DOCUMENT RESUME

ED 249 726 EC 170 828

TITLE What Can Computer Technology Offer Special Education? Research & Resources: Special Education Information for Policymakers.

INSTITUTION American Association of School Administrators, Arlington, Va.; Council of Chief State School Officers, Washington, D.C.; National Association of State Boards of Education, Alexandria, VA.; National Conference of State Legislatures, Washington, D.C.

SPONS AGENCY Special Education Programs (ED/OSERS), Washington, DC. Div. of Educational Services.

PUB DATE [82]

NOTE 19p.

PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Computer Assisted Instruction; *Computer Managed Instruction; *Computer Software; Costs; *Disabilities; *Educational Technology; Elementary Secondary Education; Microcomputers; *Policy Formation; Program Administration; Special Education

ABSTRACT

Intended for policymakers, this brief addresses issues related to computer technology and its contributions to special education. Trends are noted and three types of applications are considered: computer assisted instruction, computer managed instruction, and computer support activities. Descriptions of several computer applications in local and state education agencies are provided, including references for further information. Tables illustrate the range of administrative information capabilities of the computer in regular and special education administration. An annotated bibliography is included that cites technology periodicals and Special Education Program projects. The instructional applications of CAI (including drill and practice, simulation and games, and computer literacy) are considered and instructional benefits and drawbacks such as immediate feedback and the difficulties some handicapped children have with reading and typing are noted. A final section focuses on human and organizational issues (such as resistance to change, teacher training, and equity) and on technical issues (cost, accommodations, courseware, and hardware). (CL)

RESEARCH & RESOURCES

special education information for policymakers

WHAT CAN COMPUTER TECHNOLOGY OFFER SPECIAL EDUCATION?

Over the past ten years, educational services for and related to handicapped children have increased dramatically. These services involve a myriad of federal, state and local laws, regulations, policies and procedures. Computer technology, especially the lower-cost microcomputer, is gaining widespread acceptance as an important tool for delivering instruction and for managing and reporting special education information.

States are thwarted from achieving the full potential of computer technology in special education by an array of organizational, human and technical factors. Foremost among these is the lack of understanding of the possibilities and limitations of computer technology. The role of such information is becoming increasingly important. Policymakers need to know:

- WHAT BENEFITS CAN WE EXPECT FOR SPECIAL EDUCATION FROM THE USE OF THE COMPUTER?
- WHAT IMPACT ARE COMPUTERS HAVING ON THE TEACHING AND ADMINISTRATIVE PROCESSES IN SPECIAL EDUCATION?
- WHAT ISSUES WILL WE HAVE TO ADDRESS IN ACCOMMODATING THE COMPUTER?

This brief addresses such questions made increasingly urgent by the popularity and complexity of the special education-computer technology interface

National Association of State Boards of Education · 701 N. Fairfax St. • Suite 340 • Alexandria, Va. 22314

THE CONTEXT OF THE "COMPUTER REVOLUTION" IN SPECIAL EDUCATION

As the delivery of special education services has become more complex, the management and information needs of educational policymakers have expanded significantly. Increased government funding for and public interest in special education has led to mounting pressure for program accountability.

Computers are gaining widespread acceptance as one of the most cost-efficient ways to meet these needs. Recent statistics reinforce both the opportunity and the need for such applications:

- Since 1976, the cost of educating handicapped students has increased 50 percent – from $4.6 to $6.5 billion.

- Expenditures for instructional and related service equipment and materials per handicapped student are 60 percent more than for a nonhandicapped student – $83 per student versus $51 per student.

- Administrative/overhead costs of "processing" special education students are approximately 150 percent more than for regular education students – $500 versus $200 per pupil per year. Assessment and IEP development costs range from $200 to $300 per handicapped child for the approximately four million IEPs prepared yearly.

- Special education teachers perceive the need for new media formats and manipulative approaches which Computer Assisted Instruction (CAI) can meet. A 1978 survey of 30,000 special education teachers found that for every one teacher of students using CAI, five additional teachers perceived the need for CAI.

- Two recent surveys show that 42 percent of the nation's 16,000 school districts have one or more microcomputers. It is predicted that 90 percent of all schools will provide access to computers for instructional use by 1985 (Education TURNKEY, 1982).

Three types of microcomputer applications are emerging in special education:

(1) Computer-Assisted Instruction (CAI), which includes a range of academic subject areas and computer usages (e.g., drill and practice) in which the student interacts directly with the computer.

(2) Computer-Managed Instruction (CMI), which includes a variety of applications ranging from diagnosis/prescription and instructional management to record keeping and tracking related to procedural safeguards (e.g., IEPs).

(3) Computer Support Activities (CSA), which include applications such as test scoring and analysis, report writing and statistical analysis.

What problems and possibilities emerge when the cost and complexity of special education programs are juxtaposed with the expanding capacities of the microcomputer? Read on....

As is the case with most print material in the rapidly moving field of computer technology, this Issue Brief will be "out-of-date" soon after it is published. Educational policymakers should read the related journals, stay in touch with hardware manufacturers and software vendors, and follow the developments of the diverse projects and agencies that are addressing technology-related issues in special education.

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ABOUT THE PROJECT

This material is made available through NASBE's Special Education Dissemination Project. Working in cooperation with the Council of Chief State School Officers, National Conference of State Legislatures, and American Association of School Administrators, NASBE has undertaken a variety of activities aimed at providing education policymakers with research and practice-based information on special education.

The project is funded by the Division of Educational Services, Special Education Programs, U.S. Department of Education. However, the views expressed herein do not necessarily reflect the position or policies of that Department.

For more information about the project, contact Roberta Felker or Cynthia Chambers at NASBE.

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APPLIED COMPUTER TECHNOLOGY: LEA AND SEA APPLICATIONS IN SPECIAL EDUCATION

The following descriptions of microcomputer systems in special education exemplify a range of current computer capabilities and applications.

LEA APPLICATIONS

- The Monitor microcomputer system, developed by Utah State University for the Intertribal Indian School provides PL 94-142 compliance monitoring and generates a variety of reports on the school's status in meeting regulatory requirements.

  REFERENCES

  Thorkildsen, R. and Williams, J. Handicapped and Special Education. In Computer Education for Elementary and Secondary Schools. Washington, D.C.: SIGCSE and SIGCUE, Association for Computing Machinery, 1981.

  Thorkildsen, R., Hofmeister, A. and Erlacher, J.L. ADP Needs Assessment and the Intermountain Intertribal Indian School. Washington, D.C.: Bureau of Indian Affairs, 1980.

- The Micro Planner Administrative Planning System developed by Learning Tools, Inc., Brookline, Massachusetts, can be used on the Apple II and other microcomputers. The System is designed to provide due process child tracking, standardized program and demographic reporting, and a "what if" analysis package to project costs and services. Micro Planner includes a telecommunications capability to directly transfer reports and share curriculum information between computers. It is reported to provide an integrated system for managing and transferring information from the school to the local administrative office, to higher intermediate and state administrative units.

  REFERENCE

  Beinashowitz, J. Microplanner System Reference Manual. Brookline, Massachusetts: Learning Tools, Inc., 1980.

- Project Recipe, developed by Sarasota County Schools, Florida, is intended to provide computer-based management of instructional programs for exceptional students. It matches test results with student goals and objectives and provides a variety of IEP and related progress reports. It is accessed from terminals in schools connected to a large computer; the primary users are resource teachers working with students receiving less than 12 hours of special education per week.

  REFERENCE

  Wilson, K. Managing the Administrative Morass of Special Needs, Classroom Computer News, 1981 1 (1), 5-8.

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FOR AN EXTENDED LISTING OF SPECIAL EDUCATION MANAGEMENT SYSTEMS IN OVER 40 STATES, SEND $2.50 TO LEARNING TOOLS, INC., 4 WASHBURN PLACE, BROOKLINE, MASSACHUSETTS 02146

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SEA APPLICATIONS

- Colorado's Information System was developed primarily to meet state reporting requirements mandated by the Colorado Handicapped Children's Education Act. The System is composed of five sub-systems that provide information on: (1) cost (e.g., prior year, current and one-year projection); (2) pupils (e.g., individual and aggregate, including numbers of students referred, assessed, placed, and awaiting placement, as well as projected counts of students to be served, by handicapping condition); (3) staff (e.g., estimated and projected staff FTE, and salaries by handicapping condition and current and projected costs for salaries, benefits, and support services); and (5) "consolidated" summaries of the sub-systems. The special education information system is reported to effectively meet all state and almost all federal updating requirements.

  REFERENCE

  Peter Fanning, Director of Pupil Services Unit, Colorado State Department of Education, 201 Colfax Avenue, #523, Denver, Colorado 80203

- Florida's centralized education management information system was mandated by state legislation in 1973. There are six major data bases in the total education system: (1) student (e.g., FTE hours by special education program, by grade and school, time spent in program, and by program); (2) staff (e.g., special education roster, personnel projections by type of personnel handicapping area); (3) finance (e.g., financial data by handicapping program category); (4) facility; (5) community; and (6) programs. A detailed cost accounting system makes possible comparisons among districts and between cost and funding allocations to allow better understanding of relative efficiency and funding needs.

  REFERENCE

  Ed Allen, Director of Management Information Services, Florida State Department of Education, Capital Building Room PL 116, Tallahassee, Flordia 32301.

- New Hampshire's special education information system (SPEDIS) is a result of cooperation of local districts, the Office of Special Education, an outside computer programming consultant and the New Hampshire Central Data Processing Agency. SPEDIS is primarily a child-based system. It defines the child's needs and reports what services the child is receiving. The system includes data in four categories: (1) student (e.g., personal identification data, disability evaluations, consent and discharge statements); (2) personnel (e.g., resume information related to special education pupil placement team members); (3) financial considerations (e.g., funding eligibility status, in-district and out-of-district costs); and (4) buildings and facilities (e.g., facility identification services provided). Information in SPEDIS satisfies requirements of the federal government as well as the needs of the local districts.

REFERENCE

Paul Lapesquer, Director of the Special Education Information System, New Hampshire State Department of Education, 410 State House Annex, Concord, New Hampshire 03301

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FOR MORE INFORMATION ON STATE AND LOCAL EDUCATION AGENCY USES OF COMPUTER TECHNOLOGY IN SPECIAL EDUCATION, SEE: SPECIAL EDUCATION MANAGEMENT BY INFORMATION: A RESOURCE GUIDE. DISTRIBUTED BY NATIONAL ASSOCIATION OF STATE DIRECTORS OF SPECIAL EDUCATION, 1201 16TH STREET, N.W., WASHINGTON, D.C. 20036 $4.00 PER COPY.

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ADMINISTRATIVE APPLICATIONS: WHAT CAN BE DONE?

Tables 1 and 2 on the reverse side provide examples of the range of administrative information capabilities of the microcomputer in regular and special education. The application of such information to the specific organizational and technical requirements of a special education system can:

- provide increased knowledge about a range of special education programs at a time when administrators and policymakers are increasingly removed from daily operations;
- identify problem areas such as due process reporting where technical assistance may be needed;
- communicate problem areas and success stories to districts, state officials, legislatures and to the public;
- assist administrators in complying with new and revised state and federal laws and regulations; and
- meet reporting requirements more efficiently and cost-effectively.

* *

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Rawitch, D.G. Minnesota's Statewide Push for Computer Literacy. Instructional Innovator, February, 1982, 27 (2), 34-35.

Wilson, K. Computers for Special Education Management: Progress, Potential and Pitfalls. Hot Topics Paper. Reston, Virginia: The ERIC Clearinghouse on Handicapped and Gifted Children, 1981.

* *

TABLE 1

STANDARD APPLICATIONS OF COMPUTER TECHNOLOGY IN EDUCATIONAL ADMINISTRATION

- Class scheduling
- Grade reporting
- Test scoring
- Attendance
- Personnel record-keeping
- Accounting for income, expenses, and balance sheet accounts
- Accounts payable
- Billing for tuition, therapy and transportation
- Payroll
- Budget planning and reporting
- Inventory
- Word processing for correspondence and proposal preparation
- Generalized data base management

TABLE 2

SPECIFIC APPLICATIONS OF COMPUTER TECHNOLOGY IN SPECIAL EDUCATION ADMINISTRATION

- Counts of students screened, assessed, placed and reviewed
- Reimbursement computation according to state and federal formulas
- Generalization of standard local, state and federal reports
- Reports of students' due process status and compliance with PL 94-142
- Child counts cross-referenced by class, teachers, school and handicap
- Reports on student achievement and evaluation status
- Detailed records and summaries of diagnostic testing
- Personalized mailings to parents re IEP meetings and review
- Audit trails for program placement and review
- Interactive creation of IEP goals and objectives from curriculum files
- Generation of quarterly student reports
- Electronic mail
- Reminders when notices are due or should be sent
- Interactive access to related service information such as transportation

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TECHNOLOGY PERIODICALS AND SPECIAL EDUCATION PROGRAM (SEP) PROJECTS AN ANNOTATED BIBLIOGRAPHY

PERIODICALS

AEDS Journal
1201 16th Street, N.W.
Washington, D.C. 20036

Published quarterly
Subscription - $25.00
Membership - $30.00

The journal is a publication of the Association for Educational Data Systems. Articles focus on original research, projects and theoretical or conceptual positions related to the field of educational computing.

Bulletin on Science & Technology for the Handicapped
American Association for the Advancement of Science
1515 Massachusetts Avenue, N.W.
Washington, D.C. 20005

Published quarterly
Free

The Bulletin reports on workshops; current research supported by federal, state, local and foundation funding; new products; and resource lists.

Educational Technology
140 Sylvan Avenue
Englewood Cliffs, NJ 07632

Published monthly
Subscription - $49.00

Educational Technology is a professional journal for educators. It covers all types of educational technology and includes product and book reviews.

Electronic Education
1311 Executive Center Drive
Suite 220
Tallahassee, FL 32304

Published 10 times per year
Subscription - $10.00
$2.00 per issue

This publication carries articles on computer literacy, technological innovations, and funding opportunities. The audience includes teachers, administrators, and media specialists. One issue each year is a Buyer's Guide to help educators make purchasing decisions.

Journal of Educational Technology Systems
Baywood Publishing Co., Inc.
120 Marine Street
Farmingdale, NY 11735

Published quarterly
Subscription - $51.00

The Journal of Educational Technology Systems is published by the Society for Applied Learning Technology (SALT). It focuses on techniques and approaches for using technology in all types of educational systems.

Journal of Special Education Technology
Exceptional Child Center
Utah State University
Logan, UT 84322

Published quarterly
Subscription with membership - $25.00

The Journal is a publication of the Association for Special Education Technology. Membership dues are $25.00 per year and include the Journal and a newsletter.

T.H.E. Journal
Box 992
Acton, MA 01720

Published bi-monthly
Free on a limited basis
Subscription - $15.00

Technological Horizons in Education (T.H.E.) is the oldest periodical in the field of computer-assisted education. It covers the whole field of educational technology from computers to video-disc to audiovisual materials.

PROJECTS FUNDED BY SPECIAL EDUCATION PROGRAMS

PROJECT EDUTECH is a dissemination project which provides technical assistance to state and local education agencies in the appropriate use of technology in special education. The project activities include the preparation of bibliographies, articles, reports, fact sheets and resource guides. For more information contact Susan Elting, Project Director, JWK International, 7617 Little River Turnpike, Annandale, Virginia 22203.

MICROCOMPUTERS IN THE SCHOOLS is a project which uses a case study approach to describe the issues and solutions schools have experienced in the use of microcomputers for special education and related services. Included among its related activities is the development of information packages for assisting LEA administrators. For more information, contact Tom Hanley, Project Director, SRA Corporation, Arlington, Virginia 22210.

Education TURNKEY's SpEd Tech project is intended to assess the potential of high technology applications for improving the quality and cost-effectiveness of special education. For more information, contact Charles Blaschke, Education TURNKEY Systems, Inc., 256 N. Washington Street, Falls Church, Virginia 22046-4549

COMPUTER TECHNOLOGY: INSTRUCTIONAL APPLICATIONS AND ISSUES IN SPECIAL EDUCATION

Instructional Applications

Four major categories of technology have instructional applications in special education: (1) microcomputers; (2) videodiscs; (3) telecommunications; and (4) communication aids. The following discussion focuses primarily on microcomputers, since their increasing technical capabilities and cost-effectiveness make them the most widely accessible of the technologies.

Computer-Assisted Instruction (CAI)

The broad term for the application of microcomputers in instruction is Computer-Assisted Instruction (CAI), which encompasses various subject and computer usages in which the student interacts directly with the computer.

More specifically, CAI usages include:

- Drill and Practice, which reinforces skills already introduced in instruction. The program presents a question or problem; the student responds; the program indicates whether the answer is correct or incorrect; and the student moves on to the next item.

- Tutorial Dialogue, which presents information and concepts and monitors student progress. The program presents information or a question; the student responds; the program compares the response to the right answer and, in simple programs, either (a) branches to a remedial program, or (b) moves on to the next sequential piece of information. In more sophisticated programs called "intelligent" CAI, programs can actually model student understanding of a topic and provide a dialogue based on the assessment.

- Simulation and Games, which present information and concepts through simulated experience. The program presents a model of a "real life" situation and some alternative responses to the situation; the student tries out selected alternatives; the program provides feedback regarding the costs and benefits of the selected options.

- Computer Literacy/Programming, which presents a range of skills, from an awareness of how computers function and their impact on society to the application of basic programming skills. Students are exposed to computer applications and related information skills such as the importance of computer-related skills to different careers and the selection, running and evaluation of a program for a particular task. In addition, students may be taught programming, i.e., the actual writing of computer programs.

Instructional Issues

- The computer format lends itself well to motivating special education students who may have academic and/or self concept problems. Computers can address students by name; positive reinforcement in the forms of flashing colors, words of praise, and cartoons can be built into software programs; difficult items can be color coded or programmed to flash a message if students hesitate on

answering for a determined amount of time: "This is a tough one! Keep trying, you can get it!"

- Students with learning problems sometimes respond either very quickly or slowly to verbal or written questions. The amount of time spent by students processing a sentence on a computer screen may vary according to word difficulty, type of information presented, size of the print and amount of extraneous material on the screen. Practice on the desired response via a computer that is programmed at first to a slow response rate then progressively increased speed can help slower students improve their response rate. Students who respond too quickly can be prompted, e.g., "Stop and think! Think before you answer," to encourage more reflective thinking.

- Immediate performance feedback is especially important for special education students. The computer program can provide an immediate response to either a correct or incorrect answer, as well as analyzing work patterns to determine the types of problems or applications which need extra review. In addition, the self-correcting format can encourage individual judgement and decision-making in a non-threatening context: e.g., "Do you want to try that one again?" "Do you think you need more practice?"

- Students with reading problems may experience difficulty when instructional commands vary from program to program. Printed commands need to be kept simple and consistent while the skills are being learned.

- Many students, especially handicapped students with fine motor coordination problems, cannot type. Unless they have instructions on the keyboard, they use the "hunt and peck" system which slows down their response rate and ties up computer time.

- Attention and discrimination problems, such as focusing on irrelevant information, are more common in students with learning problems. Many commercial programs exacerbate these problems with formats that use a number of single-spaced printed lines and extra words. For example, a student who is trying to read directions at the beginning of a program may become frustrated and distracted trying to read the name of the author or publisher of a program. Such difficulties can be reduced by careful editing, color-cueing, directive arrows and/or a box which highlights important information.

- Students with learning problems may have difficulty taking what is learned in one context and applying it to a new situation. Teachers cannot assume that students who can perform computer tasks such as filling in the missing letters in a spelling word, or choosing the correctly spelled word among distractor words can also generalize to pencil and paper spelling of the word. The computer is only one of the variety of teaching materials and situations needed to ensure skill acquisition and generalization.

- Students with learning problems may be perceived as less capable of and/or less interested in the more advanced tutorial, simulation and programming applications of the computer. Their access to such applications may thus be limited with negative ramifications for future career choices and societal participation. The level of CAI to which students have access must be determined on the basis of individual <u>ability</u> and <u>interest</u>, not on the basis of a "handicapped" label.

* *

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COMPUTER TECHNOLOGY: IMPLEMENTATION ISSUES FOR POLICYMAKERS

The pivotal place of computer technology in today's information age makes a compelling argument for its inclusion in special education's repertoire of instructional and administrative tools. As with any tool, however, the application of computer technology raises issues related to: (1) the technical cost and capacities of the hardware and software; and (2) the human and organizational dynamics of its implementation. These issues are considered separately in the following section. However, it cannot be emphasized too strongly that in reality they are highly interdependent, i.e., the computer must be considered in context.

Human and Organizational Issues

- The successful implementation of computer technology in special education requires consideration of factors such as:

  (1) Resistance to Change.

  The system of special education, like any bureaucracy, is difficult to change. For many, computer technology foreshadows radical change — in styles of learning, definitions of basic skills and even in the function of the class room as the locus of learning, and in the role of the teacher and the student. Well-timed, accurate information as well as on-going administrative support are critical to successfully overcoming the natural reluctance of many special educators toward computers in schools.

  (2) The Political Context of Change.

  Each school in the United States embodies a unique educational environment. Factors such as community support for computer technology, the number and type of handicapped students, computer hardware and software currently in place, access of handicapped students to computer resources and general level of education all shape this context in powerful ways. In addition, most districts are constrained by tight resources, raising questions such as who has access to existing computer technology and whether handicapped students ought to be given time and opportunities equal to other students. Clearly, such questions must be considered in terms of local constraints and resources.

  (3) The Role of Participation.

  Research on the early implementation of state and federal special education mandates indicates that special educators who were involved in the planning for the new programs and procedures were much more likely to "buy in" to their use and maintenance (Weatherly and Lipsky, 1978). Extrapolating from this research, special education teachers and administrators who have an active role in technology planning — such as the establishment of goals and expectations for computer applications in instruction — will have greater incentive to become informed about and stay on top of these issues. However, to be effective, the opinions and information solicited from participants must be used. Symbolic participation serves only to heighten feelings of antagonism and helplessness that can lead to subversion and non-use of the proposed change.

- Speaking the Language.

People who work with computers speak a technical language of bits and bytes, ram and ROM, CPUs and CRTs. These and other terms make up a technical shorthand commonly indistinguishable to anyone outside the computer field. It is imperative that special educators develop technical communications skills necessary to establish a speaking relationship with the computer professional, the general educators, and, conceivably, their own students. Another "special education-general education jargon gap" ill serves the needs of the students – or the education professionals it sometimes separates.

- Teacher Training.

Teachers who work with special education students must be trained both in the use of computers and in the evaluation and production of curricular programs and materials. Most special education teachers have no experience in applying computer technology to the needs of handicapped students, nor is there evidence that many teacher training institutions are providing such instruction to new teachers. How many teachers still count on their students to run the film projector?

Effective teacher training can occur in a variety of contexts such as the school or district computer center, the inservice or preservice training program, their classrooms and homes. The critical point is that for computers to be accepted by special education teachers as a useful part of the education process, teachers must understand WHEN and HOW computers have an advantage over other teaching devices.

- Role Changes.

As the advent of computer technology alters the nature and content of instruction, it also predicates changes in the roles of teacher and student. New roles are emerging including that of the "student buff." Students who have had academic problems may find in the computer a new format which is motivating and with which they have no history of failure. Further, many of these students may have access to a computer at home, and can be assisted by parents eager to help their child succeed at this new and highly publicized skill.

Special education teachers may find themselves re-shaping the instructional process as their role shifts from primary information provider to those of resource linker, instructional supervisor and software developer. Teachers and students alike will need support and perspective in shaping and responding to shifts in power, information and interactions.

- Applications.

Of the problems that inhibit the effective use of computers in special education, perhaps one of the most difficult to resolve is that involving inappropriate use. Lack of understanding about what computers can and cannot do leads to problems such as:

(1) Unrealistically High Expectations.

For example, without linkages to other sytems, microcomputers have limited memories; buyers who are not aware of this limitation unrealistically expect their microcomputers to perform complex and sophisticated tasks. Generally speaking, implementation of any system involves problems and setbacks, and users should be prepared, both psychologically and practically, for the fact that technologies are not panaceas.

(2) Unnecessarily Narrow Applications.

Many educational applications of computers with handicapped students have erroneously mirrored techniques, such as programmed instruction, that are already in the repertoire of many special educators. Using computers for such purposes is not efficient since, for example, much programmed instruction may be learned just as effectively from workbooks.

Such applications mean that the full capabilities of computers are not being realized and their use as a tool for finding new ways to increasing program effectiveness and efficiency are not being creatively explored.

- Equity.

A growing number of educators are espousing the position that access to computers and computer training is further separating education's "haves" from its "have-nots." Already, the lack of involvement and/or low level involvement (e.g., drill and practice) of handicapped and other minority populations is well documented.

Issues such as the use of the computer to cut special education program costs must be balanced with consideration of the type of computer usage. Questions of differential access must be addressed in terms of both the number of computers available to special education students and the way in which they are used.

Technical Issues

- Acquisition of Appropriate Hardware.

Acquisition of computer hardware appropriate for special education instruction and management, and the efficient and effective application of such hardware is an ongoing concern for policymakers. The high estimates of microcomputer purchase indicate that such acquisition is occurring with exponential speed.

Of greater concern are questions such as: Does the hardware being purchased have the capacity to respond to the identified administrative and instructional needs of special education personnel? Is the pattern of acquisition being monitored to assure that special education students are provided access to the hardware?

- Cost.

With the advent of microcomputers and the yearly decline in cost to purchase, hardware is more affordable. However, at least two issues must be considered when calculating overall costs. First, the costs of courseware in general as well as that specifically available for special education populations remains high and is not likely to decrease to the same extent as hardware. Second, a major cost of computer technology is the oft-overlooked "person cost."

These costs become apparent in, for example, training special educators to become computer literate, assisting them in adapting existing curricula to interface effectively with available computer programs, developing standards for the evaluation of computer courseware relative to learner characteristics of handicapped students, and developing courseware keyed to the regular education curricula which can be used to support the mainstreaming process.

- Development and Acquisition of Quality Courseware.

There is a dearth of quality courseware in a range of basic and more advanced skill areas. By mid-1982, only five firms had special education courseware (CAI) applications available (Education TURNKEY, 1982). In contrast, nearly all of the existing software CMI applications were designed specifically for special education.

Clearly, part of the reason for this shortage lies in reasons such as the often unclear education priorities for special education students, and the relatively small educational market that special populations represent. Nonetheless, since publishers and distributors seem to be assuming that special education applications will be adapted from regular education subject courseware, it is incumbent upon special educators to develop the skills necessary to do so.

- Accommodations.

The installation of computer technolgies into a school may cause disruption and special educators must plan for these change. Among accommodations that may have to be made are:

(1) Provisions for changing school buildings in terms of,
   - changed or increased electrical power needs,
   - modification of walls, ceilings or floors to increase a room's capacity to hold heavy equipment or to install air conditioning and
   - installation of some means of discharging static electricity;
(2) Provision for equipment and material storage;
(3) Provision for moving equipment;
(4) Provision for maintenance and repair, including service contracts (e.g., flat rate, per call, prime time, extended time);
(5) Provision for security; and
(6) Provision for upgrading.

In addition, accommodations must be made so that scheduling assures equal access to all computer equipment for all handicapped students who can benefit.