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ABSTRACT

A nationwide mail survey was conducted of 400 randomly-selected schools in the 50 states to investigate the decisions made by schools in implementing microcomputer instruction and the procedural planning systems developed by schools to integrate microcomputer instruction into the program. An introduction, statement and explanation of the problem, discussion of major questions and basic assumptions, and description of the survey methodology are included. A literature review addresses the benefits of microcomputers for learners and trends in the use of microcomputers for instruction; 40 references are listed. Findings based on 141 responses (35%) are summarized for each of the 60 questionnaire items, and conclusions are presented in detailed, brief, and summary formats. Thirty-three recommendations for implementing microcomputer instruction are listed and eight topics are suggested for further study. A composite plan based on the specific steps and procedures actually used by schools is provided to assist schools in planning and implementing their own microcomputer instructional programs. The lack of systematic and comprehensive long-term planning before microcomputer acquisition is identified as the major weakness in integrating microcomputers into school programs. (LMM)

MICROCOMPUTERS IN THE SCHOOLS

A National Study Completed in 1983 at the State University College at Buffalo, N.Y. by Ned V. Schimizzi, Associate Professor of Education, Department of Curriculum and Supervision; assisted by Donald Dudley, student, SUCB.

TABLE OF CONTENTS

Introduction

For most Americans, schools continue to be the lamps of hope for a better life. During recent decades, schools have been criticized and sometimes blamed for our nation's failures in space, its social inequities, and its declining test scores. Today's schools are housed in modern buildings which may be equipped with central air-conditioning as well as central heating. The classroom walls are painted in pleasant pastel colors. The chalkboards may no longer be black, the bulletin boards may no longer be brown, and the floors may no longer be wooden. The lighting is brighter and more efficient and the children hang their coats in colorful metal lockers instead of closets and cloakrooms. The teachers are younger and have more formal eudcation. They may be more democratic and less authoritarian in their classroom manner. The textbooks contain colored photographs instead of black and white. The workbooks and drill sheets have remained about the same through the decades. Many young learners continue to express their creativity and originality in clever methods of playing "hooky." Some of the same students who learn how to perform incredible athletic feats never learn how to read. Too many students among those who perform satisfactorily in their academic subjects, for some reason, do not grasp the challenge to excel in them. The kinds of attitudes and emotional support provided by the home, family and parents may continue to play a decisive role in determining to what degree children succeed in school or elsewhere. This success is measured annually or semi-annually with standardized tests for which national statistical norms have been developed.

What can we say has really changed in the process of education over the duration of the twentieth century? Indeed, an 80 year old senior citizen touring today's major modern institutions including factories, shopping areas, offices, banks, and farms may suffer the least amount of future shock when visiting a classroom. The reasons for changes or lack of changes in the schools have filled many term papers and dissertations. The many educational questions and topics of today may include one of the recent developments which may make a difference in the classroom if it is implemented with planning and care and applied in appropriate and challenging ways. This development can serve the teacher both as a tool for more effective teaching and as an object of instruction.

The most important single modern development for learning may be a piece of technological hardware which is so tiny that it can lose itself underneath a human fingernail; it is called a micro-chip. It can do more than a multi-million dollar mainframe computer could do a decade or so ago. When tucked into a small cabinet the size of a typewriter or smaller and connected to a keyboard and a TV monitor it becomes what may be the teacher's first valid tool to come along in many decades. It promises to enable the teacher to engage in true individualized instruction and to do so with a variety of teaching methods, teaching styles and curriculum content. It can make learning in the academic subjects as much fun and challenging for the learner as completing a successful 30 yard pass in a football game or a jump shot during a basketball game when the

score is tied. The teacher can determine and control the desired teaching mode or method with which to engage the learner and the microcomputer. The teacher may use the computer as a tutor to drill the child and give him practice in a specific skill or content area. The teacher's lesson plans may require a simulated environment where the learner can apply what he has learned. As a reward, and a reinforcement technique, the teacher may next engage the learner(s) in educational gaming. After mastering specific skills and concepts in a given content area, the learner can be taught by the teacher to teach those same skills and concepts to the computer or to develop a computer program to teach them to other children. Indeed, the microcomputer itself can teach computer programming to the learner and do so in almost every computer language. Whatever the microcomputer does, it can do so in an interactive mode and in color, graphics, pictures, sounds, voices, and animation while respecting Dewey, Piaget or Skinner. Its increasing capabilities are surpassed only by its decreasing costs.

Microcomputer related topics have increasingly dominated national and regional conferences of education and teacher associations of all kinds since the middle-late 1970s. It is obvious that many schools and school systems have acquired microcomputers or are planning to do so. The results of this study may indicate some possible trends. A description of these trends may prove valuable to teachers, administrators, teacher educators and learners as they develop or evolve their own plans for microcomputer assisted instruction. Most important, the results of this study should reveal those major decisions concerning the implementation of microcomputers which have already been made by some avante garde schools. The results of this study should make known those specific planning procedures developed for microcomputer instructional implementation by the schools participating in this study.

These results should be valuable to those colleges and universities with teacher education programs such as the State University College at Buffalo who not only prepare teachers but also provide consultation to school systems.

Computers shall in some form and certainty, remain important throughout the young learner's lifetime.

Statement of the Problem

General Statement of the Problem

This study is an investigative analysis conducted for the purpose of determining how plans were formulated and the kinds of decisions that were made by the schools concerned with implementing microcomputer instructional applications; i.e., which decisions have been made concerning the implementation of microcomputer instruction by American school systems? Which specific planning procedures did they use?

Microcomputers in the Schools

Explanation of the problem.

This study involved a nationwide survey of randomly selected school systems in each of the 50 states. The project was designed to report the kinds of decisions that have been made by the schools in implementing microcomputer instruction. The project was designed to report the procedural planning systems developed by the schools for the purpose of integrating microcomputer instruction into the program.

Major Questions:

The investigation sought the answers to the following 60 questions:

1. Does your school system have microcomputers in the classroom?
2. Are your microcomputers tied to a "mother" unit inside the classroom?
3. Are your microcomputers tied to a "mother" unit outside the classroom?
4. In which grade do you introduce microcomputers to the children?
5. How much time does each pupil spend with a microcomputer each week?
6. For which curriculum areas is the microcomputer available to children?
7. In the curriculum areas listed in item 6, was any improvement of children's performance attributed directly to the effectiveness of the microcomputer as compared to when the teachers and children were limited to the traditional classroom methodologies and the absence of microcomputers?
8. Do you use the microcomputer for testing the children's performance?
9. The microcomputers in your schools and classrooms are used mainly for: (?)
10. Do teachers see microcomputers as supportive of Piaget's theories of learning?
11. Do teachers find that microcomputers enhance their ability to individualize instruction?
12. The children having access to the microcomputers include: (?)
13. Which microcomputer skills are required of the teachers prior to the acquisition of microcomputers?
14. The teachers acquired their computer skills by: (?)
15. Which language do most teachers seem to be using?
16. Which language is taught to the children?
17. Do the teachers perceive a marked improvement in the children's motivation to learn as a result of the use of microcomputers?
18. Do teachers perceive a marked improvement in discipline (the children's behavior) as a result of the increased motivation provided by the microcomputer?
19. Before you acquired microcomputers, did you use time-sharing computer terminals for instruction?
20. Which brand-name microcomputers did your staff choose?
21. The considerations for the brand-name selected for your particular hardware included: (?)
22. The decision to purchase a particular make and model was made by: (?)
23. The decisions concerning the purchase of courseware/software are made by: (?)
24. Is your microcomputer equipment designed for programs and courseware recorded on: (?)
25. Most of your microcomputer software/courseware is: (?)

Microcomputers in the Schools

26. What were (or are) the major obstacles in establishing microcomputers in your school(s)?
27. Would you recommend a microcomputer installation for schools elsewhere?
28. Why?
29. Why not?
30. Would you have computer-assisted instruction in your schools if microcomputers were not available?
31. How were your microcomputers financed?
32. At what future date do you foresee the availability of microcomputers in most of your classrooms?
33. How do you secure the equipment when the school is closed?
34. The enrollment in your school system is: (?)
35. How many microcomputers do you now have for each child involved with computers?
36. Do you now screen new teachers for microcomputer operational literacy?
37. If so, when hiring do you give preference to those new teachers who do possess microcomputer operational literacy?
38. Do you now require new teachers to possess microcomputer operational skills as a condition for employment?
39. Does your school system advocate the use of microcomputers in a non-programming environment only?
40. If you have more than one brand name of machine, for which do you make software for?
41. Did you have a systematic plan for implementing microcomputer instruction before you acquired microcomputers?
42. Who participated in formulating this plan?
43. Do you now have a systematic plan for implementing microcomputer instruction?
    If so, is it a five year plan?
44. What were the circumstances under which you acquired your first microcomputer?
45. Is inservice training available for teachers interested in microcomputers?
46. Is the inservice training provided: (?) (When?)
47. Is the inservice training given for credit?
48. Does this inservice training include (kinds of training)?
49. Skills-training with which peripheral devices is provided through inservice training?
50. If you teach programming to children, why do you do so?
51. What agency do you think should sponsor a microcomputer consortium?
52. For which special applications do you use microcomputers?
53. Do you have a person on your staff who has electronic tinkering abilities for modifying the equipment for either increasing its capacity or for special applications such as braille?
54. How many microcomputers do you now have for each teacher involved with computers?
55. The micrcomputers in our school are used where?
56. The teachers using microcomputers are supported by a: (?)
57. The pupils using microcomputers are supported by a: (?)
58. Which obstacles do you perceive as hindering the continued growth and development of your microcomputer program?
59. Do your schools regard the microcomputer as a tool to: (do what?)
60. Please use words or phrases in the remaining space to outline the major steps of the procedure used by your schools for establishing microcomputers in the classrooms or in a center.

Definition of Terms

microcomputer: a small, relatively inexpensive classroom computer made possible by microelectronics

"mother unit": a central unit which can control several microcomputers simultaneously

Piaget's theories: the four major stages of a child's psychological development as outlined by Swiss psychologist J. Piaget

individualized instruction: a set of teaching methods and activities where the content and pace of instruction are adjusted to the needs and abilities of the individual learner

programming language: one of several systems for coding instructions into a computer

time sharing: a large mainframe computer accommodating several terminals sometimes from a great distance. This system is slow and sometimes troublesome. It was the only method available for computerized instruction before the advent of the microcomputer.

software: all types of computer programs and their accompanying printed materials

courseware: software containing instructional programs

computer assisted instruction: making use of a computer's several instructional modes with learners

inservice training: "on the job training" for teachers

peripheral devices: devices which are attached to the computer externally. These devices perform special functions, e.g., a printer or a light pen

Basic Assumptions

These basic assumptions are related to this study:

1. Microcomputers are viable, accepted and effective learning tools on all educational levels.

2. Microcomputers are now being used with young learners in many schools.

3. While many schools have implemented or are implementing microcomputers in their instructional programs, many have not or they are still in their planning stages for doing so.

4. Those shcools which have or are now implementing microcomputer instructional programs have made decisions and development procedures for doing so. If known, these procedures and decisions shall be valuable to those schools which have yet to plan and implement their own microcomputer instructional programs. These decisions and procedures shall also be valuable to colleges and universities with teacher education programs who are planning to implement microcomputer concepts into their curriculums for teachers and prospective teachers.

The Method of Investigation

General design. This study consists of an investigation to determine the type and range of decisions made by the schools concerning microcomputer instruction This investigation should also determine the procedural steps used by the schools for implementing microcomputers into their programs.

Each school system of a selected sample received a survey instrument designed to elicit the kinds of decisions being made concerning the major issues of microcomputer instruction. The procedural steps developed by each school system to implement microcomputer instruction were also elicited. The results from these survey instruments were tabulated and computerized with the use of the Social Studies Statistical Package in order to determine which decisions were being made and which procedural steps were being used to implement the instructional use of microcomputers.

Population and Sample limitations.

The sample consisted of school systems in five enrollment categories:

a. less than 15,000 students
b. 15,000 to 30,000 students
c. 30,000 to 50,000 students
d. 50,000 to 100,000 students
e. 100,000 or more

The survey instrument was sent to 400 school systems in 50 states. Efforts were made to balance the number of districts chosen from rural areas, small towns and cities, medium and large sized cities.

Data and instrumention.

The data for this study were collected by means of a detailed 60 item survey instrument. Fifty-nine of the items were multiple choice. Each multiple choice item was designed with an open-end. The 60th item was in essay form. Its purpose was to elicit the actual step-by-step procedures used by the schools for implementing microcomputers into their instructional programs The content of the survey instrument was finalized only after the investigator spent nearly a year visiting and interviewing key microcomputer educators, in school systems and college teacher education departments around the Great Lakes. It was anticipated that the collected data would include specific information concerning the implementation of microcomputer instruction in the schools.

Reporting the findings.

The major objectives of this study were to determine: (1) the type and range of those decisions made by the schools concerning microcomputer instruction; (2) the specific procedural steps used by the schools for implementing microcomputers into instructional programs; and (3) possible trends concerning the issues involved with implementing microcomputer instruction as may be revealed in the conclusions.

Microcomputers in the Schools

For the direct reporting of the findings, the data from the survey were tabulated and reported in terms of percentages of responses for each of the options listed under each question. The term "respondent" was used when reporting the data for those questions requiring the participant to mark one option only. The questions requiring a single response are identified with a checkmark (✓). The term 'responses' is used when reporting the data for those questions allowing the participant to mark more than one option or to write in his response.

The procedures

1. Four hundred school systems were selected at random from Patterson's American Education Directory according to the enrollment categories which were pre-determined.

2. A 60 item survey instrument was designed to elicit specific information concerning the decisions made and the planning procedures developed by the school systems concerning their microcomputer programs. The questionnaire was evaluated by two colleagues including my department chairperson. The questionnaire and the cover letter are included in the appendix.

3. The survey instrument was mailed to each of the 400 selected school systems in 50 states.

4. 140 usable survey instruments were returned.

5. The data elicited by the survey instruments were recorded and computer tabulated by using the Social Studies Statistical Package and reported in simple percentages.

6. The findings were written and reported question-by-question.

7. Conclusions and recommendations were formed from the findings.

Need for the Study (Significance to Education)

The advent of the small, convenient and relatively inexpensive microcomputer has enabled schools in every community to engage in computer assisted instruction to students. While many school systems are still in their planning stages for these concepts, others have made major decisions in this area and have developed specific planning procedural steps to implement the use of microcomputers

It is the responsibility of the Department of Curriculum and Supervision, SUCB, and SUNY to continually explore and investigate those innovations which may hold promise for more effective preparation of teachers and thus, indirectly, of young learners. There is a need for those of us in teacher education to familiarize ourselves and our students with trends and issues in microcomputers as instructional tools. The Department of Curriculum and Supervision and the institution in which it is housed should be responsible for making available the

necessary leadership for exploring sound practices and procedures for implementing microcomputers into our instructional program. There are no known studies as recent or as comprehensive and specific as this one. The results of this study shall be of use to the college and its teacher preparation program when gauging those curricular needs related to microcomputer assisted instruction. The results of this study shall enable the college to more effectively consult the school communities which it services concerning the implementation of instructional microcomputing. These results should be considered for sharing with other SUNY units and the New York State Department of Education.

WHAT DOES RESEARCH SAY ABOUT THE USE OF COMPUTERS AND MICROCOMPUTERS FOR INSTRUCTIONAL PURPOSES? A SURVEY OF THE LITERATURE

Part I. Microcomputers: Their Benefits for Learners

Introduction.

Computer assisted instruction has been used and tested in a variety of human learning situations which include penal institutions and military posts as well as traditional school settings. The students using this instruction varied widely in ability levels and ethnic background as well as in personal goals. The excerpts and summaries of reports presented in this project were merely a sampling of the abundance of available research concerning computer assisted instruction. An attempt was made to summarize the results of each study in one or two paragraphs as follows:

(1) Three Minnesota correctional institutions sought to improve the reading and mathematics abilities among a group of males aged 17-21, a group of males and females aged 12-18 and another group of males aged 13-18. The program's evaluation focused on the learning of the basic skills, students' attitudes toward the learning of reading and mathematics and the staff's attitudes toward computer assisted instruction. Although the results did not clearly support the effects of computer assisted instruction on achievement, the students did show progress. The students' attitudes in general showed improvement. Their attitudes toward computer assisted instruction were generally positive as were the attitudes of the staff.

(2) When a group of pupils in grades 4 to 6 in Illinois were taught mathematics through the use of microcomputers, the results were positive in terms of both achievement and attitude. The program was described as being a clear success when presented in an "add on" mode and as particularly successful when it was integrated with the teacher's mathematics program. There were large achievement gains reported in grades four through six. The gains in grades four and five were more moderate when the children were presented with material

that was less familiar or when the reading level of the material was too advanced. A highly structured fractions strand was particularly effective in conveying understanding and skills to the pupils. An important finding was that the computer could go beyond the manipulation of symbols. It could present concepts and operations as well as measure the pupils' abilities to master them. This system demonstrated that it was capable of teaching as well as providing supportive drill and practice for those concepts already introduced by the classroom teacher.

(3) In Saskatchewan, Canada, thirty-six third grade students were identified as the poorest spellers in their grade. These students were the participants of a computer assisted spelling program. The students, who were frustrated from failure in traditional classroom settings, showed a 5.6 month gain in their spelling abilities at the end of a five week period. This was a substantial gain not expected with traditional means over the same brief period of time. Although these children were discouraged with their own academic performance, they responded positively and productively to the alternative game-like qualities of the computer program. The opportunity to try again immediately after an incorrect response provided a sense of challenge and reinforcement rather than feelings of discouragement.

(4) Adult non-readers, when presented with a computerized basic skills program, averaged a 1.12 grade level gain in reading achievement after an average instructional time of 13 hours. The data revealed that a 1.0 grade level gain could be achieved in 18.34 hours with the computerized reading program. This system seems highly motivational and successful with students who have experienced difficulty in text-oriented passive classroom environments. The novelty effect of the system was found to be extremely motivating.

(5) Sixty-four soldiers at Fort Belvoir, Virginia were divided into two groups for the purpose of learning language arts and mathematics. None of them were high school graduates. The average soldier was twenty years of age, had a tenth grade education, and had a seventh grade achievement level as measured by the California Achievement Test. One group was taught by traditional methods. The other group was taught with traditional and computer assisted instruction. After all measures were completed, the scores for soldiers in the traditional group with computerassisted instruction were higher than for soldiers in the traditional group only. This Army study indicated that computer assisted instruction can provide individualization, standardization, and efficient instruction to adult learners who require remediation in the basic skills.

(6) In Seattle, Washington, the Highline Rublic Schools established a computer assisted instruction program under Title I. Mathematics, language arts and reading instruction were presented through this program to those students who were found to be severely deficient in any one of the basic skills. These students were in grades K-12. After three years, the achievement gains indicated by pre- to post-test SAT data exceeded expectations. This system was found to be a viable method for teaching the basic skills to severely deficient children. At $100 per student for three years, the system was found to be cost efficient. Students, teachers, and parents were positive about the system.

Related Literature

(7) The results of another three year study in West Germany indicated that engineering students were able to learn pre-instructional skills in mathematics, physics, and technical thermodynamics with computers at the same level of achievement, if not better, than traditional methods.

(8) Students in grades three and four in thirteen Montgomery County, Maryland Public Schools scored a 3.6 to 4.2 month achievement gain in arithmetic after a six month computer assisted instruction program. These students had below average scores on the pretest. Students in grades 3 to 6 using microcomputers showed significantly greater gains than students in the traditional setting.

(9) Seven thousand, three hundred students who were two or more years below grade level in mathematics in 50 New York City high schools took part in the Remedial Mathematics Skills Program funded under Title I of the Elementary and Secondary Education Act. The program's objective was to improve computational skills with the use of computers, calculators and other materials. This corrective mathematics program was supplementary and individualized. The results of the Metropolitan Achievement Test (Advanced Level) indicated that statistically significant gains were achieved by the students in their mathematics skills.

(10) One hundred eleven deaf students ages 8 to 15 in Washington, D.C. made significant achievement gains in mathematics as a result of their participating in a computer assisted instruction program. The computers released teachers from tedious chores and made them available for individualized instruction.

(11) In Pittsburg, Pa., elementary school students were given a set of rules for managing their own progress through a mathematics unit. Interactive computer programs which could be controlled by the student were used. These fourth and fifth graders not only were able to manage their own learning of mathematics but learned faster and enjoyed better retention than students in traditional situations.

(12) A federally sponsored program was designed to combine the teaching of mathematics content and problem solving skills. Eighty-eight percent of the students taught this way achieved the course objectives.

(13) When a microcomputer was used to test for the mathematics weaknesses of high school students many benefits were enjoyed. Among these were the saving of teachers' time, elimination of paperwork, and a form of testing that was found enjoyable by the students. The test results were immediately available to students and teachers alike and in a variety of forms.

(14) Many functionally illiterate adults who were unable to experience success in learning the basic skills in the classroom have succeeded in doing so at the computer carrels at the Baltimore Learning Center. These CETA (Comprehensive Employment and Training Act) students have acquired the self-confidence as well as the skills necessary to succeed in productive employment.

Related Literature

(15) When computer assisted instruction was used with 875 handicapped children in Canada the results were extremely positive. These children were physically disabled, learning disabled or deaf. The achievement gains in mathematics and language arts for those children in the CAI group were several months more than the achievement gains of those handicapped children in the central group.

(16) Classroom computers have been found to provide teachers with accurate diagnosis of each child's strengths and weaknesses in reading. These computer programs followed each diagnosis with accurate prescriptive recommendations for the remediation needed by each child.

(17) A study at Stanford University was designed to identify those properties of computer assisted instruction that arouse and mainfain students' interest over rather lengthy periods of time. Among these properties were novelty, incongruity, surprise, change, some degree of conceptual conflict, and those properties of the machine itself which generate curiosity, i.e., the self pacing and accompanying sounds and motions.

(18) There were 101 students at the Texas School for the Deaf who used the mathematics Strands Program of the Institute of Mathematical Studies in the Social Sciences at Stanford University. It was found that the number of computer assisted instruction sessions provided for these students correlated positively with their Metropolitan Achievement Test gains. The MET gains for these hearing impaired students were substantial.

(19) Researchers at MIT who frequently observed children learning in LOGO computer environments reported that children experienced certain positive phenomena not experienced in BASIC computer environments. Children working in LOGO computer environments experienced immediate success. Their attention spans were lengthened considerably. They began liking numbers. They learned line integrals without noticing it while doing turtle drawings. Like Euclid, they could make complex hierarchical constructions which may give them a taste for mathematics. Finally, the observers found the children thinking for themselves as they provided their own directions for the turtle.

(20) The results of a study concluded at Wittenburg University indicated that second graders could learn basic addition facts by using a drill and practice game called Fish. The teacher reported that the students enjoyed the experience and had few problems using the computer.

(21) After a computer storytelling mathematics program for Pueblo Indian students, teachers observed an improvement in the classroom atmosphere. Student discipline improved most noticeably along with increased interest and productivity. The teacher became less of an authoritarian and more of an instructional partner. The students' behavior became more active, participatory and stimulated. Many kinds of learning took place about mathematics and the use of computers.

Related Literature

(22) A 1975 study at Stanford University indicated a high correlation between the on-line rate of progress and student achievement during a computer assisted instruction program in initial reading.

(23) When a computer assisted training program was used to supplement conventional methods of teaching a sight vocabulary to mildly mentally retarded school children their sight vocabularies increased by an average of 128 percent. This increase remained constant over a 23 week period. The control group had a 34 percent increase.

(24) Frederick H. Bell (1974) reported that computer related learning environments provided an opportunity for learners to be creative in getting their programs to run, to teach their peers what they've learned, and to gain recognition in their efforts. These may be some of the reasons why some students do outstanding work in a computer learning environment.

(25) Errol M. Magidson (1978) reported that college students using computer assisted instruction responded favorable to it in the following ways: (1) they enjoyed using PLATO computer assisted instruction; (2) they did not feel that it was dehumanizing; (3) they found it to be a helpful learning aid; (4) they sometimes used it during their free time. Magidson found that college students viewed their computer assisted instruction experiences very positively in every instructional area and regardless of the length of time it was used. Any possible novelty effects did not seem to wear off during prolonged usage. There was some annoyance and frustration reported with terminal and computer breakdowns. Note: these kinds of interruptions and breakdowns are commonplace when mainframe computers and multiple terminals are used. These kinds of breakdowns are greatly reduced or eliminated when microcomputers are used.

(26) Gerald W. Bracey reported on the work of James Kulik at the University of Michigan. Kulik analyzed 51 separate research studies with well designed methodologies. The 51 studies showed that students who received computer assisted instruction scored better on objective tests than students who received traditional instruction only. Computer assisted instruction was found to improve retention when students were tested at later dates. Kulik and his colleagues found that CAI can also improve the speed at which students can master a given set of materials.

(27) San-Yun W. Tsai and Norval F. Pohl (1980-81) seemed to find general agreement that students using computer assisted instruction were able to master a given set of materials in less time than required by students taught only by traditional methods.

(28) Gerald W. Bracey wrote about the affective motivational outcomes of computer assisted instruction as reported in a 1980 study by James Gershman and Evannah Sakamoto at the Ontario Institute for Studies in Education. Students were able to progress at their own pace and were able to make their mistakes in private without embarrassment. Their comments included: "You can learn at your own rate" and "There's no teacher to yell at you."

Related Literature

(29) Lewellen and Allen (1971-1972) reported that CAI students took less time to learn a given set of material than students being taught only by traditional methods. Time savings of 40% were reported.

Summary

In summary, Part I of the literature seemed to indicate that learners who used microcomputers benefited in several ways. Learners achieved more at a faster rate and had better retention when they participated in microcomputer assisted instruction regardless of which subject of the curriculum was involved. Disadvantaged learners and physically and mentally disabled learners had the same benefits. Learners maintained positive views of the concepts and skills which they were learning. They were more successful in learning problem solving and in being creative. Adult learners and young students were more successful in learning the basic skills with microcomputers than with the traditional methods only. Learners were highly motivated and often excited when using microcomputers.

Teachers found that they were more effectively achieving their goals in less time. They found it easier to engage in diagnostic and prescriptive teaching and remediation. Teachers found that student motivation seemed to be built into computer assisted instruction.

Related Literature

PART II. Trends In the Use of Microcomputers for Instruction:
A Survey of the Literature

Introduction

The use of microcomputers for instruction has widened considerably in the schools and in the college and university departments which prepare teachers. The implementation of microcomputers has not been without problems. This section of the survey of the literature includes some of the trends and problems revealed in a number of studies.

(30) Only 15.5 percent of 134 Southeastern teacher education colleges and universities offered a course for acquainting pre-service teachers with microcomputers according to a recent survey study. However, almost half (47.3%) offered inservice microcomputer training for the teacher education faculty. Some institutions (15.5%) were offering an introductory microcomputer course to their preservice teachers. Twenty-six percent of the institutions already had such a course for their inservice teachers. Seventeen percent of the responses indicated that their education department had a microcomputer laboratory. Thirty-six percent of the responses indicated the inclusion of one or more microcomputers in their educational media laboratory. Seventy-one percent of the respondents indicated that there was "some" or "a great" demand to have microcomputers available. Nearly half (47.3%) have offered inservice microcomputer training for the college faculty. Only four institutions reported having a formal, written policy concerning microcomputer education for either graduate or undergraduate students. The two institutions offering computer certification programs for teachers were both located in Florida. One-fifth of the respondents indicated that they had plans for offering this kind of certification. Seventy-one percent agreed that there is a need for a state or a regional clearinghouse for instructional courseware.

(31) According to R. C. Elliott, computer competencies should be accessible as a necessary resource for teachers. Colleges and universities with teacher education departments are preparing teachers who are entering classrooms where computer illiteracy is rapidly becoming as intolerable as other forms of illiteracy. Computer literacy may become the fourth "R." Learning how to learn through the act of computer programming may become one of the most valuable means for a young learner to keep pace with a lifetime of rapid technological change. Indeed, how soon will programming skills be required of high school and college freshmen?

(32) Michael T. Battista reported a lack of microcomputer instruction for preservice elementary teachers. Many among those preservice teachers who had programming instruction seemed to lack a knowledge of the important computer literacy topics. Battista noted that there was little chance of systematic instruction for elementary school students if their future teachers were not being adequately prepared.

Related Literature

(33) Laurel Dickerson and William H. Pritchard, Jr., in pointing out the important need for microcomputer literacy among educators and the planning for microcomputer instructional programs, has indicated that microcomputers can project an exponentially greater impact to the learner than television because of its storage and interactive capabilities. Thus an exponentially greater loss to the learner may occur if educators are not prepared.

(34) The results of a 1981 Alberta study concerning the use of microcomputers in instruction revealed that: 12% of the schools had one or more microcomputers; the three brand names of machines most frequently selected were Commodore Pet (45%), Apple II (31%), and Radio Shack TRS-80 (19%); the machines seemed to be evenly spread across grade levels; the most frequently reported uses were for computer literacy and computer assisted instruction. Most users expressed the need for additional equipment, software and training; the majority of those schools that did not have a microcomputer were anticipating the delivery of equipment in the near future. Sadly, a large number of this group did not know enough about microcomputers to even anticipate what their needs might be. The remaining responses reported a strong need for information about hardware, programs and additional training. Only a small number reported that they had no interest in introducing microcomputers into their schools.

(35) Thirty-one school districts in three New York State Counties were surveyed in 1981 to determine the extent of microcomputer utilization as well as the attitudes toward the concept. The responses indicated that microcomputers were used mostly in the teaching of mathematics from grades 3 to 12. Programming was taught in the 11th and 12th grades. The software was purchased except for that which was generated by students and faculty in the chemistry and programming courses. The study indicated that the machines should be made more accessible to a greater number of students. The attitudes of administrators toward microcomputers was usually favorable; teachers' attitudes varied from modest to impressed.

(36) A 1980 survey of 46 Arizona school districts revealed that computer assisted instruction was used most frequently in language courses. Arizona school districts were interested in the educational applications of microcomputers but were being held back by lack of trained personnel and effective software. Several districts recommended the following: courses in microcomputer teaching methods for education majors, inservice workshops for computer literacy and software development, a program to help districts implement microcomputers into the instructional process, and inservice microcomputer literacy courses for administrators.

(37) A 1981 survey of each California School district concerning the instructional use of computers indicated these findings: computers were used in instruction by one-third of the districts; at least 2/3 of those districts used microcomputers; hands-on experiences in 82% of the computer-using districts were limited to fewer than 25% of the students; the most frequent curricular applications in order of frequency were mathematics, computer science/literacy, business education and career education; the BASIC language was used in over 60% of the instructional applications; over 80% of the teachers in those districts using microcomputers were found to be either unprepared or inadequately prepared to function in a computer supported environment; one third of the districts not using computers were planning to initiate programs within a year or so.

Related Literature

(38) A large national survey of 974 school districts concerning microcomputers in education resulted in the finding that 74% of the districts were using computers for instruction with projections to 87% by 1985. Computer assisted learning was reported by 54% of the districts surveyed with projections to 74% by 1985. The major usage in high schools was for drill and practice in mathematics, natural sciences, business, and language arts. Projections for the 1980s included increased usage in the social sciences. Increased use is projected for the elementary grades in all subject areas with shifts to tutorial and simulation delivery systems. The major obstacles to microcomputer programs were reported as financial, lack of knowledge and training on this topic, faculty attitudes and the need for improved software.

(39) According to the results of a 1980 study completed by Lisa Loop and Paul Christianson microcomputers were already a significant tool for learning in the schools. The price barrier had been broken which was making microcomputers available both in school and in the home. Educators, encouraged by the media and their own professional organizations, were placing a high priority on learning about microcomputers. Teachers were crowding microcomputer methods courses and there was a need for materials of all kinds for supporting learning and teaching about microcomputers.

The results of interviews with teachers indicated that less time was spent on curriculum content and more time spent on computer literacy, thinking, problem solving skills, and computer applications. The teachers expressed a need for more equipment, software, and microcomputer training.

(40) The most powerful argument for the widespread introduction of microcomputers into the schools may be Luehrmann's argument which included the statement that the ability to use computers is as basic and necessary to a person's formal education as reading, writing and arithmetic.

Summary

In summary, Part II of the survey of the related literature, microcomputer training for teachers was available both inservice and on many college campuses. Much has yet to be done in the preparation of teachers. Most colleges and universities which prepare teachers still lack a written policy concerning microcomputer education for preservice teachers and for graduate students. Most school systems seem to be using microcomputers. Yet, too few students are receiving hands-on experiences.

School systems are projecting increased use of microcomputers for the 1980s with implications for the colleges and universities which prepare teachers. Microcomputers have become a significant instructional tool. Unprepared teachers will cause a great loss to learners.

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The Findings

The results of this study are expected to be of help to those schools getting started with microcomputer education. In addition, those institutions that provide services as well as prepare teachers and administrators for the schools may do so more effectively with these results.

For the convenience of the reader, the responses are summarized in rank order fashion from one to three levels as necessary. The bit count and percentages for each item are available upon request.

The sixty items in the study are summarized as follows:

138R 1. Does your school system have microcomputers in the classrooms?

Over one-third (38%) of the responses indicated that microcomputers were placed in classrooms. A somewhat smaller but significant group of responses (33%) indicated that microcomputers were available to children, but only in a center established for them in each school. Twenty-two percent of the responses indicated that microcomputers were available to children in the classrooms and in the special centers. Six percent of the responses indicated a lack of microcomputers in their schools but that they were planning to have them at some future date. Only one percent of the responses did not have microcomputers and were not planning to get any.

135R 2. Are your microcomputers tied to a "mother" unit inside the classroom?

The overwhelming number of responses to this item (82%) were "no." Twelve percent indicated a part time connection with a mother unit inside the classroom; other times the children worked with individualized and varied courseware. Four percent did indicate that their microcomputers were tied to a mother unit inside the classroom. Two percent of the responses were of mixed combinations.

134R 3. Are your microcomputers tied to a "mother" unit outside the classroom?

Only a small number of responses (4%) answered in the affirmative for this item. An overwhelming (93%) of the repsonses indicated that their microcmputers were not tied to a mother unit outside the classroom. Three percent of the responses were both "yes" and "no."

Microcomputers in the Schools

35R 4. In which grade do you introduce microcomputers to the children?

Sixty-eight percent of the responses indicated that microcomputers were introduced to the children in grade levels varying from the kindergarten to the 6th grade, i.e.,

16% in kindergarten
22% in grades 1, 2, or 3
30% in grades 4, 5, or 6
68% K-6

Only 32% of the responses indicated that the introduction of the microcomputer was delayed until grades 7 to 12, i.e.,

15% in grades 7, 8 or 9
+17% in grades 10, 11, or 12
32%

51R 5. How much time does a pupil spend with a microcomputer each week?

There was no overwhelming specific response for this item. Twenty-eight percent of the respondents indicated that each of their pupils spent 15 to 20 minutes per week on the microcomputer. Twenty-three percent were able to provide 30 to 60 minutes per pupil per week. Other responses were 8% for 1 to 2 hours per week, 4% for 2 to 3 hours per week and 5% for 4 or more hours per week per pupil.

Thirty-two percent indicated that the time per pupil with a microcomputer varied from week to week.

52R 6. For which curriculum areas is the microcomputer available for children?

Thirty-four percent of the responses indicated that microcomputers were used for the mathematics curriculum. Eighteen percent indicated that the microcomputers were used in the reading curriculum. Seventeen percent were able to make microcomputers available in the language arts curriculum, 12% in the social studies curriculum and 7% in art and music. The remainder of the responses (12%) were divided among these curricular areas: business, science, computer science, industrial arts, and guidance.

31R 7. In the curriculum areas listed in item 6, was any improvement of children's performance attributed directly to the effectiveness of the microcomputer as compared to when the teachers and children were limited to the traditional classroom methodologies and the absence of microcomputers?

Most of the respondents (75%) felt that their work was too new yet for them to make the comparison. Eighteen percent said yes on the basis of teacher observation and test scores, while 4% said no on the same basis. Two percent said yes, as determined by the results of research designed for making such a comparison while 1% said no because of the same type of evidence.

Microcomputers in the Schools

136R 8. Do you use the microcomputer for testing the children's performance?

The largest set of responses (60%) for this item were "no." The remaining 40% who responded "yes," indicated that they used the microcomputers for testing in the following modes: teacher made tests only (11%), achievement tests and teacher made tests (2%), only for that testing which was designed in the courseware (15%), most kinds of testing including those already mentioned (6%). The remaining 6% were for miscellaneous testing activities which included diagnostic testing, basic skills testing and the generation of printed tests.

217R 9. The microcomputers in your schools and classrooms are used mainly for: (?)

There was no overwhelming set of responses for this item. Twenty-six percent of the respondents indicated that they used microcomputers for drill, practice, and the mastery learning of basic concepts. Eighteen percent indicated that they used them for problem solving. Seventeen percent fostered creativity through interaction with problematic situations. Eight percent indicated that they used the microcomputer for the filing and retrieving of information. Another 20% applied the microcomputer to all of the previously mentioned uses. Most of the remaining 11% used their equipment to teach programming and computer literacy.

139R 10. Do teachers see microcomputers as supportive of Piaget's theories of learning?

The overwhelming number of respondents (50%) indicated that Piaget was not a concern at the time. Twelve percent responded with a "yes" while another 12% responded with a "no, not with available courseware." Five percent of the respondents indicated that their microcomputers were used for mastery learning only. The responses for the remaining 10T varied. Only 1% indicated a "yes with LOGO."

127R 11. Do teachers find that microcomputers enhance their ability to individualize instruction?

An overwhelming number of respondents (86%) said "yes" to this one. Only 11% said "no." The remaining responses varied.

188R 12. The children having access to the microcomputers include: (?)

Forty-two percent of the respondents indicated that they used microcomputers for statistically ordinary children, the gifted children, the slow and retarded children and the handicapped children. Thirty percent indicated that the equipment was used for the gifted children. Eleven percent used the equipment for the slow and retarded children while 5% used it for the handicapped children.

Microcomputers in the Schools

35R 13. Which microcomputer skills are required of the teachers prior to the acquisition of microcomputers?

Fifty-six percent of the responses indicated that they required only the basic literacy necessary to operate the equipment. Ten percent required the basic machine literacy and programming skills. Twenty-five percent required operational literacy, programming skills, and a knowledge of software and courseware. The remaining responses were varied or unspecified.

20R 14. The teachers acquired their computer skills by: (?)

Twenty-four percent of the respondents indicated that they acquired their skills by attending school-sponsored, inservice seminars or workshops. Seventeen percent attended classes at a college or a university. Fifteen percent engaged in self-teaching programs. Only 9% attended programs sponsored by the manufacturer or the retail outlet. The largest group, thirty-five percent, indicated that they acquired their skills from a combination of the previously mentioned programs.

32R 15. Which programming language do msot teachers seem to be using?

The overwhelming response (77%) indicated that BASIC was the language which most teachers seemed to be using. Only 6% said "LOGO." Five percent marked PASCAL. Nine percent indicated that they were using only prepared courseware and were not concerned with a programming language. The remaining 3% of the responses were varied with 2% opting for PILOT.

35R 16. Which programming language is taught to children?

The overwhelming number of respondents (76%) indicated that they taught BASIC to children. Nine percent taught PASCAL, 4% TUTOR and 6% LOGO. The remaining responses varied and included very small numbers who taught ASSEMBLER (3%), COBOL (1%).

31R 17. Do teachers preceive a marked improvement in the children's motivation to learn as a result of the use of microcomputers?

Sixty-six percent of the respondents marked "yes" for this item. Thirty-four percent indicated that they were not able to determine a response at the time.

34R 18. Do teachers perceive a marked improvement in discipline (the children's behavior) as a result of the increased motivation provided by the computer?

Forty percent of the respondents marked "yes" for this item. Only 3% marked "no." Fifty-seven percent indicated that they were unable to determine a response at the time.

34R 19. Before you acquired microcomputers, did you use time-sharing computer terminals for instruction?

Thirty-two percent of the respondents marked "yes" for this item. Sixty-eight percent marked "no."

Microcomputers in the Schools

218R 20. Which brand name microcomputers did your staff select?

The largest group of responses (44%) indicated that they selected the Apple microcomputer. The second largest group of responses (32%) indicated that they selected the TRS-80 models (Radio Shack). Twelve percent selected the Commodore Pet while 5% selected the Atari. The remaining 7% had selected among these machines: Hewlett-Packard, Texas Instruments, Sinclair, Ohio Scientific, and others.

455R 21. The considerations for the brand-name selected for your particular hardware included: (?)

None of the responses were overwhelming in a specific category. The largest group (21%) considered quality and twenty percent considered price. Nineteen percent of the responses were concerned with the equipment's flexibility and with provisions for expanding the machine's capability. Twenty percent of the responses were concerned with service availability and rapid delivery. Fifteen percent were concerned with simplicity of operation while 5% were concerned with available suitable software.

134R 22. The decision to purchase a particular make and model was made by:

Twelve percent of the responses marked "teachers" while 23% marked "administrators." Forty-four percent marked "both teachers and administrators." In essence 79% marked "teachers and/or administrators" as the decision making group when selecting hardware. Sixteen percent indicated that their decision making process included teachers, administrators and parents. Five percent included all of the aforementioned groups and students.

134R 23. The decisions concerning the purchase of courseware/software are made by:

The overwhelming number of respondents (70%) indicated that teachers and administrators made the decisions concerning software purchases. Twenty one percent indicated that only the teachers made these decisions. Only 2% indicated that these decisions were left to administrators. Only 4% included parents and only 3% included students.

136R 24. For which kind of software is your microcomputer equipped?

Fifty-seven percent of the respondents indicated that they were equipped to use both cassette-tapes and disks. Thirty-two percent used disks only while 7% used tapes only. Only 2% used hard disks. The remaining responses were for various combinations of those methods already mentioned.

170R 25. Most of your microcomputer software and courseware is acquired from which sources?

Nearly half (47%) of the responses for this item indicated that they purchased their software from the commercial market. The next largest group (24%) evenly matched the software they purchased with software that they generated themselves. Eleven percent indicated that their software was produced by teachers and staff. Fourteen percent of the respondents indicated that students programmed the software. The remaining respondents indicated a combination of the above sources.

Microcomputers in the Schools

18R 26. What were (or are) the major obstacles in establishing microcomputers in your school(s)?

The largest group of responses for this item (47%) indicated that financial problems were the major obstacles. A sizeable group (25%) cited lack of teacher preparation in the area of microcomputer concepts. Seventeen percent indicated a lack of general information concerning microcomputers. A total of 42% of the responses indicated that a lack of general information and a lack of teacher preparation as major obstacles. Four percent identified the negative attitudes or lack of perceived need on the part of administrators as obstacles. Only 1% identified lack of community support as an obstacle. The remaining responses varied widely.

34R 27. Would you recommend the use of microcomputers for schools elsewhere?

An overwhelming 99% of the respondents said "yes" for this item. One return said no, another lone return said "when the staff is ready."

8R 28. Why would you recommend a microcomputer installation for schools elsewhere.

Increased pupil motivation was cited by 24% of the responses. Thirty-one percent of the responses did so because of more effective individualized instruction with all types of pupils, i.e., gifted, average, slow, retarded, and handicapped. Twenty-seven percent did so because increased pupil motivation. Nine percent pointed to improved discipline. Five percent did so for the need of preparation for a computer society. The remaining responses varied widely.

)R 29. Why would you not recommend a microcomputer installation for schools elsewhere?

There were only fifty respondents to this item. Thirty-four percent of them would not recommend a microcomputer because of cost. Twenty-eight percent of them cited poor quality of hardware. Twenty-two percent marked lack of teacher interest and skills. Fourteen percent were of the opinion that there was a lack of evidence indicating microcomputer effectiveness. Though 2% marked "lack of purpose or general direction," no one marked "poor quality and lack of varied software."

32R 30. Would you have computer assisted instruction in your schools if microcomputers were not available?

Sixty-five of the respondents said "no" in response to this question. Thirty-five percent marked "yes."

35R 31. How were your microcomputers financed?

Forty-one percent of the responses indicated that they financed their microcomputers with local and federal funds. Twenty-one percent used local funds only, while 14% used local and state funds. Only 7% used federal funds only. Eighteen percent marked "other" which included combined local, state and federal (7%); local, state, federal and other 4%; state only 3%. The remaining responses varied widely and included a small number of machines financed by parental groups.

Microcomputers in the Schools

131R 32. At what future date do you foresee the availability of microcomputers in most of your classrooms?

The largest group fo responses (39%) for this item marked the dates 1985-1987 as the future dates which they expected the availability of microcomputers in most of their classrooms. Twenty-five percent of the respondents marked the dates from 1988-1990. Eighteen percent marked the dates 1991 to 1993. Fifteen percent indicated this kind of microcomputer availability for 1982-1984. Only 3% indicated that most classrooms had microcomputers at the time.

142R 33. How do you secure the equipment when the school is closed?

The largest group of respondents (65%) locked their machines in the classroom. Thirteen percent locked them in a closet off the classroom. This indicates that a total of 85% of the responses secured their machines in the immediate classroom area (this figure includes 7% from the "other", handwritten responses). Six percent used a vaulted room. Only 3% of the responses chained the machines to the wall, floor, or table in addition to the locked door. Only 2% used electronic security. One percent indicated that the machines were taken home by students and teachers. Only 1% locked the machines inside utility cabinets. One percent used police security. Seven percent of the respondents used handwritten responses to indicate that the machines were secured near the classroom. One percent were unspecified.

136R 34. The enrollment in your school system is: (?)

Thirty percent of the schools had an enrollment that ranged in size from 15,000 students to 100,000 students or more. Seventy percent of the responses were from schools with less than 15,000 enrollment.

126R 35. How many microcomputers do you now have for each child involved with computers?

Twenty-one percent of the responses indicated that they had one computer for each classroom. Ten percent indicated that they had one microcomputer for two children while 9% had one computer for every three children. Five percent had one machine for every four children and 17% had one for every five children. Seventeen percent indicated that their machine to child ratio was less than five to one, while only seven percent indicated that they had one machine per school. The remaining responses varied widely.

133R 36. Do you now screen new teachers for microcomputer operational literacy?

Twelve percent responded with a "yes" to this item. Eighty-eight percent responded with a "no."

66R 37. If you now screen new teachers for microcomputer operational literacy do you give preference to those new teachers who do possess microcomputer operational literacy when hiring?

There were only 66 respondents to this item. Twenty nine percent responded with a "yes" while 67% marked "no." Four percent marked "not necessarily."

Microcomputers in the Schools

.4R 38. Do you now require new teachers to possess microcomputer operational skills as a condition for employment?

Ninety-seven percent of the responses were "no." Only 2% said "yes" while 1% said "yes, when hiring math and science teachers."

R 39. Does your school system advocate the use of microcomputers in a non-programming environment only?

Seventy-two percent indicated that they did so with pupils and teachers. Twenty-eight percent responded with a "no."

'R 40. If you have more than one brand name of machine, for which do you make software for?

There were only thirty-three respondents for this item. Forty-four percent indicated that they made software for every brand. Thirty-three percent indicated that they made software for one brand only. Nineteen percent used vendor software only. The remaining responses varied widely.

4R 41: Did you have a systematic plan for implementing microcomputer instruction before you acquired microcomputers?

Thirty percent of the responses indicated that they had a systematic plan before they acquired the machines for instruction. Nineteen percent had a plan for a curriculum. Seventeen percent had a plan for the staff. Fifteen percent had a plan for the hardware and software. Seven percent had planned for space. Ten percent indicated that they had no plan before acquiring the machines. The remaining responses varied widely.

8R 42. Who participated in formulating this plan (for implementing microcomputer instruction prior to the acquisition of hardware)?

The largest group of respondents (38%) indicated that administrators had formulated this plan. Thirty-six percent of the respondents indicated that the teachers participated in formulating the plan, i.e., 74% indicated that either the teachers or administrators participated in the formulation of the plan. Eleven percent used outside consultants, 6% used vendor-planning and 8% used computer experts. The reamining responses varied widely.

.4R 43. Do you now have a systematic plan for implementing microcomputer instruction?

Sixty-six percent of the responses indicated that they now had a systematic plan for implementing microcomputer instruction. Thirty percent responded with a "no" to this item. Two percent had a plan under development. The remaining responses were of varied combinations.

If you now have a systematic plan for implementing microcomputer instruction, is it a five-year plan?

Forty-one percent replied with a "yes" for this item, while fifty-nine percent replied with a "no."

Microcomputers in the Schools

T54R 44. What were the circumstances under which you acquired your first microcomputer?

The largest group of responses (39%) indicated that they acquired their first microcomputer because of an interested mathematics teacher. Twenty-three percent did so because of an interested supervisor while 11% did so because of an interested principal. Ten percent acquired their first microcomputer because of an interested science teacher, while 7% did so because of an interested elementary teacher. Ten percent did so because of the interest of a variety of professionals including librarians and coordinators. In summary, fifty-six percent of the schools indicated that they acquired their first machine because of an interested teacher. Forty-nine percent of these teachers were science and math teachers. Thirty-three percent acquired their first machine because of an interested administrator.

133R 45. Is inservice training available for teachers in microcomputers?

An overwhelming 82% responded with a "yes" to this item as compared to 18% "nos."

239R 46. When is the inservice training provided?

The largest group of respondents (34%) indicated that this training was given to teachers after school hours in the afternoon. The training was given in the evening to 19% of the teachers. This training was provided during non-teaching periods, holidays and summers to 18% of the teachers. Thirteen percent of the teachers were trained in the use of the microcomputer during the school day. Ten percent of the teachers in question received their microcomputer training during weekends. Six percent of the responses indicated that this quesiton was not applicable to their situation.

141R 47. Is the inservice training given for credit?

Thirty-three percent of the responses indicated that the training was given without credit. Thirty-one percent indicated that credit was given. Credit was an option for 26% of the responses. The remaining ten percent of the responses varied widely and included points for recertification and for local credit.

341R 48. What does this inservice training include?

Twenty-seven percent of the responses indicated that programming was included in the inservice training. Twenty-three percent of the responses indicated that their inservice training included classroom strategies with the microcomputer. The tutorial mode was included for 17% of the responses. Sixteen percent of the responses indicated that peripheral devices such as printers were included in the training. One-on-one drill was included for 15% of the responses. The remaining 2% of the responses varied widely.

107R 49. Skills training with which peripheral devices is provided through inservice training?

Sixty-five percent of the responses marked "printer" for this item. Twelve percent marked the "card reader." Seven percent included the light pen. Five percent included the speech synthesizer while only 2% of the training programs included a speech digitizer. Only 1% included a graphics tablet. Four percent did not include any peripheral devices. The remaining 4% of the responses varied widely.

Microcomputers in the Schools

3R 50. If you teach programming to children, why do you do so?

Twenty-eight percent of the responses indicated that teachers taught computer programming to children as a form of computer literacy. Twenty percent did so as an instructional method to help children develop those mental processes necessary for problem solving. To help children develop a skill which may have occupational value motivated another 20% of the responses to teach programming. Seventeen percent of the responses indicated that they taught programming as a method of instruction and as a skill designed to enhance the child's creativity. Fourteen percent of the responses indicated that teachers taught programming as an instructional method for helping children to internalize concepts. The remaining responses indicated that they taught programming only in the senior high school; no reason was given for doing so.

'2R 51. Which agency do you think should sponsor a microcomputer consortium?

Forty-two percent of the responses indicated that a nearby college or university should sponsor a microcomputer consortium. Eighteen percent indicated that it should be sponsored by the teacher center. "A nearby large school system" was the choice of 12% of the responses. Nine percent of the responses indicated that such an organization should be a separate entity. Eight percent thought it should be tied to a nearby commercial organization. Another 8% would tie it to a state agency. The remaining responses varied widely.

18R 52. For which special applications do you use microcomputers?

The largest group of responses (44%) indicated that they used the microcomputer with the gifted. Thirty-three percent of the responses used them with the slow learners. Thus, an overwhelming 77% of the responses indicated that they used the machines with either the gifted or the slow learners. Eleven percent of the responses used the machines with the mentally retarded, six percent with the deaf and 4% with the blind, i.e., a total of 10% of the responses indicated that the machines were used with the deaf or the blind. The few remaining responses varied widely and included reading problems and applications with the physically handicapped.

32R 53. Do you have a person on your staff who has electronic tinkering abilities for modifying the equipment for either increasing its capacity or for special applications such as braille?

Sixty-seven of the responses marked "no" for this item. However, one-third (33%) of the responses replied with a "yes."

16R 54. How many microcomputers do you now have for each teacher involved with computers?

Thirty-one percent of the responses indicated that there was one microcomputer for each teacher. The availability of one machine for two teachers was indicated by 5% of the responses. Six percent of the responses indicated that they had one computer for every three teachers. Five percent indicated

the availability of one machine for every four teachers. The availability of one machine for every five teachers was indicated by 19% of the responses. Ten percent indicated that they had less than one machine for every five teachers. Four percent of the responses had one machine for the entire school. Five percent of the responses specified a laboratory equipped with many machines and open to everyone in the school. The remaining responses were so widely varied that they cannot be listed here.

170R 55. The microcomputers in our school are used in which instructional environment?

Forty-nine percent of the responses used the microcomputers in a laboratory concept and in the classrooms. Fifteen percent of the responses indicated that the equipment was used only in the classroom. The machines were checked out by the teacher as A-V equipment by another 15% of the responses. The equipment was used only in a laboratory by another 14%. The equipment was taken home overnight and weekends by 5% of the responses. The equipment was used in a resource room by 2% of the responses.

144R 56. The teachers using microcomputers are supported by a: (sources of support ive service)?

The largest group of responses (31%) indicated that those teachers who were using microcomputers for instruction were receiving support from a system-wide computer coordinator.

Twenty-four percent of the responses indicated that the teachers using microcomputers were receiving support from the building computer leader. Another 24% indicated that support was provided by a system-wide computer committee. Eight percent indicated that they received support from a user's newsletter while 3% received help from a building computer committee. Another 3% received support from the principal, department chairperson or supervisor. One percent received help from the curriculum committee. Two percent received support from other sources. Three percent indicated that they did not recieve any support. Only one percent indicated that they needed support.

131R 57. The pupils using microcomputers are supported by a: (sources of support)?

The largest group of responses (46%) indicated that the pupils using microcomputers were supported by resource persons. Eighteen percent were supported by a computer club. Thirteen percent were supported by computer journals and 4% by a user's newsletter. Eight percent of the pupils received help from parental groups and 5% received help from teachers. Four percent were supported by other sources. Only 2% of the responses indicated that the pupils were not receiving any support.

154R 58. Which obstacles do you perceive as hindering the continued growth and development of your microcomputer program?

An overwhelming 76% of the responses indicated that insufficient funds for new hardware and software were the obstacles that they perceived as hindering the continued growth and development of their microcomputer program. Ten percent of the responses indicated that their problem was too few interested teachers. Seven percent indicated a lack of perceived need. Two percent were

concerned with a lack of administration support. The remaining five percent varied and included a lack of parental and community support (1%), lack of a definite program (1%), lack of time (1%) and lack of software (1%). Only 1% of the responses indicated that there were no obstacles. None of the responses indicated an absence of pupil interest.

OOR 59. Do your schools regard the microcomputer as a tool to: (uses)?

Twenty-nine percent of the responses indicated that they used the microcomputer as a tool to challenge the able and gifted with advanced curriculum. Twenty-five percent used the microcomputer to implement remediation. Thus 54% of the responses indicated that the machines were used either to challenge the gifted or to remediate the slower students. Fourteen percent regarded the computer as a tool to implement the existing curriculum only while another 14% allowed games and recreation when appropriate. Sixteen percent of the responses engaged in experimental curricula. The remaining 2% varied widely.

60. Please use words or phrases in the remaining space to outline the major steps of the procedure used by your schools for establishing microcomputers in the classrooms or in a center.

The results for item #60 are presented on page 47 and are titled: Planning for Microcomputers in the Schools.

Microcomputers in the Schools

The Conclusions (in detail)

Seventy-one percent of the respondents in this study indicated that microcomputers were available to children in their schools either in the classroom or in a laboratory.

Eighty-two percent of the respondents indicated that their machines were not tied to a "mother" unit inside the classroom. Ninety-three percent indicated that their machines were not tied to a mother unit outside the classroom.

Microcomputers were introduced in grades K to 6 by 68% of the responses. Only 15% of the responses introduced the machines to students during the middle school years while 17% intorduced them in the high schools.

Fifty-one percent of the responses indicated that the amount of time that each pupil worked at a microcomputer varied from 15 to 60 minutes per week. Only 3% indicated that their pupils spent less than 15 minutes per week at a microcomputer.

Although microcomputers were used in all areas of the curriculum including music and art, eighty-one percent of the responses used them for mathematics, reading, language arts and the social studies (in the rank order as written).

Most of the respondents (60%) indicated that they did not use the microcomputer for testing the children's performance. Among those who did use the microcomputer for testing, the largest group (15%) did so with courseware which had testing built into the program.

Eighty-one percent of the responses indicated that microcomputers were used mainly for drill, practice, mastery learning, problem solving and creativity through interaction with probelm-solving situations. Eleven percent used their equipment to teach programming.

While 12% of the respondents indicated that microcomputers were supportive of Piaget's work, 50% indicated that Piaget was not a concern at this time. Only 1% indicated a "yes with LOGO."

An overwhelming 86% of the respondents indicated that microcomputers enhanced their ability to individualize instruction.

In varying degrees all the respondents indicated that their microcomputers were used by all children including the statistically ordinary children, the gifted children, the slow and retarded children and the physically handicapped children.

Microcomputers in the Schools

While 56% of the respondents required only the basic literacy necessary to operate the equipment prior to the acquisition of microcomputers, 35% required both the operational literacy and programming skills. Twenty-five percent required a knowledge of the software.

Teachers acquired their microcomputer skills from one or a combination of sources which included school sponsored inservice seminars and college courses.

Most teachers who were using a programming language indicated that they were using BASIC (76%). When asked which programming language was taught to children most teachers (again 76%) marked "BASIC."

Sixty-six percent of the teachers indicated that they perceived a marked improvement in the children's motivation to learn as a result of using microcomputers. The remaining teachers were undecided at this time.

A large number of respondents (40%) indicated that they perceived a marked improvement in the children's behavior as a result of the increased motivation provided by the microcomputers. Most of the remaining respondents were unable to determine a response at this time. Only 3% marked "no."

When asked about brand-name selection, the largest group of respondents indicated that they chose Apple machines. The second largest group (32%) had selected Radio Shack TRS-80 models. The Commodore Pet was selected by 12% of the responses.

There were several considerations for brand name choices of hardware. Most of the respondents indicated that these considerations included quality, price, flexibility and provisions for expanding the capability, service availability, rapid delivery and simplicity of operation. Only 5% were concerned with available suitable software.

The decisions concerning the purchase of courseware and software were made by both the teachers and administrators for 70% of the respondents. These decisions were made by the teachers only by 21% of the respondents. Only 2% of the respondents indicated that these decisions were made by the administrators only.

Most of the respondents (57%) indicated that their hardware was equipped to use both disks and cassette tapes. Thirty-two percent used disks only. Seven percent used tapes only.

Nearly half (47%) of the respondents indicated that they purchased their software from the commercial market. Twenty-four percent evenly matched the software they purchased with software they generated themselves. Others indicated that their software was programmed by teachers, staff and students.

Microcomputers in the Schools

Ninety-nine percent of the respondents said "yes" they would recommend a microcomputer installation for schools elsewhere. When asked why, the reasons given included increased motivation, increased options for teaching tools and more effective individualized instruction.

Sixty-five percent of the respondents indicated that they would not have computer assisted instruction in their schools if microcomputers were not available.

Most participants in the study indicated that their microcomputers were financed by a combination of local, state and federal funds, mostly local and federal.

The years 1985-1987 were given as the dates that 39% of the respondents expected the availability of microcomputers in most of their classrooms. Twenty-five percent marked the years 1988-1990 while 18% marked the dates 1991 to 1993. The years 1982-1984 were given by 15% of the respondents.

The machines were secured in the immediate classroom area including nearby closets by 85% of the respondents.

Most of the respondents reported a variety of figures indicating the availability of one microcomputer for from every two children to every five children. Some indicated one machine per school. There were no reports indicating a complete lack of microcomputer availability.

Twelve percent of the respondents indicated that they now screen new teachers for microcomputer literacy; of these, 29% gave preference to those so prepared.

Teachers were not required to possess microcomputer literacy as a condition for employment by 97% of the respondents.

Seventy-two percent of the respondents allowed the use of microcomputers in a non-programming environment.

Most of the responses indicated that they had some kind of systematic plan for implementation before they acquired their machines. These plans varied and may have included partial provisions for instruction, curriculum, staff, space and hardware. Only 10% indicated a complete lack of pre-planning. Most of the respondents (74%) indicated that either the teachers or the administrators participated in the formulation of the plan, i.e., administrators 38%, teachers 30%. When asked if they now had a systematic plan for implementing microcomputer instruction, 65% replied "yes." Thirty percent responded with a "no." Among those with a plan, 41% indicated that it was a five-year plan, 59% indicated that their plan was for less than five years.

Microcomputers in the Schools

When asked to explain the circumstances under which they purchased their first microcomputer, 56% of the respondents indicated that they did so because of an interested teacher, usually a mathematics teacher (in 39% of the cases). An interested principal was responsible in only 11% of the cases.

An overwhelming 82% of the responses indicated that inservice training with microcomputers was available for teachers. In 53% of the responses the training was given after school hours or in the evening while 13% of the teachers received their training during the school day. Another 28% received their training during holidays, weekends and summers. Thirty-one percent of the responses indicated that the training was given for credit. Credit for the training was an option for 33% of the responses. Training was given without credit for 33% of the responses. Programming was included for 27% of the res;onses. Another 23% indicated that their training included classroom strategies with the microcomputer. The use of the "tutorial mode" was marked for 17% of the responses. Training in the use of printers and other peripheral devices was indicated in 16% of the responses. The training included one-on-one drill for 15% of the responses. The printer was the most common peripheral device for which training was provided.

Twenty-eight percent of the responses indicated that they taught programming to children as a form of computer literacy. Twenty percent used the teaching of programming as an instructional method to help children develop problem-solving processes. Programming was taught to help children develop a skill which may have occupational value by another 20% of the responses. Seventeen percent of the responses indicated that programming was taught not only as a method of instruction, but as a skill designed to enhance the child's creativity. The teaching of programming as an instructional method for helping children to internalize concepts was reported by 14% of the responses.

When asked which agency should sponsor a microcomputer consortium, the largest group of responses (42%) indicated that it should be a nearby college or university. Eighteen percent thought it should be sponsored by the teacher center. Twelve percent thought it should be a nearby large school system.

The availability of microcomputers for teachers wanting to learn about them was not a major problem among the responses

One-half of the responses indicated that their microcomputers were used in both a classroom and in a laboratory environment. Fifteen percent indicated that the machines were used only in the classroom. The machines were used only in the laboratory by 14% of the responses. Another 15% indicated that the machines were checked out by the teacher as A-V equipment. In some cases the machines could be checked out overnight and weekends by the students.

In terms of teacher support, 31% of the responses indicated that they were receiving support from a system wide coordinator, 24% from a building leader and another 24% by a system-wide computer committee.

Microcomputers in the Schools

Forty-six percent of the responses indicated that the pupils using microcomputers were supported by resource persons. A computer club supported 18% of the students. Seventeen percent of the students received computer journals and user's newsletters. Other students were supported by parental and teacher groups. Only 2% of the responses indicated a complete lack of computer support for students.

In terms of the general applications of the microcomputer, 54% of the responses indicated that the machines were used either to challenge the unimpaired and the gifted learners (29%) with advanced curriculum or to implement remediation (25%). The microcomputer was used as a tool to implement the existing curriculum by 14% of the responses. Games and recreational software was allowed when appropriate by 14% of the responses. Sixteen percent of the responses engaged in experimental curricula.

When asked about special applications of the microcomputers 77% of the responses indicated that they used the machines with the gifted (44%) and the slow learners (33%). The remaining 23% indicated that their special applications included the mentally retarded (11%), the deaf (6%), the blind (4%), reading problems and the physically handicapped (2%). Thirty-three percent of the responses indicated that a staff person with electronic tinkering abilities was available to modify the equipment for either increasing its capacity or for special applications such as braille.

A lack of funds was cited as the major obstacle hindering the continued growth and development of microcomputer programs by 75% of the responses.

Microcomputers in the Schools

The Conclusions (in brief)

Microcomputers were available to most learners (71%) either in the classroom or in a laboratory situation.

Most of the microcomputers were not tied to a mother unit either inside (82%) or outside the classroom (93%).

The introduction to microcomputers took place in grades K-6 for most of the students (68%) others in grades 7-12.

Most students (51%) spent from 15 to 60 minutes per week at the microcomputer.

Microcomputers were used in all areas of the curriculum including music and art. The highest demand areas in order of the heaviest use were mathematics (34%), reading (18%), language arts (17%), the social studies (12%).

Most teachers (60%) do not use the microcomputer for testing the children's performance.

The microcomputers were most often used (81% total) for drill, practice, mastery learning, probelm solving and creativity through interaction with problem solving situations. Only eleven percent of the respondents indicated that they were teaching programming.

Over one half of the respondents indicated that they were not concerned with Piaget at this time. Only 1% of them were teaching LOGO.

The overwhelming majority (86%) of the respondents indicated that microcomputers enhanced their ability to individualize instruction.

In varying degrees, the microcomputers were used by all children including the statistically ordinary children, the gifted children, the slow an retarded children and the physically handicapped children.

Teachers acquired their microcomputer skills from a variety of sources that included inservice seminars and college courses.

Most teachers who were using a programming language indicated that they were using BASIC (76%).

Most teachers who were teaching a programming language to children indicated that they were teaching them BASIC (76%).

A marked improvement in the children's motivation to learn as a result of using microcomputers was perceived by most of the respondents (66%).

Microcomputers in the Schools

While most of the respondents were unable to determine a response concerning improved children's behavior as a result of using the microcomputer, 40% of them did perceive a marked improvement.

The largest group of respondents, nearly half, selected the Apple microocmputer when making purchases (44%). The Radio Shack TRS-80 model was selected by 32%.

The considerations for selecting the hardware included quality (21%), price (20%), flexibility, i.e. provisions for expanding capability (19%), service availability and rapid delivery (20%), simplicity of operation (15%). Surprisingly few of the respondents were concerned with software availability for any particular brand name machine.

Most of the decisions concerning the purchase of courseware and software were made by both the teachers and the administrators (44%), teachers only 12%, administrators only 23%.

The hardware was equipped to use both disks and cassette tapes according to most of the respondents (57%), disk only (32%), tape only (7%).

While a sizeable group (24%) of respondents indicated that they evenly matched the amount of software which they purchased with an equal amount which they generated themselves, nearly one-half (47%) of the respondents (the largest group) indicated that they purchased their software from the commercial market.

Nearly all (99%) of the respondents would recommend microcomputers for schools elsewhere.

Most of the respondents (65%) indicated that they would not have microcomputer assisted instruction in their schools if microcomputers were not available.

The microcomputers were financed by a combination of local, state and federal funds, mostly local and federal funds (40%).

The years 1985-1987 were most often (39%) indicated as the dates when microcomputers were expected to be available in every classroom; 25% indicated 1988-1990.

The machines were most often secured in the immediate classroom area or in a nearby locked closet (78%).

Twelve percent of the respondents indicated that they now screen new teachers for microcomputer literacy. Twenty-nine percent showed preference to computer literate new teachers. Only 2% required computer literacy.

In most cases, microcomputers are used in a non-programming environment.

Microcomputers in the Schools

Most of the respondents had some kind of systematic plan for implementing microcomputers into their programs before they acquired the machines. In most cases the plan was not a long-range plan. The plan was usually formed by teachers and administrators.

The very first machine was acquired because of an interested teacher(s) usually, but not always, in mathematics.

An overwhelming majority of the respondents indicated that some kind of inservice training in microcomputers was available to teachers (82%). In most cases the training was given after school hours and the teacher was given the option to accept or reject academic credit. The training included programming, classroom strategies and various computer modes and peripherals. The printer was the most common peripheral included in teacher training.

Programming was taught to children for a variety of reasons including the fostering of computer literacy (28%), problem solving (20%), occupational value (20%), creativity and the internalization of concepts (17%).

The largest group of respondents indicated that a microcomputer consortium should be sponsored by a nearby college or university (42%) teacher center (18%).

The availability of microcomputers was not a problem for teachers wanting to learn about them.

The microcomputers were available to children in either a classroom or a laboratory. They were available in both places in one-half of the situations responding to the study (49%).

Supportive services were made available by the schools for nearly all of the teachers who were using microcomputers. This support may have been from within the building, system-wide or both.

Supportive services were made available within the building for the students involved with microcomputers. These services included resource persons, computer clubs, journals and user newsletters and help from parent and teacher groups.

The most often used general applications of the microcomputer was to challenge the unimpaired and the gifted learners and to implement remediation.

The most often used special application of the microcomputer was to challenge the gifted. Other children with special needs were all included in benefiting from the use of the microcomputer including the mentally retarded and the physically handicapped.

A lack of funds was cited most often as the major obstacle hindering the continued growth and development of microcomputer programs in the schools.

Summary of the Conclusions

(1) Microcomputers were available to teachers and learners.

(2) Microcomputers were usually introduced to learners in grades K-6.

(3) More microcomputer time was needed by teachers and learners.

(4) Teachers needed more time and training for implementing the testing of learners with the microcomputer.

(5) Teachers needed to reconcile microcomputer activities with the work of J. Piaget.

(6) Efforts were needed to increase the use of educationally appropriate programming languages other than BASIC.

(7) The motivation and behavior of the learners were reportedly improved by the use of microcomputers.

(8) Teachers and administrators were involved in the decision making process for hardware and software purchases.

(9) Schools had computer assisted instruction because of the availability of microcomputers (not because of terminals).

(10) More funds were needed for hardware and software purchases.

(11) Most schools expected the placement of microcomputers in every classroom by 1990.

(12) No unusual or expensive means of securing the machines were used.

(13) Most schools used the machines in a non-programming environment. More teachers needed to learn programming.

(14) More comprehensive plans for implementing microcomputers were needed by the schools.

(15) In-service training was available to teachers; supportive services, too, were available.

(16) All categories of learners benefited from the use of microcomputers.

The Recommendations

The findings of this study warrant the following recommendations concerning microcomputers in the classroom.

Efforts need to continue for increasing the number of classrooms with microcomputers and the number of microcomputers in each classroom.

The microcomputer should be introduced to children in grades K-6. The introduction of LOGO can take place in grades K-3 for most children with proper supervision.

The amount of time that each student spends at a microcomputer needs to be increased.

Microcomputers can and should be used in all curriculum areas.

Much more needs to be done to encourage the use of microcomputers to test the children's performance.

Schools should have systematic plans and procedures established prior to acquiring microcomputers.

More software needs to be designed with respect to Piaget's work and developmental psychology. More effort is needed to help teachers perceive the microcomputer as compatible with Piaget's contributions in order to maximize their benefits to children.

Microcomputers should be used as a valuable tool for effectively individualizing instruction.

All children, regardless of special needs, should be allowed to use the microcomputers.

Teachers need to acquire basic operational literacy prior to the acquisition of microcomputers.

More teachers need to acquire programming literacy in at least one computer language which children too can learn.

More teachers need to learn the LOGO programming language as well as PILOT and PASCAL.

More efforts are needed to increase the teaching of LOGO to children.

Teachers should acquire their microcomputer skills from a variety of sources which include the college and university as well as inservice training provided by the schools.

The use of the microcomputer as a means for increasing the children's motivation to learn should be encouraged.

Microcomputers in the Schools

Teachers and administrators should take part in the decision making concerning hardware and software.

Incentives should be offered to teachers to encourage more of them to learn programming and to produce some of their own software.

New and varied sources for funding the purchases of microcomputers need to be found. Parents, teachers, students and community leaders should be included in these efforts.

Traditional budgets and sources of funds should include increasing allocations of money for microcomputers.

Schools planning microcomputer programs should consider adding microcomputer literacy to the criteria now used to screen their new teachers.

The use of microcomputers to teach programming to children should be increased.

Inservice training should be provided during non-teaching times and with pay or other incentives when possible.

Teacher training in microcomputers should include all the skills and modes of operation related to instruction, programming, peripheral devices, software related to specific curriculum areas, software related to the special needs of specific children, and the skills and familiarity needed for the classroom use of a specific piece of software, i.e., "the in and outs" of running a specific piece of courseware with children.

More efforts are needed to encourage the use of light pens and graphics tablets.

More teachers need to perceive the value of teaching programming as a possible effective instructional method for helping children to internalize concepts (conceptualization) and to help children develop their own mental processes necessary for problem solving and creativity.

Nearby colleges and universities should be prepared to accept the leadership in sponsoring a microcomputer education consortium if asked.

Schools should consider a staff person who has electronic tinkering abilities for modifying the equipment to meet special needs, i.e., increasing machine capabilities and adding such applications as braille.

The number of microcomputers per number of teachers wanting to learn about them should be increased to the level that no one is denied the opportunity to use one.

Teachers should be provided with microcomputer support services such as building leaders, committees, newsletters, and journals.

Pupils should be provided with resource persons, computer journals, user's newsletters, and computer clubs.

Microcomputer games, recreation, and experimental curricula and methods should be allowed where appropriate for the learner.

A systematic plan for implementing microcomputer assisted instruction should be developed before the acquisition of the hardware and software. Teachers and administrators should participate in formulating this plan. Students and parents should participate when possible. This plan should eventually become a long-range plan. The procedural outlines which result from these plans should include provisions for developing microcomputer awareness, gathering microcomputer information from a variety of sources, teacher training, planning for curriculum and instruction, arranging financial resources, the selection of hardware and software, purchasing, supportive materials and supportive organizations within the schools, and the implementation of the microcomputer as an instructional tool into each classroom and grade level.

Recommendations for Further Study

More study is needed to determine if and why there is an improvement in discipline (child's behavior) as a result of the increased motivation to learn which is provided by the microcomputer as perceived by some teachers.

Why is there a perceived increase in the motivation to learn when microcomputers are used?

Should incentives be used to encourage teachers to acquire the many and varied microcomputer skills and modes of operation related to instruction? If so, which incentives should be considered?

How should the microcomputer be used in order that Piaget's contributions be maximized in terms of benefits to the child and to the older student?

How may educators increase the use of the microcomputer as an instructional method for helping children to internalize concepts, increase problem-solving skills and creativity?

To what extent should microcomputer games and recreation be allowed? To what degree might they be used as motivational devices and rewards?

The results of this study should be compared to a second study conducted by this researcher titled, "Microcomputers on Campus" which is concerned with microcomputer programs in colleges and universities which prepare teachers.

This study should be repeated by this researcher in 5 years.

How may the teaching and learning of those programming languages which may be more appropriate for teachers and learners than BASIC be encouraged?

Planning for Microcomputers in the Schools

The specific planning steps and procedures which were actually applied by those schools implementing microcomputer instructional programs were elicited by a national study titled, "Microcomputers in the Schools." This study included 400 school systems in the 50 states. As a part of the study, step-by-step procedural outlines were submitted by the schools. Forty-five key planning and procedureal steps which were actually used by the schools to implement microcomputer assisted instructional programs were identified and edited into a composite plan. This composite plan was designed to provide possible assistance to those schools which are initiating the planning and implementation process for their own microcomputer instructional programs.

Please note that many of the planning steps in each stage were taking place simultaneously and not necessarily sequenced as this edited composite arrangement might imply.

Stage I. Steps in the Initial Planning

1. The faculty's initial interest and perceived need for microcomputers in the instructional program were recorded.

2. Teachers attended conferences where microcomputer aassisted instruction was being demonstrated.

3. Our interested teachers identified themselves.

4. We visited the state education department to gather data.

5. We visited other school districts to observe and gather data.

6. We demonstrated student developed and vendor courseware to administrators.

Stage II. Steps in the Planning for Inservice Teacher Training

1. We sought our initial inservice training from the state education department.

2. We paid the tuition for a number of teachers to attend a microcomputer institute at a nearby university.

3. We completed graduate courses and other kinds of continued support made available by the local college.

4. We established a microcomputer laboratory at the staff development center. This center had ten stations.

5. We provided some inservice training for teachers in machine operation and programming.

6. We listed the appropriately trained staff (faculty) members.

Planning for Microcomputers in the Schools

Stage III. Steps in the Planning for Implementing Microcomputer Concepts into the Curriculum

1. We begged, pleaded, demonstrated need and provided awareness.

2. We conducted a computer awareness mini-workshop for school-board members with administrative staff.

3. Parents were invited for hands-on demonstration.

4. We established a committee consisting of teachers who were now using computers to plan and guide the program.

5. These teachers wrote the initial proposals for the purchase and the implementation of microcomputers into the curriculum.

6. The instruction division developed a program.

7. We identified our goals and objectives.

8. We established a timeline for our program.

9. We established a long-term plan.

10. One of our first objectives was to teach computer literacy.

11. We established a microcomputer information exchange as a section of the staff development newsletter.

12. We established a master plan for the purpose of utilizing microcomputers in each curricular area: English, language arts, reading, mathematics, science, social studies and special education.

13. We expanded microcomputer applications into each curriculum area.

14. We prepared a curriculum impact statement for each grade level.

15. We purchased support items such as textbooks, magazines and user's newsletters.

Stage IV. Steps in the Planning for the Purchase of Hardware and Software.

1. We identified possible local, state and federal funds for purchasing hardware and software.

2. We considered fund raising groups including parents and students.

3. We established a committee to select the hardware according to our objectives and criteria.

4. We examined information concerning hardware and software from consultants, dealers, and other districts.

Planning for Microcomputers in the Schools

5. We established criteria for hardware selection.

6. We made a final decision as to which brand name of hardware to purchase.

7. We established a local standardization of equipment.

8. We established the cost per learner for each component.

9. We started a plan for evaluating the use of the equipment in terms of our specific program needs.

10. Each school was required to develop its own plan before machines were purchased for it. This plan included teaching and learning objectives, a needs statement, and provisions for the evaluation of the program.

11. The machines were placed with those teachers who completed the college and/or inservice program. These teachers were encouraged to share their knowledge and enthusiasm with other teachers.

12. We established criteria for software selection.

13. We began building a software library.

14. We established supportive services for teachers and learners such as computer clubs.

15. We established the security precautions needed to maintain possession of the equipment.

16. We discussed future plans for expanding the use of computers.

17. We submitted items about our computer program to the local newspaper.

18. We shared our plan for initiating computer education with our public.

Most of the procedural outlines submitted by the schools to the study contained provisions for developing microcomputer awareness, gathering of microcomputer information from a variety of sources, teacher training, planning for curriculum and instruction, arranging for financial resources, hardware and software selection and purchasing, developing supportive materials, organizing supportive organization within the schools, and the implementation of the microcomputer as an instructional tool in each classroom and grade level.

The major weakness found in implementing microcomputers into school programs by the study was the lack of systematic and comprehensive long-term planning before the acquisition of microcomputers. Ten percent of the respondents indicated that they had <u>no</u> plan before the acquisition of hardware.

Planning for Microcomputers in the Schools

Those schools which did report a plan indicated that their planning was only for one or two specific areas, such as for curriculum or space. Thirty percent of the respondents indicated a lack of a plan even after the hardware was acquired. Those schools which did plan did so for the short-term only.

Planning may be the most important single factor in the success or failure of a microcomputer program. The optimum utilization of microcomputers in the schools requires a knowledge of their complexities and their many separate capabilities for the facilitation of learning. Without systematic and comprehensive long-term planning many microcomputers may become prestigious dust-collectors and may eventually be stored beside the expensive language laboratories of the 1950s and 1960s. The real losers in such situations will be the learners. Unlike the language laboratories, computers shall be common and essential ingredients throughout the lives of the learners.

The planning for implementing microcomputers in the schools should include provisions for increasing computer literacy, encouraging teachers to learn programming and to teach programming to learners, familiarizing teachers with the several computer assisted instruction capabilities of microcomputers, and encouraging the use of microcomputers in all curriculum areas and with all children including those with special needs. The planning should include provisions for the inservice training of teachers, both within the schools and at nearby colleges and universities.

The most important long-term planning goals for teachers and administrators may be to help themselves conceptualize the microcomputer as a marvelous tool for implementing the regular curriculum, as an instrument which helps learners conceptualize formal abstract operations and to structure their own procedures for solving specific problems. To repeat the words of fellow educators, "No other single piece of equipment can do as much for education." Perhaps, we should consider adding the words "when microcomputers are in the hands of teachers who have been prepared for this tool's maximum utilization."

Summary

The outlined procedures followed by the schools for establishing microcomputers in the classrooms involved the teachers, administrators (in some cases school boards), parents and parent groups, students and student groups. Most of the procedural outlines submitted by the schools to this study contained provisions for developing microcomputer awareness, gathering of microcomputer information from a variety of sources, teacher training, planning for curriculum and instruction, arranging financial resources, hardware and software selection, purchasing, supportive materials and supportive organizations within the schools and the implementation of the microcomputer as an instructional tool into each classroom and grade level. Forty-five key procedural steps were identified in those outlines submitted by the schools.