502 Ingersoll  
Des Moines, Iowa 50312  
(515) 255-7136
Chapter 4

RESEARCH FINDINGS

This chapter has been divided into five sections: (1) Demographic and Hardware Descriptions, (2) Technical Assistance Needs, (3) Software Needs, (4) Instructional Design Needs, and (5) Personal Concerns. Responses were arranged into the five sections for the convenience of reporting information. In actuality respondents did not always recognize discrete categories of needs or assistance.

Demographic/Hardware Information

Eighty percent of the interviewees were high school teachers. Three of the respondents were teachers of lower elementary grades (2-5). Five of the interviewees had teaching assignments in the middle school grades (6-8). Only one teacher was a special education resource room educator.

Each of the interviewees was asked to identify the number of microcomputers in their building and the number of students in their building. The average number of students per microcomputer was 129 students per machine. One school district owned no machines; students and the teacher used personally owned hardware. One high school had eight
micros for a student population of 222. Sixty-nine percent of the respondent teachers noted that their building had at least two micros available for student use.

Access to the microcomputers within the school setting can restrict the use of the machine. For this reason, each user was asked to identify the physical location of the hardware. Fifty-six percent of the respondents (25 teachers) noted that a neutral room/facility was available for the micro(s) in their building. Thirty-seven percent of the users (17 teachers) reported that micros were regularly located in their classrooms. Six and one-half percent of the respondents noted that the micros were on portable carts (3 teachers). Several teachers noted the need for a neutral facility when responding to questions in the instructional design section of the interview. Their reactions will be reported later in this chapter.

Each micro user interviewed was asked how many of their students regularly used the micro as part of their instructional program. The responses ranged from three students to 327 students with an average of forty-nine students per teacher. The median number of students per teacher was twenty.

Table 2 presents the rationale which prompted the purchase of the first micro in the interviewees' district.
Table 2
Rationale for Purchase of First Microcomputer

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Number of Interviewees</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer literacy/programming efforts</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>As an instructional tool</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Improve basic skills</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Replace center-based service</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Administrative decision</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Strong teacher interest</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>AEA-provided</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Special education funds available</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Twenty-six percent (12 users) said that they used the micro exclusively for computer literacy purposes including programming instruction. Eleven percent (5 users) indicated that the machines were being used for subject content instruction exclusively. Sixty-two percent of the users (28 respondents) noted that both computer literacy and subject content purposes were being addressed by the micros.

Comparing the responses to the two questions above, it is interesting to note that micros initially purchased for either instructional purposes or for literacy/programming purposes have been employed to perform both functions. This expansion indicates that micros appear to attract new usage functions as educators become familiar with various applications.
Figure 1 and Table 3 present an inventory of micro hardware of those interviewed. Eighty-five percent of those responding used the Apple Microcomputer (or the Bell and Howell version of the Apple). Most of the users had access to a hard-copy printer (84 percent). Sixty-five percent had dual disk drives. Fifty-nine percent of the teachers interviewed noted that a color monitor was used with the micro. The availability of a mark-sense card reader, Pascal language card, a graphics tablet or the voice simulator was limited to one respondent each.

![Micro Hardware Inventory by CPU Brand](image-url)
Table 3
Peripheral Equipment Available

<table>
<thead>
<tr>
<th>Equipment Available</th>
<th>Number of Interviewees</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard copy printer</td>
<td>38</td>
<td>84</td>
</tr>
<tr>
<td>Dual disk drive</td>
<td>29</td>
<td>65</td>
</tr>
<tr>
<td>Color monitor</td>
<td>26</td>
<td>59</td>
</tr>
<tr>
<td>Mark-sense card reader</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Pascal language card</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Voice simulator</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Graphics tablet</td>
<td>1</td>
<td>2.2</td>
</tr>
</tbody>
</table>

One area education agency loans the Apple Graphics Tablet for use for a period of two weeks per user on a first-come-first-served basis. The expanded use of graphics is mentioned several times as a need in later sections of this chapter. For users who may wish to author their own software using graphics to illustrate it, the graphics tablet provides a fast and effective means of producing visuals.

Each user was asked when they first had regular access at school to a micro for their instructional use. Figure 2 presents the findings of that question: 65 percent of the users interviewed had acquired access to the school micro within a two-year time frame. Ninety-three percent of the users had had access to a micro in the school setting.
for three years or less.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-1982</td>
<td>6%</td>
</tr>
<tr>
<td>1980-1981</td>
<td>22%</td>
</tr>
<tr>
<td>1979-1980</td>
<td>37%</td>
</tr>
<tr>
<td>1978-1979</td>
<td>28%</td>
</tr>
<tr>
<td>1977-1978</td>
<td>4%</td>
</tr>
<tr>
<td>1976-1977</td>
<td>3%</td>
</tr>
</tbody>
</table>

Figure 2
School Year When First Micro was Available

Student use of the micros can be estimated to be from three to six months less than reported for the teachers interviewed. In the next section the technical training received by teacher-users will be reported. It will be noted that many teachers used the micro for their own training, prior to using it with students. About 45 percent of the users noted that their self-training on the technical use of the hardware took between five and eighteen months. During this time, students were not able to use the hardware.

Summarizing the demographics and hardware information collected from the forty-five users, a profile of the typical user can be sketched. The typical microcomputer teacher is likely to be a math teacher in a small Iowa
high school. Equipped with an Apple Microcomputer with a printer, dual disk drive and color monitor, the machine is used for computer literacy/programming as well as regular course content instruction. About twenty students regularly use the micro as part of their instruction. The first micro available in the school was acquired within the past twenty-four months. Two machines are now available. The micros are physically located in a neutral room within the school building.

Technical Training Needs

The respondents expressed strong feelings about the technical training necessary to operate the micro hardware. One high school math teacher explained:

The more you know that hardware, the more you can make the machine do what you want it to, the more satisfied you will be about using the micro with students.

A high school science teacher noted:

You cannot learn it out of a book. I had the manuals two months before the machine arrived. You have to have hands-on experience before you can really figure the thing out.

The majority of the instructional microcomputer users trained themselves on how to operate the hardware. Eighty-four percent (38 users) indicated that they learned how to operate their micro by reading the manuals and by working with the equipment. Most of the users said that the process was tedious, frustrating and at times
infuriating—but the feeling of accomplishment was significant once mastered. Two interviewees noted that they received a series of training sessions from their area education agency on the use and operation of the micro hardware. Two other users noted that they received training in graduate level courses aimed at teaching programming. Only one user received training as part of her pre-service training.

Of the thirty-eight users who were self-taught, over half (20 users) noted that they used the machine for self-training prior to using it with their students. The amount of training time varied from several weeks up to one and one-half years use prior to student action on the hardware. Many teachers admitted that initially, many of their students were more aware of the unique features of the hardware than they. As one teacher noted, "The kids had more time and energy and patience to work with the machine. Some of those first year kids really taught me a lot."

Sixty-four percent of the users (29 teachers) indicated that they had sought out and had received some additional training since their initial training on the micro. Several reported more than one course or workshop. The types of training received are recorded in Table 4. The users who received additional instruction after initial training on the micro have been identified in Table 5. This table also presents the sources of that additional
training.

Table 4

<table>
<thead>
<tr>
<th>Type of Training</th>
<th>Number of Users</th>
<th>Percent of 29 Respondents*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC programming</td>
<td>20</td>
<td>69</td>
</tr>
<tr>
<td>Workshop on software production</td>
<td>8</td>
<td>27.5</td>
</tr>
<tr>
<td>Workshop on micro utilization</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Course on data structures</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>Course on file building</td>
<td>1</td>
<td>3.4</td>
</tr>
</tbody>
</table>

*Some respondents reported more than one type of training thus the sum of percentages is greater than 100%.

Table 5

<table>
<thead>
<tr>
<th>Source of Training</th>
<th>Number of Users</th>
<th>Percent of 29 Respondents*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area education agency</td>
<td>13</td>
<td>45</td>
</tr>
<tr>
<td>Community college</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Out-of-state university</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>In-state university</td>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td>Professional organization training program</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Student</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>No one</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Some users provided multiple sources thus the sum of percentages is greater than 100%.
Respondents were asked who they would contact first if they had questions regarding using the hardware as it should be or could be most fully used. The responses to that question are recorded in Table 6.

Table 6
Source of First Call for Assistance

<table>
<thead>
<tr>
<th>Source</th>
<th>Number of Users</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area education agency</td>
<td>20</td>
<td>44</td>
</tr>
<tr>
<td>Vendor</td>
<td>16</td>
<td>35.5</td>
</tr>
<tr>
<td>Other users</td>
<td>7</td>
<td>15.5</td>
</tr>
<tr>
<td>Student</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>No one</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Forty instructional microcomputer users identified some additional technical training needs or assistance they would like to receive now or in the immediate future. These needs are summarized below. In some cases, users identified more than one training need. Responses are recorded in Table 7.

A surprising number of respondents requested additional training in either machine or assembler languages. These languages are very sophisticated. To identify a desire to receive training in these languages demonstrates that some users have considerably more than a casual interest in programming.
Table 7

Technical Training Needs of Micro Users

<table>
<thead>
<tr>
<th>Training Needs</th>
<th>Number of Users</th>
<th>Percent of 40 Respondents*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic equipment repair and maintenance</td>
<td>13</td>
<td>32.5</td>
</tr>
<tr>
<td>Machine language programming</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Assembler language programming</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>Elementary BASIC programming</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>Advanced BASIC programming</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Pascal programming</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>File building</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>How to create graphics</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>RPG-2 programming</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Advances in technology</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Some respondents reported multiple needs thus the sum of percentages is greater than 100%.

Two persons interviewed noted that they had attended a fundamentals of programming class, were intimidated by the math majors in the class, and subsequently dropped the course. These users suggested that a BASIC programming class be offered for non-mathematics majors. One user wanted a quick reference book available which would list specific machine failings and an accompanying "try this" list of possible solutions.

The preferred mode of addressing the above identified
technical needs were further defined by the interviewees and are presented in Table 8.

Table 8
Preferred Mode of Addressing Technical Needs

<table>
<thead>
<tr>
<th>Mode</th>
<th>First Choice Preference</th>
<th>Second Choice Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshop</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>College credit course</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Other users</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>One-on-one consultation</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Vendor</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Publications</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

Several of the users indicated that college credit courses were the preferred mode because it would help move them on the salary schedule. They also indicated a desire to have the class offered off-campus, close to their teaching assignment and with a hands-on-equipment mode.

When asked what advice they would offer to new or potential instructional users, the interviewees offered an array of suggestions. Time to learn the hardware and hands-on experience were the most recommended factors in initial training. Several users suggested taking a class in basic computer literacy and machine operations if at all possible. Many of the suggestions centered around hardware purchases:
Before buying, figure out how the machine is to be used. You don't need an Apple to teach programming.

Availability of repair service should be a major factor in the selection of equipment.

Availability of software should be a major factor in the selection of equipment.

Buy a total system with printer, dual disk and color monitor...you'll need it and it is hard to convince the board twice that the money is well spent.

Many of the users suggested that there be a ready resource person who is knowledgeable, who can be phoned any time during the day or night to address technical/machine questions during the first year of operations.

In summary, the typical microcomputer user was self-taught in learning how to use the microcomputer hardware available. This training period generally consumed several months of time--time that students could have been using the hardware. The typical user has attended a programming course provided by an institute of higher education subsequent to training on micro operations. The user would like to learn more about basic repair and maintenance of their micro as well as additional programming training. The typical micro user would contact an AEA person first for technical assistance, however would prefer to secure additional training from credit granting institutions if possible. The workshop mode is also very attractive. The advice the typical user would offer to a new or potential instructional micro user can be summarized as follows:
Buy equipment after deciding how it is to be used. Extensive hardware is not needed to teach programming. If the hardware is to be used for CAI consider carefully the software availability. Buy a full system with printer and disk drives and save a trip to the school board. Whatever equipment one purchases, know what level of repair service is available. Plan on spending a lot of time and some frustration in learning how to make the machine do what you want it to do. Finally, locate a ready resource person who can help ferret out solutions to problems over the phone.

**Software Needs**

The design of this study centered on the technical and instructional design needs of microcomputer users as well as the personal concerns which affected the use of the micro as an instructional tool. Software issues bridge technical needs and instructional design needs. Instructional software is both machine oriented and educationally significant at the same time. For that reason, this section of the research summary documents the existing software circumstances of users and identifies what software needs users perceive.

Sixty-two percent of the users interviewed indicated that they had written instructional software for their own use. These twenty-eight teachers also noted that authoring good software took a considerable amount of time and energy. Many indicated that they preferred to individualize their courses with personally written software, but the time needed for authoring was not always available. Only one teacher noted that released time was provided in his
schedule to coordinate computer activities in the building.

In lieu of self-authored software, most teachers secured software from their AEA or through a regional users exchange group. Seventy-one percent of those interviewed (32 users) said that the AEA/Minnesota Educational Computer Consortia software was the primary source of software used. Twenty-six percent (12 users) said that self-produced software was the primary software used with students. Seventy-seven percent (35 users) of the teachers interviewed said that they "always" or "usually" previewed software prior to assigning it for student use. As one teacher in north central Iowa noted, "You can't do like you can with films. You never know what the quality of the stuff is, if the title reflects the content of the programming or if the material is too hard or too easy for the individual student's needs. You just have to look at each of those programs yourself and make sure you got what you want."

If the software library is relatively small, physically locating and evaluating a specific program is relatively easy. However, as the number of software programs grows and the depth and breadth of the collection increases, the need for a pragmatic cataloging system becomes apparent. Instructional software is usually documented with information about the specific learning objective addressed, the grade level range for which the software is appropriate, and an example of the instructional mode used to address the
objective. Eighty-nine percent of the users interviewed noted that no uniform software cataloging system was in place. Of the five users who did have a system, three of the users had software exclusively from MECC. The MECC software is fully documented. (Some AEAs have provided the hardcopy documentation for the subscribers of the MECC material distributed in their area.)

When asked to identify what percent of the software available to them was documented with instructional objectives, the users provided the information contained in Table 9.

Table 9

Percent of Software that is Documented

<table>
<thead>
<tr>
<th>Percent of Software Now Documented</th>
<th>Number of Users</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>95</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>90</td>
<td>5</td>
<td>11.1</td>
</tr>
<tr>
<td>80</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>75</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>70</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>25</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>6.6</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>40.0</td>
</tr>
</tbody>
</table>
Each user was asked to estimate the percent of the software used regularly, defined by instructional approach. The sum of all percentage figures provided by the users was divided by the number of factors per instructional approach to arrive at a composite percentage listing of all interviewees. Table 10 shows the percent of software used regularly.

Table 10

Regularly Used Software by Instructional Mode

<table>
<thead>
<tr>
<th>Instructional Approach</th>
<th>Composite Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill and practice</td>
<td>33</td>
</tr>
<tr>
<td>Tutorial</td>
<td>12</td>
</tr>
<tr>
<td>Computer assisted testing/analysis</td>
<td>3</td>
</tr>
<tr>
<td>Computer managed instruction</td>
<td>0.3</td>
</tr>
<tr>
<td>Simulations</td>
<td>15.7</td>
</tr>
<tr>
<td>Problem solving</td>
<td>9.5</td>
</tr>
<tr>
<td>Games</td>
<td>11.5</td>
</tr>
<tr>
<td>Guidance</td>
<td>2</td>
</tr>
<tr>
<td>Other (including programming)</td>
<td>14</td>
</tr>
</tbody>
</table>

Ninety-one percent of the interviewees (41 users) noted that their preferred language for software was their specific machine's version of BASIC. The reason most often cited for this preference was the desire to be able to
adjust the software to meet local needs. The amount of time permitted for a specific response was most often cited as one of the factors that might be altered to meet specific students needs.

Commercial software was not held in high regard by the majority of micro users interviewed. Because commercial software is usually expensive, usually cannot be previewed at the local district site unless accompanied by a salesperson, and because it is usually difficult to adjust, if at all, the interviewees were reluctant to state a preference for the commercially produced software. The preferred sources of future software acquisitions are noted in Table 11.

Table 11
Preferred Sources of Future Software Acquisitions

<table>
<thead>
<tr>
<th>Source of Software</th>
<th>Percent First Choice</th>
<th>Percent Second Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEA/MECC type arrangement</td>
<td>51</td>
<td>17</td>
</tr>
<tr>
<td>Other users</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Self-produced</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Commercially produced</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>No preference</td>
<td>1</td>
<td>29</td>
</tr>
</tbody>
</table>

Each of the teachers was asked, "What are your greatest needs regarding software?" The responses to this
question are divided into three sections: generic needs, training needs and subject-matter-specific needs.

The single most pressing need regarding software was documentation. Twenty-six percent of the interviewees (12 users) said that a documentation system was needed and that individual program documentation was lacking. Thirteen percent of those interviewed indicated that their software library lacked depth. Too few specific instructional objectives could be addressed with computer assisted instructional materials. Four users requested more time to evaluate or produce new software so as to increase the school's holdings. Two non-Apple users expressed a need for additional sources of software. One elementary teacher wanted more animation to accompany existing software and more graphics in general for new software to be acquired.

Software training needs were listed as follows:

1. Training on how to adjust existing software for better local use.
2. Training on how to evaluate software to determine its usefulness and quality.
3. Training to explain to non-micro users what software was available for their courses of study and how they could integrate the use of the micro into their subjects.

The last training need is reflected in a strongly expressed need for subject specific software:

1. Basic skills software in areas other than math. (26 percent of interviewees)
2. Supplemental math software listed by instructional objective with emphasis on problem solving. (17.5 percent of users)
3. Tutorial and/or simulations for upper level science courses such as physics, chemistry and anatomy was requested by two teachers. (5 percent of sample)

4. Farm management software and accounting software (PET) each received one request.

5. One teacher suggested that some language materials be developed for their Southeast Asian students.

When asked what advice regarding software they would provide to new or potential instructional microcomputer users, 37 percent of the teachers recommended previewing software prior to purchase. The availability of software was the subject of much advice. Several teachers suggested that one join a user's group and/or become close friends with AEA or vendor personnel so as to expand the sources of locally produced software. Several users warned that much poor software is available for little or no cost, but takes up disk space and can be more distracting than helpful.

Three users suggested that software with graphics was always preferred as students seem to respond more positively to the animated material. For smaller children, the speed of the character flow and the size of characters as well as the problem of physically typing can create some problems.

One teacher warned future users about overuse: "Like anything else, kids will burn out if you use the micro too much."

In summary, the typical instructional micro user is most concerned about the availability of quality software.
While able to produce instructional software, the user prefers to secure free or inexpensive software that has been produced by educational organizations or personnel. The typical user almost always previews instructional software prior to assigning it to a student. The available software is unlikely to be documented nor is there a uniform documentation system to catalog programs available. The typical software library is likely to be composed of drill and practice and simulation material, however there is a good collection of problem solving and gaming software which is also used extensively. Desired but absent is subject specific software, especially in the basic skills areas.

Most of the software available has come from the AEA/MECC agreement, and this type of arrangement is the preferred one for future acquisitions. Commercially prepared material is not well received; software developed by other educational users is preferred.

The typical user feels a strong need to document the available software while adding software for teachers in subjects other than the user's. The typical user recognizes the need for instructing other educators how they might use the micro for their courses of study. This need was expressed further in the personal concerns section and will be reported again later in this chapter. The interviewees felt so supportive of the instructional use of the micro that they wanted to share the technology with their
colleagues. The typical user would suggest that the software be carefully previewed prior to purchase. Securing software from other users or through AEA or vendors is a good way of expanding the library for a small cash outlay.

**Instructional Design Needs**

As noted in the demographics section of this chapter, microcomputers were reported to have been used for computer literacy as well as content level instructional purposes. How teachers were using the machine and what instructional design needs they identified is the essence of this section. For the purposes of this section "instructional design" refers to the appropriate mix of all factors which lead toward increased student learning. Interviewees responded that the micro is a powerful instructional tool for most students. They believed that some students benefited more from using the micros than did others. Additions to the course offerings of most schools as a direct result of having access to the micro were cited. The teacher-users also identified some specific needs to help make the micro and their use of it more profitable in terms of student achievement.

What percent of the students who use the micro really benefit from that use? The interviewees' responses are shown in Table 12.
Table 12
Percent of Student Micro Users who Benefit from Use

<table>
<thead>
<tr>
<th>Percent of Students Benefiting from Use</th>
<th>Number of Teachers</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td>98</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>95</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>90</td>
<td>4</td>
<td>8.8</td>
</tr>
<tr>
<td>85</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
<td>6.6</td>
</tr>
<tr>
<td>70</td>
<td>3</td>
<td>6.6</td>
</tr>
<tr>
<td>66</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>60</td>
<td>4</td>
<td>8.8</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>40</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>4.4</td>
</tr>
</tbody>
</table>

The composite average of the above percentage rankings indicates that the teacher-users perceived that 69 percent of the students using the micro really benefited from that use. Many of the interviewees noted that the benefits identified included a reduction of computer anxiety, an increased confidence to master technological difficulties and similar holistic effects.

Does the microcomputer benefit one group of students more than another? The teachers interviewed presented scattered opinions on this question. Thirty-seven percent of the respondents (17 teachers) indicated that the higher achieving or gifted students profited most from the micro use. One explanation for this perspective was provided by
a secondary math teacher in central Iowa: "The gifted kids in this school have the most access to the hardware. Before anyone can enroll in the programming course, they have to have completed three years of math including Algebra II. Those students in the programming class have first access to the machine. I guess that we have made it an elitist tool."

Thirty-three percent of the teachers (15 teachers) said that the micro benefited students at both ends of the achievement ladder. The upper level student and the lower achiever were noted as the major beneficiaries. "The CAI stuff really helps the lower level kids and the bright ones are challenged by the programming process," explained one eastern Iowa educator. Another teacher noted that the computer is able to give lots of attention to those who need it the most, the lower level student, the disruptive student and the gifted student. Only 11 percent (5 teachers identified the lower level student as the recipient of the micro's instructional capacity. Eight percent of the interviewees felt that the machine benefited all students equally. Eight percent of the teachers identified the disruptive or unmotivated student as the population best suited to the microcomputer. Neither grade level nor teaching assignment changed the responses to the above question.

Seventy-five percent of the teachers interviewed (34 persons) said that they were individually prescriptive when assigning software for student use. The other 25 percent
of the instructors noted that almost every student progressed through the same sequence of assigned software. It appeared that the micro was being used largely as a supplementary teaching device. When questioned if work on the micro was graded or evaluated as part of a unit or class grade, 60 percent of the teachers using the micro noted that the machine was a tool to help master specific objectives. As such, work on the micro itself was not evaluated. Thirty-four percent of the users indicated that the micro work was regularly evaluated. As noted in the first section of this chapter, 28 percent of the teachers identified the micro was used primarily for literacy efforts. Upon closer analysis, only five of those twelve teachers using the micro for literacy indicated that work on the micro was regularly evaluated for unit or course grades. There appeared to be little agreement among either group of users—the computer literacy teachers or the subject level content teachers—as to evaluating student efforts when using the micro.

Has the micro affected the school's curriculum? Fifty-five percent of the educators interviewed (25 teachers) responded that the micro had made an impact on the school curriculum. The specific listing of changes identified by the teachers is shown in Table 13 (some respondents noted more than one change).
Table 13
Identified Changes in School Curriculum as a Result of the Microcomputer

<table>
<thead>
<tr>
<th>Change in Curriculum Identified</th>
<th>Number of Teachers Noting Identified Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer literacy course added</td>
<td>12</td>
</tr>
<tr>
<td>Programming course added</td>
<td>13</td>
</tr>
<tr>
<td>Data processing in business course added</td>
<td>2</td>
</tr>
<tr>
<td>Increased enrollment in advanced math courses</td>
<td>3</td>
</tr>
</tbody>
</table>

There has been considerable discussion both within and outside of the educational community as to the relative merits of the microcomputer. Often the discussion revolved around the toy-tool dichotomy of the microcomputer. Each of the forty-five teachers was asked: "In your opinion is the microcomputer a toy or a tool?" Seventy-five percent of the teachers emphatically considered the microcomputer a tool to enhance student learning. Twenty-three percent listed the machine as both a toy and a tool. Only one of the teachers interviewed viewed the machine as a toy. When quizzed about the toy aspect of the micro, several of the interviewees expressed the conviction that the machine was whatever the teacher who was using it, expected it to be. Several teachers noted that games were used as rewards. The single special education teacher in the sample noted
that behavior modification programs with students earning use of microcomputer games as rewards was a productive addition to her ability to work with very difficult students. Many of the educators noted the use of games as an excellent means of reducing initial student machine anxiety.

Area Education Agency personnel were identified by 62 percent of the users as the first person to contact for assistance with instructional design problems. Thirteen percent of the interviewees said that they would seek instructional design help from other users of microcomputers. The remaining teachers suggested that vendors, university personnel or publications would be the primary source of instructional design assistance.

When specifically asked to identify their current or anticipated instructional design needs, the users noted the following:

Assistance to introduce the microcomputer to teachers of other subjects within the school. Identifying priority-use software in subjects other than their own was an associated need. (35 percent of responses)

Time to better integrate the existing software into established courses of study. (17 percent of the responses)

Assistance with scheduling students and other logistical problems in making better use of the hardware from a time/task perspective. (12 percent of the responses)

Model computer literacy courses of study guides including one request for a K-12 scope and sequence. One teacher requested software to help teach better computer literacy. (12 percent of the responses)
A separate room or facility for the computer so that greater access and fewer interruptions of class functions could be accommodated. (10 percent of the responses)

More hardware and more software were also indicated as needed by several of the instructors.

Depending upon the identified needs, users selected either a small group workshop or one-on-one consultation with an AEA person or another user as the most preferred modes of addressing their instructional design needs. Indeed the process of introducing the benefits of micros to other staff members was seen as a workshop function.

Machine anxiety and the lack of time were identified informally as the greatest blockades to increased faculty interest. A number of interviewees also confided that they wanted other staff members to be able to use the micro but had mixed emotions on the subject knowing full well that already heavily scheduled hardware would be taxed further with more teacher interest. Additional teacher training was seen by some as counter-productive to continued use by the interviewee's students at present levels.

When asked what advice they would offer new or potential instructional microcomputer users, the responses were scattered. Several teachers noted that new users needed to be prepared to spend time re-designing their classes when the micro was to be used. The process of integrating the micro into existing courses of study demanded some restructuring of traditional methods according to several users.
One user warned that student attention span must be monitored when using the micro as with any other instructional tool. She suggested that some kids just burn out on it faster than others. One teacher noted that specific learning objectives for each class were a prerequisite before the micro and its software could be properly utilized. Another instructor suggested that each piece of software should list the readability of the material contained on the disk (documentation). Finally one teacher advised "Don't be upset when the kids get ahead of the teacher on using the machine."

In summary, the typical microcomputer user felt that the majority of students who use the micro gain some direct benefit from its use. The gifted student and the lower achieving student were identified as deriving the greatest benefit from work on the micro. The typical micro user saw the machine as a tool that can also be used in a controlled environment as a toy when appropriate for student growth. Each student was usually assigned a unique sequence of software in lieu of all students progressing through the same material. Microcomputer usage is not in and of itself graded; it is a means of instructing a specific learning objective. As a result of having the micro available, the typical user's school has added either a computer literacy course or a programming course or both. The typical user would like to share the micro with other instructors but needs assistance in identifying good software that will
address the needs of other teachers. The area education agency is seen as the first support service provider when solutions to instructional design problems become identified. Time is necessary to integrate the use of the micro into the existing course of study according to the users. In essence, the micro is a respected instructional tool.

**Personal Concerns/Reactions**

The final section of this chapter deals with the personal reactions and concerns expressed by the forty-five teachers interviewed. Interviewees were asked to express their opinions on how the microcomputer affected them, what personal concerns they had about the use of the machine and how the machine's use affected the users vis-a-vis other teachers, friends, and/or family. Personal anxieties and concerns accompany any attempt to integrate an innovation into a teacher's professional efforts. These concerns must be resolved before progress can be made in making the innovation a more natural aspect of the teaching-learning process.

The forty-five interviewees were asked to explain their overall reaction to the micro. All teachers responded in very positive terms. Forty-two percent used the term "great." Other educators said that the micro was the best thing since sliced cheese, since the wheel, since the automobile, since candy and since sliced bread. Several of the users suggested that any limitations of the micro rested
with the teachers themselves and their creative ability to fully use the technology. One math teacher considered the micro as "the most innovative thing in mathematics education in two hundred years."

A pair of questions asked the users how the micro had affected them as teachers and as persons. The impact on the users in terms of their professional development was significant. Twenty-five percent said that they spent considerably more time at school since the micro arrived. Five teachers admitted that the micro provided them stimulation to stay in education in lieu of other career alternatives. Seven teachers noted that their approach to curriculum building had been altered since learning how to program. The preparation of instructional units were more logical, sequential and were divided into smaller units of information. "After taking the programming course, I suddenly became aware of the need to organize material that I presented to students in smaller sequences. It just never occurred to me before," noted one southwest Iowa teacher. Three teachers noted that they were able to break some traditional teaching habits and try new instructional methods after experiencing success with the micro. One teacher explained that he had always used lecture-demonstration in his math instruction. He now uses the micro plus some peer teaching and has been able to allow students to be at different stages of achievement in the sequence of instructional
objectives. "I'm not so lock-step as I used to be."

Four teachers suggested that the increased motivation the micro provided the students was contagious. One teacher noted that she was able to secure her present position over other candidates because she had received micro-computer training as an undergraduate.

From a personal perspective the interviewees expressed mixed emotions toward their work with the micro. Twenty-five percent of those interviewed expressed in negative terms concerns about the excessive time required on weekends and at night to learn how to operate the equipment and prepare software for it. Nine percent of the teachers noted that the time spent with the micro caused serious problems with their spouse. One of the educators expressed her feelings in simple terms, "I am tired."

Another 25 percent of those questioned noted that the micro had added a considerable academic challenge to their life. "Since the machine came, I feel like I am growing as a person." Seven teachers noted that they were engaged in teaching adult education programming courses, selling micro hardware or micro software since they became involved with the micro at their school. Eighteen percent of the teachers said that the micro had become a new hobby, allowing them to meet a new group of friends and expand their leisure interests. Four teachers noted that conquering the machine was tantamount to conquering a considerable problem.
As a result of achieving confidence with the micros, these users felt an increase in their own self worth and greater self-confidence. One user noted that he had begun a Masters in Computer Science program as a result of his work with the micro.

"How has the micro affected those people you are involved with (friends, spouse, other teachers, etc.)?"

Responses to this question were also split between positive and negative comments. Twenty-five percent of the teachers expressed a considerable concern about the amount of time away from the family required by the micro's use. Three teachers noted that students no longer had the opportunity to search them out for additional help unless that assistance involved using the micro. Jealousy by other staff members was noted by three instructors. Three other teachers noted that their work with the micro provided them closer working relations with other staff as they were attempting to provide instruction to other faculty members. Three teachers noted that machine technophobia apparent in non-users had to be resolved.

When provided the opportunity to express any further concerns they felt toward using the micro a variety of comments were generated. These concerns have been divided into four categories for ease in reporting. The categories are training, hardware, student concerns and utilization concerns.

Twenty-five percent of the educators interviewed
expressed a personal concern about providing training to other teachers within their school district or in other schools regarding the use of the micro as an instructional tool. One northeast Iowa teacher stated this concern as follows: "I guess that I am just so convinced that using the micro is such a good thing that I become frustrated that other teachers cannot or will not share in this great innovation." One teacher felt concern that many of her colleagues still considered the micro a toy, without ever "bothering to check it out for themselves."

Concerns about student use were expressed by several interviewees. One teacher was most upset with the potential overuse of the micros. She feared student "burnout" on the micros because some teachers might overuse or misuse the hardware. One teacher noted that he had several students who were really "hackers" with the micros to the point that other subjects were being ignored or dropped. Two teachers expressed anxiety about the misuse of the micro as a pacifier for students who could not or would not accept instruction in other modes.

Hardware related issues concerned a group of other interviewees. Fifteen percent of the sample were concerned with too little hardware to effectively meet the needs of their students. One metropolitan teacher was concerned with theft of equipment by students and the subsequent security that prevented greater access to more students. One teacher
was concerned that the micro equipment was not used more fully. He, too, felt that access to the equipment at night and on weekends was instructionally productive. He reported that he could not spend any more time at school. Two teachers were concerned that they did not have a source of information on new equipment and technology and that the possibility of replacing equipment or upgrading equipment was remote due to budget considerations.

Utilization concerns were also varied. One teacher was worried about controlling games. Another teacher expressed some anxiety about using copyrighted materials which were secured through unidentified sources. Budget restrictions and the possibility of not having resources to expand the software collection were mentioned by two users. One teacher speculated on the use of the machines if he were to move on, "I am afraid they would end up like the old reading machines, no one here but me knows how to use the micros. I just don't have the time to train other teachers and the kids, too. I don't know why they are scared of the machines, but someone else on the faculty should be involved." One teacher noted that she was concerned that her AEA consultant might be reassigned or might move on, leaving her with no one to call for assistance.

In summary, the personal concerns of the typical user center on time and expanded use of the micro technology. The typical user is very excited about being involved with
the microcomputer even though excessive time was spent away from the family to learn how the machinery works and to produce software. For the typical user, the micro has been professionally refreshing and intellectually challenging. The lack of interest or hostility displayed by some faculty peers was perplexing and bothersome. More hardware would be helpful, but budget problems seem to overshadow the aspirations to increase the number of micros available.

The needs, advice, concerns and experiences of forty-five first generation microcomputer users has been presented in this chapter. These teachers have acquired equipment without the benefit of formal training on how to use it. They have produced software, developed new courses of study, established logistical scheduling patterns, experimented with student utilization and coped with consternation expressed by some fellow educators. Some typical users reported that some of their needs had been resolved. Those resolved needs were replaced with more sophisticated requests for assistance. It is fair to assume that some level of similar needs will occur with the next generation of users. The following chapter will contain suggestions on how various support service agencies might address these identified needs and assist future microcomputer users with their efforts at providing a more significant educational program to their students.
Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The intent of this study was to determine what Iowa educators identified as their personal concerns, instructional design and technical assistance needs necessary to use microcomputers as effective educational tools. Microcomputers, because of their relative low cost, portability and capacity to be dedicated to the instructional task have become familiar equipment to a few educators in Iowa's schools in the past six years. By surveying the first generation of micro users as to their support service needs, educational service organizations such as state and regional agencies, institutes of higher education and professional organizations might establish the support network necessary to assure the continued use of computer technology in the schools while upgrading instructional applications. Research has indicated that as any educational innovation is integrated into the existing school curriculum, technical needs, instructional design needs and personal concerns emerge from the adopters. These needs and concerns must be resolved before the innovation can become a fully functional
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educational tool. This study documented:

1. What personal concerns instructional microcomputer users have regarding the integration of the innovation into their curriculum.

2. What instructional design needs microcomputer users identify and what are the preferred source and mode of addressing those needs.

3. What technical assistance needs instructional microcomputer users identify and what are the preferred source and mode of addressing those needs.

The instructional use of the computer dates to the early 1960's when a few center-based model projects were established. From its genesis, the reoccurring problems of user training and software development have dulled the widespread use of the computer in the classroom. In Iowa, the development of the instructional use of the computer was restricted to a few geographical locations and a very few Iowa school children. Partially due to the cost of center-based equipment, partially due to a state-imposed effort to restrict the proliferation of computer equipment in education, computer assisted instruction was not an available alternative to most Iowa educators.

The advent of the microcomputer did provide inexpensive computer hardware for instructional applications. Micros now can be found in 75 percent of Iowa's school districts. The reoccurring problems of teacher training and
software support services persist.

In an effort to identify what microcomputer users perceived as their support service needs, a structured interview was developed. Forty-five "typical" instructional micro users were identified--three users nominated by each of the fifteen area education agency, educational services directors. Person-to-person structured interviews were conducted with forty-one of the teachers. Four other interviews were conducted by telephone. The interview sought need information and the preferred source and mode of addressing those needs. Additionally, the interview sought the user's advice in terms of technical assistance, software needs, instructional design matters and personal ramifications. Information was solicited so as to informally establish a state of the art profile of the typical user. The profiles were presented at the end of each section of Chapter 4. The data from the interviews were compiled and tallied and were presented in terms of central tendencies and percentage rankings.

Conclusions

Personal Concerns

Personal concerns of instructional microcomputer users were focused on the amount of time that has been demanded to learn how to use the hardware and in preparation of instructional software. Users consistently reported a
desire to train their fellow faculty members on the progress of microcomputer utilization. This concern surfaced in one form or another in three of the five sections of the structured interview. Many of the users identified expanded training for other faculty members as a major concern. When discussing software, interviewees noted that additional software in subject areas other than their own was a need. This software was desired so they might help other faculty use the micro as a teaching tool. Over 50 percent of the teachers-users noted that they would like to be involved in explaining to other faculty the benefits of using the micros.

This concern carries with it mixed blessings for many of the educators interviewed. Many users expressed a strong desire to help fellow faculty members learn how the microcomputer could be used with their instructional responsibilities. Those same teachers also recognized that additional microcomputer users would strain already tightly scheduled hardware and dilute software budgets.

Concern about restrained budgets was expressed by a few of the users, noting that future equipment and/or software acquisitions were questionable items. Lack of knowledge on basic student utilization was expressed by some of the educators. These users had questions on student attention span with the micro, fears of overuse, and the impact of animation and graphics.
Many of the teachers who had several years of experience with the micro noted that they no longer had major concerns about the amount of time dedicated to micro use for several reasons. First they had achieved some level of machine competence, their software libraries were in a developing stage and finally, they came to the conclusion that the use of the micro had to be put into perspective vis-a-vis personal responsibilities and professional obligations. There appeared to be a developmental sequence that the first generation of users traversed as they acquired greater sophistication in using the micro. This sequence of personal feelings validates informally the research completed by Hall and George with the C-BAM project noted in Chapter 1.

**Instructional Design Needs**

The second question of this study involved identifying the instructional design needs of microcomputer users. Users were also asked to identify their preferred mode and source of addressing those needs. The spectrum of these identified needs is scattered across a broad assortment of instructional design issues. The users did have focused opinions on the mode and source of addressing the needs that were identified. Three categories of needs surfaced: training needs, software needs and logistical support needs.

How to adjust existing software to more specifically meet the needs of students was expressed as a need by many of the non-programming users. These users offered specific
examples of such adjustments: how to vary the amount of
time permitted for student responses; how to reduce or in-
crease the speed of character flow on the terminal, how to
adjust shell software (basic games like "Hangman") to use
the spelling words of the week or the vocabulary words of a
specific unit.

Many users noted that they did not know how to
evaluate software. While a vast majority of the users noted
that previewing software prior to acquisition was essential,
many users noted that they did not have a clear set of cri-
teria upon which to judge software.

The preferred source of addressing training needs
was the area education agency (AEA) or other users. The
interviewees noted that hands-on workshops or one-on-one
consultations with a knowledgeable person would be the
preferred mode.

Software needs were very specific:

1. Software in the basic skills areas addressing
   individual learning objectives was a strongly
   identified need. This software would also in-
   crease the chances that faculty not using the
   machine might do so. An expanded software library
   with more graphics and animation in all subject
   categories was identified as needed.

2. A system to catalog existing software which can
   accommodate future acquisitions was identified
   by 25 percent of the users. Documentation of
   individual programs in hardcopy form is an associ-
   ated need. As software libraries expand, the
   physical location of programs/disks becomes a
   pressing need.

The vast majority of the users will look to their
area education agency for software assistance. The arrangement with the Minnesota Educational Computer Consortia (MECC) and Iowa's Area Education Agencies has provided the vast majority of the instructional software used most by teachers in the state. This software also appears to represent the majority of the documented software. It is well liked by the teachers and they expect more of the same. User groups and software exchanges managed by the area education agencies were very well received. Future software acquisitions will have to be acquired at little or no cost according to most users--school budgets allow no other alternative. Several users suggested that a panel of users from a given area evaluate available software. Selected software could then be circulated by the AEA for individual schools to reproduce. Testing, evaluation and documentation of software might be a service of the AEA. In addition, arrangements similar to that with MECC should be explored further.

New software development was seen as a function of statewide organizations. A University of Northern Iowa project begun last summer to produce software in the mathematics discipline by current users was cited as a model effort in producing quality, user-based inexpensive software.

Facility problems and time constraints were identified by some users as perceived concerns with little hope for easy resolution. A few users noted a need for a separate facility for their microcomputers so that classroom
activities might continue while giving expanded access to students wishing to use the machines. Some users noted that they needed more time to plan how to use the existing micro capacity better with their current curriculum. Integrating the micro into the curriculum could be facilitated with more planning time. Both of these needs were noted to be within the realm of local education agency control.

Model curriculum guides and scope and sequence materials in the area of computer literacy were identified by some interviewees as needed. Respondents did not express a preferred source of such materials.

Technical Assistance

The third question this study addressed was the technical assistance needs identified by instructional microcomputer users. As in the preceding sections, the preferred mode and source of addressing the needs was also recorded. The technical assistance needs of the respondents were identified to include training in the following areas:

1. Basic repair and maintenance of hardware.
3. Assembler language programming.
4. BASIC programming—beginning and advanced.
5. File building programming.

The preferred mode of addressing the above training needs were evenly split between college credit coursework from institutes of higher education and workshop training
provided close to the home school district. Hands-on training was identified as important to both college work and workshop experiences. Area education agency personnel were identified as the preferred source of technical assistance in hardware operations difficulties with vendors as a second choice.

Recommendations

At a time when financial and political forces appear to undercut the vitality of educators and their efforts, it is refreshing to find a group of teachers unanimously excited about a single innovation. All forty-five educators interviewed expressed not just positive feelings toward the micro, but feelings of excitement and anticipation. If for no other reason than the affect on morale, the microcomputer has had significant impact on Iowa education. The charisma of the microcomputer is likely to continue, especially if the capacity of hardware increases and the costs of hardware fall as industry experts suggest. However, user training and software issues will continue to impair the instructional applications of the computer as they have in the past with center-based services, unless educational support service providers of the state can coordinate their efforts and plan a comprehensive program of services to assist the first generation of users and train/support subsequent users. Many resources now available in the state could be adjusted
to help meet the needs identified by the users in this study. However, first and foremost, a comprehensive statewide plan for the development and implementation of meaningful support services is needed so that human and fiscal resources will be apportioned judiciously.

Such a plan should identify the training and support service roles of various institutions and organizations within the state. The effort might be coordinated through the Iowa Department of Public Instruction, through the Council for Instructional Computing in Iowa, through the Area Education Agency/Institute of Higher Education Task Force on Cooperation, Iowa Association for Supervision and Curriculum Development or other interested groups.

In lieu of such a plan, the following recommendations are presented as suggestions for need resolution.

The Iowa Department of Public Instruction should:

1. Identify the use of the microcomputer as a significant instructional process. As such the Curriculum and Instruction Division should coordinate efforts in micro utilization and provide leadership to teacher preparation institutions, area education agencies, local education agencies and professional organizations.

2. Increase efforts to secure some level of funding from the state legislature or through anticipated federal revenue sharing funds for the establishment of a software materials clearinghouse or otherwise assist local users in securing effective micro software.

3. Establish a model curriculum guide/resource directory in the areas of computer literacy and programming.
4. Establish a task force to design a model documentation format and cataloging system that would provide statewide uniformity and inventory-determination capacity.

5. Provide leadership for the appropriate use of the micro computer by encouraging research into utilization impact, optimal student conditions, etc.

6. Reverse the perception of many educators that the Department is interested only in regulating the use of the computer and substitute a service perspective.

Iowa institutes of higher education should:

1. Provide courses, off-campus if possible, in BASIC programming, microcomputer utilization, machine language and/or assembler language.

2. Provide college credit for courses designed to produce quality, user-based micro software.

3. Train college of education staff on the various educational applications of the microcomputer with emphasis on the subject discipline.

4. Provide training on several different brands of micros as part of the pre-service preparation of teachers.

5. Initiate basic research into the impact of the micro as an instructional tool identifying ideal/optimum/model conditions for utilization.

Area Education Agencies should:

1. Identify at least one person who is knowledgeable to serve as a resource/contact person for micro users in their area.

2. Support with coordination services/meeting facilities/newsletter distribution and/or printing efforts of micro-users group(s) within their area.

3. Provide a file of curriculum guides/scope and sequence materials in the areas of computer literacy and programming instruction.

4. Provide training to new users through one-on-one instruction or workshops using hands-on methods.
Such training would provide a new, confident generation of users while addressing the desire of present users to help their fellow faculty. Such training should be subject matter specialized. For example, a workshop for vocational agriculture teachers in using the micro might be delivered. Resolution of machine anxiety and basic machine operations should be the major scope of this effort.

5. Provide a basic machine repair and maintenance workshop for area users in cooperation with vendors, yearly.

6. Continue cooperative purchasing efforts.

7. Continue software acquisition efforts such as the MECC agreement.

8. Train users and potential users in identification of criteria for evaluating software.

9. Provide a graphics tablet on a loan basis to users so as to encourage the use of graphics with software.

10. Provide/facilitate with community college efforts, programming courses in BASIC and Pascal.

11. Provide hardcopy documentation to each user subscribing to the MECC materials.

12. Assist the Department of Public Instruction in securing financial support/legislative backing for a statewide clearinghouse for software materials.

13. Assist local district efforts in "marketing" the use of the micro to educators in subjects/grades not presently using the micro.

14. Provide one-on-one consultation to educators as they attempt to integrate the use of the micro into their existing courses of studies by providing examples of scheduling matrices, tutorial applications, demonstration teaching using the micro for class-size tutorials, and similar applications which expand the use of the micro beyond the one-student-to-one-machine practice.

15. Use the micro as a teacher inservice training tool especially in the areas of mandated training such as human relations, hence modeling the use of the micro as an instructional tool.
16. Identify community resource persons and locations willing to address students on computer technology and applications so as to expand the career education aspects of the micro.

17. Assist local districts with public information and board of director training so as to build a strong political foundation for computer based instruction.

Local school districts should:

1. Provide at least one hour per day for an identified computer coordinator to coordinate building efforts, maintain and/or localize software, train other faculty and manage the computer efforts of the building.

2. Establish an equipment/software acquisition program and budget funds accordingly.

3. Provide released time to educators willing to learn how micro applications might enhance their courses of study.

4. Provide moral support and encouragement to educators initially using the micro.

5. Provide a neutral facility for computer equipment wherever possible.

6. Plan a computer literacy course of study for all students prior to graduating.

7. Provide a computer programming course as an elective for all students.

Professional organizations should:

1. Identify units/courses/concepts which particularly lend themselves to computer instruction and appropriate funds/human energy to develop software to address those needs.

2. Provide training services to new users with subject specific software; identify model sites using the micro successfully.

3. Provide professional literature, convention time and newsletter space for micro users to explain their experiences with the microcomputer.

4. Establish a list of criteria for software evaluation efforts.
Finally, what educators do not know about the impact of the micro is probably as great, if not greater, than what is known. Considerable research into proper utilization, software development factors, and student perceptions of the micro is needed. Teachers in this study identified that students who excelled and students who were low achievers appeared to benefit most from use of the micro. Which students should be using the micro? For how long a time? Which types of software modes benefit students most? Resolution of machine anxiety remains a very serious problem for new users. How can this resolution be effectively addressed? Additional research in this area would benefit both students and teachers.

Summary

The use of the microcomputer for instructional applications is less than six years old in Iowa. Yet already the widespread use of the micro for computer literacy and for content instruction is becoming an accepted part of the educational community. The first generation of micro users has identified their needs and concerns--problems that center-based users identified twenty years ago: user-training and software to help students grow. Research on the integration of any innovation has indicated that support services to educators attempting to adopt a new practice or method is essential if that innovation is to realize success. This study has identified the personal concerns, instructional
design needs and technical assistance needs of existing users. It is safe to assume that new users will have many of these same needs. Support service providers in Iowa, including state and regional agencies, professional organizations and institutions of higher education can and should address the needs of micro users in a coordinated manner using the resources and human energy already available.

As one interviewee put it: "The micro is just a fantastic thing for kids and teachers, but we just can't do it all on our own. We need time; we need help to do it right."
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BIBLIOGRAPHY

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APPENDIX A

LETTER AND FORM TO DIRECTORS OF EDUCATIONAL SERVICES
TO NOMINATE INTERVIEWEES
May 1, 1981

Dear,

I would like to seek your assistance as I begin my dissertation work at Drake. As you know, I am preparing a study on the perceived needs of instructional microcomputer users of the state.

Could you identify for me three (3) typical microcomputer users (instructional applications only) and their building principals from your area? The teachers identified should be major contact people who use the microcomputer regularly as part of their classroom experiences. I will be conducting telephone interviews with these six people during the month of May. Essentially, I will try to identify their level of usage integration into the curriculum and their support service needs. I will not identify how they were selected for the study unless specifically asked. The final report will reflect only statewide data.

The enclosed form and postage-paid envelope are for your convenience. Would you please respond by May 1.

Thank you.

Sincerely,

Dennis M. Schrag
200 North Lakeview Drive
Clear Lake, Iowa 50428

Enclosures
Person Completing this form: ____________________________
AEA Number ______

TEACHER/PRINCIPAL PAIR I

Teacher's Name ____________________________
Principal's Name ____________________________
School District ____________________________
Building ____________________________
Address ____________________________

City ____________________________ State __________ Zip ______

Phone (___ ) ____________________________

TEACHER/PRINCIPAL PAIR II

Teacher's Name ____________________________
Principal's Name ____________________________
School District ____________________________
Building ____________________________
Address ____________________________

City ____________________________ State __________ Zip ______

Phone (___ ) ____________________________
TEACHER/PRINCIPAL PAIR III

Teacher's Name

Principal's Name

School District

Building

Address

City

State

Zip

Phone (___)

Please return to Dennis Schrag, 200 North Lakeview Drive, Clear Lake, Iowa 50428
APPENDIX B

FILM-USERS SURVEY - GRANT WOOD AREA EDUCATION AGENCY
Circle the grade(s) that you taught last year:
1 2 3 4 5 6 7 8 9 10 11 12

Check the subjects that you taught last year:
- reading
- language arts
- social studies
- math
- science
- fine arts
- vocational arts
- physical education
- health education
- foreign language
- other (specify)

Check the subjects for which you used film last year:
- reading
- language arts
- social studies
- math
- science
- fine arts
- vocational arts
- physical education
- health education
- foreign language
- other (specify)

Estimate the total number of films you used last year (from any source): 
____________________

What was your intention when you ordered films? Check the responses that most accurately apply to you:
- to reward behavior
- to influence conduct
- to provoke thought
- to foster ideas
- to foster values
- to impart information
- to illustrate or demonstrate
### Please circle the most accurate response for each question about your use of films last year:

- **A=** Always
- **U=** Usually
- **S=** Sometimes
- **R=** Rarely
- **N=** Never

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Did you preview films before you used them?</td>
</tr>
<tr>
<td>U</td>
<td>Did you introduce films to the class before you showed them?</td>
</tr>
<tr>
<td>S</td>
<td>Did you discuss the films after you showed them?</td>
</tr>
<tr>
<td>R</td>
<td>Did you stop and discuss a film while showing it?</td>
</tr>
<tr>
<td>N</td>
<td>Did you show only a portion of a film?</td>
</tr>
<tr>
<td>A</td>
<td>Did you show films more than once to the whole class?</td>
</tr>
<tr>
<td>U</td>
<td>Did you show films without the sound?</td>
</tr>
<tr>
<td>S</td>
<td>Did you show films to a small group or to an individual rather than to the whole class?</td>
</tr>
<tr>
<td>A</td>
<td>Did you arrange for an optional repeat showing of films for your students?</td>
</tr>
<tr>
<td>U</td>
<td>Did your films arrive during the time requested?</td>
</tr>
<tr>
<td>S</td>
<td>Did you return films without using them?</td>
</tr>
<tr>
<td>A</td>
<td>Did you evaluate the effectiveness for your own future use?</td>
</tr>
<tr>
<td>U</td>
<td>Did you keep a record of the films that you used with comments and/or order information?</td>
</tr>
<tr>
<td>S</td>
<td>Did you recommend that other teachers in your building use or not use films that you ordered?</td>
</tr>
<tr>
<td>A</td>
<td>If you discovered damages or undesirable contents in a film, did you alert the suppliers to the problem?</td>
</tr>
<tr>
<td>U</td>
<td>Did you encourage your students to evaluate the films that you showed?</td>
</tr>
</tbody>
</table>

**OPTIONAL COMMENTS:** Please use this space or the back of this sheet to make comments about this questionnaire, to list problems that you encountered with films, or to make suggestions about improving film use in classrooms.
APPENDIX C

CONCERNS-BASED ADOPTION MODEL QUESTIONNAIRE
In order to identify these data, please give us the last four digits of your Social Security number: ______  ______  ______  ______

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the innovation adoption process. The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years experience in using them. Therefore, a good part of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time. For the completely irrelevant items, please circle "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time. 0 1 2 3 4 5 6 7

This statement is somewhat true of me now. 0 1 2 3 4 5 6 7

This statement is not at all true of me at this time. 0 1 2 3 4 5 6 7

This statement seems irrelevant to me. 0 1 2 3 4 5 6 7

Please respond to the items in terms of your present concerns, or how you feel about your involvement or potential involvement with ________

(please specify the innovation). We do not hold to any one definition of this program, so please think of it in terms of your own perceptions of what it involves. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with the above-named innovation.

Thank you for taking time to complete this task.
<table>
<thead>
<tr>
<th></th>
<th>Irrelevant</th>
<th>Not true of me now</th>
<th>Somewhat true of me now</th>
<th>Very true of me now</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am concerned about students' attitudes toward this innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I now know of some other approaches that might work better.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I don't even know what the innovation is.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I am concerned about not having enough time to organize myself each day.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I would like to help other faculty in their use of the innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I have a very limited knowledge about the innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I would like to know the effect of reorganization on my professional status.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I am concerned about conflict between my interests and my responsibilities.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I am concerned about revising my use of the innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I would like to develop working relationships with both our faculty and outside faculty using this innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I am concerned about how the innovation affects students.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I am not concerned about this innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I would like to know who will make the decisions in the new system.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I would like to discuss the possibility of using the innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I would like to know what resources are available if we decide to adopt this innovation.</td>
<td>0 1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
16. I am concerned about my inability to manage all the innovation requirements.

17. I would like to know how my teaching or administration is supposed to change.

18. I would like to familiarize other departments or persons with the progress of this new approach.

19. I am concerned about evaluating my impact on students.

20. I would like to revise the innovation's instructional approach.

21. I am completely occupied with other things.

22. I would like to modify our use of the innovation based on the experiences of our students.

23. Although I don't know about this innovation, I am concerned about things in the area.

24. I would like to excite my students about their part in this approach.

25. I am concerned about time spent working with nonacademic problems related to this innovation.

26. I would like to know what the use of the innovation will require in the immediate future.

27. I would like to coordinate my effort with others to maximize the innovation's effects.

28. I would like to have more information on time and energy commitments required by this innovation.

29. I would like to know what other faculty are doing in this area.

30. At this time, I am not interested in learning about this innovation.
31. I would like to determine how to supplement, enhance, or replace the innovation.
32. I would like to use feedback from students to change the program.
33. I would like to know how my role will change when I am using the innovation.
34. Coordination of tasks and people is taking too much of my time.
35. I would like to know how this innovation is better than what we have now.
APPENDIX D

LETTER TO PROSPECTIVE INTERVIEWEES
October 1, 1981

Teacher
Local School District
City, Iowa

Dear __________________:

As a microcomputer user, you are on the threshold of a new and exciting educational innovation. Using the micro as an instructional tool assumes that you have a source of support services for software, hardware and instructional design problems.

As my Drake dissertation project, I am collecting information from a very select group of micro users. I need your help by responding to a 15-20 minute structured interview to be held in person at a time convenient to you. I have enclosed a copy of the interview questions so you can be thinking of your responses.

Please complete the enclosed card and return to me TODAY.

Thanks,

Sincerely,

Dennis Schrag
5502 Ingersoll
Des Moines, Iowa

cc: Building Principal
APPENDIX E

RESPONSE CARD TO PROSPECTIVE INTERVIEWEES
Dear Dennis:

Sure I'll be glad to help with the structured interview. Please call me at the number below to set up an appointment that is mutually convenient.

A/C  _____  _____  _____

The best time to call me at the above number is:

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>October 12</td>
<td>at ________</td>
</tr>
<tr>
<td>Tuesday</td>
<td>October 13</td>
<td>at ________</td>
</tr>
<tr>
<td>Wednesday</td>
<td>October 14</td>
<td>at ________</td>
</tr>
<tr>
<td>Thursday</td>
<td>October 15</td>
<td>at ________</td>
</tr>
<tr>
<td>Friday</td>
<td>October 16</td>
<td>at ________</td>
</tr>
<tr>
<td>Saturday</td>
<td>October 17</td>
<td>at ________</td>
</tr>
</tbody>
</table>
APPENDIX F

STRUCTURED INTERVIEW PLAN
MICROCOMPUTER USER'S SUPPORT SERVICES

Structured Interview
Dennis Schrag
Drake University Dissertation Project

Dear Microcomputer User:

Thank you for agreeing to participate in this structured interview concerning your involvement with the microcomputer in education. The thrust of this interview is to determine what support services and needs selected instructional micro users in Iowa may identify. Results of the survey will reflect only statewide data. Individuals responding will NOT be identified in any way. There are no right or wrong answers--only your valued opinions. Before the interview I will ask your permission to audio tape record your responses. The interview will take about 15-20 minutes. Your direct and frank opinions are requested. Thank you for your help and time.

Dennis Schrag

Section 1: Demographics

User's Name ______________________________ Date __________________
School District __________________________ AEA# ____________
Building _________________________________ Phone ______________
Address _________________________________ City ______________

Subject/Grade taught using micro ________________________________
Number of micros in building ________________________________
Number of students in building _______________________________
Where is the micro physically located in the building?

How many of your students use a micro as part of their instruction?
Is the micro used for: __Computer Literacy
_________________Content Instruction

Section 2: Hardware

Brand of CPU ________________________________
Month/Year District Acquired ____________________________
Peripherals: _________________________________________
Why did the district acquire the micro? ___________________
Section 3: Technical Assistance

(The following questions seek your response to technical assistance—the help users might receive to assure that hardware and software is used as it should and can be.)

When did you receive initial technical training on use of the micro?
Who provided that training? ____________________________
Was it satisfactory? ____________________________
Month/Year began use with students ____________________________
Since initial training, have you secured additional technical assistance?
What were your technical needs then? ____________________________
Who provided that assistance? ____________________________
If you were having technical problems, who would you contact first?
Can you identify any additional technical information/training you would like to receive now? Identify: ____________________________

Please rank order the following modes of securing technical help:

____ Workshop
____ College credit course
____ Other users
____ Consultant/AEA
____ Vendor
____ Literature
____ Other: specify: ____________________________

What advice would you offer other educators contemplating the purchase of a micro for instruction regarding the technical training aspects of the machine? ____________________________

Section 4: Software

Have you written software for your own course objective(s)?

How often do you preview software prior to student use?
Always  Usually  Seldom  Never

Is there a uniform documentation library listing learning objective(s) for the software you have access to? ____________________________

What percent of the software available to you is documented? ____________________________
Approximate percent of all software you use by instructional approach:

- % Drill and Practice
- % Tutorial
- % Computer assisted test construction/scoring
- % CMI
- % Simulation
- % Problem Solving
- % Games
- % Guidance
- % Other: ____________________________

As students use the micro, is their work graded/evaluated as part of the course/unit grade? ____________________________

What is the preferred language for instructional software? ____________________________

What has been the primary source of the software you have now? ____________________________

What is your preferred source of new software you may acquire? ____________________________

- Other users
- Self produced
- Commercially produced
- Non-profit produced (MECC)
- Other: ____________________________

What are the three greatest needs you have regarding software: ____________________________

What advice would you offer a new instructional computer user regarding software? ____________________________

Section 5: Instructional Design

(Instructional design is defined as the appropriate mix of student, teacher, hardware, software and curriculum to cause optimum learning. The following questions have to do your instructional design needs and suggestions.)

What percent of your students have benefited by using the micro? ____________________________

Has some one group of students benefited more? Which? ____________________________

Does each of your students progress through the same sequence of assigned software? ____________________________

Has your curriculum changed as a result of the micro? ____________________________

How? ____________________________
In your opinion, is the micro a toy or a tool? __________

Explain: __________

To whom would you turn first if you had questions regarding the micro and your own instructional design? __________

What instructional design needs can you identify now? __________

What would be your preferred mode of addressing instructional design needs you might have. Rank order:

- College class
- Other users
- Workshop
- Publications
- Consultant/AEA
- Other: specify: __________

What advice of an instructional design nature would you offer a new microcomputer user? __________

Section 6: Personal Considerations

(The following questions seek your opinion and feelings on the impact the micro has had on you and those you are involved with.)

What is your overall reaction to the micro? __________

How has the micro affected you as a teacher? __________

How has the micro affected you as a person? __________

How has the micro affected those people you are involved with? (friends, spouse, other teachers) __________

What concerns you the most regarding the micro? __________
On the following six questions, would you rate your situation on a scale from one to seven with one indicating the statement is TRUE of you now and seven indicating that the statement is not true or does not apply.

1. I am concerned about revising my use of the microcomputer.  
   1 2 3 4 5 6 7

2. I am concerned about not having enough time to organize myself each day.  
   1 2 3 4 5 6 7

3. I would like to familiarize others with the progress of the micro.  
   1 2 3 4 5 6 7

4. I feel good about my use of the micro and anticipate few changes in my current operations.  
   1 2 3 4 5 6 7

5. I have some good ideas that need to be tested to get better results from using the micro.  
   1 2 3 4 5 6 7

6. I am concerned about the conflict between my micro interest and my professional and family (friends) responsibilities.  
   1 2 3 4 5 6 7

What personal advice would you offer a new instructional micro user?

Thank you very much. I would be happy to send you a summary of my findings if you would be interested.

Yes  No

Dennis Schrag  
5502 Ingersoll  
Des Moines, Iowa  50312  
(515) 255-7136