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ABSTRACT

Developed by the Educational Technology Task Force of the Georgia Department of Education, this guide was designed to help educators plan for computer use in schools. This step-by-step approach for the planning and implementation of educational technology was written from the standpoint of an entire school system, but the principles described apply equally well to individual schools, individual classrooms, or to any academic or administrative division. A brief introduction provides background information, which is structured in six major stages: (1) Conducting Preliminary Activities; (2) Setting Directions; (3) Integrating Technology into Curriculum, Classroom Management, and School Activities; (4) Selecting Software and Hardware; (5) Planning for Staff Development; and (6) Organizing and Implementing for Success. Appendices and tables include a job description for the Technology Coordinator position; samples of philosophy and work statements, survey instruments, and software evaluation forms; an introduction to Georgia's plan for educational technology; descriptions of computer applications; forms for faculty computer competency, hardware, and software/courseware inventories; needs assessment questions and tools; resource lists; an outline for a local staff development program; and software copyright information. A bibliography is included. (DJR)

Educational Technology

Local Planning Guide

Georgia Department of Education

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Acknowledgments

Credit goes to the Merrimack Education Center for its generous permission to include material in the *Georgia Educational Technology Local Planning Guide* from its *Computer Applications Planning** and for permission to modify and expand the numerous charts and visuals that depict the procedural steps. The steps for planning a technology program are expertly captured in Merrimack's detailed procedural manual.

The Merrimack Education Center, one of 11 Lighthouse Technology Centers nationwide, helps to plan, conduct and promote the use of instructional technology applications for the National Diffusion Network of the U.S. Department of Education. The Center recently developed a series of seminars designed to assist state departments of education and local school systems in developing three-year technology application plans. Information on these seminars can be obtained by writing

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The authors wish to express sincere appreciation to the Montana Office of Public Instruction for use of its 1983 publication, *The Elements of Computer Education*, and to the American Association of School Administrators for use of its 1984 publication, *High Tech for Schools: Problems and Solutions*,** a 96-page Critical Issues Report, available from AASA, 1801 North Moore Street, Arlington, VA 22209. These agencies provided liberal permission to use many charts, quotations and tables from their publications. Many ideas and concepts from these publications provided food for thought as we developed the *Georgia Educational Technology Local Planning Guide* and we highly recommend these publications to educators who are planning for technology.

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Introduction

As of July 1984, 36 states reported state-level activities that addressed the use of computers in schools. At least nine states have developed computer guides, curriculum guides, planning guides or application manuals. The Council of Chief State School Officers Reported that there are more than 1½ million computers being used by more than 20 million students in 750,000 schools, K-12, in this country. The most commonly used and most rapidly acquired new technology in schools today is the microcomputer.

Why this proliferation of computers in schools? Many educators have become convinced that the use of computers can greatly improve administration and instruction in schools, given adequate resources and training. There is no question that the inexpensive, simple-to-operate personal computer can improve education today as time and labor-saving devices, as high-speed problem solvers and as motivational devices which add new dimensions to instruction. An equally important reason for schools to be interested in computers and new technologies is that they are an obvious artifact of the most important transformation in world culture since the Industrial Revolution. The industrialized nations of the world are in the early stages of an "information revolution." The children in our kindergartens today are likely to begin adulthood in a world where the most sought and influential skills will be in the areas of information acquisition, analysis and synthesis. Communication with and through machines will be a necessary part of life as the world becomes more service-oriented and uses electronic technology in more creative ways to run our society. Our educational system must respond to this information-oriented world.

Integration of technology into educational programs may involve changes in administrative procedures, distribution of financial and personnel resources, class scheduling, curriculum content, teaching practices, classroom management and staff development activities. The role of the teacher will not change, however. The teacher will continue to plan the curriculum, provide access to information and help students develop problem-solving techniques. Nor will technology eliminate the need for classroom management by teachers. Instead, it will change the style of management as more teachers use computers to assist with lesson plans, grade books, attendance and the creation and revision of tests. The use of technology in classroom management should result in more time for the teacher to be about the business of teaching. Technology will not eliminate the need for educational administrators, but it will alter their style, as more administrators allow computers to assist with letter and report writing, record keeping, budgeting and inventory management. Technology offers exciting additions to the educational environment, new teaching tools and new ways to communicate. Technology will enhance the educational process, so much so that denying today's students access to new technology would be comparable to denying yesterday's students access to printed materials.

All school systems in Georgia are required by the Quality Basic Education Act to develop and update a systemwide electronic technology plan which describes how they will integrate the use of technology in instruction, in classroom management and in administrative offices. This comprehensive plan must also detail strategies for selecting hardware and software and include proposed staff development activities. The Governor's Educational Information Network Task Force has already conducted some planning for the information needs at the state level. The activities of this group will dramatically affect the long and short-range adminstrative considerations in your local plans. The administrative activities mandated under the Quality Basic Education Act and the activities being planned by the Governor's Task Force include the collection of full-time equivalency student data, personnel information and a uniform budgeting and accounting system. There is a strong possibility that the state will provide hardware and software to implement the recommendations of the Governor's Task Force. Any state-mandated activites should be included in your long-range administrative plan along with administrative activities not provided or mandated by the state.

This planning guide introduces you to a variety of activities useful for the design and development of an educational technology plan. It defines educational technology as an integrated and systematic method of planning, implementing and evaluating the total process of teaching and learning through the communication media. These media include all interactive mechanical and electronic delivery systems.

This guide focuses on educational technology rather than computers, because computers are merely the newest technology in the information revolution. Many other technologies are on the horizon, often driven by computers. The combined capabilities of lasers, videodisks, interactive video, holograms, telecommunications and satellites in educational activities must be considered. Rather than focus on a single technology when planning, you should plan for the influence that many emerging technologies will have on your educational programs. Educators today must be aware of the demands that the information revolution is making on education and the opportunities afforded by new technologies to meet those demands.

The guide is designed to provide a step-by-step approach to the successful planning and implementation of educational technology in school systems. It is not designed to be a comprehensive guide for educational planning, as it is assumed that educators involved with technology planning have experience with developing lesson plans, designing curricula or designing programs for a school system.

The guide is organized into stages and steps. The stages represent groups of steps that go together and are included as an aid to organizing the steps into manageable clusters. The 20 steps take the user through a logical planning sequence. Even though it is suggested that you follow Steps 1-20 in order, the sequence of implementation is an important decision for the individual school or school system.

It is likely that you have begun some technology implementation already. If that implementation is not too extensive, you can begin with Step 1 and work your existing activities into the implementation plan. You do not need to start over. List and define what you have already accomplished and detail your main goals. Then fill in the areas not addressed or covered. If your present level of implementation is fairly extensive you will have to be more careful about how you develop planning activities. How you prepare long-term and short-term comprehensive plans will be affected by what is already taking place in technology. Some decisions made earlier may restrict the decisions you make during your new planning cycle. In any event, it is important to remember that planning for the integration of educational technology is no different from planning for any other change or improvement in schools. There is a logical, systematic curriculum planning process that all of us use when designing a new curriculum or improving an existing one. When we use that process we must work around the existing curriculum and procedures, changing or eliminating here and making allowances there. Remember, planning is a fluid process. Assess where you are now and proceed in a logical fashion.

There are no two school systems that use educational technology in exactly the same way. This is true for individual schools within a system and for individual classrooms within a school. This guide makes no assumption about your current uses of technology. The procedures presented here can be treated as a blueprint. All steps from beginning to end are presented, but you can use individual parts of the blueprint or all of it to serve your particular needs. The answers to some problems may be found in this guide, but some problems will be unique to your circumstances. The guide attempts to provide a set of procedures and standards that will help you discover the best solution to your problems.

This guide was written from the standpoint of an entire school system. The principles that are described here apply equally well to individual schools, to individual classrooms or to any academic or administrative division. Whether your responsibilities are for a single classroom or an entire school system, this manual contains procedures for identifying your needs, identifying and selecting appropriate applications, managing your program and evaluating your efforts.

Development and implementation of a technology program does not have to be

accomplished all at once. It is better to implement technology gradually and plan carefully as you implement. Planning for technology must be a flexible process because changes in technology are occurring every day. As technology changes, so do your resources and teaching tools.

You may want to read this guide now and then read it again in six months. Some of the areas discussed will be clearer after you've begun implementation and worked with the problems.

Several articles are included in the appendices as resources. When reviewing these articles, the reader is cautioned to note the date of each publication, especially when costs are mentioned. All references from this guide and from the articles in the appendices are available to Georgia local education agency superintendents and central office staff from the Education Information Center in the Georgia Department of Education.

Stage One — Conducting Preliminary Activities

Be not the first by whom the new is tried,
Nor yet the last to lay the old aside.
Alexander Pope

Planning for educational technology requires careful preparation prior to making decisions. A successful educational technology program depends more on the people running the program than on the equipment being used. Choosing the appropriate people to gather information and make decisions is of utmost importance. Creating awareness among decision makers is also a vital preparation activity. Stage One describes the preliminary steps that should be completed to get ready for planning. These steps are identifying system leadership, presenting basic principles and expected outcomes, and conducting awareness activities.

Step 1 — Identify System Leadership

The superintendent and other leaders in the school system must support educational technology publicly. The superintendent must keep abreast of the activities of the planning committee and should have a general concept of the options provided by technology programs in the schools.

Appoint a Technology Coordinator

The first step in starting an educational technology program is the appointment of a technology coordinator. The technology coordinator will manage and provide leadership throughout the planning and implementation stages. The technology coordinator should be appointed by the system superintendent. This coordinator ought to be recognized by system personnel as having leadership skills and should have public endorsement and support from the superintendent. This coordinator may operate directly from the office of the superintendent or assistant superintendent, but must have direct access to the superintendent for support, systemwide coordination and policy decisions. The coordinator should be interested in and knowledgeable about technology and be allotted the time necessary to develop a comprehensive educational technology program. Technology planning and coordination should be designated as the coordinator's pricrity area. The technology coordinator also will serve as the chairperson of the technology committee. A brief job description for the technology coordinator and a listing of suggested responsibilities is included in Appendix A.

Appoint Technology Committee Members

The selection of the people who will comprise the technology committee is vital to the success of the entire technology program. Any major change requires involvement by all parties who will be affected by that change. Each program and administrative area should be represented on the technology committee. Traditionally, school systems have curriculum, staff development and advisory committees. The Georgia Board of Education requires a leadership team for media programs and expansion of these or other existing committees should be considered. A personal letter from the superintendent appointing each committee member is appropriate. The committee should include members who can provide technical assistance and curriculum development guidance. It also is important to have participation from persons who are new to the use of technology. It may be wise to include a skeptic on the committee to prepare for antitechnology attitudes and computerphobics. The technology committee should include representation from the following personnel.

- Teachers (from elementary, middle and high schools and from each program area)
- Teacher aide(s)
- Media specialist(s)

- Curriculum director or instructional coordinator (and other central office support personnel, as appropriate)
- Principals from each level
- School board member
- Secretary/clerical representative
- Parent(s)
- Student(s)
- Community representative(s)
- Superintendent (may serve as a committee member in a small system)

To ensure the continued success of educational technology efforts, the technology committee should be an ongoing committee. The size of the school system will determine the size of the committee, but most technology committees will need subcommittees. These subcommittees may be necessary in the areas of staff development, software and hardware selection and evaluation, program design and evaluation, curriculum and instruction and administrative use. Subcommittees may contain persons not on the full committee, but each subcommittee must be chaired by a committee member. With this approach, the system committee can remain small and still involve many school and community representatives. A steering committee, made up of the coordinator and subcommittee chairpersons, should be chosen prior to the first meeting of the whole technology committee. The size of each of the subcommittees should match the amount of work to be done. Since subcommittee participation is a major responsibility for most members, assignments should be kept small and manageable within timelines.

Each school should have an in-school technology resource person who provides information to the technology committee and shares committee activities with school personnel. This in-school technology resource person may or may not be a member of the system technology committee and could be a media specialist, a teacher or the principal.

Step 2 — Present Basic Principles and Expected Outcomes

Prior to the first meeting of the whole technology committee, the steering committee should meet with the superintendent to develop guiding principles for the committee and expected outcomes of committee activities. The superintendent should address the human and financial resources available to the technology committee for planning. A flexible timeline should be established for various committee activities and products. During this first steering committee meeting, the committee should develop statements regarding areas of concern. These areas might include student goals, teacher goals, administrative goals, the relationship of computer skills to the existing curriculum and the method for making decisions on equity issues, staff development, program priorities and resource allocation. The basic principles developed at this time should be flexible enough to be modified easily and to enable input from people representing all areas affected by technology. These basic principles, questions to be addressed and expected outcomes will be important for providing a sense of direction in subsequent planning. For samples of such statements and a copy of the introduction to the Georgia Department of Education *State Plan for Educational Technology*, see Appendix B.

A statement describing the basic principles guiding the development of educational technology in the schools should be presented in writing to all technology committee members and to all in-school technology resource persons. This statement should be made available to the community for public relations purposes and to prepare them for requests for assistance in Stage Two. The technology coordinator must develop a way to ensure that interested people are invited to provide input through the system technology coordinator or in-school technology person.

The development of a comprehensive plan for educational technology in the school system is a major goal of the technology committee. The development of a process for recording progress, projecting needs and initially delegating responsibilities is an important first step. The technology coordinator must develop a plan and delegate responsibility for keeping records, including minutes, public relations information and the collection and compilation of data. Specific committee members should be assigned to work with the technology coordinator in developing a tentative plan for the comprehensive evaluation of ongoing technology efforts. The technology coordinator

and each subcommittee chairperson must define the roles of the subcommittees and develop a tentative timeline for the first year.

Some public relations activities planned by the technology committee may include distributing news releases; holding a computer open house; publishing a monthly newsletter; developing a volunteer program; providing adult education programs; establishing computer clubs to involve students, teachers and parents; and visitation by and to businesses involved in the computer industry or using computers and related technologies in daily activities.

Step 3— Conduct Awareness Activities

Only a few teachers and administrators currently have extensive experience with technology or have had the opportunity to take formal course work in technology education. Very few educators are aware of all possible uses for technology in schools. Even those staff members who are computer literate need updates on the state of the art in technology. The purpose of awareness activities is to ensure that the technology committee and the affected population have appropriate information from which to make knowledgeable recommendations. The technology coordinator will plan and coordinate awareness activities with assistance from the technology committee.

The target groups for awareness activities are technology committee members; administrators, teachers and support personnel; board of education members; and parents, students and community members. Do not assume that technology is only for teachers and administrators.

Awareness activities are for orientation purposes and should not be confused with the detailed staff development necessary for implementation of the systemwide educational technology effort. At this stage, the focus should be on developing general awareness of technology and possible instructional, administrative and teacher support uses for technology in the classroom, office and media center. A thorough series of awareness sessions is crucial to subsequent steps in the planning process. These sessions do not have to be extensive and time-consuming, but everyone needs to be involved.

Some educators fear change and technology. The selection of the person who presents the first awareness session can have a significant impact on attitudes regarding technological change. The awareness sessions might be presented by the system technology coordinator or another local specialist. Often the best person to conduct training for administrators is an administrator and for teachers is a teacher. The acceptance of presenters by their colleagues will lend credibility to the presentation, reduce resistance and encourage other faculty to participate. Some students who are mature enough and advanced in using technology may be included as presenters in awareness activities.

Be cautious about using local vendors or highly technical experts for initial awareness activities. The vendor may be overly prejudiced toward his or her product and may not have the necessary information regarding the applications of other products. The technical expert may lose many members of the audience and reinforce fears that technology is too complex for the average person. Stimulating, enjoyable activities that focus on everyday use of technology in educational settings can create enthusiasm.

Ensure that key administrators are involved early and given special attention. Administrative commitment and involvement are essential if the technology program is to receive long-term support and acceptance. It is also important that leadership personnel be kept one step ahead of everyone else during the awareness phase so that they will be prepared to provide initial guidance in planning. At the system level, this means involvement of the superintendent or those members of the superintendent's staff who will have administrative responsibilities and decision-making authority for the technology program. At the school level, this leadership may be from the principal, the instructional coordinator, department heads, lead teachers or media specialist.

Create Special Awareness for Technology Committee Members

Some technology committee members will already be knowledgeable about technology. Some will have a little information and some will be neophytes. It is important that all

committee members be brought to a similar awareness level to have a basis from which to make informed and cooperative decisions. The technology committee should be made aware of current options for technology use in schools. Future uses for technology, the rapidly changing nature of technology and its potential financial and programmatic impact should be discussed, and awareness presentations on managing technological change should be included.

Despite experience with innovation and perhaps because of the deep involvement in planning for change, educational planners frequently overlook the reactions to major change efforts. When the intimidations of technology are coupled with the general resistance to changes in the status quo, the potential for failure increases. The committee should recognize the possible barriers to successful program development and implementation and should formulate strategies for overcoming resistance. (Merrimack, 1984, p. 15)

Plan and Conduct Systemwide Awareness Activities

Awareness activities should be conducted for administrators, board of education members, teachers, support personnel and other school staff. The content and format of the awareness activities must fit the interest and needs of the participants. Suggested topics follow.

- ***A Brief History of the Role of Technology in Education.*** It is important to develop a perspective on the use of technology in education and how technology today is similar to and different from technology of the past. The rapidity of changes in technology should be emphasized.
- ***Present and Future Applications of Technology in Education.*** Very few people are aware of the diverse types of technological applications in education. Seeing demonstrations of a variety of applications in computer-assisted instruction, instructional management, administration and special services can help to broaden perspectives and inform participants of the possibilities that exist today. The content should include videodisks, telecommunications and technology to assist handicapped students.
- ***Courseware and General-purpose Software.*** Demonstrate instructional software for several classroom applications and use a variety of machines. Demonstrate business and management software, such as word processing, spreadsheets, data-base management, student record keeping, media management, class scheduling and lunchroom management.
- ***The Impact of Technology on Curriculum, Instructional Strategies and the Role of the Teacher.*** Many teachers are concerned about how they will be affected by the introduction of technology into the classroom. Their concerns are legitimate and must be addressed.
- ***The Impact of Technology on Administration and Operation of the Educational Program.*** Educational leadership and support staff also have concerns, fears, desires and expectations about how technology will affect them. These issues must be recognized and addressed early in the awareness process.
- ***The Role of the School in Preparing Students for Life in a Technological Society.*** Information on the use of technology in society, with a focus on the ways students will be expected to use technology in their future education, in their vocation and at home, should be presented. Discuss how educational programs might prepare students for life in the 21st Century.

Plan and Conduct Awareness Activities for Students, Parents and the Community.

Many of the activities listed above will be appropriate for students, parents and the community. Other areas to be emphasized are possible benefits to students; saving time, resulting in improved instruction; improved achievement scores; community and school cooperation and goals of the system technology committee. PTA meetings, community gatherings, civic and business club meetings and student assemblies provide opportunities to make brief awareness presentations.

Conduct Additional Activities to Increase Awareness

- Distribute sections of this *Local Planning Guide for Educational Technology* to key administrative staff and members of the technology committee. Assign members

to research and lead discussions on each area.

- Identify administrative and instructional applications for technology within your school system or in nearby systems. Have key administrative personnel and teachers visit those sites and prepare to discuss how they might be applied to your program.
- Arrange for administrators and department heads to attend a technology fair or computer conference sponsored by the Georgia Department of Education, RESAs, universities or vendors.
- Contact and visit nearby colleges, universities and postsecondary vocational-technical schools. Many of them have computer centers, technology centers or innovative programs in the use of technology in education.
- Identify businesses or industries that use computers or advanced technologies and arrange visits by key administrators, teachers, students and parents.
- Provide screenings of films, slide-tape presentations and public television programs that show applications of educational technology. The planning video tapes "Ready or Not" developed by the North Carolina Department of Education and the videotape series "Planning for Educational Technology" can be obtained by requesting them through your media contact person from the Video Duplication Center of the Georgia Department of Education.
- Arrange for hardware and software vendors to make presentations to key administrators and faculty. Be sure that the computer representatives know you are in the exploratory phase and are not ready to purchase. Ask that their presentations be nontechnical. See several different brands of products and a broad range of educational applications.
- Have students or faculty find and share articles in popular magazines and educational journals regarding applications of technology in education.
- Seek out individuals from CESAs (RESAs), colleges, the Georgia Department of Education or other school systems with expertise in educational technology to make presentations to staff and parents.

Stage One — Checklist

Conducting Preliminary Activities

You should complete the following activities in Stage One before you proceed to Stage Two in planning for educational technology in your school system.

- ☐ A full- or part-time technology coordinator has been appointed for the school system.
- ☐ Technology committee members representing teachers, teacher aides, media specialists, instructional leadership, principals, school board members, clerical personnel, parents, students and the community have been appointed by the superintendent.
- ☐ The superintendent has met with the steering committee or the full educational technology committee.
- ☐ The basic principles and expected outcomes from the technology committee have been developed and presented.
- ☐ A timeline for meetings and products has been established.
- ☐ In-school technology resource personnel have been selected and briefed by technology committee members regarding the basic principles and expected outcomes of the planning process.
- ☐ A method for record keeping and evaluation of activities has been developed and responsibility assigned.
- ☐ Public relations activities have begun.
- ☐ Awareness activities have been provided for the educational technology committee members.
- ☐ Awareness activities have been selected carefully and provided for administrators, teachers and support personnel.
- ☐ Awareness activities have been integrated into ongoing activities for students, parents and the community.

Stage Two — Setting Directions

I am vitally interested in the future because I plan to spend the rest of my life there.
Charles Kettering

You thus far have identified a technology coordinator to chair a working technology committee. The committee has been organized to plan and coordinate the implementation of a technology effort in your system for at least the first two to three years of operation. The committee has conducted extensive awareness activities for all segments of the educational community. Administrators, teachers, students, parents and community leaders are aware of technology's potential to improve the quality of education. Your committee and the people involved in system planning now have at least a minimum level of knowledge and understanding from which to make recommendations and plan for enhancing administration and instruction through the use of technology. You are now ready to go on to the next stage of your planning.

Stage Two is important because decisions made now will determine the nature and direction of the entire technology effort. The steps in this stage will help you decide how, when and where you want to use technology in your school system.

A caution is in order here. Following the awareness activities, it is likely that you and your committee will be eager to purchase equipment and software for use in your classrooms and offices. However, there are important planning tasks which must be conducted before you make those decisions.

Stage Two consists of surveying and identifying needs, setting priorities for action, developing broad goal statements and identifying planning resources.

Step 4 — Survey and Identify Needs

The first point to decide in setting directions is to identify the needs in your system that can be met through technology. This identification process will consist of two parts. The first is a survey to determine respondents' present technological expertise and attitudes toward and recommendations for the application of educational technology in your system. The second is an old-fashioned needs assessment to help identify the instructional and administrative parts of your system most in need of limited technology resources. Even if you already have an active technology program and a current plan in place, an annual survey to aid short-range planning is highly recommended. If you have a systemwide needs assessment that is less than two years old, it will serve. At the very least, you will want to evaluate the effectiveness of your present program and correlate it with the results of your survey and most recent needs data.

It is important to examine your technology needs periodically and to assess your system's program needs objectively. You should be able to support your recommendations with opinions from a cross section of the educational community, including administrators, teachers, students and parents. A systematic survey and assessment will take time and effort, but afterwards you will be able to place more confidence in your plan and demonstrate the importance of a technology program to the school board when requesting funds. A good survey and assessment will

- justify initiating, continuing or expanding the program,
- demonstrate the beliefs of all segments of the school community regarding technology,
- provide hard evidence for decision makers who fund this program,
- become a basis for the development of short- and long-range goals for the technology education program,

- give everyone a chance for input,
- assure that the request to start a technology education program comes from the students, staff and the community, rather than from one or two interested teachers or the administration,
- make people think about technology and how it can help schools, stimulate curiosity and enthusiasm, and
- provide good public relations between the school and the community.

Conduct the Technology Survey

Questionnaires should survey all categories of people served by the educational program, including administrators, support staff, teachers in all grades and subject areas, students, parents, members of the business community, civic leaders and institutions of postsecondary education.

It is important that the sampling include as many individuals as you have the time and resources to survey. A larger volume of data will not only give you a more realistic picture but the more people you contact, the greater the involvement and support will be for what your system decides to do. It is recommended that every effort be made to survey all administrators, support staff and teachers. Some populations, like students and parents, will be too large to survey completely. For these groups a representative sample should be selected at random. Collecting a high percentage of the sample is critical for a valid survey. This may require follow-up cards and, perhaps, phone calls.

A collection of sample survey forms is included in Appendix C. Most of these forms refer only to computers, but it is a good idea to modify these forms to include other technologies. We strongly recommend that you design your own survey instruments using the advice in this section and the examples in the appendix. It is unlikely that you will be able to find one instrument that will meet the needs of your system exactly. In addition, the exercise of developing your own survey instruments will make your committee more familiar with your surveys, how they were constructed and what type of information is sought. This familiarity will enhance the committee's use of information in subsequent steps. As you develop your technology surveys, be sure to gather information from each respondent in at least the following three areas.

1. ***Background information on each respondent and level of experience with technology.*** Questions in this section should range from name and school or community affiliation to the kind of hardware and software the respondent can operate.
2. ***Applications the respondent thinks are of highest priority.*** The usefulness of responses will depend upon the knowledge of the respondent of the potential instructional and administrative uses of technology in education. One of the major objectives of the awareness activities was to prepare people to respond knowledgeably to this section of the survey.
3. ***Respondent's attitudes about educational technology.*** It is important, first of all, that this section appear on a separate page or as a separate instrument so that anonymous responses can be made. Otherwise you will not get reliable results. You may want to ask respondents to indicate personal data other than their names so that you can categorize responses. Do not fall into the trap of thinking that an "attitude" survey is not important and can be skipped for the sake of time and energy. It may be the most important aspect of your surveys. If you find that a majority of your educational community is still negative toward or afraid of technology, no technology plan will be successful. You may need more awareness and public relations activities.

Analyzing part one of your survey should help you assess the levels of experience and expertise of your respondents. From education respondents you should be able to get a picture of your faculty's training needs and some indication of people who might provide training. You should also be able to identify good candidates for the hardware and software selection committees. You will want to identify individuals from the community who can offer inservice or consultative help or who show enough interest to be invited to serve on subcommittees. You may find a potential inservice instructor from the student respondents, especially in the area of computers. More importantly, you will get an idea of the level of experience and expertise of your students and thus possible starting points for curricular programs.

Part two of each survey should provide information on how important particular technology applications are to the majority of your respondents. The pattern of responses should help you decide whether to begin your technology program in instructional areas, classroom management or administration. These responses may also help you decide what hardware and software to purchase.

Part three of each survey should tell you the level of acceptance or resistance to technology you might expect from each group. The questions should be designed to determine if respondents perceive technology as a valuable tool in education and in preparation for careers. Some questions should assess the respondents' attitudes about technology in their lives. Finally, this section should elicit information on attitudes about student use of technology, especially use of computers. Responses to these questions will give you an overview of what each respondent group believes about these areas and can provide a good basis for designing further awareness activities, staff development and public relations efforts.

In addition to this information, the surveys can help respondents understand their own attitudes and beliefs about the new technologies. What better way to begin planning for educational technology than with your entire professional staff, students, parents and community represented?

Compile a System Needs Assessment

A significant initial investment of time, money and commitment from your school system is necessary to begin even a modest program in educational technology. If educational technology is considered an innovation in your system, there may be numerous individuals and groups intently scrutinizing your progress to protect their tax money or the status quo. For these reasons, it is imperative that the instructional and administrative uses of technology detailed in your plans be those obviously in need of improvement and most likely to yield positive results. A needs assessment is in order.

For most school systems this will not be a difficult task. Any existing assessment that is two years old or less will suffice. The existing information on system needs may come from or be a combination of Southern Association of Colleges and Schools (SACS) studies, the assessment parts of plans for state or federal program proposals and system or school improvement plans. If you have assessments that are more than two years old but less than six, you may only need to update this information. Data such as student scores are easy to update. For more subjective information, such as staff and parent surveys, sampling the original respondents will provide enough information. If your system has not conducted a needs assessment in the past six years, you will need to do so in preparation for your technology activities. Appendix D contains a checklist and references for a variety of needs assessment literature and tools.

Much of the data you have is likely to be assessment of instructional needs. School systems seldom assess needs in administration, even in the administration of the classroom. This may be because the direct connection between administration and student performance is difficult to portray or assess. But technology, especially computer utilization, is an educational innovation with applications for every part of the school environment. Technology can be a tremendous boon to administration in the central office, the principal's office and the classroom.

Unlike the complicated techniques necessary to pinpoint priority instructional needs, assessment of administrative needs for educational technology is relatively simple. What is required is a good awareness activity for all teachers and administrators to demonstrate the possiblities for technology in the workplace and a survey to elicit preferences. This survey should discover what respondents think are the most pressing administrative problems for the most people. If your awareness activities for administrators and teachers included administrative applications, the assessment in this area could accompany the survey questionnaire to these groups.

The final task in this needs assessment is to identify those needs which can be positively affected by technology. A good assessment will identify a comprehensive list of needs. Your committee is only interested in those instructional and administrative needs that can be addressed by technology. These needs may be identified and added to the list of applications recommended by the surveys from Step 3.

The instructional and administrative needs that can be met through technology, along with the applications of technology recommended in the various survey reponses, from the basis of your one- to three-year plans for educational technology implementation. But some priorities must be established first.

Step 5 — Set Priorites for Action

The surveys and needs assessments will undoubtedly reveal more needs and uses for technology than you have the resources to accommodate. The committee therefore will need to set priorities for its work and eventual recommendations. It is important for the committee to come to a consensus on these priorities and to record them for ongoing direction. A written copy of identified needs will help avoid future misunderstanding within the committee. These priorities will also be the starting point for setting long- and short-range goals.

Deciding on priorities is, for the most part, a matter of professional opinion by the committee. There are two important sources of opinion that may help guide these decisions. They include a compilation and analysis of the surveys and needs assessment data and the opinions of the school board, superintendent and principals. These individuals will have a strong effect on the success of any activity.

The committee should first list all the major needs identified in the surveys, the needs assessments and those collected informally from influential education and community leaders. This list of needs can then be compared to a set of broad criteria, such as those listed below. The committee should try to identify other criteria that are of particular importance to their school system or education situation.

- ***Student Need.*** How critical is the need to the further education or careers of our students?
- ***Implementation.*** Can the need be met in a reasonable period of time?
- ***Cost.*** Is the expected cost of meeting the need within the general budget limitations of the system? Be careful at this point not to close off options solely because they may require more resources than are presently available.
- ***Present Level of Staff Preparation.*** Does the system already have some staff that can begin work toward meeting this need with little further training required?
- ***Fit with Basic Principles.*** Will pursuing this priority further one or more of the basic principles set forth by the superintendent and steering committee in Step 2?

A simple chart listing all the identified needs down the side and a column for each criterion across the top could be filled out using a scale of one to ten by each committee member and then by the group together to work out conflicts. You may want to assign different weights to certain criteria considered more important than others. If the system expects a grant to defray costs, for example, the opinions of the superintendent and board might carry considerably more weight than cost estimates. If a more mechanical method of setting priorities is needed or if it is difficult to come to a consensus within the committee, the reader is directed to one of the source documents on methods of setting priorities, listed in Appendix D. These sources explain evaluation techniques, including paired comparisons, weighted group averages and the needs matrix.

A final caution is in order here. Setting priorities for program development over the one- to three-year period addressed by your plan should not mean that existing activities are ignored. The committee should examine what applications are already in place and determine how these pockets of innovation can be supported and incorporated into your plan. Often, the efforts of an individual or small group of teachers can form the foundation for a comprehensive program. Building on such a foundation can usually be accomplished quickly and efficiently and often without the resistance that accompanies the development of totally new programs.

The committee should prepare a ranking of the top-priority need areas and a rationale for why they were chosen and how they were ranked. This information should be presented for the superintendent's approval with a recommendation that it be shared with the board for support.

Step 6 — Develop Broad Goal Statements

The committee has identified in order of importance the applications it will recommend to the system. These recommendations are detailed enough to allow the committee to go on with specific planning for instruction, classroom management and administration. Committee members have an important public relations function as representatives of the community and school system. Using the data from Step 4 to set priorities is complicated. The meaning of the priorities is likely to be clear only to the committee members. The committee should prepare broad goal statements to better communicate outside the committee and to clarify direction within the committee. Specific objectives for each priority area will bring these recommendations into focus. The sequence of goals-objectives-action is what most people will expect and understand.

You may ask why goal statements were not the first order of business in setting directions in Stage Two. The range of potential applications for technology is broad and the acceptance of its integration into all aspects of the school by teachers and administrators is absolutely critical. Therefore, it is important that the priorities for action be based upon an assessment of faculty and community recommendations rather than upon a set of goals developed by a representative committee.

Goal statements are generally considered broad statements of intent to set direction for activity or decision making. In this planning process the committee has already developed two sources of goal statements. The first source is the basic principles and expected outcomes in Step 2. These are like statements of your philosophy, general in structure but directive. The second source is the priorities for action set in Step 5. These are more specific than basic principles but are perhaps more directive because they identify specifically those areas of application recommended directly by the users through your surveys.

There are numerous sources of goal statements in the literature for using computers in instruction. There are fewer sources for goal statements that cover classroom management and administrative uses of computers, and there are almost none that address the more generic category of "technology in education" emphasized in this guide. However, given a few examples and the experience of your committee members, developing comprehensive goal statements need not be a difficult or time-consuming task.

Although directed toward computers alone, the three main goals for the five-year plan of the Princeton (N.J.) Regional Schools are noteworthy examples.

1. Extension of computer experiences through the elementary grades so that the learning experience is supportive of the district's commmitment to the teaching of thinking skills.
2. Integration of computer experiences throughout the middle school and high school programs so that computer science is perceived as a basic skill fully applied rather than an isolated separate specialty.
3. Adoption of computerized administrative techniques such as word processing and record keeping in order to streamline operations and demonstrate real applications of technology. (From AASA, 1984, p. 48.)

These are good examples because of their specificity and their clarity. Each statement includes two important components not always found in goal statements. First, there is a statement of intent ("adoption of computerized administrative techniques . . ."), and then the purpose of that intent is included (" . . . in order to streamline operations and demonstrate real applications of the technology"). This latter element is often absent in goal statements, but its inclusion is highly recommended.

The curriculum subcommittee may wish to conduct a preliminary draft and refinement of these statements and then bring the refined goal statements to the whole committee for review. In some cases, the planning committee may which to set up a process for review of the goals by all teachers and administrators in the system before seeking system approval. Note that such a review may take considerable time to accomplish.

Since the organization of the planning process thus far is somewhat nontraditional, some

readers may be confused. A report of progress to the superintendent and inhouse technology resource people on the products and recommendations of the committee to date would contain basic principles and expected outcomes, goals and priorities for action. Keep in mind that the purpose of devising goal statements is to provide an organizing framework for the remainder of your planning.

The importance of being sure that goal statements reflect the wishes and professional judgments of the community and staff cannot be overemphasized. Furthermore, the extremely critical Stage Three, which includes detailed plans for instruction and administration, must grow directly from the goals set here, because these goals organize the priorities set in Step 5.

Step 7 — Identify Planning Resources

While people are critical to the success of the planning effort, their effectiveness is determined in large part by the quantity and quality of resources they have to develop the plan.

Typically, these resources fall into four categories.

1. ***Information.*** What are the latest trends in technology? What are other school district doing? What exemplary materials, programs and practices are available for review? What does the latest research have to say?
2. ***External experts.*** What specialized skills and knowledge will we need to procure? From what source(s)? At what cost?
3. ***Planning time.*** How much time is required for meetings? For work sessions, both individual and small groups? For preparing reports?
4. ***Materials.*** What reports, journals and special publications are needed?

The committee chairman and the subcommittee leaders (the steering committee) should prepare a preliminary list of resource requirements for review by the committee members and for approval by the superintendent. Plans should be made for procuring resources so that they are available at the appropriate stages of the planning process.

Stage Two — Checklist

Setting Direction

You should complete the following activities in Stage Two before you proceed to Stage Three in planning for educational technology in your school system.

- ☐ A technology survey has been conducted.
- ☐ A needs assessment has been conducted/compiled addressing both administrative and instructional needs in technology.
- ☐ Priorities have been set based upon analysis of surveys and needs assessments with local administrative input.
- ☐ Broad goal statements have been developed.
- ☐ Planning resources have been identified.

Stage Three — Integrating Technology Into Curriculum, Classroom Management and School Administration

We need to know how to use these tools, and we also need to have opportunities to 'mess around,' to try them in different situations or with different problems.
In other words, we need opportunities to think about and integrate the technologies into our problem-solving processes to develop a sense of what we can do with them.
Lewis A. Rhodes

The goal of this guide is to help school systems plan for the integration of technology into all applicable areas of the school, instructional and administrative. The emphasis is on **integration.** The technology curriculum, for example, cannot be separated from the systemwide curriculum. You may decide to start separate courses for computers and other technologies, but over time, deliberate integration of computer skills into the existing curriculum should take place.

In Stage Three the technology committee, along with appropriate teachers and administrators, will design the specific plans for implementation. The preparation stages have been completed and it is time to start planning for the educational program and its support services, Step 8 develops the school administration plan and discusses using technology in the central office and the principal's office. Step 9 designs the teacher-support plan and addresses taking advantage of technology to help teachers with classroom management and the development and support of activities in the class. Step 10 develops the curriculum program and will give the committee and other necessary school personnel the opportunity to detail their plans for the instructional program.

We recommended that your school system plan for the integration of technology in the order of Steps 8 through 10: administration, teacher support, instruction. This may mean waiting to implement the instructional program until the second or third year.

Experience and research suggest that beginning with administrative applications familiarizes the administrators and clerical staff with the technology first and thereby gains their understanding and support. The teacher-support plans and the instructional plans for the students are likely to fail if administrators are not knowledgeable and enthusiastic about technology. In some systems concentration on the administrators and clerical staff alone the first year may not be politically feasible. You might consider including one or two pilot teacher-support activities the first year to show direct support of student activities. The bulk of the teacher-support activities should take place in the second year or second phase of your implementation.

Regardless of how you order the administrative and teacher-support plans, it is critical that the teachers be comfortable with the technology before they attempt to use it for instruction. There are dozens of ways the teacher can use technology to enhance the classroom without demonstrating skills before children or using computers as a tool for instruction. Only when the administrators and teachers are comfortable with technology should the implementation of the instructional program begin. We realize that many schools and teachers are still not familiar with or comfortable with the new technologies. We are recommending that you design your plans so that these people are not expected to implement or administer an instructional program until they are knowledgeable and at least accepting of, if not comfortable with, the new technologies.

In this stage you will be developing three major components of your system or school plan — the administrative plan, the teacher-support

plan and the instructional plan. At this point you may choose to treat them as separate subplans to be integrated in Stage Six. The master plan you put together in Stage Six begins here. That master plan, along with each of the subplans, ought to be presented in both narrative and graphic or chart form. The two forms of your plan, singly or in combination, should provide a major communication tool.

Below are six categories of information that should be considered by the subcommittee personnel responsible for each of the sections as they develop their subplans. The narrative plan needs to contain considerable detail for each of the six categories. For the graphic or chart display, you may summarize the information for clarity.

1. ***Activities.*** Draw up major activities for each of your subplans. These should include
   - activities specific to the particular subplan (adminstrative, teacher support, instructional).
   - staff development activities,
   - software and hardware selection activities scheduled during planning periods, and
   - other support activities necessary to implement your instructional and administrative programs.

1. ***Time.*** Timelines detailing years and months (and in some cases even weeks and days) when each activity is to take place should be included. Specific target dates must be determined.

3. ***Budget.*** Projected costs should be given for each activity or group of activities. The narrative plan will require detailed budgets, but the graphic form of the plan should contain only round figures without a lot of detail.

4. ***Resources.*** This category should include any resources other than funds, such as support from outside agencies or resource personnel.

5. ***Products.*** This may include any number of things, from plans to reports to curricula.

6. ***Responsibility.*** Responsibility will depend on the scope and complexity of your plan and the number of people working on it. But it is always a good idea to list contact people on your plans, especially if they are going to be made public. It's a great motivator.

Be careful not to let your overall plan become too complicated. You may decide not to include all six categories listed above, as the overall plan is primarily a communication tool. People who were not involved in the development of the plan must be able to read and understand both the narrative plan and the graphic display of that plan. Keep the large, overall plan as simple as possible without leaving out anything important. The subsections of your total plan can contain the detail necessary for those who must carry them out.

One final caution as you begin to work on this crucial step: Remember that this is first and foremost an educational planning task. Planning well at this point will require that your committee and staff have some familiarity and expertise with technology, especially computers, and that you have access to a technology advisor. Do not allow your concerns for technology, and perhaps your lack of confidence in this new field, to allow you to forget what you already know about sound educational planning and what you know about your own school system. This task remains a professional education task, even though the committee will have many technical questions to address.

Step 8 — Develop Administrative Plan

Your plan for using technology to assist administrators will be the easiest of the three plans to develop. The tasks to plan for and their outcomes or products are fewer and much more definable than the other two areas, the number of individuals to be trained is smaller and the software programs available to carry out the tasks have been evaluated more often than most of those for instruction and teacher support. Your administrative plan should contain two distinguishable parts, one for the central office and the other for the prinicpal's office. Many of the needs will be similar, the main difference being a matter of volume. For example, each school must collect attendance data, but the central office is responsible for compiling it. The principal's and superintendent's tasks are similar in kind and the steps for developing a plan are the same, but the total system plan should contain a central office subplan and one for each school office. These plans should be closely coordinated to

assure compatibility of machines and programs.

There are four generally accepted areas for the use of current technology in the administrative office. All of these uses are computer-based now. Other technologies are on the horizon, including better computers, but the practical, available technology today is delivered on computers. (For a description of other technologies potentially useful to school administrators, see Appendix E.) The four administrative application areas are word processing, data-based records management, spread sheets for budget management and specialty packages (such as lunchroom management, scheduling and resource inventory management).

Experience and the literature suggest that you should consider implementation of these applications in the order in which they appear above. This produces the best results and a smooth transition from annual administration to automation. Word processing is recommended first because it is generally easiest for the whole staff to learn and is an application used more than any other in the office. The temptation may be to rush into adopting a scheduling program because scheduling gives administrators so much trouble. But if you want to automate your operation, take full advantage of technology and get the most for the school system's dollar, consider these four areas in the order presented as you design your adminstrative plan.

Assure Administrator Involvement and Review Staff Awareness

It is critical that any administrator who will be expected to use technology or will be offered use of technology in his or her office be involved in the development of the administrative plan. Remember that administrators are no less susceptible to "computerphobia" than teachers. They will respond positively to being included and asked for their opinions. As a matter of fact, adminstrators are more likely to expect to be asked for their input. Perhaps an ad-hoc subcommittee made up of all the adminstrators (if the system is not too large) or a good cross section of adminstrators (both those eager to adopt the technology and those not so eager) would be a good idea. Don't forget the clerical staff. Introduction of technology is likely to change their jobs even more than those of the administrators. Resistance among this group can be very strong, and if serious enough, can delay or even prevent effective implementation of office automation.

It is equally critical that all administrators, whether on the committee or not, be aware of the various applications of the available technology. It is likely that most of the preliminary activities in Stage One — Conducting Preliminary Activities and Stage Two — Setting Directions have concentrated on instruction and teacher support, including the awareness activities. If this is the case, perhaps a special set of awareness activities for administrators and clerical staff would be in order. (See Appendix F for articles on several administrative applications.) It would be a good idea to review the awareness levels of your office. Include the clerical staff in this awareness survey. If you find anyone who has not had at least a minimal introduction to ideas the planners are considering, be sure that they are informed before the committee adopts recommendations that will require those administrators or clerical staff members to accept and use computers to do their jobs a different way.

Identify Needs in Each Office

The professional and clerical staff in the central office and each principal's office must now examine jobs that are being done currently and target those whose efficiency they would like to improve through automation. The best jobs to consider for automation are those that are the most labor-intensive or time-critical. We do not mean that you must choose between the major application areas (word processing, data bases, spread sheets, special uses). Rather, you should decide what word processing jobs you want to tackle first, then what kinds of data base applications you need and so on.

Just because you would like to make a particular job faster and easier through automation does not mean that that job lends itself to automation. Computers and other office technologies cannot perform every job better than the old manual systems. Here are a few questions to consider about each task to help you decide what jobs to automate and how.

- ***What is the volume and frequency of the job?*** A small job or one that is conducted infrequently may not be worth the trouble to automate. Other jobs may be so large that all of your data will not fit on one floppy disk, which therefore affects the kind of database and equipment you must use.
- ***How many fields (categories of information) will the files contain?*** Some database programs allow only a certain number of fields per entry. To a lesser degree, some spreadsheet programs limit the number of lines and columns available. Although most spreadsheets have unlimited entry size, the user has to be sensitive to what can be printed on standard paper for display purposes.
- ***What are the maximum lengths of field names that might be contained in those jobs?*** You can abbreviate, but this may become confusing.
- ***How many ways would you like to manipulate a given set of data?*** Basic data that needs to be manipulated many different ways is a prime area for automation. A good example is bus scheduling. In order to make decisions, you may want to look at the number of students along certain streets and highways; then the number of children in certain broad areas of the school system; then the number of students within two blocks of the currently assigned bus stops, and so on. All of these questions could be answered from a common data base of student information or a specialty package designed for this job.

You will notice that, except for the first question, this information refers mostly to data bases and spreadsheets. Word processing is so generic that decisions about what word processing applications to employ are mostly a matter of preference for the administrators and clerical staff.

Decide on Scope and Timing or Applications

Once you have decided on the tasks that you and your staff want to automate, you should decide on timelines and support activities. Before making any final decisions about automation, however, talk to administrators and clerical staff from other systems who use technology in administration. Get their advice on how to sequence and time the introduction of your applications. Don't forget that training will be the most important part of your plans. Ask other systems about the amount and kind of training they would recommend if they were doing it again.

Step 9 — Design the Teacher-Support Plan

The area of teacher support or classroom management is often the most ignored by school planners. The programs included in this area may be mistakenly lumped in with instruction. Teacher support includes applications of technology that can be used by the teacher to make classroom management more efficient and effective. Some of these activities can be accomplished without a machine in the classroom. Some of the more common kinds of classroom management programs include the following.

- Grade book programs allow the teacher to record and manipulate grades electronically for homework, tests, quizzes and special projects.
- Test generation and scoring programs allow teachers or entire faculties to develop a bank of items for tests in any subject area and to produce randomly generated examinations. It is easy to generate a separate test for every class period or every student. Some programs will score the tests and some will make recommendations to individual students for further study on objectives they missed.
- Material generation programs allow teachers to design specific materials to support the curriculum and lesson plans. These range from graphics that enhance the appearance of curricular material to crossword puzzles and word search puzzles tailored to any subject matter.
- Student and parent report programs produce grade reports and individually selected comments for students or parents. These programs make it easy to make midterm, monthly or even weekly status reports to students and/or parents.

Many of these programs will also generate individualized letters to parents or students with paragraphs selected from an array of prepared ideas and suggestions.

Unless a school has teachers who have some experience with instructional technology and are begging to begin using it with kids, it is advisable to let teachers begin their experience with technology by learning to use the teacher-support programs first. Most teacher-support programs are fairly simple to learn and are very "user friendly." They are also varied enough to help teachers learn most of the basics about computer use they will need later, and teachers can learn at their own pace. Most importantly, teachers can use these programs on their own without anyone, especially kids, watching them make mistakes. This is particularly important for teachers with computerphobia, a common malady that has destroyed some school-level technology programs.

Your plan for using technology to assist teachers should not be a difficult one to develop. The tasks are straightforward and easily definable. A carefully considered needs assessment to decide which programs to adopt is not required because there are so few basic teacher-support programs that every school ought to be able to afford at least one program in each category. Many are in the public domain. The programs themselves are quite simple and therefore do not require much training. Many require no training at all. Finally, the emphasis in this plan is on introducing the teachers to what is available and letting them use the programs voluntarily. Therefore, a highly structured plan is not necessary. You need to make at least one program in each of the four categories described above available to each principal. Encourage the principals to follow commonsense ideas for easing new ideas into a school.

1. ***Prepare Principals.*** In a school where the use of technology is new, the principal must be the person to introduce the idea that technology can assist teachers in the classroom. The principal should be the one to advocate and demonstrate its use to the teachers, although someone from the central office, a teacher or another school administrator could also serve this function. The principal must take this on as a special project and carry it through until the majority of the target teachers are using the technology. Unless a principal is willing to take on that role, we recommend that the system not attempt to introduce technology to the teachers and students in his or her school. Often, however, a principal who is reluctant to take a leadership role in technology in his or her school will have a change of heart after a year of successful technology application in the office. This is another reason why it is recommended that you place your first major emphasis on the adminstrator's office. Because of the critical importance of the principal at this juncture, the remainder of the suggestions in this step are addressed to the principal.

2. ***Select Teachers.*** Do not expect all teachers to participate at first. Try to let these programs sell themselves. Participation must be open to all interested teachers. There will likely be some teachers who will never choose to use the available technology. It is too new and different. That's all right. Don't try to force them. Some of them may come around when instructional technology is introduced. The important thing is to concentrate on those teachers who are interested and be sure that they have the materials and support they need when they need it. As an alternative, you may want to select informally a small cross-sectional group of teachers to experiment with and field test the programs you will later introduce to the whole faculty.

3. ***Select Programs.*** If your school is unable to obtain at least one program in each of the major categories of teacher-support software, you will need to survey your interested teachers about the kinds of programs they would like. The more informal this is—the better. The survey must be as complete as possible; be sure to ask every teacher whom you expect to participate. In a large school this may require a more formal paper-and-pencil survey. Using your own judgment to analyze teachers' preferences, try to obtain programs that will have immediate benefits to the teachers in terms of saving time and increasing efficiency. Don't forget to review software in the public domain for teacher-support programs if financing is a problem.

4. ***Provide Learning Opportunities.*** With just a little help, most teachers will be able to learn to use these programs on their own. At this stage (the first time many teachers

will have their hands on the computer outside a workshop) it is important that teachers be allowed the oportunity to work with the computer in a private situation. This means putting the machines in a workroom away from students where teachers have access to them on a regular basis. It also means that you will need to provide special strategies for allowing teachers to work with the technology independently. A check-out system to take equipment home on weekends or on holidays is a good idea. Most insurance companies will welcome the idea because the machines are safer in teachers' homes than in the school. Make it as easy as possible for teachers to have exposure to the technology in a relaxed atmosphere during the initial phase.

5. ***Sell the Ideas.*** It is very important that you continue to showcase what technology can do in support of the classroom. Demonstrations by principals to the staff are the best way to accomplish this. Demonstrations by teachers, when introduced by the principal, will also suffice. Theso demonstrations should be brief and preferably limited to 10-15 minutes. A brief explanation and demonstration of how a crossword puzzle can be generated for any subject matter area and a brief demonstration of how the computer can be used to send letters home to parents are good, brief examples. Try showcasing what other teachers are doing with the technology.

You should attempt to accomplish two things with your teacher support plan. First, you want as many teachers as possible to take advantage of the technology to improve their classroom management and curriculum delivery. Second, you want the teachers to gain practical experience with the technology in a nonthreatening, productive atmosphere. The real payoff of curriculum and instruction improvement will be greater if you accomplish both of these goals.

Step 10— Develop the Curriculum Program

This section is not intended to be a detailed treatise on curriculum develpment. There are numerous texts and monographs that provide ample guidance in that area. (You will want to review *Instructional Computing: A Resource Manual*, developed by the Office of Instructional Services.) Moreover, it is recognized that there are several approaches to developing curricula, and that one person's goals are another's broad objectives. For these reasons, the procedures do not need to be discussed here.

The committee may involve various outside individuals for particular tasks in the planning process.The committee can best decide who the others should be and when to involve them. We strongly recommend that a special effort be made to involve as many system staff who affect instruction as possible. Don't forget to include support personnel and do not limit teacher participation to specific grade levels or content areas.

A three-step process is proposed for developing the technology curriculum as part of the system-wide curriculum.

1. Develop student competency statement
2. Develop curriculum objectives
3. Develop instructional strategies and applications

Develop Student Competency Statements

The goal statements provide the organizing framework, but more specific statements of student competencies are required to guide the development of the curricular program. Although these statements are more specific, they are not yet linked to the existing subject matter areas. That will be accomplished during the second part of this step.

We use the term competencies to refer to knowledge and attitudes, as well as skills. The competencies must specify what students need to do with technology in continuing their education and in their careers. You can expect some debate about the exact nature of these competencies, since experts do not agree on this. There is, however, widespread agreement that students should know how to use technology to perform basic educational operations.

What you expect students to do with the technology will dictate the level of literacy you require. Robert Taylor, the author of *The Computer in the School: Tutor, Tool, Tutee,* proposes a set of computer literacy categories.

He suggests that a computer can be used in three ways: as a tutor (computer-assisted instruction), as a tool (word process or graphics device) and as a tutee (programming or otherwise instructing the computer to perform special operations). Taylor's first mode of computer use, tutor, requires primarily that the student be able to turn on the machine and load a disk. The second goal area, tool, requires extensive knowledge of the keyboard and a little knowledge of the computer's operating system to set up files, prepare disks for data entry or transfer and copy data. The last mode, tutee, or teaching the computer to perform special operations, might require knowledge of memory configurations, compilers and similar technical components and operations.

Table 1 provides a selective sample of competency statements that might be developed for a student goal. Note that in addition to the obvious statements dealing with specific skills, students are expected to know how computers can be misused by individuals to invade privacy or otherwise abuse the private and public rights of individuals and organizations. Communicating computer use involves knowing what appropriate communication is.

Once the curriculum subcommittee has developed student competencies for each of the goals, it will need to determine the student populations for which they are appropriate. This involves deciding what grade levels and subjects fit the goals. Determining what grade levels are most appropriate for the introduction of specific competencies will require judgment. The committee should review sample technology curricula available for computers (contact your CESA or the Georgia Department of Education) as well as ensure that these competencies fit with the existing curriculum. To accomplish this task, the curriculum subcommittee may want to seek advice from a sample of teachers and administrators before bringing this work to the full planning committee.

Develop Curriculum Objectives

Student technology competency statements are combined with the existing curriculum during the development of curriculum objectives. This may be accomplished by assigning each competency to one or more subject-matter areas and modifying it to specify the technology application that will be made in that subject area. Thus, the curriculum subcommittee may decide to assign competencies relating to word processing on the computer to the English/language arts area. Such an assignment would mean that teachers in that area would have primary responsibility for teaching that competency. If basic technology skills are to be taught in a technology lab, subject area teachers will still have responsibility for seeing that these skills are employed to enhance the learning of traditional subjects. How that teaching would be accomplished cannot be specified at this point; it should be determined by the development of instructional strategies and applications in the final part of Step 8.

The assignment of word processing to the English/language arts area is relatively straightforward. It is possible, however, that you may want to have general word processing skills developed in a typing class and leave only subject matter applications to the English/language arts department. In some cases, it will be difficult to assign competencies to one specific subject area, and two or more may be selected. For example, competencies related to using computer graphics programs could be taught in math or art. When more than one area is involved, the subcommittee will need to ensure that instructional planning avoids unnecessary duplication and encourages coordination in the development of basic technology-as-tool skills.

The integration of technology competencies into the existing curriculum is a major undertaking. It may require substantial modification of existing objectives and the development of new ones. Integration also provides motivation for examining the existing curriculum, and adding new competencies may require that existing ones be eliminated or modified. The time for teaching technology competencies must come from the available instructional time. This pressure on limited time resources can only be relieved by adjusting the existing curriculum.

In addition to the time pressure, the introduction of technology competencies may force a reevaluation of what is important and necessary to teach. Experts have cited the need to emphasize procedural over factual knowledge and the need to expand conceptions

Table 1

Sample Goal and Student Competency Statements

Goal

Students will be able to use the computer and appropriate software to communicate and compute.

Competencies

1. Students will understand how computers are used to communicate and perform computations in various occupations.
2. Students will understand what uses of the computer are inappropriate.
3. Students will know the layout of the computer keyboard and the functions of special keys.
4. Students will know how to use the computer's operating system to perform general-purpose operations such as file and disk copying and related file maintenance operations.
5. Students will be able to select and use an appropriate sofware program for graphing data.
6. Students will be able to select and use an appropriate word processing program for preparing written reports and papers.
7. Students will be able to use the computer to access and search online automated information files.
8. Students will be able to select and use appropriate software for manipulating data for synthesis, analysis and projections.

From **Computer Application Planning,** Merrimack Education Center, 1984, p. 30.

of basic skills to include higher-order analytic and problem-solving skills. The newer technologies provide an opportunity never available before. While such a reshaping and revitalization of the curriculum may be too large a task to be undertaken by the subcommittee, some attention should be given to areas where further examination and development are needed. Perhaps the subcommittee can recommend the formation of subject area committees to reexamine the existing curriculum.

Modifications of the existing curriculum should be expected. If technology is to have the projected impact on our future education, our work and our lives, it would be surprising if it did not have considerable impact on the curriculum.

Table 2 provides several examples of the transformation of technology competencies, in this case computer competencies, into curriculum objectives. Note that in many examples, the objective integrates the computer competency with a traditional skill covered in the existing curriculum. In some cases, the availability of the computer will motivate teachers to modify or add new content and skill objectives.

At this point, a key question for the committee is how much curriculum development work can be included in the long-range plan. The scope and the level of detail of curriculum development activities (developing curriculum objectives, instructional strategies and applications) conducted by the subcommittee alone will be dictated by the time and other resources available. The subcommittee may be able to develop curriculum objectives and detailed instructional applications in only one or two subject-matter areas during the first year. The plan itself may contain only one or two complete program units or modules to serve as illustrations for the school committee of what will be accomplished with additional training and time. The program plan may indicate only general curriculum areas to be phased in over the three-year period.

Develop Instructional Strategies and Applications

This step involves the specification of instructional objectives, methods, materials and performance assessment measures. While it follows naturally from the development of the broader curriculum objectives, this activity should not be undertaken until some staff development has been conducted for the faculty members who will be responsible for implementing the instructional plan. **This level of curriculum planning must be conducted by the respective subject-matter teachers.** The curriculum subcommittee may serve as the coordinating body, but it may need to expand and perhaps separate into teams of teachers organized by grade level and subject matter.

Experience indicates that teachers will resist implementing an instructional program that they have not helped develop. Moreover, detailed instructional development should be considered a legitimate and necessary part of the overall staff development program (see Stage Five). Thus, while the development of instructional strategies and applications is covered in this section, it should be coordinated with the planning for staff development (Stage Five) and hardware and software selection (Stage Four).

The development of instructional strategies and applications involves the determination of the specific student performance expected, the instructional approaches or methods to be used, the materials and equipment required

Table 2
Computer Curriculum Objectives

English/Language Arts

Students will be able to use a word processing program to prepare a research report, including footnotes and a bibliography.

Students will be able to use spelling checker software to identify and correct spelling errors in their written work.

Mathematics

Students will be able to use the LOGO programming language to calculate and plot various geometric forms.

Students will be able to use courseware to learn and apply algebraic operations.

Science

Students will be able to use courseware to observe and analyze chemical and physical changes in various substances.

Students will be able to plot data from experiments and develop graphs and other visual representations.

Social Studies

Students will be able to use graphics software to prepare charts and graphs illustrating various characteristics of society.

Students will be able to access online data bases (e.g., newspapers, encyclopedias, etc.) to conduct research on selected topics.

Art

Students will be able to use the LOGO programming language to develop and combine the basic forms.

Students will use courseware to learn how to mix colors.

From **Computer Application Planning,** Merrimack Education Center, 1984, p. 39.

Table 3
Instructional Applications

Curriculum Objectives

1.0 Students will be able to use a computer word processing program to prepare a research report, including footnotes and a bibliography.

2.0 Students will be able to access online databases.

Instructional Objectives

1.1 Students will use a word processing program to set margins, tabs, and line spacing, move paragraphs and edit text.

2.1 Students will use a modem and appropriate communications software to connect with online encyclopedias.

Instructional Methods

1.2 Demonstration of operations of word processing software; hands-on use by students.

2.2 Demonstration of techniques for searching an online encyclopedia.

Materials/Equipment

1.3 Word processing software and instruction manuals. Computer lab with no more than three students per computer. A large-screen monitor for whole-class demonstration.

2.3 Modem and communications software. Large-screen monitor for whole-class viewing. Handouts describing steps in connecting to database and describing searching techniques.

Evaluation

1.4 Students will prepare a one-page essay in which margins, tabs and spacing are set as required. Students will be able to demonstrate the ability to move paragraphs.

2.4 Students will access a specific online database and obtain information through appropriate searching techniques.

From **Computer Application Planning,** Merrimack Education Center, 1984, p. 42.

and the methods and measures for assessing student performance. Table 3 provides an example of an instructional objective, together with a description of suggested instructional methods and materials and assessment measures. For each curriculum objective, there may be several instructional applications.

Although the development of curriculum objectives and instructional applications is a difficult and time-consuming process, there are many resources available in this area. Teachers engaged in such instructional planning can select curriculum and instructional objectives and review entire instructional applications and lesson plans. While teachers will still need to be trained in the development process, the time required to "cut and paste" and customize this material for local use will be considerably less than that needed for development from scratch. A few resources including such material are cited in Appendix G.

Integrating computers into the curriculum is an ongoing task that will require the efforts of all faculty members. The planning committee can establish a curriculum framework and begin to fill in the details. The faculty, however, will need to complete the detailed instructional planning and they will require training before they are

ready to undertake this task. The faculty will need considerable support. Once again, the early awareness activities and taking the proper approach to the topic of technology are critical to ensuring acceptance and cooperation. The cycle of awareness/curriculum development/ staff development/instructional implementation will likely be repeated at regular intervals throughout the multi-year implementation of the technology program.

Stage Three — Checklist

Integrating Technology into Curriculum, Classroom Management and School Administration

You should complete the following activities in Stage Three before you proceed to Stage Four in planning for educational technology in your school system.

- ☐ **An administrative plan has been developed.**
  - ☐ Administrators have been involved in the development of the administrative plan.
  - ☐ The technological awareness level of all administrators has been examined and increased where needed.
  - ☐ Administrative application needs of the central office and each of the principals' offices have been identified and agreed upon.
  - ☐ The scope and timing of the administrative plan have been set.
- ☐ **A teacher-support plan has been developed.**
  - ☐ Principals have been involved in the development of the teacher-support plan and provision has been made for principal training, when necessary, prior to working with teachers.
  - ☐ Teachers in each school have volunteered or been selected to participate.
  - ☐ Programs for teacher use have been selected, depending heavily on teacher recommendations.
  - ☐ Training and other learning opportunities for teachers have been set up.
  - ☐ Each principal has a plan for sharing various uses of technology to support the classroom with all teachers.
- ☐ **A curriculum program plan has been developed.**
  - ☐ Student competencies have been identified.
  - ☐ Curriculum objectives have been developed.
  - ☐ Instructional strategies and applications have been designed.

Stage Four — Selecting Hardware and Software

When the world first encountered the copying machine, the stereo record player and the hand-held calculator, understanding their function wasn't a problem. The copy machine copied, the calculator calculated and the record player played records.

But the personal computer doesn't have a single definitive role. One minute it's an enormously powerful calculator, the next minute it's a word processor and the next minute it's a game machine. Small wonder that a first encounter with a personal computer can produce a cloud of confusion.

The confusion begins to lift when one recognizes the difference between computers and computer programs.

The personal computer is simply a program player. Its single function is to run whatever program it is fed — economic model, word processing or game — in the same way a record player runs Tchaikovsky, Miles Davis or Rodney Dangerfield.

It follows that software is of first importance inasmuch as it determines what the computer does. Bad software, like bad records, makes even the best hardware perform badly.

Peter Lundstrom
A Personal Guide to Personal Computers

The selection of software and hardware is an important and time-consuming process. You will need dedicated subcommittees for these two activities; however, some people may serve on both. You will need technical people, educational content experts, media and instructional personnel and people who have good education material selection skills on both subcommittees. These subcommittee members must be given the time necessary to review and select the software and hardware that will make your technology program a success. Some school systems have selected one person in the system or one person in each school and given them the time (at least one hour per day) to review software. Also, the subcommittee members may want to ask the intended consumers to try out some software and hardware prior to purchase. This activity would involve people from all components of the school system.

The best advice regarding the selection of software and hardware is that you first search for the software that most adequately responds to your previously identified needs. After deciding on the most appropriate software, you then begin to choose hardware that runs this software. If you already have hardware and software, you will discover that software (and often hardware) review is a continuous process. You would, of course, continue extensive reviews of software that runs on your existing machines, but you will want to keep an eye out for good software that runs on new or different hardware and meets your current and emerging needs.

Stage Four contains the steps necessary to select software (Step 11) and select hardware (Step 12).

Step 11 — Selecting Software

Currently, school districts have a wide variety of sources for obtaining software or courseware. Seemingly, everyone with a computer and some programming skills has gotten into software production — from the computer hobbyist working alone in a home office to Control Data Corporation — which in 1982 decided to make available on microcomputers some of its 8,000 hours of computer sources developed for mainframe computers over a period of 20 years.

So much software is being produced that anyone trying to keep up with day-to-day developments can spend a major portion of his or her time doing just that.

An even harder and more necessary task is determining the quality of what is being produced and whether it fits the needs of a local school.

The task is difficult for numerous reasons. Prominent among these are: the large and growing number of software programs and producers, the inability of many districts to keep up-to-date on new products, the refusal of many software producers to give out preview copies of programs, and the status of software evaluation. (AASD, 1984, p. 64)

If you have followed the steps in this guide up to this point, you have identified specific needs for computer technology in your educational program. You identified outcomes, established specific goals and objectives and set priorities for your technology program as described in Stages Two and Three. You should have listed the categories of people who will be using computers and the functions those computers will serve. The software that you select should serve the functions you identified and be appropriate for the people you identified. The quality and usefulness of your software determines how adequately the computer will serve your needs.

Most software programs will not run on different types of computers, because computer programs generally are written to run on one or perhaps two computers. Some programs are written in different versions to run on multiple brands and models. However, you generally will find that software will not transfer directly between different brands and models of computers.

Remember that it is the courseware/software that assists in the teaching process, not the computer. Software sets up the moment-to-moment interaction between student and machine. Selection is vitally important. Everything you know about the selection of educational materials applies to software selection.

The evaluation and selection process offered here is designed to coordinate the future selection of software and hardware with your current resources and equipment use. If you purchased computers and software before developing a comprehensive technology plan, you probably purchased in response to a perceived need. In that case, the activities in Steps 11 and 12 will help you evaluate present software and hardware in terms of your new plan and select new material and equipment to implement that plan over the next one to three years.

The software selection process has four major tasks. They are to establish the software selection committee, set up a review process, locate software for review and apply software evaluation criteria.

Establish Software Selection Committee

You will need to establish a subcommittee for software selection to implement your school system's technology goals and objectives. The size of the subcommittee will depend on the size of the school system, the degree to which your system intends to incorporate technology (decided in Stage Three) and the degree of change your system is ready to accept. You should use representatives from the technology committee, the central office, the principals, teachers of all grade and subject levels, media specialists and special areas such as school psychology and counseling. It is important to have representatives from all areas in your school system so that software selection will be made with all system goals and end users in mind. The software subcommittee will be choosing software in the following categories.

- Administration
- Teacher support
- Instruction
- Special applications

The degree to which you emphasize each area will depend on the priorities set in Stage Three and the timelines set for those priorities. Remember: **You do not have to do everything the first year!**

The technology committee must develop software guidelines and criteria to match the specific objectives of the technology program and curriculum of your system. A software review process and appropriate forms also must be developed. The software subcommittee should develop plans for purchase, distribution and cataloging of software. If the software subcommittee members are not members of the systemwide technology committee, they msut be made aware of the systemwide goals for technology use. This subcommittee must research the use and effectiveness of existing software in your schools and compare these findings with system goals.

Set Up the Review Process

You may want to develop your own software review form for your school system or you may find it easier to adapt or use parts of the forms listed in Appendix H. No review form can be used for all software and by all schools. What you want to check for in each program will depend on your specific plans. Creating your own form after examining samples is more likely to ensure that the special characteristics of your plan will be addressed.

Don't try to complete a comprehensive review of educational software the first time you see a program. Run through it without taking notes. Try to "bomb" the software (i.e., make mistakes and see how it responds). Then make notes and fill out the software review form that your system has developed. When you obtain software from vendors or visit software review centers, try out each alternative and response in the program. There are many evaluation criteria for software. The number of criteria you actually apply depends on such factors as the time and resources you have available for assessment, the cost of the software and the scope of its use.

It is not necessary to specify in your plan all of the software that will be purchased. The curriculum subplan should be completed before the software is purchased. The plan should include a brief description of the selection and evaluation process and some rough estimates of the kind and cost of software needed to support the implementation of the first major program initiatives.

Locating Good Software

In selecting software for review, you will find that there are a number of sources. Local vendors may loan you software for review, or at least give you a catalog with a general description of the software. (See Appendix I for a partial list of vendors.) You may ask the vendor or other technology users to give you the names and phone numbers of educators currently using the software. One of the best ways to find out if software does what it claims to do is to ask other educators what they think about it, how they use it and what problems they've encountered with it. The Georgia Department of Education has two software review centers located at Macon Area Vocational-Technical School and North Georgia Technical and Vocational School. Georgia also distributes public-domain software. Contact the Georgia Department of Education Division of Instructional Media for details. You also may be able to get information about software from toll-free hotlines for computer use. Local universities and colleges may have consultants and graduate students who can provide information or do research for you. When you visit other schools or attend conferences, be sure to notice what is being done with technology and get names and phone numbers of resource people. Begin to build a list of people from the public and private sectors who can answer your questions. Also, many local computer stores have electronic mail services. Use your computer to do research. You may find out about new software and will most certainly find some computer users who would be willing to help you in the great search for the best software.

Your software selection committee will not be able to evaluate all software that is available for educational use. Luckily, there are many public and commercial organizations and agencies that evaluate software. Use some of these to get information about software that you cannot review personally. You may want to use a computer database, such as RICE (Resources in Computer Education), operated in conjunction with MicroSIFT. See Appendix J for a list of software evaluation resources. Databases can assist a system in locating software developed for specific students or areas. Educational technology magazines and other periodicals advertise and often evaluate and compare educational software for specific purposes, such as word processing in the classroom or student scheduling packages. *Electronic Learning* and *Educational Technology* are good sources for software information. See Appendix K for a list of educational technology journals.

There is a tremendous amount of public-domain software available for many models of computers. This software is legal to copy and may be obtained by sending blank disks to the supplier or providing the cost of the blank disks. If your school system decides to use public-domain software, it should be reviewed

Tips on Obtaining Review Copies

Although experts advise schools and systems to request review copies of recommended software and to try it out with students before making a purchase, many companies will not grant such requests.

Here are options used by some systems.

- Ask for a demonstration disk (available at low or no cost).
- Purchase only the documentation.
- Purchase one copy for preview before placing an order for multiple copies.
- Visit agencies with extensive software collections. (A list of agencies in each state was featured in *Electronic Learning* magazine, January and February 1984 issues.)
- Smaller districts may pool funds to buy software for review.
- Set up local inservice workshops and invite other districts. Exchange information about software.
- Contact publishers and tell them when you are having inservice workshops. Ask them to send salespersons to demonstrate programs that interest you. Ask vendors to suggest a user in your area who can demonstrate the program.
- Attend all the computer shows you can.
- Share your findings about software with other districts.
- Ask the editors of computer magazines to review packages of interest to you.

Some organizations and groups are urging school decision makers to purchase software only from producers and distributors with favorable purchase policies (e.g., free preview, guaranteed replacement of defective disks or cartridges, a 30-day money-back guarantee if the purchaser is not satisfied, free back-up disks).

Tip — Your system may have a better chance of obtaining a preview copy if you send along with your request a written guarantee that you will not make an illegal copy of the software during the preview or after purchase.

From **High Tech for Schools: Problems and Solutions,** American Association of School Administrators, 1984, p. 67.

carefully for technical soundness and pedagogical accuracy. Do **not** let students review this software first, as some software may be very inappropriate for student use. Programs should be cataloged and abstracted by teachers and correlated to the existing school curriculum.

It is possible for educators to write programs. You may have someone in your school system who is a very competent programmer. However, programming your own software is like writing your own textbook. The process requires much technical knowledge that has nothing to do with the subject matter of your program. If you could not find a textbook of good quality, you might very well have had to create something to serve in its place. Likewise, if you absolutely cannot find a program that will do what you need, you might consider creating your own program. However, you could spend a year learning how to write a program to do a specific job for you, only to find that you could have purchased a program that does the same thing for under $25.

Develop and Apply Software Evaluation Criteria

Remember to use the same sound educational and administrative judgment in selecting educational software as you would in choosing any other materials for your system. Software should be categorized by educational areas for evaluation purposes. You may want to divide it into different subgroups (elementary, counseling, secondary math, K-12 language arts) for identification and evaluation purposes.

You should compile a description of the software to be examined. Someone from the subcommittee should be designated to obtain as much of the identified software as possible and find independent evaluations of it or names of persons who use it and can be contacted regarding the pros and cons.

Software should be judged in two general areas, **technical soundness** and **pedagogical accuracy.** Technical soundness includes the operation of the program and the usability of the documentation. Generally, the newer software has a greater probability of technical soundness. Pedagogical accuracy covers areas such as effectiveness of the educational approach, correctness of subject matter and appropriateness of the computer response to student input.

Pedagogical Accuracy:

- ***Subject Accuracy.*** Until recently, most programmers who developed educational software were not educators. Consequently, some software has inaccurate subject information, spelling mistakes, grammar errors and sexist language. Instructional software must be factually accurate and must represent a clearly defined segment of the instructional activity.

- ***Appropriate Feedback and Reinforcement.*** When the user acts, the program should make an adequate response. This is particularly important when the user makes an error. The type of feedback in any program should be appropriate to the audience. Noises and pictures are good for some users, but not for others. The type of feedback is critical to how well the program will help the student accomplish the goals specified by the teacher. If students must give the correct answer for the computer to go to the next step or question, some would never get off the first question. A good program should allow the teacher to set the number of trials before the program goes forward. Must the student give the information to the computer in a particular form? Will the computer accept misspelled words? Does the computer answer the student with "Wrong, Bonehead"? Are correct responses given positive reinforcement? Is the reinforcement for a wrong answer more stimulating to the student than the response to a correct answer?
- ***Reading Level.*** Teachers should analyze the reading level of the material carefully. Unfortunately, programmers who are not teachers often develop very fine programs for elementary students, but with a high-school reading level.
- ***Appropriateness for Suggested Chronological Age.*** Is the software appropriate for the population using it? Some of the software on the market assumes a level of sophistication in the use of computers which your staff and students

Public-Domain Programs — Almost Free

Sources of "almost free" software include some computer magazines and books, user groups and unprotected material developed by districts, universities and educational service centers.

Shortcut — Teachers and administrators can find this type of "almost free" software by working through groups that collect and screen it. A prime example is SOFTSWAP, a collection of public-domain instructional software for microcomputers, jointly sponsored by the San Mateo County Office of Education and Computer-Using Educators, a microcomputer users group in California.

SOFTSWAP programs are evaluated by teachers and edited for accuracy of content, instructional value, good programming techniques and effective use of the computer. Visitors to the San Mateo County Office of Education may copy the programs without charge or you may order by mail for $10 per disk.

For more information, contact SOFTSWAP Microcomputer Center, San Mateo County Office of Education, 333 Main Street, Redwood City, California 94063.

Another noteworthy source is the Young Peoples' Logo Association (YPLA) Software Exchange, 1208 Hillsdale Drive, Richardson, TX 75081.

See *The Computing Teacher* (March 1984) for a listing of disks available from SOFTSWAP and YPLA and additional sources of public-domain software.

Note — One problem with "almost free" software is a lack of reviews of the material. Therefore, districts often must rely on good in-house evaluation methods to screen it.

From **High Tech for Schools: Problems and Solutions,** American Association of School Administrators, 1984. p. 70.

may not have, and some software is below the level of many persons for whom it is intended. Does the software fit the grade level and subject specified? Be sure not to discourage remedial students by using childish software that will offend them.

- ***Nondiscriminatory Content.*** Software should be free from discriminatory, sexist or biased language and pictures. The rules that apply in evaluating other educational materials apply here.

Technological Soundness

- ***Modification/Control by Operators and Teacher.*** Some programs use sound or music for motivation or for indicating correct or wrong answers. This noise can be a serious distraction. If the computer makes a low noise for a wrong answer and a high noise for a correct answer, everyone in the class can tell if Suzi is getting wrong answers. If the program's soundtrack is not an integral part of the instruction or is not meaningful to the learner, be sure you have the option of turning it off. Check to see if the program allows the teacher to choose a number of problems for the student to do. A teacher should be able to modify the difficulty level of a program and keep track of student progress. All of these elements add up to flexibility, a major criterion for any software. If the software is to be used by a network system or a hard disk, be sure that the software you purchase will run on them.

- ***Ease of use.*** Make sure that the software operates simply. The program should start automatically, without codes or fancy procedures. If a variety of options is available once the program is started, menus should be provided to guide the user through them. All instructions for use of a program and for responding during its operation should be readily available and clearly understandable. If the program isn't self-explanatory in its operating procedures, its usability and desirability will be diminished.

- ***Indestructibility.*** One writer has said that an indestructible program is one that a hyperactive third grader or three active I-wanna-press-the-keys-this-time first graders cannot crash in less than a minute.

- ***Screen Presentation.*** Look carefully at the manner in which the material is presented on the display screen. Some programs completely fill the screen with single-spaced print. This is hard to read, especially for beginning readers, slow readers or the visually impaired. Another feature of some programs is the use of reversed print (white on black) or words in flashing print. This also may cause visual discrimination problems for some students. If you are evaluating programs with these features, you may wish to pre-test them with students. In good programs, the layout on the screen will be uncluttered. If questions are asked, there should be ample room for seeing both the question and the answer on the same screen.

- ***Answer Entry.*** As you review elementary mathematics programs, carefully note how the answer must be entered. Is it from right to left or from left to right? Does the program prompt the student for each digit to be entered in the answer or does it simply leave a space for the entire answer with no directions on how to enter it? Does the computer leave a space at the top of the problem for the student to carry a number? The differences between programs should be noted by the teacher and problems anticipated before they occur.

- ***Instructions.*** A program's instructions should be clear, concise and presented on the screen in a way that can be read easily. Instructions usually fall into two categories: instructions for running the program that give various choices for subject, level of difficulty, number of problems and speed before proceeding; and instructions to the student as he or she interacts with the program while the program is being run. In the first case, quality programs will provide a menu of choices for what the program will do. The student or teacher simply chooses options from the menu. Other questions may be asked of the user. These questions ensure that the selected problems are as restricted as you wish and thus can serve individual student needs. The instructions for the student must take reading level and screen presentation into account. As the student proceeds through the program, the

instructions should be neatly arranged on the screen. Only essential information should be displayed at any one time. Lines of print should be spread out and the reading level of the instructions should be consistent with the reading level of the students for whom the program is intended. The user should be able to return to crucial operating instructions at any time.

- ***Manuals, Documentation, Teacher Guides.*** If the program has a simple menu and good instructions, only minor documentation is needed, such as the type of machine it runs on, the memory required, the subject area and grade level and how to boot the program. If the program is more complex it should include simple, easy-to-follow, step-by-step documentation. All instructional software should have a teacher guide complete with learning objectives and a scope and sequence chart that shows how the material covered in the program fits with the curriculum and how the teacher can best use this software in the classroom. Most software does not have all of this documentation. If this is the only criteria lacking, your school system may want to write documentation to ensure that the software is being used properly in the classroom and is targeted to meet the needs of students within the school system curriculum.
- ***Compatibility With Your Hardware.*** If you already have computers in your program, you may want to purchase additional software for them. If you are purchasing computers for the first time, you need to ensure that the software you purchase will run on the computers you buy. Often the software producer or the hardware producer makes claims about compatibility between software and hardware that prove misleading. Try to see a demonstration of the software on your machine.

Step 12— Selecting Hardware

If you want to handle something like a NASA space program,
which is unlikely if you're working with a home computer,
I'd recommend all the ROM's you can get and tell them not to spare the RAM's either
I'd make sure that they gave me plenty of K's too
A computer without any K's as they say in Silicon Valley,
is like a 1947 Chevy without a foxtail on the aerial.

Russell Baker
New York Times News Service

Now that you have located and reviewed enough software to meet your system needs, you are ready to test-drive several computers.

In Step 12, there are four major activities that will assist you in selecting your hardware. They include the following.

1. Explore funding options
2. Become familiar with hardware functions
3. Specify selection criteria
4. Compare available equipment

Comparing, evaluating, selecting and purchasing hardware is one of the most interesting aspects of starting or managing an ongoing program of educational technology. A note of caution: Some schools have spent large amounts of money for computing equipment which is not used because 1. it did not work right, 2. it worked but did not do what it was purchased to do, 3. the necessary software was not acquired or available or 4. no one knew how to use the hardware. These pitfalls can be avoided if you conduct the four activities in the hardware selection and acquisition process.

Conducting these activities will be more beneficial if you have carefully specified the short- and long-range goals in your educational technology plan and have decided on the functions that technology will serve.

A subcommittee should be appointed to select hardware. Members should include at least one person from the system technology committee, at least one person from the software selection subcommittee, persons knowledgeable about the technical aspects of equipment, persons responsible for budgeting and decision making and persons knowledgeable about educational applications for technology. In a small school system, the

hardware selection subcommittee may be the same as the software selection subcommittee. Most importantly, the subcommittee must be familiar with the recommendations of the software subcommittee. The selections of the software subcommittee will have a great impact on the decisions of the hardware subcommittee.

The hardware selection subcommittee members will need to understand the system's goals for educational technology and spend some time becoming acquainted with the state of the art in technology. The hardware selection committee should be familiar with the basic operations and functions of computers, videodisks, telecommunication devices and other peripheral devices. Familiarity with the basic components is essential in determining whether what you purchase will meet your stated needs.

Explore Funding Options

Hardware cost projections for the first year should be based on the top-priority administrative, teacher support or instructional goals your technology committee has set. In *Computing Teacher* (March, 1985), David Moursund offers the five categories of expenditures shown in Table 4.

Over time, the percentage of the budget allocated to software will rise, while that for hardware will decrease. Don't forget ongoing costs for blank disks, printer ribbon and printer paper. These should be added to the regular materials and supply budget. One-time expenses may include such items as mobile carts, printer stands or additional furniture, electrical power expansion units and changes in lighting or air conditioning. If a large system decides to service its own machines, include the cost of training technician(s), work benches and tools and the parts and manuals necessary for the local repair work.

Another option to consider when projecting costs is leasing, which diminishes the cost of hardware and obsolescence. The burden of large up-front costs for computers can be reduced by lease-purchase agreements. While the life of most hardware is about five to seven years, some models may become less useful than new hardware for specific applications within three to four years. Equipment that is no longer useful for one application may be assigned to another, less demanding function.

Several other suggestions for low-cost acquisition or reducing the cost of hardware are listed below.

- Contact utilities that may be upgrading their equipment.
- Ask for donations from business and industry.
- Participate in bulk or mass purchases. (Georgia has a state contract system and does some bulk purchasing through the department of education. Contact the department for more information.)
- Take advantage of special offers from manufacturers and distributors.
- Negotiate for free software and training when you purchase hardware.
- Consider lease/purchase arrangements for hardware.
- Build community support for additional funding or for refocusing current funds by working through parent groups, service groups and adult education. (AASA, 1984, p. 47)

Some school systems receive equipment from private donations and from PTA and civic groups. Prior to accepting donations, the school system should answer the following questions.

- What assistance will the donor provide to ensure that the equipment can be used effectively and that the staff will be trained?
- How much teacher time will be required to produce an adequate computer-based instructional program with this equipment?
- How can this equipment be used in our existing program?
- Do we want to build the school or system computer program around this brand? (AASD, 1984, p.47)

Become Familiar with Hardware Functions

Prior to purchasing any technological equipment, you need to know what it can do and what it cannot do. You should begin to learn and use the technical vocabulary. The hardware selection subcommittee members must be able to determine if the components can perform the functions necessary to meet

Table 4

First-Year Technology Costs

Category	Suggested Percentage
Hardware	50%
Software, print materials, other support materials	16%
Inservice education (initial and continuing training for administrators, teachers, support personnel and aides)	8%
Computer coordinators	16%
Contingency*	8%

*In the first year, Moursand suggests, this amount will be needed to supplement inservice education; in subsequent years, it might be used for purposes such as remodeling, accessing large data banks, videodisks or other special-purchase peripherals, or setting up a hardware/software lending library for students and parents.

system needs and be able to compare efficiency between different brands of computers and equipment. Your hardware selection subcommittee should be familiar with the purpose, optimal capacity, function and interaction between the following basic pieces of equipment.

- ***Keyboard.*** The keyboard is used for input. Most keyboards have keys that actually depress like those on a typewriter. Others may have touch-sensitive plastic membranes with an outline of each key. Keyboards with real keys have several advantages over the membrane keyboards. Touch typing is much easier on a real keyboard, which also is easier for young students. The touch of the keyboard is important if the computer is to be used for long periods of time. Try out different keyboards. Does the keyboard have the special function keys necessary to run the software you have selected? Are there so many special function keys that it will be difficult for students to learn to use them? Do you need a numeric keypad attached to the keyboard? Unless you are teaching accounting or doing major budgets on the computer or entering grades on a regular basis, the numeric keypad may be unnecessary. Does the computer allow you to use both upper- and lower-case letters? This is certainly necessary for teaching word processing or creative writing, but may not be necessary for math or many elementary education programs.
- ***Monitor.*** Computers use monitors (CRT — cathode ray tubes, or VDT — video display terminals) to show information. Most computers use monitors, but some can use a regular television set. Monitors come in a variety of forms and qualities. Some display in black and white, black and green or black and amber. Some have full-color displays. Research and experience have indicated that the green screens are easier on the eyes than black and white. In most cases, a monitor gives a better picture quality than an ordinary television. However, the quality of the picture depends on the computer as well as the monitor. There really is no need for a color monitor (more expensive) if you are going to do budgeting and word processing. In fact, many color monitors are not clear enough to use on an extended basis for word processing and could cause eyestrain. Some companies have produced monitors that can switch from color to black and white. If you do need a color monitor

for running color software, be sure that the colors are clear and do not run together.

- ***Mass Storage.*** For storing and loading programs and data rapidly, a disk run by a disk drive is usually the best way to go. The use of hard or fixed disks is increasing, especially when several computers may use the same disk or if a large quantity of information is to be stored. Cassette tapes also are used to store and load data. They are inexpensive, but very slow to load.
- ***Memory.*** Computers have various capacities for storing data. If word processing is your goal, or if you wish to write or run large, sophisticated programs or accommodate a wide range of peripherals, you will want hardware with a generous memory capacity. In general, the more memory you have the better, but don't overbuy if you don't need it. Check the software you intend to use to determine the maximum memory needed to run it.
- ***Modem.*** If you wish to connect your system to another computer and receive and send information over telephone lines, you will need a modem. A modem translates computer data into sound frequencies that travel over telephone lines to other computers. A person with a computer hooked to a telephone line is able to access information sources throughout the world. Specialized data banks keyed to particular branches of knowledge are presently on-line, and others are being developed. A student can tap the world's knowledge resources from any school in any city with a modem.
- ***Printer.*** If you want a permanent visual record of the information generated by the computer, you will need a printer. A printer produces a hard copy of the computer's information. There are various kinds of printers, each distinguished by the method used to reproduce the characters on paper. Printers have their own particular features — speed, number of characters per line and the way they attach to and interact with the computer. As you evaluate printers, consider these features carefully. Remember that your computer and printer must be compatible. If a vendor says it can make a printer and computer work together, you may want to see it demonstrated.

  Decide whether you need a letter-quality printer (expensive) or a dot matrix printer to meet your needs. You may wish to test-drive one of the new laser printers.

It is unlikely that a school system will have only one model of computer throughout the system. Certainly, over time, this will not be the case. Total standardization may not be desirable, even if it is achievable. Students should be exposed to a range of equipment as they work on different applications and as they move through the grades. Future schooling and work will require that students be able to adapt to new and different equipment.

All hardware selection subcommittee members should be kept abreast of the changes in technology as they occur. One or more members should be responsible for collecting new information and passing it along to all committee members. Even if some members are familiar with the components of a system, you might need an update on the most recent developments regarding voice input devices, sound synthesizers, touch panels, laser printers and graphics pads and their uses in educational programs. Knowing about the latest state-of-the-art hardware can improve your chances of acquiring equipment that will do what you want it to do when you want it to do it, and can perhaps save money. If your knowledge of trends and changes in technology's capabilities is current, you may be better able to predict what your needs will be in the future.

One way to keep abreast of changes in technology is to read for that purpose. There is an abundance of interesting and accessible information on computers in education. Books, periodicals, articles, guides, bibliographies and other publications are readily available to you. Magazines are the best way to keep current. Your school system should subscribe to at least one of the following types of journals: an educational computer or educational technology magazine, a personal computing magazine for the hobbyist and a magazine devoted to technology. See Appendix K for a list of periodicals that will help you keep abreast of educational technology.

Other ways of keeping up-to-date on technological change are to visit stores that

sell hardware, attend user group meetings, or attend conventions of professional societies and commercial vendors. Talk with others who have experience with computers in education. Human resources may be more helpful than printed material. People who have already been through the process of hardware selection can provide many hints and share successful and unsuccessful tactics. Be sure to solicit opinions from more than one source. Have those who ultimately will use the machines test the equipment. This may be accomplished by asking the vendor to bring loaner equipment to your system or visiting centers where hands-on workshops are conducted. Local colleges, universities, state or regional agencies may have established educational technology centers that offer technology labs and provide training. Georgia currently offers the Macon Computer Center, located at the Macon Area Vocational-Technical School, and the North Georgia Center, located at the North Georgia Area Technical and Vocational School, for this purpose.

Specify Selection Criteria Based on System Goals and Projected Use of the Equipment

Merrimack suggests that the hardware selection subcommittee make a list of all intended applications, the intended users, and where, when and how the equipment will be used.

According to Robert Tinker, the committee must also gather data on the estimated time students, teachers and other employees must have on a computer to accomplish their objectives. The committee also will need to determine how many students or employees can use the computer simultaneously. Can students work in groups of two to a machine?

How many computers should you buy? How many should be purchased over the time frame of the comprehensive technology plan? As a general rule, systems can figure that an average of one machine per 10 students is equivalent to about one-half hour of machine time per student per day. The Minnesota School Districts Data Processing Joint Board offers guidelines on the number of computers needed per student for various applications in Table 5.

There are other major factors beyond the basic goals and needs of the school system that must be considered when selecting hardware.

- ***Cost.*** Base prices for computer systems vary considerably. A realistic range of costs for a basic system (computer, disk drive and printer) for most school uses can range from $700 to more than $5,000, depending upon brand and what extra equipment is included. At the present time (1985) a reasonable cost for a good computer without a printer will be about $900. Adding

Table 5

Computers Per Student

Application	Computer Per	Students
Programming	1	2
Drill and Practice	1	1
Tutorial	1	1
Utility	1	1
Simulation/Modeling	1	small group
Problem Solving	1	small group
Information Retrieval	1	depends on application

From: **Computer Literacy Curriculum Guide, Grades K-9;** Minnesota School Districts Data Processing Joint Board, September 1982.

a printer to this system should cost $200 to $400 for a dot matrix printer or $500 to $1,500 or more for a letter-quality printer. These estimates are based on state contracts and educational discounts. When comparing the costs of different brands, compare machines with similar capabilities.

- ***Peripherals and Components Included in Base Price.*** Whatever the cost, be sure you know what it includes. A system should include a CPU (central processing unit), a monochrome monitor (add an additional $100 to $200 for a color monitor), one disk drive, a keyboard and at least 64K of memory. Other components could add to the cost, depending upon the component and the company. Other components which may be included are an additional disk drive, joysticks and paddles, voice input devices, voice output devices or sound/music synthesizers, graphics pads, clock cards, modems, interface cards and electronic scanning devices.
- ***Capability and Expandability.*** Your committee should determine what computer capabilities are required to run the software you intend to use and identify the available hardware systems that have those capabilities. The ability to add components to the basic system may be very important if your budget is limited and you expect to enhance the system later on. Check the system for additional slots or mechanisms by which peripherals can be added. Determine if you can add interface cards yourself or if you must return the computer to the manufacturer and pay not only for the cards but for the labor to have the cards installed as well. Will your computer connect with other computers for disk sharing, access to information networks and telecommunications? Will your computer interconnect with video tape recorders and video disks? Another consideration is the use of the computer by students with disabilities. Can devices be added to the computer system so it can be accessed by voice, light pens or joysticks to enable physically handicapped students to have equal access to the computer?
- ***Flexibility and Durability.*** Is the computer sturdy and durable? Will two hyperactive seven-year-olds destroy it in five unattended minutes? How is the computer to be used in the school? Your need for durability may be dependent on the type of use. Any equipment used by young children or moved around in a school should be durable. Some machines come with carrying cases, are lightweight and sturdy. Some are virtually immobile. Check with other school systems that are using the equipment you are thinking about. Another type of flexibility relates to the computer's ability to run different types of software. Does it handle drill and practice software, but not keep records? Can the system do more than one kind of computing with almost equal ability and expense? Be sure to ask about the environmental controls your computer needs to function optimally. (More about this in Step 20.)
- ***Documentation.*** Anyone who makes or sells hardware should provide written manuals on installation, operation and routine maintenance of the system. Unfortunately, not all systems come with this necessary information. Unless you have someone trained and assigned to set up and service equipment, quality documentation is essential. Documentation also is necessary to assist new learners and experienced users in carrying out the day-to-day operations of the system. Documentation must provide information on the system, not the software being used.
- ***Training.*** Find out if the store or vendor is willing to provide training for your employees in the operation of the equipment or the use of certain software. Will the vendor train your personnel to make minor repairs to equipment? Does the supplier have any full-time training and support specialists? Do they have facilities to train in their offices? Are they willing to come to your schools to provide training? Do they charge for the training? Is some of the training free? If teachers and other school system employees don't know how to use the computers, they will never meet your system goals.
- ***Maintenance.*** Review the warranty for parts and labor, servicing procedure and service costs. Most warranties are for 90 days. This means that if you received the computers in late May, they might be out of warranty before the beginning of the next school year. Repair services are essential to keep a

computer system operating without major interruption. Although the durability of the system is a factor, all systems may malfunction eventually, making maintenance necessary. You will need to know whether your system can be repaired locally, whether the vendor will train your personnel to provide maintenance and whether spare parts are available. Review the costs of service contracts when you review the initial costs for equipment. Often satisfactory agreements can be made between vendors and school systems on a basis of dollars per year per computer to cover all repair and maintenance expenses.

- ***Customer Service.*** Find out if the store or vendor selling the hardware will provide assistance in installing the equipment and answering questions about running and maintaining the equipment at no or low cost. Does the dealer provide full-time service persons? You may want to inspect their service facilities. Do they appear to be well-organized? How long does it take to repair items? Will they guarantee turn-around time for repair? Find out what kind of reputation both the manufacturer and seller of the equipment have. Have they been in business long? Are they reliable? Do they back up their warranties, and do they answer questions promptly? Get referrals from other school systems.
- ***Software Availability.*** The range of software and languages that the machine runs should be reviewed carefully. Unless your computer is dedicated to a single application (such as word processing) you will want to diversify with a variety of software as time goes by. Software will probably be available from other sources than the vendor. It helps if other software houses are writing for this particular machine.

Compare Available Equipment

Use what you already know about audiovisual equipment when selecting hardware. The same rules for evaluation apply to computers and other technological equipment. When you combine that knowledge with a clear view of your system's goals and learn a few basics about computers, you can make wise hardware selection decisions.

The hardware subcommittee may want to devise a rating system to compare different equipment. You may also want to weight each item according to its importance in meeting your system needs. Table 6 lists the factors discussed previously in checklist form. You may want to create your own forms.

Do not make decisions in the presence of vendors. It may be easy to trust someone who seems to have all the answers, but you may be disappointed later. Ask the vendor to demonstrate what it says can be done with its computers and peripherals. Ask for the names of other school personnel who are using the equipment. Check out these references.

Don't put off your decision to purchase computers until the "new stuff" comes out. There will always be "new stuff" and you will never get on with the integration of technology if you wait. Obsolescence should not be a major concern, as computers will have some use in classrooms for a long time to come. The skills learned on one machine should be easily and readily transferred to learning on a second or third machine. It is far more important to know how and when to use technology than to have the newest computer.

Once the selection process is completed and recommendations have been made, it may be necessary to translate the results into procurement specifications. You may not be able to specify a particular brand of hardware, but you will be required to order based on specific capabilities. Many educational collaboratives and other organizations offer assistance in preparing bid specifications and in procuring hardware at discounted prices. Be sure to check the state bid price, double check with vendors for current educational discounts, check with your CESAs for discount prices and check with other school systems to find out about the deals they have obtained. You may want to discuss with the vendors the length of time it will take to receive the equipment after it has been ordered. It may take from six weeks to four months to receive equipment, so the timelines for staff development and implementation of system technology objectives may need to be modified.

Table 6

Hardware Evaluation Worksheet Information

On the hardware evaluation worksheet, assign an importance factor of 1 to 3 for each category, depending on how important you think each category is to your decision. The factor should be developed by your system subcommittee and should be consistent as you rate various machines. (1 = not important; 2 = important; 3 = very important.)

As you compare machines, give each one a rating of 1 to 3 in each category (1 = poor; 2 = average; 3 = good). For example, if dealer service is not available, give it a 1 under the "Service" category; if it is good, give it a 3. If the machine is easily moved and compact, the "Flexibility" category may get a 2 or 3. If no software is available, that category may be given a 1.

When all the categories have been rated, multiply them by the importance factor you originally assigned. The end results are then added together. The highest total will indicate the microcomputer best suited for your use. Color of the case, unnecessary extras, or the salesperson's personality should not affect the choice.

Table 6

Hardware Evaluation Work Sheet

Brand _____ **Model** _____

Criteria	Importance (1-3)	Rating (1-3)	Total	Comments
1. Cost				
2. Flexibility				
3. Mainframe Interface				
4. Keyboard				
5. Monitor				
6. Expandability				
7. Peripheral Options				
8. Sound, Voice				
9. Graphics and Characters				
10. Color				
11. Software				
12. Service				
13. User Training				
Total				

Stage Four — Checklist

Selecting Software and Hardware

You should complete the following activities in Stage Four before you proceed to Stage Five in planning educational technology in your school system.

- ☐ A software selection subcommittee has been appointed.
- ☐ A system software review form has been developed.
- ☐ The software review process has been developed.
- ☐ Software has been located for review.
- ☐ The software selection subcommittee is knowledgeable about systemwide goals for educational technology and existing software and its use in the system.
- ☐ Software evaluation criteria have been developed and applied and software that meets system goals has been identified.
- ☐ A hardware selection subcommittee has been appointed.
- ☐ Funding options have been explored.
- ☐ The hardware selection subcommittee has become familiar with state-of-the-art equipment.
- ☐ Hardware selection criteria has been developed based on system goals and projected use.
- ☐ Available equipment has been compared and rated and recommendations for purchase have been made.

Stage Five — Planning for Staff Development

Computer literacy may be defined as the skills, knowledge, values, and relationships that allow the teacher to comfortably use the computer as an instructional tool to prepare students to be productive citizens in a computer-oriented society.

Computer Task Force
College of Education
University of Minnesota

Staff development is the most important ingredient in planning for the use of technology. Without adequate training of personnel, no plan for implementing technology will be successful. Training is also the most time-consuming aspect of the preparations to implement and may easily cost more (in training expenses, materials and personnel time) than the software and the hardware combined. Along with the purchase of hardware and software, a well-planned and ongoing staff development program must be a major goal to help faculty and administrators develop new knowledge, attitudes and skills.

A program of staff development must be planned and offered by all school systems implementing technology. This program should be based upon specific competencies identified by the technology planning committee through its earlier planning activities.

Staff development and program implementation need not be completed in the same year. What is important is that a plan be thoughtfully developed to cover all the areas necessary for reaching your system goals in technology.

Training should be offered on a regular basis, not just once. It must raise the level of competency of all the staff and keep them abreast of the fast-changing field of technology. Most importantly, the software, equipment and the opportunity to use them must be available to teachers and administrators when training begins. Without the immediate opportunity to begin applying what they are learning to concrete situations, the effects of the training may be lost.

The main thing to remember in planning for staff development is that it is not separate from the rest of your planning. The staff development plan does not stand alone. On the contrary, it must grow directly out of your administrative plan, the teacher support plan and the curriculum program plan you designed in Stage Three. These are blueprints for your staff development. Remember, staff training is offered in order to implement those plans and objectives. The following principles are directed toward training teachers, but apply to all personnel when planning for technology staff development.

- The inservice training should prepare the teacher to perform the task and also provide criteria for determining the teacher's degree of success.
- Training activities should be in a sequence that gradually increases in complexity.
- The training should be sufficiently flexible to allow teachers to begin at their own level of ability and to progress at their own rate.
- Training should take place during the day and make use of actual teaching situations involving students.
- The training should be adjusted to the instructional setting that exists.
- Incentives should be provided to motivate the teachers.
- Whenever possible, district or school teachers should be used as instructors in the model program.

- Teachers should have an opportunity to practice new skills in the course of their regular teaching.
- Skills acquired in a training program will go unused if administrators do not emphasize their value.
- Teachers involved in a training program should have continuous access to an available facilitator — a trained technical resource. (Grossnickel, 1982)

Step 13 in planning for technology identifies the competencies needed by the staff. Step 14 includes determining who needs training for which competencies. Step 15 is to consider costs associated with staff development. Step 16 is the actual planning of the program activities, using input from all categories of persons to be trained. This step will include determining the content of the training program, scheduling the workshops, conducting ongoing follow-up activities and evaluating all staff development activities.

Step 13 — Identify Competencies

The specific competencies needed by your faculty will depend on the goals and objectives that were developed by the technology committee in Stage Three. Not every teacher or staff member will need to be proficient in every competency identified. The specific competencies that are needed by an individual will depend on that person's role within the educational program and on his or her personal and professional goals.

Competencies should be organized in groups according to similarities. The training may be developed according to the competency groups. The following is a description of initial competencies which may be included in your training for educators. (A suggested outline for a technology staff development program can be found in Appendix L.)

- Ability to operate appropriate hardware. This would include locating the necessary switches, booting disks, listing and reading a catalog or directory and loading and running programs.
- Ability to define basic technology terms.
- Ability to select software which is both effective and efficient for solving a particular problem or performing a particular task. This would include discussing how programs can be used in class; how programs can be used for more than one purpose or subject area; how programs can be extended; and the preliminary work needed before using some programs in class.
- Ability to maintain software media (diskettes, tape) so that it is always operative and readily available.
- Ability to follow instructions to use software applications in accordance with the intended purpose.
- Ability to maintain equipment properly.
- Ability to explain the impact of computers in society.
- Familiarity with copyright laws and the legal aspects of software use.
- Ability to use computer hardware and software effectively in a variety of ways as an instructional medium. Some instructional and support functions include computer-assisted instruction, computer-managed instruction, drill and practice applications, tutorials, simulations, games, problem solving, remediation, enrichment, diagnosis and prescription, testing and evaluation, classroom records management and programming.
- Ability to use authoring languages or packages.

To assist in developing activities for further workshops, you may want to review the list of student competencies developed by your curriculum committee. The teacher competencies necessary to help students acquire computer literacy and computer science skills should be developed from the student competencies list.

A limited number of staff members may need or request training in programming languages such as Basic, LOGO or Pascal. This training would be classified as intermediate and advanced. Prerequisite competencies for learning programming include the ability to clarify and state a problem, to design a solution for the problem and to convert the solution into an executable computer language.

Those in administrative positions should be able to use computer software and hardware appropriately in the performance of administrative functions, including accounting and bookkeeping, budgeting, class scheduling, maintaining personal records and student permanent records, storing grades and reporting grades, testing and measurement, word processing, physical plant maintenance, transportation, and maintaining school and personal calendars. See Appendix M for a survey of supervisor's needs.

The first general awareness session for administrators can be the same as for teachers and other staff persons. However, the remainder of the administrative training sessions should be devoted to administrative functions and planning for and supervision of technology use.

It is a well-documented fact that the success of a school's curriculum program change or development is directly related to administrative leadership. A school or system with an administrator who is knowledgeable about computers and can work with staff in the process of developing a computer program can almost be guaranteed a successful implementation of that program. (Montana, 1983, p. 103)

It is strongly suggested that the principal take the leadership role in technology. Therefore, the principal should be trained before the teachers. This early training will help the principal become aware of the impact of technology in many curriculum areas and prepare for the costs of hardware, software and staff development. This does not mean that the principal is to be the technology expert in the school. However, the principal must appoint a coordinator as soon as possible to help him or her implement technology smoothly. Also, it will help the process if the principal uses technology regularly to carry out his or her duties.

The following were rated by Ted Mims of Louisiana State University, Jim Poirot of North Texas State University and a group of 10 education administration authorities (AASA, 1984, p. 51) as the top 10 technology competencies for school administrators.

1. Be able to justify the cost of educational computing.
2. Have a working knowledge of the computer hardware and software terminology needed to communicate with data processing or computer professionals.
3. Be able to identify possible funding sources for instructional and administrative computing.
4. Be able to identify training needs of teachers in the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.
5. Be able to demonstrate an awareness of trends in computing as they relate to educational computing.
6. Be able to describe the computer training needs of students.
7. Be able to identify training needs of teachers and administrators related to the administrative computers.
8. Be able to identify various alternatives for using computers in instruction.
9. Be able to discuss legal, moral and human-impact issues of computing, particularly as they relate to educational issues.
10. Be able to identify administration tasks that could be computerized.

The least desirable of the 42 competencies for administrators rated was "Be able to write simple programs."

Step 14 — Determine Who Needs Training for Which Competencies

The second major step in planning for staff development is to determine which staff members need training for which competencies. As with specifying competencies, let the plans developed in Stage Three be your guide for identifying who needs training for which competencies. These plans should not only designate goals and accompanying activities, but also provide a timeline for implementation and a designation of which staff will be responsible. This will constitute an outline of your first priority training tasks.

You will need to assess the present level of competencies of the staff to be involved in the programs designed in Stage Three. The survey of staff conducted during Stage Two will provide you with initial information to determine who needs what kind of staff development. That survey measured both technical competencies and personal and professional goals for development in the area of educational technology. This may not be specific enough and you may need to develop an additional questionnaire similar to those in Stage Two to gather specific information on the skills and knowledge of individual teachers and administrators. (Note — Be sure this questionnaire does not come across as a test. A general survey of specific skills is better than offending potential trainees before the program begins.) A very simple survey to determine training needs is included in Appendix N. Do not bore your experts with assessment or training sessions they don't need. Try to use these inhouse experts to plan and conduct training sessions.

If your initial training plans are of a pilot nature, you may want to ask for volunteers. Volunteers in training are usually more enthusiastic and are willing to devote the time necessary to succeed in learning new skills.

Step 15 — Consider Costs Associated with Staff Development

Suppose that you've bought word processing, student scheduling, database management and spreadsheet programs. Now you can, quite realistically, assume that ***complete*** *training for both a primary user and a backup person may require 90 hours of instruction per software program, at an average cost of $10 per hour per trainee. Combined, then you can count on a minimum of 360 hours of training time at a cost of $3,600, probably a good bit more than the cost of the microcomputer itself.* ***(Electronic Learning,*** *April 1984, p. 30.)*

The subcommittee planning staff development activities will be able to delineate accurate cost projections for the first year of your plan. However, projecting costs for staff development beyond the first year will be difficult due to changes in your plan and changes in technology. After program objectives and implementation activities for each year are identified, determine the number of teachers who will implement the objectives. Next, determine the costs of providing training to that projected number of teachers and add teacher stipends, substitute teacher pay, consultant reimbursement, material expenses, rental of facilities and other associated costs, as necessary.

You will also need to determine potential funding sources for staff development. Be sure to consider state staff development funds and federal funds which can be used for technology staff development activities.

Step 16 — Plan Staff Development Activities

Staff development must be planned as an ongoing activity rather than a one-time event. These guidelines for staff development in educational technology have been recommended by some school systems.

- Try to find inhouse people to run the workshops.
- Seek assistance from local colleges, universities or CESAs.
- When planning the training sessions, be sure to involve teachers and staff members representative of those to be trained.
- Begin training with applications that are easy to use and non-threatening.
- Use applications which solve real problems.
- Include hands-on experience as one-half of all training.
- Focus on problem-solving skills which can be applied to any technology.
- Encourage a positive attitude toward technology.
- Emphasize the necessity for human control of technology.
- Ensure that the training activities are sequential and gradually increase in complexity.
- Try to provide incentives which motivate the faculty to participate actively.

- Consider training a core of system staff and use them to train the remainder of the faculty. Remember that only trained staff can serve as trainers.
- Allow the technology coordinator for the system to attend training to upgrade his or her skills.
- Ensure at least one machine for every two people (one-on-one is preferable) during hands-on sessions.

Determine the Content and Format of Training Workshops

When planning the content and sequence of staff development activities, don't forget the cycle of administration, instructional support, classroom instruction described in Stage Three. It is important to the long-term success of your technology program that faculty and staff know they are getting the support they need, that they are treated fairly and that they have an effective voice in organizing and controlling their environment. Develop a logical, sequential staff development plan that provides each member of your educational program with staff development that addresses identified needs. Share the plans developed in Stage Three with teachers and administrators so they can understand the sequence of the staff development activities and how the activities fit into the system technology plan. Provide each staff development activity at a time when it will be beneficial to the staff members. Try to use teacher work days or substitute teachers so that staff members being trained can concentrate on their learning.

It is recommended that initial staff development activities be conducted for four to five hours over a period of several days in a row rather than one hour per week for six weeks. This provides the intense time necessary to learn the objectives of the training, try it out for several hours, ask questions and try out applications that may be of use in the classroom or office.

You should introduce equipment into a program on a schedule controlled by the speed at which teachers can be trained to use it. If you don't have the time necessary to release teachers and staff for training, you may not be ready to implement technology in your system.

If you must contract with outside consultants to provide some of your staff development activities, be sure to specify the following information prior to your workshop.

- Specific needs to be addressed
- Outcomes desired
- Time and length of workshops
- Facilities and equipment available
- Number, type and level of participants
- Compensation

Appendix O contains several articles about technology workshops that should be reviewed prior to planning technology workshops. An excellent series of articles on technology inservice appears in *Electronic Learning*, September 1983 through April 1984.

Conduct Follow-up Activities

One of the basic principles of successful change in educational programs is that program innovation requires direct support in the form of personal contact from a change agent (a director, coordinator or supervisor) over a long period of time (often two years or more). Your technology coordinator must be available for assistance and reassurance. Someone should be assigned to observe in the classroom, to determine if and how technology is being used by students and teachers and to offer immediate support. The faculty and staff must know that they have not been left on their own with a new technology they do not always understand.

Informal sharing sessions can be set up in each school after the school day or during other planning time. These sessions should be at least once per week in the initial stages of implementation. Much can be accomplished if informal sharing from classroom to classroom can be maintained.

Activities other than formal training sessions can assist the staff in gaining competencies. They include

- reading and research in specific content areas,
- teaming inexperienced teachers with experienced teachers,
- observing exemplary computer applications in other schools,

- developing individual or small-group work sessions for materials development or curriculum infusion,
- attending regional, state and national conferences focusing on education and technology, and
- providing options for self study by allowing teachers to check out computers, software and documentation to teach themselves.

Each staff member or group (principal group, secretary group, math teacher group) should be required to participate in one or more activities listed above as a portion of their staff development follow-up.

Evaluate Staff Development Activities

Be sure to include both written and informal evaluation criteria at the end of all workshops and training sessions to help determine if your sessions met the stated objectives and did so in a positive manner. Try to determine what the groups liked and did not like about the sessions, including time of day, pacing of activities, strategies used in the activities and materials. Were they boring or exciting? Emphasize that you need thoughtful responses and not the usual hurried response to such evaluation instruments. You should plan for formative and summative evaluations not only of activities, but of the entire staff development program. It will help if you regularly use the results of these evaluations to plan for your future workshops.

You probably will not want to give and score formal tests of teacher competencies. This is time-consuming, costly and can be intimidating. You may want to provide a self-assessment guide for staff to use in determining their own competencies and need for improvement.

Stage Five — Checklist

Planning for Staff Development

You should complete the following activities in Stage Five before you proceed to Stage Six in planning for educational technology in your school system.

- ☐ Identify competencies necessary to implement technology successfully in your schools.
  - ☐ Administrative
  - ☐ Teacher
  - ☐ Clerical
  - ☐ Support personnel
- ☐ Determine who needs training for which competencies.
- ☐ Plan for and project costs associated with ongoing staff development.
- ☐ Develop specific staff development activities and accompanying timelines for first year.
- ☐ Develop general objectives and timelines for staff development for second and third years.
- ☐ Plan for and begin to implement appropriate evaluation, follow-up and support activities.

Stage Six — Organizing and Implementing for Success

We cherish our follies only because
we are used to them,
not because they are not really follies.
We must make room for expanding knowledge,
or at least make as much room as possible.
Surely it is as important to forget the old and useless
as it is to learn the new and important.
Issac Asimov

Recent research and experience testify to the importance of program implementation. It does not necessarily follow that a well-defined curriculum, a trained staff and adequate materials and equipment will result in the implementation of a program as planned. Considerable attention to the actual delivery of services is required. Several questions need to be addressed. What is the system's policy regarding software duplication? Who will provide ongoing advice and resource assistance to faculty? How will the implementation be monitored? By whom? How will access to the technology and courseware be allocated and scheduled? How will equipment be maintained, secured and insured? What evaluation data will be collected?

A district-wide technology program developed over a three- to five-year planning period is a different undertaking than a collection of individual activities. Such a program requires detailed attention to organization and implementation. This section describes the four major steps that need to be undertaken. Step 17 is to develop system policies for software, Step 18 provides for program coordination and implementation, Step 19 is to develop a logistical support system, and Step 20 is to develop materials and equipment support system.

Step 17 — Develop System Policies for Software

All school systems should provide information about copyright laws to persons using software. The school system should have a distributed policy on software duplication and procedures to ensure that pirating software is not silently condoned by the system.

The illegal copying or reproduction of computer software is a major concern of the educational software industry. All educators should be aware of Public Law 96-517, passed by Congress in 1980. This law amends the federal copyright law and gives the purchaser of a computer program the right to copy a piece of software if, and only if, 1. the copy is necessary in order to use the program with a computer, and 2. the copy is for backup purposes only. When the reproduction of material violates the vendor's right to reasonable return, teachers and school systems are placing themselves in jeopardy of a civil suit. A sample system software copyright policy can be found in Appendix P.

The purpose of a systemwide policy on software duplication is to help teachers, aids, clerical personnel, media specialists, support personnel and administrators stay within the law when using microcomputer software. Education policy makers should recommend strict compliance with the copyright law. Most educators have heard of the law and associated court cases and want to avoid any penalities.

When requesting software for review prior to purchase, a school system should share a copy of its policy regarding illegal copying. This may encourage the vendors to share software prior to purchase. Policies concerning computer software duplication and usage vary widely. When acquiring microcomputer programs, the specific right to

copy, network or perform other activities extending beyond individual usage of the software on a single terminal should be clearly defined in the purchase agreement. Frequently, these rights must be negotiated on a title-by-title basis with the software vendor or distributor. An additional fee beyond the basic software cost may be charged for duplication, networking and other rights. If you are uncertain whether a specific use is legal under your software purchase agreement or license and are unable to secure this information, follow your system's procedure for determining legality. This may require an option from your system's attorney.

Remember that the archival copy of a computer program allowed under the law may be used to replace a damaged circulation copy. It may not be used to make an additional copy for circulation unless your purchase agreement or license so indicates. If you shift the archival copy to circulation but want to retain an archival copy, you are required to purchase a new copy unless your purchase agreement or license provides otherwise.

Notices indicating that the use of school-owned computer hardware and software to make unauthorized copies is illegal and a violation of school policy should be posted in areas where microcomputer equipment is in use. You may need to check school and system policies to ensure that all users understand the policies.

Step 18— Provide for Program Coordination and Implementation

While the planning committee serves as the principal means of coordinating overall program development, a committee is not the most efficient means for implementing the instructional programs. Ideally, one individual should be designated as the implementation director for the instructional program, responsible for overall management. Many districts will find it difficult to allocate a full-time position to this role. In such cases, an existing administrator or teacher-manager should be given such a part-time responsibility. In a small system, your technology coordinator can perform this function. Given the strong curriculum emphasis advocated, it is recommended that the coordinator have a balanced expertise — a blending of technology with sound pedagogy. Appointing a computer specialist who is inexperienced in curriculum development and implementation may communicate to the faculty that technology is separate from and more important than the ongoing curriculum.

Implementing the instructional plan is by far the more complex of the three subplans and requires attention to many factors which research and experience have shown to be critical to successful change efforts in schools. Consider these guidelines in putting your plans into effect.

- Keep faculty informed of program implementation activities throughout the school and district.
- Schedule meetings at which the faculty can discuss implementation difficulties with their colleagues and share ideas for dealing with them. Use these sessions to be sure that everyone has a clear understanding of the program.
- Encourage and support the principal in the role of facilitator and resource to the faculty.
- Provide teachers with sufficient time to prepare or adapt instructional materials for their own use. They will need time to practice using the courseware on the computer.
- Pay attention to what is actually happening in classrooms. Ensure that actual implementation is going according to plan. If not, find out why.
- Document implementation activities. What problems were encountered? How were they solved?
- Provide encouragement and support from the central office staff.

A few important guidelines merit additional attention.

Continue Training and Staff Development. As we indicated in Stage Five, training is not a one-time effort, but an ongoing process with an agenda dictated in large part by information obtained from monitoring the implementation

Software Copyright Do's and Don'ts

1. Don't make a copy unless you have the permission of the producer.
2. Be skeptical of those who say, "Go ahead and copy, nobody will never know." Check with your school's attorney or get the written permission of your supervisor.
3. Don't believe anyone who says the "Off-Air Guidelines" and the guidelines for books, periodicals and music apply to microcomputer software. Computer software is very different and no copyright guidelines have been approved by the national educator-publisher negotiating committees which created the other guidelines.
4. Do buy enough software to get your job done. Buying enough will relieve the temptation to make unauthorized copies.
5. Don't load one diskette into several machines without authorization from the producer.
6. When licenses are offered by producers, buy the licenses and adhere to the limitations in the licenses. Going beyond the terms of a license is as much a violation of the law as any other unauthorized copying.
7. Don't allow computer clubs to use school facilities unless they agree in writing to adhere to the Copyright Act. By letting them stay, you share the legal liability with the club should they be apprehended.
8. Have strict rules restricting the use of any "archival copy." While the law allows one archival copy, it may not be used in the classroom. Do keep it in a restricted area, out of reach of all users.
9. If you accept a preview or on-approval copy from a producer, distributor or dealer, be responsible for ensuring that no copies are made. The Copyright Law applies to previews, just as it applies to software you have already purchased.
10. Don't authorize purchase of equipment specifically designed to break protection codes built into most software. Possession of such equipment may be used in court as evidence against you, since its main use is to make unauthorized copies.
11. Do share with teachers, students and administrative personnel a statement reflecting your personal respect for the Copyright Law. Your leadership will inspire others to maintain ethical practices.

From "Should I Copy Microsoftware?" The International Communications Association, 3151 Spring Street, Fairfax, VA 22034-2399, (703) 273-7200.

of the program. The technology committee should communicate clearly to the superintendent and the school committee that successful implementation and expected student performance outcomes cannot be realized without ongoing and responsive staff development.

The Principal's Role as Technology Leader is Vital. The opportunities for a substantive leadership role are many. The principal should have sufficient technical knowledge to assist staff or to decide what technical assistance is needed. He or she should take an active role in the development and implementation of the curriculum and serve as a consultant to the teachers in integrating the computer into the existing curriculum. Most importantly, the principal should monitor program implementation, noting problems and unanticipated outcomes and providing staff with the "hand-holding" that is essential to the successful implementation of such a complex innovation.

Program Evaluation is Essential. Two types of evaluation information will be collected in order to "fine-tune" technology implementation and make judgments about its effectiveness. First, the implementation needs to be monitored to determine if it is proceeding as planned. This can be accomplished through checklists, observations and discussions with teachers. Experience indicates that implementation falters when teachers are not clear about what specific activities are required to implement a program. A simple checklist of indicators may serve as a guide for teachers on what is expected. The checklist may also serve as a self-administered instrument to enable teachers to identify problems that need to be addressed through additional training sessions.

The second type of evaluation deals with the impact of the program on student performance. Can the students operate the equipment? Have their writing skills improved as a result of using the computer as a word processor? Are there any indications that students' problem solving skills are improving? Most of these performance questions will need to be addressed by customized tests and instruments, because commercial instruments are not widely available.

Putting all the elements of the instructional plan into operation will require detailed specification of activities and their sequencing. You will use the projected timelines developed in the beginning stages of planning. These timelines should be revised and expanded over time. Activity scheduling methods can range from simple to complex. You may want to use a project management system requiring the use of a computer. Table 7 is an example of a simple implementation schedule for student competencies and subject areas that shows the staging and phasing of key activities over a three-year period. Similar simple forms can be developed for your staff development plan and your hardware and software procurement plans. This kind of form is good for presentations to the school committee because it describes broad program directions.

Step 19 — Develop Logistical Support System

The logistical support system deals with the allocation of hardware and software across the applications specified in the three technology subplans. It will be necessary to use a distribution and scheduling system for each plan for each school building, and in some cases throughout the system, because the pieces of equipment will number less than the number of applications. Most hardware should be housed in a central location in a school and checked out as is any other piece of valuable equipment. An exception to this recommendation is the self-contained computer lab, where students can be sent to learn basic computer literacy skills or to use the computers to do assigned work in a subject area.

The logistical plan should specify what equipment will be used and by whom. In many cases, this plan can be managed by a teacher, media specialist or administrator's secretary. As the courseware collection grows, it could be managed centrally and distributed to teachers as needed. The expense of a comprehensive courseware collection may require a systemwide distribution process. Table 8 is an example of a school distribution plan for instruction.

Table 7

Staging and Phasing of Computer Applications

Student Competencies and Subject Areas

Grade Levels	1984-85	1985-86	1986-87
K-3			
4-6			
7-9			
10-12			

From Merrimack, 1984, p. 80.

Table 8

Hardware and Software Distribution Plan

Period	Teacher	Application	Equipment (#)	Courseware
1	Benson	Word Processing	Apple IIe (2)	Bank Street Writer
1	Marks	Scientific measurement	Timex (6) with interface boards	Measuring & Plotting
2	Jones	Graphing population shifts	Commodore (4)	Graphics
3	Harris	Searching online data bases	Apple IIe (1) with modem	Micro-Courier

The location of the equipment in a school will affect how students and teachers use it. A computer lab, for example, may indicate to students that the computers are a separate course of study, unrelated to their traditional subjects. Teachers need to be encouraged to assign students to use computers to complete assignments in many subject areas (e.g., using a word processor to prepare a report; using a graphics program to prepare charts; using a tutorial program to practice vocabulary in a foreign language; using a music program to compose a song). The link between the computers in the classroom and those in the lab must be strengthened in order to integrate computers into the whole curriculum. If computers exist in a lab only, a scheduling system should be developed to assign students to the lab.

The important concept here is that the placement of equipment should match instructional applications. Teacher-directed demonstrations, individual tutorials and *ad hoc* student uses may require only a single computer in a classroom. Word processing, programming instruction and CAI lessons may require at least one computer for every two students. Such a requirement might be met with a dedicated lab of computers or several computers in a classroom.

Step 20 — Develop Materials and Equipment Support System

Experience with technology, especially computerrs and courseware in schools, indicates that equipment is highly susceptible to damage and theft. The purpose of the materials and equipment support system is to assure that adequately operating hardware and software are available as needed to support the program. There is a variety of issues to address when planning for the optimal material and equipment support system in your schools. The major areas are:

1. assuring that the physical environment and location are appropriate and conducive for housing and using technology;
2. providing for routine maintenance and repair;
3. providing for security of this expensive equipment and
4. developing rules for scheduling, checkout and transfer.

Planning for Appropriate Location and Physical Environment for Computer Equipment

- **Electricity.** Electrical power for a microcomputer and accessories should be within operating voltage ranges, usually 110 volts AC. Minicomputers and mainframes usually require a higher voltage. Make certain that you ask what the voltage requirements are. Also ask what the total amperage is for the most demanding equipment in the system. You should make sure that your wiring is sufficient to support all workstations and any peripherals.

  The power source should be free from short-term power changes, either surges or outages. You can purchase inexpensive power surge protectors or power tap/extension units for less than $50. Power retainers cost much more, in the range of $1,000. Be sure to alert personnel in the office and maintenance regarding the need to notify computer users if the power is scheduled to be turned off. Be sure to make backups on a regular or routine basis to keep from losing information.
- **Carpeting.** Static electricity built up in the body can be discharged into the computer, especially through the keyboard, and can damage integrated circuit chips. Reduce this probability by having users ground themselves to the case before using the computer or use static prevention sprays. The purchase of non-static carpeting may save equipment and prevent other disorders associated with static generated around the computer.
- **Location.** If you are planning a computer lab, a location should be selected that minimizes the need for the contact with trailing wires. Not only are visable wires unattractive and dangerous, but they also cause difficulty when tracking problems. Machines should not be placed too close together, especially if more than one student will be using each computer. Students need to have space for their

working papers and books. Traffic patterns are important, especially when there are only one or two computers in the room. A location away from the door and in a place where people do not congregate is wise.

- **Furniture.** Additional furniture may be necessary to support the office or classroom environment. You will want to purchase printer stands and you need to plan for storage of your software and computer supplies.
- **Telephone lines.** If your schools are expected to connect to the central office by modem or your classes will be using databases for research, you will need to plan for phone lines to support these activities.

Providing Repair and Maintenance Services

Computers are not as delicate as they appear, but they do require periodic maintenance and they do break down. Maintenance and repair contracts usually are available from the computer distributor or from special repair facilities. As the amount of equipment increases, some consideration might be given to hiring a technician to take care of minor maintenance.

Providing for Security

All equipment should be marked and stored in secure facilities when not in use. The planning budget should include cost estimates for installing security systems. Computers located in labs are easier to secure. When selecting a room for a computer lab, consider its accessibility. Choose a room in the center of the building that has few or no windows. Choose a room with one entrance, not one that has doors to adjacent rooms. You may want to install deadbolt locks and other security devices. Allow teachers and school employees to take the equipment home over the weekend, vacations and holidays. You can secure individual machines with security cables attached to the wall, furniture or to other computers. Be sure to mark the computers with the school's name. You may want to etch the school's name into the computer's mother board. Investigate the feasibility of insurance.

All equipment should be listed on the district's master list of insured equipment. The location of each piece of equipment in the district is important, particularly as the amount of equipment grows. An inventory of equipment should include the serial number and model number of each machine or peripheral, the school system's inventory number (if used), the date of purchase, the type of funds used for purchase, location of equipment and other information pertinent to the school system. It is easy to use a database to store this information.

Developing Rules for Scheduling, Checkout and Transfer

One individual in each school must be solely responsible for the use, checkout and transfer of computer equipment. This person will be responsible for the inventory mentioned above and for scheduling daily and weekly activities. Software inventory and checkout must be maintained. The person must be sure that teachers checking out software and equipment know how to operate them. You may consider appointing a media specialist or interested teacher. Be sure that this person has the time necessary to carry out these responsibilities effectively.

Stage Six — Checklist

Organizing and Implementing for Success

When you have completed the following activities in Stage Six, you will have a completed, working plan for successful implementation of technology in your school system.

- ☐ Develop and distribute a system policy on software duplication.
- ☐ Provide for program coordination and implementation.
- ☐ Provide for program evaluation.
- ☐ Develop a logistical support system.
- ☐ Develop materials and equipment support system.
- ☐ Plan for appropriate location and physical environment of equipment.
- ☐ Provide repair and maintenance services.
- ☐ Provide for the security of equipment.
- ☐ Develop and implement a process for scheduling, checkout and transfer of equipment.

Appendix A

Sample Job Description
Technology Coordinator

Qualifications

1. A master's degree from an accredited college or university.
2. At least two years' successful experience in computers relating to teaching and/or administration.
3. Experience in staff development and/or curriculum development.
4. Familiarity with state-of-the-art technology as it pertains to school applications.
5. Knowledge of appropriate resources, organizations and software resource availability.
6. Knowledge of appropriate resources, organizations and vendors relative to hardware resource availability.

Reports to

Assistant superintendent of schools.

Job Goal

To ensure the smooth and efficient operation of all technology education applications, including hardware, software, training and instruction for the school system. Technology application responsibilities are to be coordinated with the administrative and instructional goals of the school system.

Performance Responsibilities

1. Assumes overall support for the proper selection and application of hardware to provide for the program needs in the various levels of the school system.
2. Assumes responsibility for networking of hardware capacities within the school system.
3. Assumes responsibility for the organization of staff development programs related to the application of technology in the instructional process.
4. Conducts training seminars and workshops on the proper application of hardware and software within the school system.
5. Assists the school system in the development of K-12 technology education curriculum.
6. Provides technical assistance to special departments (i.e., business office, media centers, special education office and guidance office) in the utilization of technology in administrative and other related areas.
7. Coordinates the systemwide educational technology committee that develops long-range plans for the school system.
8. Assumes responsibility for developing staffing plans for the proper support and application of technology at the various levels of the school system.
9. Assumes responsibility for developing student user groups and facilitating community usage of technology resources as appropriate.
10. Assumes responsibility for development of a system-wide software distribution plan, software exchange and selection system for the utilization of the computer software within the school system.
11. Assumes responsibility for updating educational technology plans and documents on a six-month basis.

Terms of Employment

Twelve-month work year.

Adapted from **Computer Application Planning**, Merrimack Education Center, 1984, pp. 5 and 6.

Appendix B

Sample Statement of Philosophy For Educational Technology Program

Basic Principles

The introduction of new interactive learning technologies into the curriculum presents us with significant challenges and opportunities. Not only can the computer and related tools help us to deliver instruction more effectively and productively, it can serve as an impetus for revitalizing what we teach. In developing and implementing a technology-based instructional program, we wish to recognize these principles.

- The most pressing needs for educators continue to be the teaching of the basic skills—reading, writing, mathematics and problem solving. Without such skills, technology literacy is of limited value.
- Aside from the basic equipment and software use skills, technology competencies need to be integrated into the existing curriculum.
- Technology presents us with an opportunity to revitalize the existing curriculum, not merely automate it. The demands of the emerging information age require that traditional basic skills be augmented with such "new" basics as evaluation, synthesis, analysis, application, decision making and communication.
- Students will need to use technological tools to locate and manipulate information in their further education and in their careers. Therefore, the curriculum must give more emphasis to the development of processing and thinking abilities than to factual knowledge.
- Students need to learn how to make appropriate use of computers and related technologies to learn new skills and knowledge and as a device for programming special applications.

Adapted from **Computer Application Planning,** Merrimack Education Center, 1984, p. 12.

Sample Superintendent and Steering Committee Work Statement for Technology Planning

Objective

To produce a three-year plan for the implementation of a comprehensive, systemwide technology program.

Major Questions To Be Addressed

1. What will students need to know and be able to do?
2. What grade levels and what subject areas will the program initially address?
3. What competencies will teachers and administrators require in order to implement the program? How will they be helped to acquire these competencies?
4. What effects will technology education have on the existing curriculum?
5. What new materials and equipment need to be purchased? How will these materials and equipment be distributed, secured and maintained?
6. How will program priorities be phased in over the three-year period?
7. How much will the program cost? By year? How should it be funded?

Expected Outcomes

1. A recommended administrative plan for the central office and all school offices. This plan should specify appropriate applications and the sequence in which the applications are to be installed.
2. A teacher-support plan for each school that indicates the kind of applications initially recommended by teachers from each school.
3. A technology education curriculum plan that is fully integrated with the existing curriculum used in the district. The curriculum is to specify a definition of technology literacy, a skills scope and sequence, criteria for mastery, required instructional materials, and instructional management procedures.

Each Plan Should Include

1. A staff development plan that specifies what staff will receive what training and related development services. The plan should include timelines and resource requirements.
2. A hardware and software procurement plan matched to each plan. The plan should include recommendations on specific equipment and software and costs over the three-year period. Also include a proposal for how to coordinate equipment and software and for how to coordinate equipment and software between plans to prevent duplication.
3. An implementation plan which specifies how each program is to be phased in over the three-year period, what faculty and organizational changes will be required and how each program will be monitored and modified over time to address unforeseen opportunities and problems.

Adapted from **Computer Application Planning,** Merrimack Education Center, 1984, p. 13.

Georgia Department of Education
State Plan for Educational Technology
Introduction
1984

Prior to the development of any plan, the fundamental themes from which the plan will evolve must be identified and clearly stated. The following themes are considered to be essential and will be used as the basis for the development of Georgia's educational technology effort.

Theme 1
Georgia Must Address the Information Age

Educational leadership must address technology in its broadest context. Until recently most technology planning has focused on the use of the tools of technology. Planners now realize that the actual task is to deal with the changes caused by technology. One of the major changes, for example, is the speed with which human knowledge increases. Traditionally, this increase occurs as we recombine and synthesize new information from existing information. Technologies such as the computer are allowing us to access a much broader range of knowledge; to manipulate, compare, synthesize and reach conclusions about new knowledge so rapidly that it is changing not only what we learn but the very nature of how we learn and the skills we will need to learn and live in the future. Therefore, Georgia's state plan for educational technology must focus on the information age and its influence on society and the learning process, not just the tools of the age.

Theme 2
Georgia Must Be Educationally Effective

Much has been written about the lack of effectiveness of current educational delivery systems. It has been suggested repeatedly, for example, that we should increase the school day or school year to improve the quality of education. Effective application of learning technologies offers the possibility of increasing the quantity and quality of the teaching and learning that occurs during the traditional school day. Another suggestion has been that teachers need to spend more time on the task of teaching. Applied educational technology can reduce teachers' clerical burdens and allow more time for teaching. Student skills such as critical thinking, problem solving and composition are often cited as critical to the learning process and often lacking in recent graduates. Learning the basics of computer programming, the use of simulations and electronic word processing have already proven to be effective approaches to teaching these important skills. Careful application of learning technologies can save professional time, provide immediate feedback and evaluation, directly teach those skills that are often omitted in standard curriculums and enrich the schooling experiences, thus providing a more effective educational experience for students.

Theme 3
Georgia Must Be Educationally Efficient

Educational technology should not be viewed as a panacea for all the ills of public education which are continually described by various commissions and reports. However, technology should be thoroughly examined as one possible way to address some of these criticisms. In applying technology to the educational process there exists the danger of waste and ineffectiveness and, at the same time, the promise of significant, positive educational impact. The state must plan in a manner which will ensure that we pursue only those areas which can be validated or documented as educationally sound and cost efficient.

Theme 4
Georgia Curriculum Must Reflect the 21st Century

The speed with which technology is causing change in our environment has resulted in an increased emphasis on developing lifelong learning skills. Most high school and college graduates of the 1980s must acquire new skills to continue any career, whether laborer or professional. In addition, careers and jobs requiring new skills will continue to arise faster than schools and universities can prepare students. We can no longer teach only the specific content of knowledge

needed for successful adulthood. Since it is now obvious that information is at the heart of the present revolution, just as industrialization was the driving force of the Nineteenth and early Twentieth Centuries, Georgia's educational program must identify and teach those human skills and attitudes most compatible with an information-based society. We must develop the skills necessary for the individual to use technology to acquire and effectively use knowledge as it evolves and is needed later in life.

Theme 5
Georgia Must Keep in Step

Educational planners have an inherent responsibility to certify that the basic content of their curricula and the organization of their delivery systems are consistent within the national and international framework of a mobile society. While this does not mean that Georgia must approach education as other states do, we must ensure that we are not out of step with the national and global picture. Already it is apparent that the availability of technology is causing a major shift in the educational systems of many of our surrounding states. Failure to keep in step will result in the loss of technology-related industries and the subsequent economic benefits to Georgians. We must create new support for learning technologies and follow the lead generated by other state legislatures in creating the educational resources and positive state image that will adequately prepare our youth and attract Twenty-first Century industries.

Theme 6
Georgia Must
Coordinate Educational Resources

The department of education must guarantee a high level of awareness on the part of all leadership personnel responsible for the development of educational programs in Georgia. The state must also ensure that policies are developed which will allow equal access to the resources and benefits of technology. The speed with which change is occurring as a result of technology and the associated information explosion will require creativity and flexibility to optimize the use of our human and financial resources. We must effectively use the benefits of these technologies while avoiding the pitfalls and dangers. One such pitfall is failure to realize the necessity for the infusion of technology into all aspects of the educational setting. For technology to be effectively used a network of support systems and resources must be in place. Therefore, technology implementation must be viewed as a process requiring comprehensive, consistent and coordinated implementation. A piecemeal approach will produce waste and failure. A broad base of involvement, cooperation and support from all components of the educational process, including local school systems, the Georgia Department of Education, CESAs, the Georgia Legislature, business and industry, the governor and higher education, will be needed to provide this comprehensive integration.

Appendix C

Sample Survey Instruments

Staff Survey

1. Do you have any computer experience? ☐ Yes ☐ No

   If yes, please describe _____

   _____

   _____

2. Do you feel comfortable with your knowledge and understanding of computers? ☐ Yes ☐ No

3. Would you like to learn more about computers? ☐ Yes ☐ No

4. Would you attend computer inservice training (or a computer workshop)? ☐ Yes ☐ No

5. Do you feel it is important for the students in our school to learn about computers? ☐ Yes ☐ No

6. Would you like to be involved in teaching students about computers? ☐ Yes ☐ No

7. Do you feel that our school district needs an organized computer education program? ☐ Yes ☐ No

8. Would you like to be involved in the planning and development of an organized computer education program? ☐ Yes ☐ No

9. Comments: _____

   _____

   _____

   _____

   _____

Reprinted with permission from **The Elements of Computer Education,** Montana Office of Public Instruction, 1983, p. 11.

Student Survey

1.	Do you or your parents own a computer?	☐ Yes	☐ No
2.	Have you had hands-on experience with a computer?	☐ Yes	☐ No
3.	Do you have an understanding of BASIC or some other computer language?	☐ Yes	☐ No
4.	Would you like to know more about computers?	☐ Yes	☐ No
5.	Would you like to have computers integrated into your regular class instruction?	☐ Yes	☐ No
6.	Would you be interested in taking a class on computers?	☐ Yes	☐ No
7.	Are you comfortable with your knowledge and understanding of computers?	☐ Yes	☐ No
8.	Do you feel that the ability to use computers is important to your future?	☐ Yes	☐ No
9.	Do you feel that the ability to use computers is important to your future job opportunities?	☐ Yes	☐ No

10. Add any comments here _____

_____

_____

_____

_____

Reprinted with permission from **The Elements of Computer Education,** Montana Office of Public Instruction, 1983, p. 12.

Community Survey

1.	Do you have a computer in your home?	☐ Yes	☐ No
2.	Is there a computer in your place of business?	☐ Yes	☐ No
3.	In your occupation, are you directly or indirectly involved with a computer?	☐ Yes	☐ No
4.	Do you feel the ability to use computers is important to your future?	☐ Yes	☐ No
5.	Are you comfortable with your knowledge and understanding of computers?	☐ Yes	☐ No
6.	Do you feel it is important for the students in our school district to learn about computers?	☐ Yes	☐ No
7.	Do you feel the ability to use computers is important to the future job opportunities of students in our school district?	☐ Yes	☐ No
8.	Do you feel that we should have a computer education program in our school district?	☐ Yes	☐ No

9. Add any comments here _____

_____

_____

_____

_____

Reprinted with permission from **The Elements of Computer Education,** Montana Office of Public Instruction, 1983, p. 13.

Documentation of Current Computer Applications

For each application, obtain the following information:

Subject Area:

Grade:

Teacher:

Objectives:

Hardware Required:

Software:

Special Student Population(s):

Reprinted with permission from **Computer Application Planning,** Merrimack Education Center, 1984, p. 18.

Inventory of Faculty Computer Competencies*

Determine number and percent of faculty with the following competencies:

_____Can operate computer.

_____Can locate and choose software.

_____Can run software.

_____Can evaluate software.

_____Can develop instructional applications in which computer use is integrated.

_____Knows computer terms.

_____Understands basic computer operations and capabilities.

_____Can use shell programs, utilities and authoring languages.

_____Can write programs.

_____Can develop microcomputer courseware.

_____Can teach programming, data or word processing.

_____ Other: _____

* This list adapted from Computer Literacy Curriculum Guide: Grades K-9, Minnesota School Districts Data Processing Joint Board, September, 1982.

Hardware Inventory Forms

Computers:

Type	Number	School (room)

Computer Peripherals (i.e., printers, modems, disk drives, 80 column boards, plotters, joy sticks, etc.)

Type	Number	School (room)

Reprinted with permission from **Computer Application Planning,** Merrimack Education Center, 1984, p. 20.

Courseware/Software Inventory

Instructional Area	Program Name	Type	School (room)

Reprinted with permission from **Computer Application Planning**, Merrimack Education Center, 1984, p. 21.

AASA Assessment Questions

Step #1: Assessment

Districts should conduct an assessment primarily to answer the question "Where are we?"

The Minnesota guidebook advises, moreover, that an assessment of technology is no different from an assessment of any other type of curriculum material or program. "Sound practices which have been successful in the past should be continued with this activity."

The following list of questions, taken from the guidebook should help districts carry out their assessment:

- What educational technologies are currently being used (e.g., computers, telecommunications, television, film, cable, TV, interactive video, lowpower television, satellite communications, microwave communications)?

- How much educational technology hardware do you currently have available?

- Where is the educational technology hardware located (e.g. in labs, regular classrooms)?

- What are the present applications of technology in each of the following: instruction, administration, classroom management, other?

- What skills do the staff have with the technology present in the district?

- What staff development opportunities are available?

- Is there a curriculum guide with an appropriate scope and sequence in the major subject areas?

- Is there a curriculum guide with an appropriate scope and sequence for the use of the various technologies?

- Are there advisory committees that are community-based as well as staff-based to provide an overall support network for technology?

- Is there one individual responsible for implementation of the overall technology program in the district?

- Are hardware purchases, software purchases and equipment repair centralized?

- Are other educational agencies, organizations or businesses involved in your technology programs? (If so, describe their involvement.)

Reprinted with permission from Critical Issues Report: High Tech for Schools, American Association of School Administrators, 1984, p. 28.

PLANNING FOR EDUCATIONAL COMPUTING

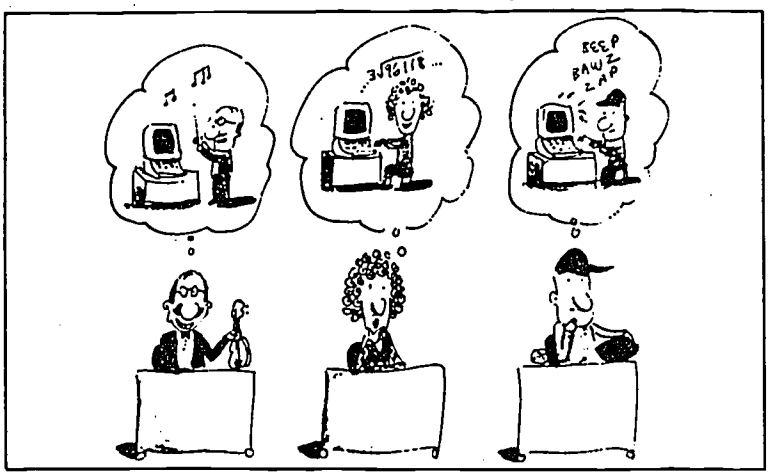
A QUESTIONNAIRE FOR EDUCATORS

How do the educators in your school or district feel about the use of computers in education? This ready-to-use questionnaire can help you find out.

By Jim Poirot and Merridee Heidt

PLANNING FOR THE IMPLEMENTATION of computers in a school or district requires a carefully thought out series of steps, ranging from setting your objectives to identifying the hardware and software to meet those objectives, to choosing your specific system. But even before you initiate those steps, the first step—and, in many ways, the most important one—is finding out what the people in the school think about computers. Surveying your faculty's attitudes will not only involve potential users in the early planning stages of computer implementation, but will also provide you with valuable data about such things as in-service training needs.

One way to get this important information is to administer a questionnaire similar to the one on page 37 and 38. This questionnaire was originally developed for *Microcomputers in Education: A Scholastic Program in In-Service Training*, a multimedia training package which provides educational computing leaders with the necessary materials for the training of teachers and administrators. The goal of the questionnaire is to provide the educational computing leader with valuable information on the needs, interests, and attitudes of faculty towards computers and computing.



Dr. Jim Poirot, chairman Computer Science Department, North Texas State University, is the author of many books and articles on educational computing.

Merridee Heidt, M.S., Computer-Based Educational Systems, is an educational computing consultant in Houston, TX

THE QUESTIONNAIRE...

THE QUESTIONNAIRE ITSELF has three parts. Part I provides background data on the individual educator as well as information on his or her current level of computer expertise. Part II surveys respondents' attitudes towards computers in education. And Part III focuses on the types of educational computing applications the respondents feel are important.

...AND HOW TO USE IT

THE FIRST STEP IN USING THE questionnaire is to distribute it to all teachers and administrators within the school or district. You might also attach a covering letter such as the one below.

Dear_____.

We are just beginning to think about introducing microcomputers for instructional and administrative purposes to (Name of School or District), and would like to know what you think about this idea.

Your opinions are important. Help us to make the most responsible choices about computers in our schools by taking a few minutes to complete the attached questionnaire. Please return the completed questionnaire to (Place) *by* (Date). *Thanks.*

Once the questionnaires have been returned and the responses tabulated, you can begin to use the data for planning the next steps in the process of bringing computers to your schools. Here are some ideas on how.

Part I: The answers to the background questions in this section will help you to both assess the extent of your faculty's training needs, and to identify those individuals who have some level of computer expertise. By knowing who and where these key people are, you will be able to seek their help in a variety of ways—as in-service trainers or hardware or soft-

(Continued on page 36)

Reprinted with permission from **Electronic Education**, Sept. 1982, pp. 34, 36-38.

(Continued from page 34)

ware selection committee members.

Part II: In general, the responses to items in this section will tell you the level of acceptance or resistance to computers you might expect.

The response pattern to items 7–12 will tell you whether or not the computer is perceived as a valuable tool. If, for example, the majority of respondents indicate that they feel computers in education are somewhat of a luxury, then you would know that when it comes time for training, you might want to provide them with further information on the cost- and learning-effectiveness of computers.

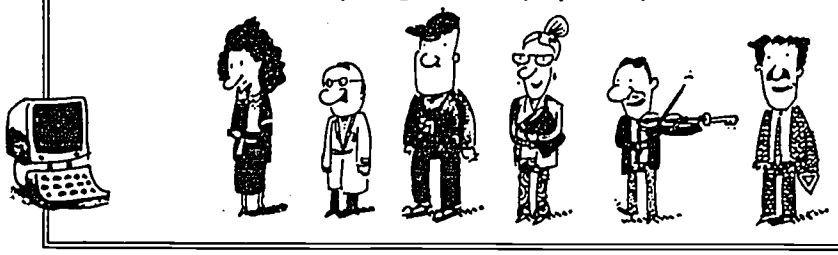
Items 13–21 are of a more personal nature. They ask respondents how they personally feel about using a computer to help them do what they do. If the majority of respondents indicate that they are disinterested or threatened, then you might design your training program to both rally interest and assuage fear. On the positive side, this cluster of items will also help you to identify those teachers and administrators who are most eager to get started with computers. In addition, the responses to these questions will give you a reading on the ways in which they would like to use computers as well as their current interest in in-service training.

The last three questions in this section, 22–24, tap faculty attitudes towards student use of computers. If the response pattern indicates that faculty question the value or the effect of computers on students and learning, then you might want to discuss why they feel that way, or perhaps even invite an educational computing teacher from a neighboring district to talk about his or her personal use of the computer for instruction. On the other hand, if the majority of faculty feel that all students should learn about computers and how to use them, then you will, most likely, want to begin to think about planning the appropriate curriculum.

Part III: This section of the questionnaire provides you with information on how important particular computer applications are to the majority of faculty. Overall, the pattern of responses can help you to decide where to begin with computers. For example, if the majority of respondents indicate that they feel instructional applications (items 25–32) are more important than administrative applications (items 33–39), then your computer program should, initially at least, reflect this attitude.

The responses in this section can also help later on, when you start making hardware and software decisions. For example, if most of the respondents feel that word processing is an extremely important application, then word processing software and printers will have to be considered when a budget is being prepared.

In addition to providing specific information about faculty attitudes, the questionnaire can also help educators understand their own feelings about computers. And what better way to begin planning for educational computing than with your entire professional staff thinking about the computer's potential? **EL**



PLANNING FOR EDUCATIONAL COMPUTING

A QUESTIONNAIRE FOR EDUCATORS

PART I

1. In what area of education do you work? *(Check all that apply)*

____ Administrative
____ Teaching
____ Staff

2. What grade level(s) do you teach, or what are your responsibility levels? *(Check all that apply)*

____ K-3
____ 4-6
____ 7-9
____ 10-12

3. In which of the following subject areas do you teach or work? *(Check all that apply)*

____ Science
____ Social Studies
____ The Arts
____ Business Education
____ Mathematics
____ Language Arts
____ Career Education
____ Foreign Languages
____ Physical Education
____ Other: _____

4. Please respond to the next four questions by circling *1* for "Yes" and *2* for "No."

		Yes	*No*
A.	Do you own a home computer?	1	2
B.	Have you ever *regularly* used a computer system for personal computing?	1	2
C.	Do you personally use computers at your school?	1	2
D.	Do you consider yourself a "beginner" in the use of computers in education?	1	2

5. How many college courses (if any) have you taken in which you used a computer? _____

6. How many in-service training sessions (if any) have you attended on computer use? _____

PART II

Please carefully read statements 7-24 and respond by circling 1, 2, 3, 4, or 5 to indicate the degree to which you agree or disagree with each statement.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
7. Computers are valuable tools that can be used to improve the quality of education.	1	2	3	4	5
8. Computers should be used by schools more than they are now.	1	2	3	4	5
9. A school system should buy all other educational materials before purchasing computers.	1	2	3	4	5

PART II

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
10. A computer is an unnecessary luxury in most school settings.	1	2	3	4	5
11. Computers are of little value in education because they can be used to teach only one or two subjects.	1	2	3	4	5
12. Computers are of little value in the classroom because they are too difficult to use.	1	2	3	4	5
13. Teachers should know how to use a computer in their classroom.	1	2	3	4	5
14. Computers are a danger because they dehumanize teaching.	1	2	3	4	5
15. I would like to have a computer for use in my classroom. *(Teachers only)*	1	2	3	4	5
16. I would like to have a computer to assist me in instruction. *(Teachers only)*	1	2	3	4	5
17. I could make a computer very useful to my school.	1	2	3	4	5
18. I don't feel threatened by computers.	1	2	3	4	5
19. I would enjoy using a computer in my work.	1	2	3	4	5
20. I would like to have a computer to help me with paperwork.	1	2	3	4	5
21. I would like to attend in-service training on computer use in education.	1	2	3	4	5
22. Computers provide motivation for students to learn.	1	2	3	4	5
23. All students should learn about computers and how to use them as problem-solving tools.	1	2	3	4	5
24. Computers in schools have an adverse effect on students.	1	2	3	4	5

PART III

Numbers 25-39 list possible educational applications of computers. Please respond by circling 1, 2, 3, 4, or 5 to indicate your opinion of the importance of each application.

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
25. Computer literacy for all students	1	2	3	4	5
26. Problem-solving tool for all students	1	2	3	4	5
27. Assistance in basic-skills areas	1	2	3	4	5
28. Enrichment for gifted/talented students	1	2	3	4	5
29. Assistance for slow learners	1	2	3	4	5
30. Aid for reluctant learners	1	2	3	4	5
31. Aid for handicapped students	1	2	3	4	5
32. Computer programming	1	2	3	4	5
33. Typing (word processing)	1	2	3	4	5
34. Generating instructional-support materials	1	2	3	4	5
35. Grade averaging/reports	1	2	3	4	5
36. Supplying student personal data	1	2	3	4	5
37. Student scheduling	1	2	3	4	5
38. Attendance accounting	1	2	3	4	5
39. Inventory control	1	2	3	4	5

Are you ready for the micro?

by Harry Miller and Carolyn Clausing

In recent years we've witnessed a revolution - the microcomputer revolution. From their little heralded introduction just a few years ago to their profusion today, their acceptance, especially among educators, is something just short of a miracle. Many of the microcomputer's miraculous applications, however, have been misleading.

The use of microcomputers in a classroom must be given thorough consideration. Long before the purchase of a microcomputer is made and the cartons of monitors, keyboards and disk drives are unpacked, teachers need to seriously consider the need for the purchase. This consideration should be written down in the form of educational specifications. This document should spell out the manner in which the microcomputer can be used in the teaching/learning process and if this will enhance the learning environment. Further, the question of cost effectiveness must be addressed. Does the acquisition of a microcomputer assist with learning tasks not already being done effectively and at less expense?

In order to encourage the justifiable purchase of a microcomputer the following check list can be used as a guide.

Yes	No	
___	___	1. Would you encourage your pupils to use an electronic calculator in your classroom?
___	___	2. Do you presently use several forms of audio-visual equipment in your lessons?
___	___	3. Is your school principal committed to the use of microcomputers?
___	___	4. Does your school presently have all the necessary materials and equipment to provide a good program for meeting your students' needs?
___	___	5. Do you presently use a microcomputer for your own needs?
___	___	6. Do you have a free period that you can devote to learning about the use of the microcomputer and is there someone available to offer the necessary hours of in-service instruction?
___	___	7. Can you justify the cost of a microcomputer in relationship to the costs of other classroom learning materials?
___	___	8. Are you able to identify the peripheral equipment you will need and can you give the exact costs of such equipment?
___	___	9. Can your classroom accommodate one or perhaps several microcomputers and do you have the needed furniture and electrical outlets?
___	___	10. Have you prepared a well-thought-out set of educational specifications regarding the use of microcomputers in your classes?
___	___	11. Have you surveyed the type and quality of software you are planning to use and have you provided for their cost?
___	___	12. Does the microcomputer come with a good service contract?

If you find that your answers to the majority of these questions are "no" perhaps you need to reconsider the purchase of a microcomputer for your class. You may wish to invest the money in some other needed educational materials. Not much educational value can be gained from the microcomputer that is placed in a closet at the rear of the classroom shortly after its novelty wears off. EE

Dr. Harry Miller is a professor in the College of Education at Northeast Louisiana University in Monroe, La. Mrs. Carolyn Clausing is a teacher with Jefferson Parish Schools, La.

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Appendix D

Needs Assessment Tools
Checklist of Steps

This checklist describes **what to do** to conduct a system-wide needs assessment. The process recommended here consists of six basic steps. The checklist can be used in several ways. It has been designed in what experience has shown to be a logical, sequencial order for use in a cookbook fashion by a project coordinator or steering committee. As with a recipe, any step or ingredient which is left out will effect the quality of the product. A second, less strict, application is to use the checklist as a directory, that is, as a source of recommendations which can be altered according to local circumstances. This checklist is also ideal as a tool for review to be sure that the planners have successfully completed each task, and to verify that any which have been left out were left out by rational choice rather than through an oversight. The sequence and detail of this six step process has been field tested over a three year period with the help of over thirty local school systems. If this sequence is varied or the elements changed, be sure to do so only after careful consideration.

Step 1 Initiate the needs assessment process

This step entails gearing up for the needs assessment: selecting needs assessment committee members, orienting them and making tentative plans.

☐ **Task 1** **Establish a Needs Assessment Committee**

- ☐ Select a coordinator
- ☐ Identify a resource person
- ☐ Outline required committee functions/prerogatives
- ☐ Choose a committee with cross sectional representation

☐ **Task 2** **Orient the Committee to the Overall Needs Assessment Process**

- ☐ Brief committee on strategies, recommendations
- ☐ Identify current resources and constraints

☐ **Task 3** **Make Tentative Plans**

- ☐ Review specific needs assessment components
- ☐ Determine desired comprehensiveness of the local plan
- ☐ Determine individual committee member responsibilities
- ☐ Set tentative timelines

Step 2 Conduct perceived needs assessment

School publics are surveyed to determine what they view as the **top** school needs. It is recommended that the publics surveyed include administrators, teachers, and students, and that approximately five top needs of each group be identified and then merged into one list.

☐ **Task 1** **Review/Finalize the Perceived Needs Assessment Process**

- ☐ Specify target individuals or sample sizes
- ☐ Finalize instruments
- ☐ Detail administration procedures
- ☐ Define points to be made to each target group
- ☐ Finalize data analysis mechanics

☐ **Task 2** **Conduct the Perceived Needs Assessments**

- ☐ Conduct school **administration** assessment
- ☐ Conduct **teacher/school staff** assessment
- ☐ Conduct a **student** assessment

☐Task 3 **Identify Sets of Top Needs**

- ☐ Score the instrument(s)
- ☐ Determine top needs by group
- ☐ Merge into one cross system list

Step 3 Verify perceived needs by objective means

The aim of Step 3 is the verification by objective means of each of the top perceived needs to determine that a major problem, limitation, or discrepancy does in fact exist. That is, do test data, structured observations, interview data, or other means (existing or new) bear out the identified needs? Thus, the list is further delineated.

☐Task 1 **Plan for Verification**

- ☐ Orient committee on possible verification tools
- ☐ Select objective means to verify each need (existing or new)
- ☐ Plan for administration (procedures, timeline)

☐Task 2 **Validate the Perceived Needs**

- ☐ Collect/compile existing or new data
- ☐ Analyze all data
- ☐ Compare perceived needs with analysis of objective measures
- ☐ Finalize the cross system perceived needs list

Step 4 Determine System-wide need priorities

One cross-system survey instrument is developed and administered during Step 4. A discrepancy-type instrument is suggested for surveying everyone's perception of: (1) the importance of addressing a need and (2) the degree to which this need has been met to date. From those perceptions, needs can be rank ordered, resulting in a system-wide list of priority needs.

☐Task 1 **Organize for a System-wide Ranking of Needs**

- ☐ Review the plan for determining system-wide priorities
- ☐ Develop one cross-system survey instrument
- ☐ Determine groups to respond/sample sizes
- ☐ Determine procedures for ranking resulting needs
- ☐ Specify administrative mechanics

☐Task 2 **Conduct the Assessment**

- ☐ Administer the instrument (distribute/collect)
- ☐ Score the instruments

☐Task 3 **Place Cross-system Needs in Priority Order**

- ☐ Rank order the needs
- ☐ Compile priority list of cross-system needs

Step 5 Choose need to be addressed by improvement efforts

Step 5, involves deciding which of the system-wide needs is to be the focus of improvement. It is recommended that one (or possibly two if they are closely related) be identified by weighing what is most desirable to address and what resources are available. Obtaining school system approval and communicating undertakings to the educational public are also parts of the step.

☐Task 1 **Determine Which Need is to be Improved**

- ☐ Estimate the resources required to tackle each need
- ☐ Select need(s) to address

☐ Task 2 **Obtain School System Approval**

- ☐ Obtain Central Administrative Approval
- ☐ Obtain School Board Approval

☐ Task 3 **Communicate Findings/Undertaking to the Public**

- ☐ Decide on points to be made to various publics/presentation modes
- ☐ Present information within the system (faculty, students)
- ☐ Communicate information to parents/community

Step 6 Conduct a causal analysis of the need to be improved

This step requires a look at factors which might have caused the identified need. Six factors are recommended for analysis in relation to the need: students, teachers, curriculum, resources, management and the community. The causal analysis study is to delimit or redefine the need with respect to possible causal influences. A master list of causes is generated and ranked, and a report published.

☐ Task 1 **Organize to Conduct the Causal Analysis**

- ☐ Review the process
- ☐ Assemble/orient representatives from the need area(s) affected
- ☐ Determine additional support required
- ☐ Set timelines, responsibilities

☐ Task 2 **Analyze the Need in Relation to Six Causal Areas**

- ☐ Decide which of the Six Causal Areas to investigate
- ☐ Describe desired conditions in each area
- ☐ Examine interrelationships across the six areas
- ☐ Select analysis tools or techniques for data collection
- ☐ Collect and analyze data

☐ Task 3 **Place Causal Factors in Priority Order**

- ☐ Generate a list of primary causal factors
- ☐ Decide which have the greatest impact on the system
- ☐ Place the causal factors in priority order
- ☐ Choose final areas to attack through an improvement effort

☐ Task 4 **Evaluate Your Needs Assessment Process Using "Needs Assessment: Checklist of Steps"**

☐ Task 5 **Develop a Report of Causal Factors**

- ☐ Submit report to Central Administration and Board for approval
- ☐ Communicate report to educational community and public

This document was written by Stephen M. Preston and Willard Crouthamel for the RDU Resource Center.

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Resource List

NEEDS ASSESSMENT PUBLICATIONS

Publishers of Models

Alameda County Needs Assessment Model (ACNAM). Office of the Alameda County Superintendent of Schools, 685 A Street, Hayward, California 94541.*

Atlanta Assessment Project. Instructional Services Center, 2930 Forrest Hill Dr., SW, Atlanta, Georgia 30315.

Batelle's Surveys. Center for Improved Education, Batelle Memorial Institute, 505 King Avenue, Columbus, Georgia 30315.

CSE/Elementary Evaluation Kit: Needs Assessment. Allyn and Bacon, Inc., Longwood Division, 470 Atlantic Avenue, Boston, Massachusetts 02210.

Dallas Model. Dallas Independent School District, 3700 Ross Avenue, Dallas, Texas 75204.

Florida Needs Assessment Development Project. Florida Department of Education, Tallahassee, Florida 32301.

"Institutional Goals Inventory (IGI)." Educational Testing Service, College and University Programs, P. O. Box 3813, Princeton, New Jersey 08540.

Phi Delta Kappa Model. Phi Delta Kappa, Commission on Educational Planning, P. O. Box 789, Bloomington, Indiana 47401.

Pupil Perceived Needs Assessment Package. Research for Better Schools, Inc., 1700 Market Street, Philadelphia, Pennsylvania 19103.

Quality Education Program Study (QEPS). Office of the Bucks County Superintendent of Schools, Doylestown, Pennsylvania 18901.

"Research and Development Utilization Project." Georgia State Department of Education, 1862 Twin Towers East, Atlanta, Georgia 30334.

Rookey, T. Jerome. Needs Assessment Model: East Stroudsburg. East Stroudsburg State College, Monroe County, Pennsylvania, May, 1975.

South Carolina Needs Assessment Model. Office of Planning and Evaluation, South Carolina Department of Education, 608 Rutledge Building, Columbia, South Carolina 29210.

Managing Needs Assessment

Bishop, Leslee J. "Casual Analysis Re Instructional Needs." University of Georgia Department of Curriculum and Supervision, Athens, Georgia 30602.

Dick Walter and Lou M. Carey. "Needs Assessment and Instructional Design." Florida State University, Tallahassee, Florida.

English, Fenwick W. and Kaufman, Roger A. Needs Assessment: A Focus for Curriculum Development, Washington, D. C.: Association for Supervision and Curriculum Development, 1975.

Hoenes, Ronald L., N. Kemp Mabry and John M. Morris. District/School-Perceived Needs Assessment Package. Georgia Southern College, Statesboro, Georgia 30458, 1976.

Needs Assessment in Education: A Planning Handbook for School Districts. State of New Jersey, Department of Education, Division of Research, Planning and Evaluation, 225 West State Street, Trenton, New Jersey 08625, February, 1976.

Nix, Jack P. "Needs Assessment Package." Georgia State Department of Education, Division of Program and Staff Development, Office of Instructional Services, Atlanta, Georgia 30334.

"Pupil Perceived Needs Assessment Package." Research for Better Schools, Inc. 1700 Market Street, Philadelphia, Pennsylvania 19103.

"We the People..." School Board of Brevard County, 3205 South Washington Avenue, Titusville, Florida 32780.

Wentling, Tim L. and Len Albright, Administrator's Manual for the Identification and Assessment System. Bureau of Educational Research, University of Illinois at Urbana-Champaign.

Management System: Needs Assessment Program Worksheets and Handouts. Education Improvement Center-South, Woodbury-Glassboro Road, Pitman, New Jersey 08071, (609-589-3410).

Mullen, David J., and Mullen, Rosemary C. "A Principal's Handbook for Conducting a Needs Assessment Using the School Program Bonanza Game," Georgia Association of Elementary School Principals Quarterly, Athens, Georgia, 11(1), 1974.

"Needs Assessment: A Guide to Improve School District Management." American Association of School Administrators, 1801 North Moore Street Arlington, VA.

Needs Assessment Guidelines. Ohio Department of Education, Division of Planning and Evaluation, Columbus, Ohio.

Data Collection Analysis Techniques

Brown, Frederick Gramm. Measurement and Evaluation. Illinois: F. E. Peacock Publishers, 1971, pp. xiv 7 198.

Eastmond, Jefferson N. Conducting Public Opinion Surveys for Schools: "A Do-It-Yourself" Activity for Project Next Step. Worldwide Education and Research Institute, 2315 Stringham Avenue, Salt Lake City, Utah 84109, September 1971.

Education for the 70's A Survey of Community Opinion About the Tacoma Public Schools. Tacoma Public Schools, Washington, May 1971, pp. 132, ED 053 191.

Provus, Malcom M. Discrepancy Evaluation. Berkeley: McCutchan Publishing Corporation, 1971.

Stephen, Frederick and McCarthy, Phillip J. Sampling Opinions: An Analysis of Survey Procedures. New York; John Wiley and Sons, Inc., 1958, pp. 451.

Webb, Kenneth and Hatry, Harry P. Obtaining Citizen Feedback: The Application of Citizen Surveys to Local Governments. Publications Office, The Urban Institute, 2100 "M" Street, N. W., Washington, D. C. 20037, 1973, pp. vi and 105, $1.95.

Educational Objectives/Goals

Bloom, Benjamin, et al. Taxonomy of Educational Objectives, Handbook I: Cognitive Domain. New York: McKay, 1956.

Harrow, Anita. A Taxonomy of the Psychomotor Domain. New York: McKay, 1972.

Phi Delta Kappa, Commission on Educational Planning, "Educational Goals and Objectives: A Model for Community and Professional Involvement." Bloomington, Indiana, 1972.

"Workshop Packet for Education Goals and Objectives." Phi Delta Kappa, Inc. Commission on Educational Planning, Box 789, 8th and Union, Bloomington, Indiana 47401.

Appendix E

Administrative Uses

In a survey of almost 1,500 school districts nationwide in 1982, the Educational Research Service (ERS) found that almost 90 percent were using computer technology for administrative purposes. The median date of the introduction of computer technology was 1972, according to ERS. An even earlier introduction was reported for larger districts and for districts with higher per-pupil expenditures.

A majority (59 percent) of the districts that used computers for administrative purposes either owned or leased equipment. ERS also found that 41 percent were purchasing services from an educational regional service agency, 29 percent were purchasing services from a commercial agency or college, and 15 percent were participating in a time-share arrangement. Most districts were relying on mainframes or minicomputers.

Some changes, however, are occurring. Some districts are giving building administrators computer capabilities they never had before by linking them to a large central computer.

Another change: Low-cost microcomputers and recent advances in software for these machines have put "computer power" within reach of the smallest districts and, in some cases, individual administrators within a district.

"At present prices, it is a worthwhile tradeoff to purchase personal computer stations to reduce the general paperwork burden that inhibits productivity," says Stanley Pogrow, associate professor of educational administration, University of Arizona.

Writing in *The School Administrator*, Pogrow adds: "The ease of using new software makes it more feasible for individuals without technical background to use computers effectively."

Another reason to consider the microcomputer for administrative use comes from Chase W. Crawford, consultant, Management Information Services for the Florida Department of Education. In the agency's "Educational Administrator's Survival Guide to Administrative Uses of Microcomputers," Crawford points out that the storage capacity of some microcomputers is now equal to that of many older, full-size computers.

Potential Uses

In general, Crawford says, four situations would generally justify the use of a computer provided that the task to be performed is of high enough priority to computerize. These are:

1. When massive amounts of data are processed through well defined operations.
2. When processing is highly repetitive.
3. When speed of processing is of great importance.
4. When the task to be performed is not practicable by other means.

The North Carolina State Department of Public Instruction groups the potential uses of computers for administrative purposes into three broad categories:

1. Traditional business data processing similar to that which exists in most large business and commercial concerns.
2. Management aspect of the instructional program, including student data that traditionally have been collected and maintained by individual teachers as well as guidance counselors and other support personnel.
3. Networking capability that can link individual schools to the system-level computer in addition to computers in other schools and agencies for information exchange and compilation of data.

Note: The Department offers a model for ad-

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ministrative uses as one way to design a coordinated systemwide plan (see the model in this chapter).

Supt. Phillip E. Leahy, Englewood (N.J.) Public Schools, lists 69 possible applications of microcomputers for school management in *Administrative Uses for Microcomputers, Volume 1: Software* (Association of School Business Officials of the United States and Canada, 720 Garden St., Park Ridge, Ill. 60068; $10). Twenty-six of the uses are concerned with students (e.g., enrollment projections, discipline history); 19 with personnel (e.g., staff directories, calendar); 15 with finances (e.g., general ledger, state aid forecasting); and 9 with facilities (inventories, custodial schedules).

Current Uses

How are schools currently using microcomputers in administration? A clue comes from a survey conducted in the fall of 1983 by the Florida Department of Education. It revealed that all but 11 of the state's 67 county districts were using microcomputers for one or more administrative purposes. The top administrative uses, according to the survey, were (in descending order): student records, attendance, media management, school accounts, FTE (full-time equivalent) accounts, instructional records, property records inventory, textbook inventory, and grade reporting.

Examples

- The Sacramento City Unified School District installed a pilot attendance system in two large high schools after losing $680,000 in three months because of reduced attendance. Traditionally, teachers took attendance for the first period classes only, and the district received state funding based on these figures. The new system, consisting of a microcomputer coupled with classroom scanning devices, enables teachers to enter attendance records at the start of each class.
- Approximately 1,000 classrooms (grades 1-12) are using a computer managed instruction system in diverse areas, including math, science, social studies, English, and reading. The microcomputer-based system, known as CAM — Demonstration Evaluation Center, was developed in the Hopkins (Minn.) Public Schools and is now part of the federal National Diffusion Network. To use CAM, teachers must first commit themselves to basing their instruction on course objectives developed by curriculum groups and teaching teams. Teachers test the objectives on a regular basis, every two or three weeks. CAM has also developed techniques to assist teachers in identifying instructional strengths and weaknesses. (For more information: Marie Weld, Evaluation Center, Hopkins Public Schools, 1001 State Highway 7, Hopkins, Minn. 55343.)
- Approximately 48 percent of 182 school public relations practitioners responding to a survey by Clement J. Cleveland of Benton Harbor, Mich., said they were using microcomputers primarily for these activities: word processing, database management (e.g., sorting names for mailing lists), typesetting, and accounting activities. Using his own district as an example, Cleveland estimated a 60 percent net savings in costs to produce one district document (a staff directory) using a database management program on a microcomputer and an electronic typesetter.
- Many districts are mounting a war on truancy with computerized, automatic phoning devices that let parents know when their youngsters are absent. In New York City's Taft High School, the "phone robot" raised attendance 8 percent in a three-month period. In Chicago, Tilden High School reported an attendance rate of 86 percent after the installation of the machine, up from 80.5 percent a year earlier. In Cincinnati's Withrow High School, administrators said they hoped to cut absenteeism from 18 percent to 5 percent. The principal said he also intended to use the machine to send home all kinds of additional messages — good ones as well as bad.
- Many districts are using computers to cut energy costs by controlling HVAC (heating, ventilation, and air conditioning) systems, lighting, and hot water consumption. Here are some examples of reported savings: The Colfax (Calif.) Union High School — savings of $14,000 per year through reductions in electricity consumption and diesel use; Tupelo (Miss.) High School — savings of $90,000 per year by chopping electrical energy consumption in half.

Deciding If You're Ready

A prime consideration in any decision to computerize or to change the way computers are used for administrative purposes is people.

That point was emphasized by Supt. Donald L. Kussmaul of the Tiskilwa (Ill.) Unified School District. He identified the specific people in a district who determine whether attempts to computerize administrative functions will succeed.

- The office staff. "Staff must be involved from the beginning. They must be convinced that it will be an aid. If they are afraid of the computer and what it might do to them and their job, then the program will fail from the beginning."
- Auditors. "They have used computers for years; consequently, the auditors are a wealth of knowledge about successful computer programs. In many instances, they can refer you to programs that are presently working and individuals who can help in selecting a good program."
- Board of education. "Involve the board of education in assessing administrative computer needs. . . . Make board members aware of the time it takes to do the payroll or prepare for a board meeting and the routine functions that must be done every month. The board must be convinced that the expenditure for a computer operation will be of value to increase efficiency and/or create savings in the future."
- The administrator. "You must be convinced that the computer will be of value. You must be willing to endure the change and some confusion when going to a computer operation. If you are saying, 'I don't know anything about computers, this is all new to me,' and six months later you are saying the same thing, you must reevaluate your position and either get interested in computers or continue as you have. There is nothing wrong with continuing as you have. Don't make the mistake of going for computers if you are not convinced."

Florida's Crawford outlined other considerations in deciding whether to computerize administrative functions:

- Initial cost (the initial hardware and software cost might outweigh the benefits to be gained).
- Computer illiteracy (not knowing which functions can and cannot be performed by a computer).
- Computerphobia.
- Security (figuring out which methods to use to ensure limited access to data).

Specific Steps

The following steps in making a decision come from Crawford and other sources:

- Become computer literate. Recognize that computerphobia is a common problem that starts to disappear with knowledge and, particularly, hands-on experience.
- Enable other staff members to do likewise.

What's An Administrator To Do?

It's Monday morning; your phone rings several times. Here are some of the requests:

Item #1. Come up with a budget for a short term project.

Item #2. Project facility use and staffing needs (and cost figures) for both regular and special education programs.

Item #3. Give a speech to the PTA meeting tomorrow night.

Item #4. Come up with a system to keep track of the skills of all volunteers, so they can be matched with needs identified by classroom teachers.

How do you fill all of these new requests, in addition to keeping up with your regular work?

For more administrators in the future, the answer may be: turn on your computer.

In a district inservice for Portland, Oreg., principals, Judy Edwards Allen, professor of education at Portland State University, offered these solutions to the above problems:

Item #1. "Using an off-the-shelf microcomputer program for which the generic name is 'spreadsheet' and the trade name is some version of 'Visicalc,' you can play with various versions of the budget in question, changing line items and seeing immediately the effect on the bottom line without hours of tedious work with a calculator. When the budget finally looks like you want it to, you can print it out for your supervisor."

Item #2. "Using the spreadsheet again," Allen noted, "you can develop the necessary projections and can relate them to reality by attaching real cost figures."

Item #3. "Using a word processor at your desk, you can develop your speech, move or delete or insert paragraphs or lines or sentences or words, check your spelling, and print out versions of the speech as it develops. You can store the speech on a diskette and modify or add to it again later for another occasion."

Item #4. "Filing and database programs carrying trade names such as DBMaster, Visifile, PFS, or Data Factory could be useful in meeting the need for a small database," Allen said.

They should be involved in decision making about computerization, too.

- List all of your potential uses of a computer, now and in the foreseeable future. Determine whether computerization is needed at the district or school level, or both.
- Set priorities. Determine, for example, which manually performed tasks that could be computerized require the most work and/or the most time. Keep in mind that you generally must have a good manual procedure for completing a task before you will be able to computerize it.

Consider: If you put junk data into a machine, you will get junk data out. Here's an example of applying this principle, as explained by Jerry Kantlehner in *School Business Affairs*: Suppose you want to computerize administrative details of the custodial service. You will need to determine if inventory data is timely and accurate, if detailed usage and recorded data exist, and if material and labor costs have been established in each area involved.

- Outline what you need to have done regarding each task (e.g., if you are considering purchasing a word processing system, determine the number of users and where they are located, the quantity and kinds of written materials they produce most often, and whether it is for in-house or outside distribution).
- Talk to other schools or districts about their experiences in using computers for administration tasks.
- If you do not have computer expertise, draw on those in the community who do. "In addition to providing informed guidance," notes Sue Talley, former manager of micro systems for the Minnesota School Districts Data Processing Joint Board, "this guarantees that these individuals will accept part of the responsibility for successful implementation."
- Talk to sales personnel. Crawford advises: "The way in which a salesperson approaches you as a customer is very important. Avoid a salesperson who tries to sell you computers; choose one who tries to sell you functions."
- Conduct a cost/benefit analysis for each function being considered for computerization.
- Consider what security methods you will need to assure limited access to data.
- Consider future needs. Keep in mind that it's better to buy hardware that will meet your needs next year, too, rather than considering only what you require right now.

Guidelines: Purchasing Micros

Crawford gives three basic steps to follow in deciding which microcomputer to purchase for administrative purposes:

1. Decide which administrative functions should be automated and in what order of priority.
2. Identify which software best automates these functions.
3. Select the hardware that runs the selected software.

The New Jersey School Boards Association offers some additional "common-sense guidelines" for purchasing and implementing an administrative system in *Micros for Managers: A Software Guide for School Administrators* (the Association, 315 W. State St., P.O. Box 909, Trenton, N.J. 08605; $25 plus $3 for postage). It recommends:

- Fully test the hardware system, configured to meet your specific data retrieval, storage, and manipulation requirements.
- Get an evaluation of your system configuration from other users who have experience with the system.
- Do not buy a hardware system to serve multiple functions, that is, a system for both administrative and instructional purposes.
- Allow sufficient time for the selection/purchasing process. Do not rush into purchasing any hardware/software configuration, no matter what its reputation.
- Do not eliminate old procedures and systems until the new configuration is fully operational. In fact, operate the old and the new in tandem for a substantial period of time before dismantling the old.

The minimum requirements for a microcomputer to be used for administrative purposes, in Crawford's opinion, are: a standard typewriter keyboard, an 80-character wide screen with a diagonal measure of at least 12 inches, a 132-column wide, quality dot-matrix or character impact printer, 64K memory, and two floppy disk drives.

Micros for Managers recommends several optional pieces of hardware for administrative uses: an automatic optical card reader (for test scoring and test analysis applications); and, for scheduling and attendance applications, a hard disk [a microcomputer storage device] with a minimum of 5 megabytes capacity.

Guidelines: Purchasing Software

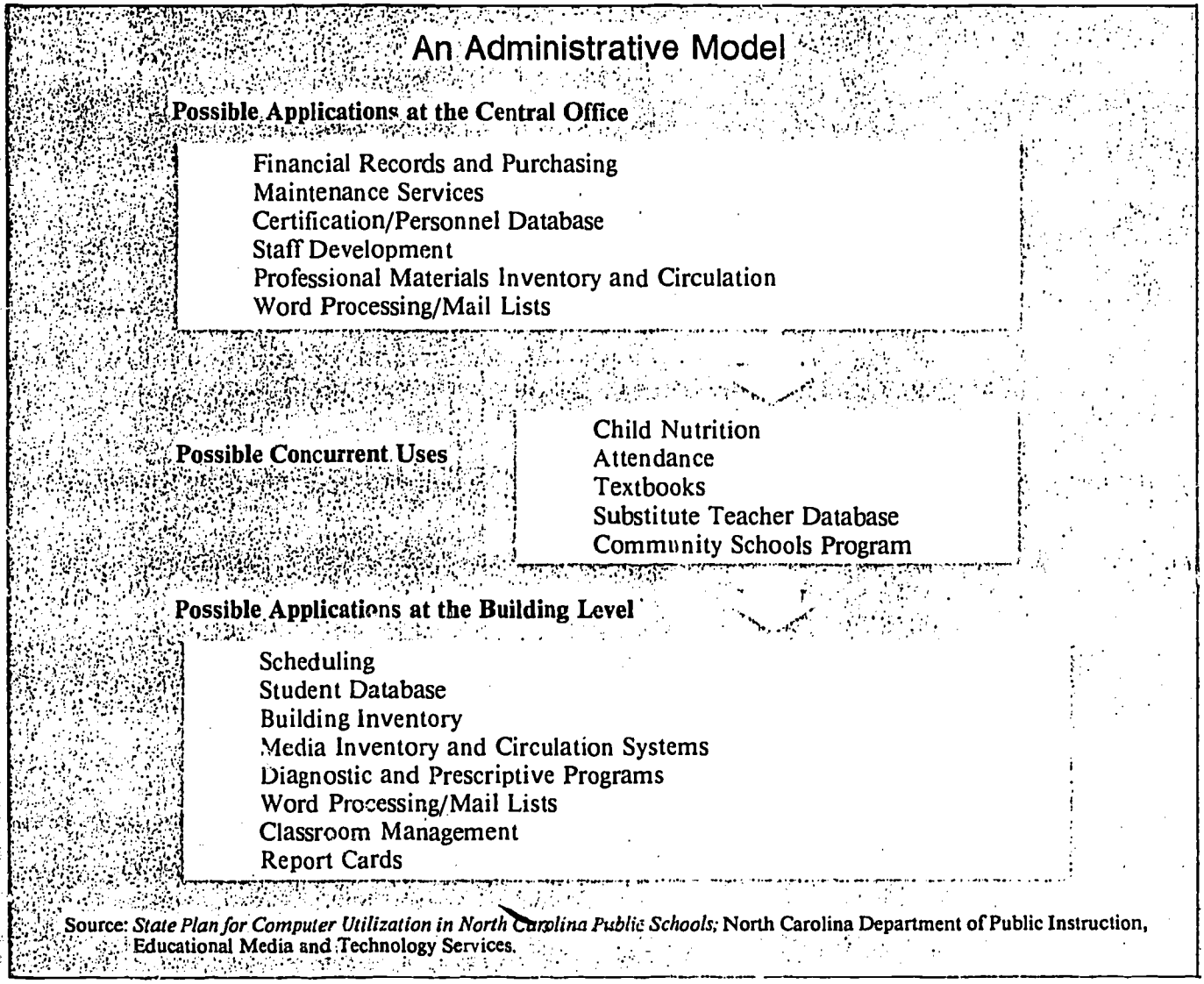
In terms of software, educational administrators can use the most popular and readily available "general" software packages to perform most administrative jobs. In addition, according to Crawford, there are more than 250 software programs designed specifically for educational administration purposes (e.g., attendance, class scheduling).

Note, however, that Crawford advises administrators to consider buying general software programs rather than those designed to handle specific functions of educational administration.

This general software falls into three categories: data (or database) management systems, electronic spreadsheet systems, and word processing systems. According to Crawford, such software is more effective for several reasons: it can be used for multiple purposes; it allows more flexibility in designing how information is put into the machine and how it comes out; it is available from a local retailer rather than a mail-order supplier; and it is less likely to have "bugs" in it than recently developed educational administration software.

Another point to consider is the *efficiency* of using general purpose software. An example: Using a database management system, information such as student names, addresses, and other data can be typed once and used as a common base for various reports (e.g., attendance, scheduling classes, recording grades). It does not have to be retyped for each separate use.

What about designing and programming a system that precisely meets your needs? Crawford's



Source: *State Plan for Computer Utilization in North Carolina Public Schools;* North Carolina Department of Public Instruction, Educational Media and Technology Services.

general advice is to purchase educational administration software rather than to design your own system.

This advice is seconded by Richard Wootton, Arizona State University, Tempe. "Writing your own administrative programs in a high level language is no longer recommended in view of the more cost-effective and excellent software available." He recommends the use of general purpose software, noting that "you need not be a programmer to use it, just moderately accurate on a keyboard, patient, and persistent.

"Even if you buy standardized administrative software," Wootton adds, "almost any school or district should obtain the appropriate spreadsheet, filing system, and word processing programs for the computers which it has. You will discover that they have many uses for saving time and improving operations."

For help in evaluating the software in which you are interested, obtain a copy of these two forms: "Administrative and Instructional Management Package Description" and "Administrative and Instructional Management Package Evaluation." The forms are available from the Northwest Regional Educational Laboratory, 300 S.W. Sixth Ave., Portland, Oreg. 97204.

Note: Crawford periodically updates "The Educational Administrator's Survival Guide to Administrative Use of Microcomputers." Included in the Guide are criteria for evaluating software and hardware and descriptive lists of available software. For more information, contact Chase Crawford, Consultant, Management Information Services, Florida Department of Education, Tallahassee, Fla. 32301.

Tips

✓ Remember that computers are not a cure-all. Dale Hancock, principal of Willis Junior High School, Chandler, Ariz., offers this advice: "With an organized administrator, computers will be efficient. With an unorganized administrator, they will be inefficient."

✓ Beware of the hidden costs of computerizing administrative functions. Examples: training costs for those who will use the system, costs of consultants for needs assessment and initial set-up, maintenance costs, special furniture to accommodate new equipment, insurance.

✓ Purchase hardware and software from a dealer who has a good reputation, an onsite repair capability, and a convenient location.

✓ Don't underestimate the "people problem" in implementing new technology. Some experts recommend gradual conversion, for example, in automating offices. Sue Talley, formerly of the Minnesota School Districts Data Processing Joint Board, advises: "Most often, staff will need training to overcome their apprehension of initial machine use and then specific operational training to use the software as the selection and acquisition committee envisioned. Focus initially on applications which have a high probability of success. . . . Let the success of the initial installation serve as a building block to growth in other areas. Peer communication of success creates interest and desire for productive use."

Talley favors slow implementation so that problems can be corrected while they are small. "Converting the entire clerical staff to the use of word processing may slow production drastically at first," she says. And, no matter who must learn to use the new technology, "they must have time away from regular duties to do so," she adds.

Judy Edwards Allen, professor of education at Portland (Oreg.) State University, offers this guideline: "There is a direct relationship between *comfort* with the computer and the number of hours spent in becoming computer literate." For administrators, "who are used to being leaders," she says, "it's very *uncomfortable* to feel not in control of something (i.e., computers) which is having such a pervasive effect on your school."

But, she adds, only a small number of hours are needed to start to become comfortable with computers. "One way to accomplish this," she notes, "is to take a computer home with you over the weekend and get acquainted in private, then ask questions of your most computer literate teacher. You may wonder, 'How can I be a leader if I have to go to one of my teachers to get literate?'" But, Allen asks, "how can you be the leader if you don't go to the teacher and become literate?"

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THE MICROCOMPUTER IN THE ADMINISTRATIVE OFFICE

Fred Huntington

There is only one resource that an administrator cannot increase when needed. It is not money. It is time. There is never enough time and there is no way to get more than twenty-four hours in a day. The only alternative is for the administrator to manage time more wisely. How does the school administrator keep up with the additional demands that are being heaped upon him or her? How can an administrator manage time wisely when more work is being expected of him or her?

There is an answer. Not a panacea, but a way to get organized and to eliminate some of the drudgery of the paperwork. The answer is the use of a microcomputer in the administrative office. Time management is only one way that a microcomputer can assist the manager. Other uses (which ultimately affect time management) include word processing, attendance, financial accounting (budgeting/payroll), data collection (inventory), and paper shuffling.

While some of the applications mentioned here will pertain only to the central office or to the site-level administrator, many of the proposed uses will fit both categories.

Time Management

Software manufacturers are just beginning to publish programs that will help a manager keep track of his or her many appointments and obligations. For example, the Epson QX-10 Computer has a built-in clock that will beep at certain predesignated times to announce time of appointments.

If an event is scheduled for several months in advance, the computer will keep track of it. If an administrator's time is being split between funding sources and a log is needed to keep track of the time spent on each project, the computer can be programmed to automatically calculate the time spent on each project.

When an executive has to work ten to fifteen hours a day, time is too valuable to waste. The computer can help keep the appointments straight, make notes about when the last conference occurred, and more. Some time management systems include other functions such as address/phone books, desk organizer notebooks, and a card index.

Basically, three main types of programs help the manager to manage time more efficiently: word processing, financial accounting (including the popular electronic spread sheets), and data base management. A description of each category will follow, along with possible applications.

A serious warning must be issued, however, to those administrators who want to computerize their offices. Start slowly and add gradually. Learn each component of the present system before going on to something else. One should not expect to walk in on Monday morning with a new computer and have everything computerized by Friday afternoon.

A good way to start is with a word processing system. Learn the word processor, and then add a spelling checker, and then a mailing list. Don't be afraid to play a few games. The games will help teach the use of the keyboard and the idiosyncrasies of the computer. Play the games after hours, however, as other people in the office might not understand!

The next move would then be to an electronic spread sheet (explanation to follow). After that add a simple data base management system.

Another warning: don't scrimp on the system. It is cheaper to do it right the first time. An entire system, one of the best available, including a letter quality printer, can be purchased today (1983) for between four and six

thousand dollars. That is less than half a year's salary of the worst secretary. A good system will not only do more work than a half-time secretary, but it will do it much faster and much more professionally and efficiently.

Sometimes when organizations go to computers, they don't save any work, they just get more information. A manager must be careful not to fall into that trap. It is probably not important to a principal, for example, to know how many Title I children with Spanish surnames live on Main Street, have been in the district three or more years, and have shown at least a year's growth on their CTBS Math Computation scores. But it is possible to easily find that information.

After the manager gains confidence in his or her ability to use the word processor, an electronic spread sheet, and a simple data base system, then it is time to start looking at some of the accounting or attendance packages and the more sophisticated data base management systems. It may take a year or more to get to that point, but that is all right. A year spent learning a system will pay off in large dividends later. If the computer was to do nothing other than word processing, it would pay for itself in a short time.

When choosing a system, the administrator should talk to everyone who will talk to him or her. Go through the computer magazines and call the toll-free numbers and pick the vendors' brains. Some will be nice and will give lots of time. Others will only take orders and won't give you the time of day. Remember those who were helpful when the final purchase is made.

Find out when the local computer users' groups meet (usually can be determined by calling the local computer store). Read all the computer books the local library has. Buy and read as many computer magazines as possible and talk to friends who have systems.

Starting Point: The Word Processor

Word processing is simply a method of using the computer to write letters, make reports, and generally put down on paper that which used to be typed or scribbled on a note pad.

When someone says he or she is going to purchase a word processor, it is generally assumed the person already has a computer, printer, disk drive and monitor. The term *word processor* is usually meant to refer to the software, that is, the program on the five-and-a-quarter inch floppy disk that goes in the disk drive, and the documentation (directions) that accompany it.

Some offices used to refer to a word processor as a dedicated computer (one meant exclusively for word processing, plus the printer and drives). Today, computers serve many roles and are not generally dedicated to just a single function such as word processing.

A word processor (the computer program) must not be purchased simply because it is the cheapest or most popular. A word processor must be chosen according to the needs which have been determined. For example, if the writer is going to use the word processor only for an occasional letter, then a simple, inexpensive word processor such as Bank Street Writer might be a wise choice. If the writer is going to spend a lot of time with the processor, and write ten or more pages for some documents, then the best, most sophisticated program money can buy should be the consideration. There are no savings to be had by purchasing an inexpensive word processor that does not fulfill its intended purpose. The most expensive, generally available word processors on the market today for microcomputers have list prices in the $400-$700 range, and can usually be purchased at large discounts.

If the person using the system is going to need a lot of hand holding, then pay the full retail price and buy locally where help can be obtained. Do not expect to get both a discount and help.

Obvious uses of the word processor include letters to parents, staff members, general correspondence, staff bulletins, and reports. Most people find that with a word processor, a final, professional-looking copy can be obtained in less time than it used to take to scribble down notes to one's self. In many cases, the secretary is no longer needed to type letters and reports.

There are options available with many word processors that check for spelling and grammar. Several word processors will even utilize a built-in thesaurus to find synonyms quickly and easily; in a second or two it will look up the word and then instantly place it in the body of the text, if so desired.

If the writer decides that a paragraph is in the wrong place, a few quick keystrokes will move that paragraph to a different part of the manuscript. If a name is consistently misspelled in the same way two hundred times in a document, one command will change the name to the correct spelling, all two hundred occurrences, in a matter of seconds.

Many people have said that the best all-around word processor on the market today is WordStar. Although sometimes considered difficult to learn to use, there are now a number of tutorials, books, and sound recordings that make WordStar easy to master.

It is very important that one not buy a word processor until reviews in the computer magazines are pored over and some lengthy discussions are held with people who have used that particular word processor extensively. In most cases, the word processor is the single most useful, most important piece of software a manager can own.

Financial

After an administrator starts to feel comfortable with the word processor, then the next step is using an electronic spread sheet such as VisiCalc, SuperCalc, MultiPlan, 1-2-3, etc. These programs have been called electronic scratch sheets and will allow even the novice to make complicated budget projections based on a number of variables. For example, if a school principal were to plan his or her instructional aide's cost using VisiCalc, then he or she could tell in less than a second what all costs would be if insurance benefits were to increase two percent or if a three percent raise was given instead of a five percent raise.

Budgets become very easy to plan and modify. The electronic spread sheets do all the calculations and recalculate the changes almost instantly.

For specific purposes, templates and financial modeling packages may be added to the spread sheets. A template is a model produced for a specific application. The user does not have to format anything, just input the numbers. Many templates are available for general business use, but very few have yet been produced specifically for educational purposes.

More complex accounting procedures can be introduced on the computer as familiarity proceeds beyond spread sheets. Payroll programs, for example, can possibly save many hours and dollars by calculating the payroll, taking out deductions automatically, and printing the checks and W-2 forms.

Financial programs are beginning to appear that are specifically designed for schools. For example, Addison-Wesley Publishing Company publishes a program called PURCHASE which manages the annual school purchasing system's entire process from preparation of bids to the final awarding of orders. It claims to eliminate tedious typing such as requisitions, bid invitations, and delivery schedules. Supposedly, arithmetic errors are virtually eliminated and professional quality work is produced.

Addison-Wesley also publishes BURSAR which monitors funds generated by extracurricular activities. This system allows a person to open, close, and update accounts, journalize transactions, monitor accounts on video display, and print trial balances and monthly statements for up to 250 fund accounts and up to ninety-nine asset accounts.

Attendance

Attendance accounting seems to be a natural problem for the computer to handle. However, caution is advised here.

There are a number of attendance programs available for microcomputers. The problem is that each state has different laws so each state has to have a different program. An administrator would be wise to stay away from any attendance program that has not had extensive testing and use in the state in which the program is to be implemented.

Under no circumstance should an attendance program be purchased until it has been checked out by talking to officials at no fewer than two schools that have been using it for at least a year. If the vendor is not willing to supply names of users, then that should be a clue to a would-be purchaser. If the product is "too new" then offer to Beta test the program for the manufacturer in turn for a free copy of the program. As with any accounting procedure being done on the computer for the first time, do not discontinue the old way of accounting until everyone is sure the computer is doing its task completely right. This may mean double work for a while but it will be well worth it in the long run.

Another problem is that when microcomputers are combined with five-and-a-quarter inch disk drives, there is a great deal of disk switching which considerably slows the attendance accounting procedure.

If attendance accounting is to be done with a microcomputer, then a hard disk (a non-removable disk capable of large amounts of storage) should be considered. The difficulty with using a hard disk is that many publishers are afraid that someone will try to copy their programs and thus format the software so that it cannot be copied, not even onto a hard disk. Therefore, its effectiveness might be limited.

Inventory and Data Base Management System

Inventory control is very easy when using a program such as dBase II. The user can create a program to inventory all the audiovisual equipment in a school or district in less than five minutes. With this type of program (called a data base management system), once the data are entered, the operator can ask the computer to print out a list of all the projectors purchased in the last five years that have a CX in the serial number and it will be done in just a matter of seconds.

dBase II is available for many different computers, and is one of the best currently in use. Other good data base systems are now becoming available for various microcomputers.

A data base management system can also keep track of student referrals, report cards, important dates, serial numbers, books, records, P.E. equipment, absences, and much, much more. It is in most cases the second most important piece of software that a manager can own.

Paper Shuffling

One of the best uses of a computer is to train the computer to rid the manager of the over-burdening mountains of paperwork. In California, for example, when a student is suspended, there is usually at least half-an-hour of paperwork to be done by the principal. Then, the documents have to be typed by an already overworked school secretary. To make it worse, suspensions invariably seem to happen at inopportune times when there is not enough time to do them properly.

This writer has solved that problem by writing a program that does the suspension paperwork for him. A year's worth of suspension records were examined. All infractions ever mentioned as factors leading to suspension were programmed into the computer. Now, if a child is to be suspended, there is a long list of infractions to choose from, and the principal may add her or his own.

What used to take thirty minutes now takes thirty seconds. If it is the second time a child is suspended, it takes even less time because the child's name and address are already a part of the data base. The program now grinds out all the forms needed by the district office while typing a very professional-looking, personalized letter to the parents.

Where the form letter used to say "A copy will be placed in your child's cum folder," it now says "A copy will be placed in Sally's cum folder." There are personal references throughout the letter. And, if the parents don't show up for the suspension conference, they get another personalized form letter that stresses the gravity of the situation.

Likewise, teacher evaluations were done by this writer in much the same manner. While not all evaluation procedures would lend themselves to computerization, it is a quick and handy way to take care of the more routine part of the evaluation.

There are many, many more ways the computer can be used in the administrative office. If the work is presently being done on paper, the chances are that it could be done more efficiently and thoroughly on the computer in much less time.

One positive side effect is that as the teachers in a school see their administrator use the computer to cut down on his or her work load, the teachers become less afraid of the computer and become more interested in seeing how it can help them in their classrooms to help children.

Start Small

The administrator should start using the computer in the administrative office on a small scale and gradually become familiar with its functions and not expect overnight miracles. The computer is just a tool, and like any other tool, it takes time to learn to use it.

Start with word processing and then move to an electronic spread sheet. Be cautious of attendance programs. Initiate a data base program as soon as possible.

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WORD PROCESSING AND TEACHER EVALUATION

How a word processor helps me give constant guidance to my teachers.

BY J. R. PENNINGTON

J. R. Pennington is the Director of the Georgia Department of Education's Educational Technology Task Force and the former principal of Decatur High School in Decatur, GA.

(Editor's Note: *Some of word processing's vast range of school applications are well known: sending "personalized" letters to parents, for example. The potential benefits of using word processing programs, however, extends as far as your own imagination can take them. In this article, former high school administrator J. R. Pennington describes the way he used a word processor to help improve his handling of an important daily responsibility.)*

Please take notice of the following recommendations and/or commendations. These comments aren't meant to represent a formal evaluation. Rather, recommendations are intended as suggestions or guidelines for improvement; commendations are intended as recognition of above average performance.

COMMENDATIONS:

Lessons are well planned, classroom management assures a well disciplined and responsive atmosphere.

RECOMMENDATIONS:

More attention should be paid to maintaining accurate daily records of each student's punctuality and attendance.

Teacher's Signature Date

In this screen shot, a standard form letter has been combined with commendations and recommendations.

SEVERAL YEARS AGO I STARTED looking around for a better and easier way to do teacher evaluations. The idea I finally stumbled upon involved using a word processing program to "merge" memos to individual teachers with a list of predetermined commendations and recommendations. It's a process that should work well for anyone who has a word processing program with a merge or insert function that allows the combining of text from two or more files into a single document.

What I Needed to Accomplish

In my search for new ways to tackle teacher evaluation, I had two major considerations. First, if an evaluation is going to be effective, it needs to be timely. Teachers shouldn't have to wait for months before they find out whether you think they're doing a bang-up job—or whether you feel there is room for improvement in certain areas. Second, any kind of feedback, whether it's praise or admonition, has to be specific and unambiguous.

Many of the evaluation forms currently used by school administrators make both of these goals difficult to achieve. They tend to be long and usually require you to evaluate a large number of "evaluation areas" at one time. This means that you wind up reviewing a teacher's performance over such a long period of time that the teacher may fail to relate your ratings and comments to specific personal circumstances or activities.

I've always felt that the most effective evaluation is a written one, made on an individual basis as the need arises, rather than according to a set evaluation schedule. In other words, when a teacher performs in an outstanding way, he or she should immediately receive a letter of commendation for the good work. Or, conversely, when a teacher fails to perform well, he or she should receive feedback that specifies the weak areas and suggests ways to improve.

I think most people (teachers and administrators) would agree that this kind of evaluation is desirable. But it's difficult to do all year long for every teacher because of the substantial time and effort required to produce those letters. Difficult, that is, unless you have a word processor. A word processor with a merge or insert feature lets you combine a standard form letter with new comments, or, as in my case, with carefully selected commendations and recommendations.

How I Set Up the Procedure

My first task in creating this electronically-aided evaluation system was to develop, on the word processor, a brief form memo. I gave the memo the name Teacher Evaluation Form A (an easy one to remember), and saved it. Then I made up a list of commendations and recommendations. By reviewing old evaluation letters, I was able to come up with quite a few of these. *(For some examples, see the box on page 68.)* I saved each commendation or recommendation in a separate file, giving each file a short, easy-to-remember name. I labeled my commendations, for instance, C1, C2, C3, etc., and my recommendations R1, R2, R3, etc. Most word processing systems allow you to store over 100 file names on a single disk, so I was able to compile a fairly comprehensive list of comments.

Once my files were set up, the rest was fairly easy. Throughout the school

(Continued)

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(Continued)

year there were times when I felt that various teachers should receive commendations, recommendations, or both. Since my evaluatory comments were already prepared, all I had to do was select the appropriate form, (Teacher Evaluation Form A) and use the processor's insert, or merge, function to combine a copy of it with the comments I wanted to include *(see screen shot on page 66)*.

If you and other administrators in your school or school system use the same word processing system, you might consider pooling your evaluatory comments and form letters. This would help make your evaluation process consistent throughout your school.

How have the teachers responded? At my school, teachers told me they much preferred reading my comments than receiving a number rating on a more impersonal form. Also, teachers liked receiving a timely evaluation. The results showed that they made changes more quickly and there were fewer misinterpretations of comments. Finally, this method allowed me to give three or four times more feedback to teachers than I would have been able to provide otherwise.

If this procedure works well for you—don't stop with evaluation letters! There are all kinds of similar applications you can make using your word processor. For example, you could develop Individual Educational Plans (IEP's) by first developing a form letter and then creating separate files for additions, including long-range goals, evaluation strategies, and various state and federal guidelines. The fact is: There are probably as many applications of this procedure as you have time to think up. Good luck... **EL**

SAMPLE COMMENTS

C1. The pleasant manner in which you relate to both students and teachers is noted and appreciated.

C2. Your cooperation in both class and extracurricular assignments is appreciated.

C3. Your lessons are well planned. Your classroom environment is pleasant; your students appear to be well-disciplined and responsive.

C4. Your classroom activities seem very interesting to students and directly relate to the major points of the instructional material.

C5. You appear to be a very adaptable teacher who is receptive to new ideas in education and who demonstrates a flexible approach to teaching.

R1. More attention should be paid to maintaining accurate daily records of each student's punctuality and attendance.

R2. More attention should be paid to the classroom conduct of your students.

R3. Try to maintain a neater classroom.

R4. Continue to perform in the excellent manner noted above.

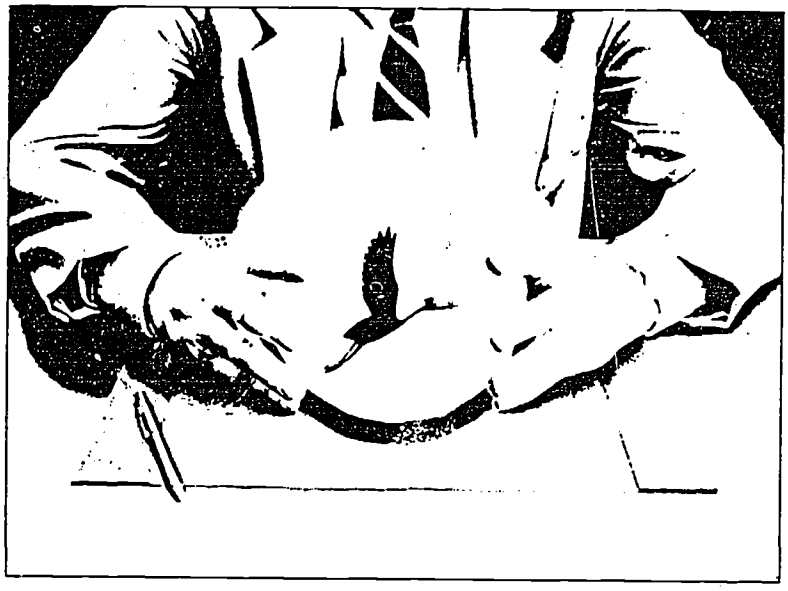
THE ADMINISTRATOR'S NOTEBOOK

SPREADSHEETS AND PUPIL ENROLLMENT PROJECTIONS

How I predict enrollments with less than one percent error.

BY PAUL KACANEK

Paul Kacanek is Coordinator of Research Evaluation and Pupil Services for the Ypsilanti School District in Ypsilanti, MI.



A FEW YEARS AGO, policy makers in the Ypsilanti Public School District had to make some serious decisions. Like many school districts, we suffered the three-pronged attack of a flagging economy, an eroding tax base, and declining enrollments. Money was tight and several schools had a number of empty classrooms. We had to consider closing one or more schools and modifying the middle school grade-level structure.

Since staffing and classroom use hinged on enrollments, precise enrollment projections were essential to study the best use of our facilities. That was easier said than done. Two problems presented themselves.

First, the only data that we had on hand—districtwide projections by grade level—were inadequate because they didn't include information on students in each school building. In short, we didn't have actual student head counts, only the percentage of students that was used for state funding.

Second, we realized the calculations and updates would be tedious at best. An electronic spreadsheet was the answer. For one thing, an electronic spreadsheet can update figures immediately: Enter the new numbers and the program recalculates all the variables at once. This is important since most districts need to know how many students they'll have before they can determine how many teachers—and classrooms—they'll need. And because you can instantly recalculate any figure, you can easily pursue "what if" questions. For example, you can project what might happen if all sixth graders currently in elementary schools were moved to the middle school.

> "I CERTAINLY WON'T COMPLAIN IF THIS FALL'S PROJECTIONS ARE AS CLOSE AS LAST YEAR'S."

The Spreadsheet Layout

Our enrollment projections began with my roughing out what I wanted the spreadsheet to look like. I wanted to include data for a total of ten years—five years in the past (actual data) and five in the future (projection data). I wanted to show information for each school for each of the ten years and then also the cumulative information for the schools during those years. In displaying this information, I included the names of the schools in the first column, and actual enrollments or projected enrollments for each school in each of the ten years in the succeeding columns. Finally, I wanted to break this information into other grade-level configurations, which would be displayed in two additional tables.

The Forecasting Model

Though the spreadsheet program could quickly take care of the laborious calculations, it could not actually forecast, of course. Hence, the physical layout of the spreadsheet was only the beginning of the task. I still needed to create a model that would enable me to forecast accurately. In essence, I needed a way to determine reliable numbers to add or substract within the cells of my spreadsheet.

(Continued)

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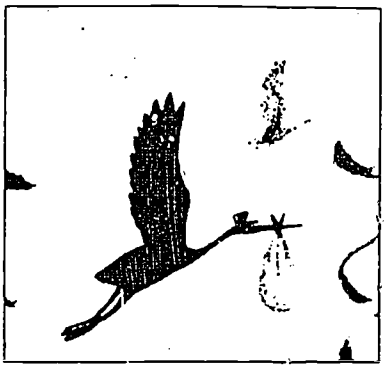
To begin with, there were three major considerations I needed to address. First, I had to identify the underlying assumptions of the model. In my case, I assumed that:

- no unusual changes had occurred in the characteristics of the district (for example, district boundary changes, a new housing development, or the closing of a nearby private school);
- the projected elementary school enrollments did not include self-contained special education classrooms;
- cohort survival ratios—the number of first-grade students, for example, moving into second grade—over the past five years were reliable.

Second, I had to decide which type of *live birth rate* (reflecting the number of births) would generate the most accurate projections. After examining city, township, and county statistics, I found the county data to be the most reliable predictor.



Finally, for purposes of comparison I had to make sure that the enrollment data was consistent. I decided to use student head counts that had been reported annually to the Michigan Department of Education on the "Fourth Friday" in September.

Using the Program

Once I had determined the guidelines for comparing data, I could put the data into the spreadsheet cells and run the program. I began by entering student enrollment data for each school in the district for the past six years. The spreadsheet program then:

- automatically computes cohort survival ratios for each grade within each building;
- generates five-year projections for each grade within each building;
- combines these statistics into a total district enrollment summary, broken down by grade level.

With the district summary data, I programmed the spreadsheet to provide two alternative grade-level configurations: one for grades one through six and grades seven and eight; the other for first through fifth grade and sixth through eighth grade. I also programmed it to provide projected enrollments for sixth through eighth grades for each of the two middle schools. (While some of my configurations may not be applicable to other districts, I mention them here to illustrate the flexibility of using the spreadsheet.)

The beauty of the spreadsheet, of course, is that annual updating is uncomplicated. It requires deleting one column, inserting a new column, and then editing some text. For instance, next year I will be deleting the 1978-79 data column and inserting a column for "Fourth Friday" data for 1984-85. The spreadsheet will automatically calculate the projections for 1985-86 through 1989-90. Editing would include, for example, changing the 1988-89 heading to 1989-90.

Another advantage is that you can print either the complete model or any portion of it. In the spreadsheet program I used, all I had to do to direct the printer to print the entire model in compressed type was to enter "the carrot symbol, C I K, carrot symbol, H 0 F" in the "set up" string in the print command sequence.

The enrollment forecasting model has been particularly successful. The projected district enrollment for last fall was 5,850 and the actual enrollment was 5,906, a difference of less than one percent. I certainly won't complain if this fall's projections are as close as last year's. EL

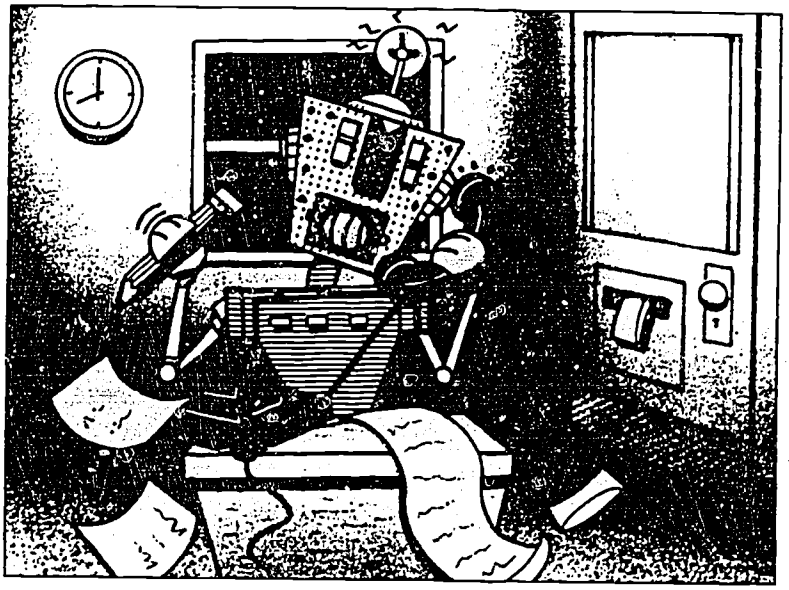
THE ADMINISTRATOR'S NOTEBOOK

TRACKING TRUANTS WITH AUTOMATIC DIALERS

Used with micros, dialing machines can increase attendance and simplify reports.

BY TONY MCGINTY

Tony McGinty is an Associate Editor of Electronic Learning.



IF YOU COULD FIND SOMEone willing to stay late at school every day to call the home of every student to get an explanation for every absence, you'd hire him, wouldn't you?

Well, you don't have to. You can buy him. Or to be more accurate, you can buy any one of several robotic dialing systems to do the same thing. Not only can these dialers make calls faster than any human being, they can be programmed to call long after the school has closed, when working parents are easiest to reach.

Administrators are using dialers to get messages to parents quickly—everything from when report cards are coming home to the date of the next PTA meeting. But administrators agree, the most effective use of these systems is in contacting the parents of absent students. Across the country, school systems using dialing systems report they are effective in improving average daily attendance:

- In Broward County, Florida, schools report countywide gains of two percent in high school attendance. One of these, McArthur High School, reports a gain of seven percent.
- In Stockton, California, the Stockton Unified School District reports that attendance in its high schools is up by one to four percent.
- In New York City, the Board of Education tested a dialer at Taft High School in the Bronx. After attendance rose ten percent, the city decided to purchase a dialer for every high school. Los Angeles is doing the same.

For schools in the 38 states with funding formulas that take student attendance into consideration, the increased attendance produced by a robot dialer can more than pay for the $4500 average price of a system. Also, some systems can be linked to microcomputers to produce routine administrative reports that simplify the task of tracking and reporting school attendance.

DIALERS MAKE CALLS FASTER THAN HUMAN BEINGS CAN, AND CALL WHEN WORKING PARENTS ARE EASIEST TO REACH

How They Work

The basic system is a stand-alone dialer with two tape recorders. *(For comparisons, see chart on following page.)* One tape recorder plays the school's message. The second records a response to the school's message.

The list of phone numbers to be called is entered into the dialer using the kind of keys found on a Touch-tone phone. Other methods of entry, such as those that make it possible to enter numbers from a tape cassette, are also available.

Several of the systems also allow phone numbers to be entered from a microcomputer linked to the dialer, either from the computer's keyboard, or from a data base that can be saved on the computer. However, not all the manufacturers who claim you can download numbers from a computer data base into their dialer supply a software package that can do this. Unless you're prepared to write your own program, you'll be better off dealing with a manufacturer who has a software program available for your computer.

Once the phone numbers are loaded, the dialers are generally able to

(Continued on page 26)

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A GUIDE TO SELF-DIALING ATTENDANCE SYSTEMS

MANUFACTURER	DIALER/PRICE	HARDWARE SYSTEM INCLUDES	ADDITIONAL HARDWARE	METHOD OF ENTERING NUMBERS	SOFTWARE AVAILABLE	SYSTEM CAPACITY	MULTIPLE MESSAGES	FEATURES
Computer Dynamics Corp. 3754 Hawkins, NE Albuquerque, NM 87109 800/545-6404 NM: 505/345-2455	Dynapro $2995 Dynatel $3995	Dialer, transmit tape and response tape Dialer, transmit tape and response tape, computer interface port, printer	 Any computer (O)	By hand, by cassette tape By hand, by cassette tape, from computer data base	N/A No	1,000 numbers per cassette 1,000 numbers per cassette or diskette	No 8	TR/AR/AH TR/AR/AH
Creative Marketing Concepts 8265 Commercial St. La Mesa, CA 92041 619/698-8638	Prospector 8200 $3995	Dialer, transmit tape, response tape, and small built-in printer	Memory units with 2,000 additional numbers (O)	By hand	N/A	2,000 numbers	Only with add-on memory unit	TR/AR/AH/LD
InteleCom 4321 W. College Ave. Appleton, WI 54915 800/558-3483	Talking Computer $3995	Dialer, transmit tape, response tape, computer interface, printer	Any computer (O)	By hand, by cassette tape, from computer data base	16 Message Capability software ($200)	1,200 numbers	16 with optional software package	TR/AR/AH/LD
Melita Electronic Labs 8070 E. Morgan Trail PO Box 5120 Scottsdale, AZ 85261 602/998-3600	Melita 3000 Series 1 line, $6995 2 lines, $7995 3 lines, $8995 4 lines, $9995	Dialer, transmit tape, response tape, computer interface port, battery backup	Any computer (O), printer (O)	By hand, by cassette tape, from computer data base	School Software (no extra cost)	30,000 numbers	2	TR/AR/AH/LD
Microlog Corp. 4 Professional Dr. Gaithersburg, MD 20879 800/562-2822 MD: 301/948-5307	Truant $4995	Dialer, transmit tape, response tape, computer interface port, printer, battery backup	Apple IIe, II Plus, IIc (O), IBM PC (O)	By hand, from computer data base	Available for Apple family and IBM PC ($500)	1,000 numbers	99	TR/AR/AH/LD
RIKA Communications 150 Broadhollow Rd. Melville, NY 11747 800/645-7152	Explorer III $4905	Dialer, transmit tape, response tape, computer interface, printer	Any computer (O), Scan-Tron scanner Model 1200, $1795 (O)	By hand, from computer data base	CDI School Attendance Plus ($1000)	1,700 numbers	9	TR/AR/AH/LD
School Office Software Systems 3408 Dover Rd. Durham, NC 27707 919/493-3366	Robotic Telephone Assistant $750	Modem, tape recorder, timer	Apple II (N), two disk drives (N), printer (N)	Frum computer data base	Yes	1,500 numbers	No	AR/LD

KEY: O: optional equipment which may be used with dialer; N: necessary equipment which must be used with dialer; TR: tape response allows party called to respond to taped message; AR: automatic redial; AH: automatic hangup if dialer reaches answering machine; LD: long distance; system can make local and long distance calls from same list.

(Continued from page 24)

call between one and two thousand numbers from memory. A timer starts and stops the dialer at preset times.

The printout capabilities of the systems range considerably. Some simply print out a list of the numbers called. Others are capable of printing out complete class registers including cumulative absences.

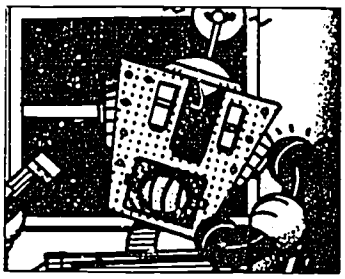
While most of these systems are separate pieces of hardware that *can* be linked to a microcomputer, one, the Robotic Telephone Assistant, is not a separate piece of hardware. The system consists of a modem (which can be used for other telecommunications purposes), a single tape recorder and a software package that must be linked to an Apple II series micro. This system is not equipped to tape responses from parties called, but it does produce an array of reports after it completes its calls.

Dialer Features

The systems vary in the number of messages they can deliver from as few as one to as many as 99. Multiple message systems allow administrators to tailor the information they send. For example, messages can be sent in different languages, or separate mes-

sages can be sent to the homes of absent and tardy students. Using multiple messages generally slows down calling since the dialer has to pause and search for the correct message. But, since messages are generally short—30 to 60 seconds long—the delays caused by multiple messages are not generally a problem, unless the calling load is very heavy.

If, however, a school's calling load is expected to be extremely heavy, or if the dialer will be housed in a district office to serve several schools, Melita Labs makes systems that place a high priority on calling speed. These systems can operate over multiple phone lines, contacting two, three, or four homes at a time.



ACROSS THE COUNTRY, SCHOOLS USING DIALERS REPORT THEY ARE IMPROVING AVERAGE DAILY ATTENDANCE

Automating Attendance

The most expensive dialing system available automates the entire attendance process using the Explorer III dialer, a computer, an attendance software package, and an optical card scanner. A laminated optical card is created for every student. Teachers take attendance by sending the cards of absent students to the attendance office. The cards are run through an optical scanner linked to a computer data base of the entire school register. Absences are noted in each student's cumulative record, and a list of homes to be called is created and sent to the dialer. This system also produces several reports. EL

Appendix G

Curriculum and Instructional Objectives Resource List

Anderson, Ronald E., and Klassen, Daniel L. "A Conceptual Framework for Developing Computer Literacy Instruction." AEDS Journal, Volume 4, Number 3, Spring, 1981.

Computer Literacy Curriculum Guide: Grades K-9. St. Paul: Minnesota School Districts Data Processing Joint Board (TIES), September 1982, pp. 12-50.

Cupertino, Union School District. "K-8 Computer Literacy Curriculum." Revised 1982. The Computing Teacher, March 1983, pp. 7-10.

Grady, M. Tim. "Long-Range Planning for Computer Use." Educational Leadership, May 1983.

Hunter, Beverly, Dearborn, Donald, and Snyder, Bruce. "Computer Literacy in the K-8 Curriculum." Phi Delta Kappan, October 1983.

Hunter, Beverly. My Students Use Computers: Learning Activities for Computer Literacy. Reston, VA: Reston Publishing Company, Inc., 1983. See particularly Chapters 3 through 7.

Appendix H

A Process for Screening, Evaluation and Placement of Instructional Software in Local School Curriculum

I. Getting Ready To Implement a Software Review Process

1. Select potential reviewers and set dates for training.

2. Implement training activities.

II. Instructional Software Review Placement

1. Identify software for review.

2. Locate software and schedule review sessions.

3. Evaluate programs recommeded at the initial screening.

4. Place recommended programs into school curriculum.

5. Organize selected data from review forms into an easy-to-use data base management program.

6. Develop a system for dissemination of instructional programs (and related information) chosen for placement.

INSTRUCTIONAL SOFTWARE REVIEW

SCREENING - EVALUATION - PLACEMENT

(Georgia CESA Computer Consultants, FY'86)

Phase I Screening

Program Name: _____ Version: _____

Disk/Cassette Name: _____ Cost: _____

Publisher: _____ Copyright Date: _____

Part of Series: __No __Yes (Name of series: _____)
Program Medium: __Disk __Cassette __Cartridge __Other: _____
Subject Area: _____ Level: __K-8 __9-12 __Other

HARDWARE CHARACTERISTICS

Computer Data:
__ Apple
__ Commodore
__ IBM
__ Tandy Radio Shack
__ Other: _____

Model: _____

Operating System: _____

Language: _____

Peripherals and Other Computer Requirements:

__ Color Monitor
__ Printer/Plotter
__ Language Card
__ Additional Disk Drives
__ Joysticks/Paddles
__ Mouse
__ Graphics Pad
__ Light Pen
__ Synthesizer (Speech/Sound)
__ Additional Memory: _____ K
__ Other: _____

PROGRAM CHARACTERISTICS

Instructional Modes Used:

__ Drill or Practice
__ Tutorial
__ Simulation
__ Instructional Game
__ Problem Solving
__ Demonstration
__ Utility
__ Other: _____

	Yes	No
Has management system?	__	__
User can control pacing?	__	__
Contains on-screen instructions?	__	__
Includes printed documentation ?	__	__
Uses sound?	__	__
Uses graphics?	__	__

Group size for instruction:
__ Individual
__ Small Group
__ Large Group

Brief Description of Program: _____

_____

GENERAL QUESTIONS

Does this program make appropriate use of a computer? __ Yes __ No
Was program reliable during screening? __ Yes __ No
Describe problems encountered with program:

_____

RECOMMENDATION

__ Recommended for general evaluation and possible placement into curriculum.
__ Not recommended at this time.
(Comment: _____)

Screened by: _____ Date: _____

System/School: _____

Phase II General Evaluation

CONTENT/INSTRUCTIONAL DESIGN

Yes	No		
—	—	1.	Content is current and accurate.
—	—	2.	Content is appropriate for intended grade level(s).
—	—	3.	Program defines and meets objectives.
—	—	4.	Material is presented in a clear, concise, and logical manner.
—	—	5.	Program requires active participation from user(s).
—	—	6.	Adequate practice/feedback is provided.
—	—	7.	Program is likely to be motivating to students.
—	—	8.	Program stimulates cognitive growth or promotes thinking skills.

QUALITY OF DISPLAY/PRESENTATION

Yes	No		
—	—	1.	Text is clear, easy to read, and spaced for clarity.
—	—	2.	Learner can control the pace/progression of displays.
—	—	3.	Graphics are used appropriately and efectively.
—	—	4.	Use of sound adds to the presentation and is not distracting.
—	—	5.	Color, where applicable, is used as a key presentation feature.

EASE OF USE

Yes	No		
—	—	1.	User instructions are available and understandable .
—	—	2.	Directions and formatting are consistent throughout.
—	—	3.	Program can be used by a person with minimum computer skills.
—	—	4.	User interaction is appropriate for the target audience.
—	—	5.	Unexpected input is handled effectively and appropriately.
—	—	6.	User is provided with easy-to-use escape feature(s).
—	—	7.	Help functions are available and understandable.
—	—	8.	Program requires minimum teacher supervision/intervention.

REPORTING/MANAGEMENT FEATURES

Yes	No		
—	—	1.	User is informed of progress or achievement.
—	—	2.	Feedback is appropriate and reinforcing.
—	—	3.	Program has record-keeping that is useful and easy to obtain.

SUPPORT MATERIALS

Yes	No		
—	—	1.	User/teacher's guide is provided.
—	—	2.	Supplementary student materials are provided or referenced.

RECOMMENDATION

— Recommended for placement into curriculum.
— Recommended for more specific evaluation.
— Not recommended for use.

(Comment: _____)

Evaluated by: _____ Date: _____

System/School: _____

Phase III Placement

Grade Level: _____ Content Area: _____

Topic: _____

Objective(s) Addressed:

Suggested Use:

— Lead-In Activity
— Direct Instruction
— Follow-Up/Skill Building

Specific Comments for Use:

Phase I Screening

Program Name:	Title of program as it appears in the documentation.
Version:	A number that is assigned when more than one revision has been released. (Ex.: 2.0) Many programs have no version number.
Disk/cassette Name:	Name that appears on the disk/cassette label. This may or may not be same as the program name.
Cost:	Regular retail price of <u>one</u> disk/cassette which contains the program.
Publisher:	Name of the company which produced the program. (Ex.: Spinnaker, Broderbund, etc.)
Copyright Date:	Year published.
Part of Series:	The program is one of a sequence of related programs.
Program Medium:	Material on which the program is sold. (Ex.: diskette, cassette, cartridge, etc.)
Subject Area:	Major content area addressed. (Ex.: science, mathematics, reading, etc.)
Computer Data:	Make of computer. (Ex.:Apple, TRS-80, etc.) Model of computer. (Ex.:IIe, C-64, PCjr, etc.) Operating system used on disk. (Ex.:DOS 3.3, TRSDOS 1.2, PC DOS 2.0, etc.) Language in which program written, <u>if known</u>. (Ex.:BASIC, Pascal, machine code, etc.)
Peripherals:	Additional devices which should be attached to the computer in order to use the program. A regular monitor/tv and one disk drive or cassette player are assumed to be in place.

Instructional Mode:	Type of use for which program is best suited. (Ex.:Drill, simulation, instructional game, etc.)
Management System:	The program aids in sequencing activities based on user performance.
Pacing:	The user controls rate at which material is presented.
Instructions:	On-screen directions are provided.
Documentation:	Printed directions, teacher information, etc. are available.
Uses Sound:	Sound is an integral part of the program.
Uses Graphics:	Graphics/animation is an integral part of the program.
Group Size:	Size of audience for which the program is best suited (Ex.:Individual, small group, large group).
Brief Description:	Major focus of program content and activities.
Appropriate Use:	Special characteristics of the computer are utilized in the program. These characteristics are presented in a unique way or are usually not attainable by other means.
Reliability:	Program run was trouble-free and ran to completion.
Problems:	Note problems you encountered in running the program. (Ex.:Program stops for any reason, program objective(s) not clear, unexpected output occurred, etc.)
Recommendation:	Recommend for evaluation if you peceive the program has potential value in classroom instruction and meets local software needs.

Phase II General Evaluation

Content/Instructional Design

1.	Content Accuracy:	Desirable: Content presented is consistent with the facts and format as usually presented at that grade level. Undesirable: Errors are found in content, spelling, punctuation, or other areas.
2.	Appropriate for Grade Level:	Desirable: Program content can be referenced to state or local curriculum guides. Undesirable: Content is too advanced or too simple for the intended grade level for use.
3.	Meets Objectives:	Desirable: There is a clear and logical relationship between the tasks presented to the user and the stated instructional objective(s). Undesirable: There are significant differences between local school instructional objectives and program objectives. The program's main focus is entertainment.
4.	Manner of Presentation:	Desirable: There is a logical sequence in the presention of tasks. The content addressed is clearly identifiable and gets to the point in an efficient manner. Undesirable: The situations chosen or manner of presentation detract from the content.
5.	Active Participation:	Desirable: The task(s) presented to the user requires some intellectual activity. Undesirable: The major interaction is "Press Any Key To Continue" or the program gives little chance for user interaction.
6.	Content Related Feedback:	Desirable: Immediate appropriate, positive reinforcement is provided for each correct response. Differentiated reinforcement (ie. praise for large-scaled accomplishments) is provided. Undesirable: Feedback is demeaning or is not appropriate for the level of the user. Feedback to incorrect responses is more attractive than for correct response.
7.	Motivating to Students:	Desirable: Interaction has a high potential for attracting and holding student interest while completing the instructional task(s). Undesirable: Tasks are too numerous, repetitive, or frustrating.
8.	Promotes Thinking Skills:	Desirable: The program involves decision-making, logical thinking, problem-solving, or other characteristics which stimulate cognitive growth. Undesirable: Program activities require only simple recall of knowledge or "page turning".

Quality of Display/Presentation

1.	Text/Screen Displays:	Desirable: Textual displays are well-spaced and easy to read. Undesirable: Crowded, unreadable screens or scrolling displays are typical throughout.
2.	User-Controlled Pace:	Desirable: Directions, examples, help prompts, and other information remains on the screen until the user is ready to continue. Multiple and varied branching is evident and may be controlled by the user. Undesirable: User has no control of presentation rate. The sequence of tasks is predetermined and fixed. (Ex.: Number and sequence of tasks is the same for all users.)
3.	Appropriate Graphics:	Desirable: Graphics or animation, if used, are an itegral part of the instructional activities (ie., used to improve clarity of presentations). Non-essential graphics may be used for maintaining student interest. Undesirable: Graphics are non-functional or distracting. Incorrect responses result in a graphics reward.
4.	Appropriate Sound:	Desirable: Sound, if used, improves the quality of the presentations. Non-essential sound may be used for maintaining student interest. Program options allow the teacher to control sounds (ie., on/off). Undesirable: Sound is non-functional or distracting.
5.	Appropriate Color:	Desirable: Color, if used, is an essential part of the tasks presented. Non-essential color may be used as a motivational technique; however, it should also be usable on a monochromatic monitor. Undesirable: Color is non-functional, distracting, or difficult to distinguish.

Ease of Use

1. **User Instructions:**
   Desirable: Directions for use are available in the program and are optional, at the user's request. Directions are appropriately written for the intended user.

   Undesirable: Directions are absent or do not clearly describe what the user is to do to complete the tasks.

2. **Formatting Consistency:**
   Desirable: Screen layout, question format, requests for input, and method of entering student responses are consistent throughout the program.

   Undesirable: Directions and formatting vary from task to task. (Ex.: Pressing the RETURN/ENTER key is required for some inputs but not required for others.)

3. **User Skills:**
   Desirable: Intended users should be able to operate the program easily and independently. An easy-to-use menu feature should be available. A self-starting feature is desirable.

   Undesirable: The program requires specialized or technical knowledge as a prerequisite for use.

4. **User Interaction:**
   Desirable: Skills required for successful program use are easily attainable by intended users. (Ex.: Multiple choice options for answers to avoid typing errors; touch tablet input for primary age users in place of keyboard input, etc.)

   Undesirable: The program requires keyboard skills beyond the range expected of the user.

5. **Unexpected Input:**
   Desirable: Friendly, informative messages are provided in response to common errors. Extra carriage returns or spaces should be ignored by the program. Unreasonable user responses, such as entry of letters for numbers or responses outside of expected ranges, should be detected and feedback provided.

   Undesirable: User errors cause program execution to stop or the computer to "lock up".

6. **Escape Feature:**
   Desirable: User is provided a clear, easy-to-use way to terminate program execution. (Ex.:Press ESCAPE/BREAK key to exit; press a function key to return to menu, etc.)

   Undesirable: User is forced to complete program, break program runs, or turn the computer off/reboot to exit from the program.

7. **Help Function:**
   Desirable: Meaningful, built-in help routines are available via simple keystrokes.

   Undesirable: A help function is not available, or it simply repeats initial directions or a glossary of terms.

8. **Minimum Supervision:**
   Desirable: The program clearly relates to the local instructional sequence of tasks. If appropriate, worked examples are provided using the format and process which is required when using the program.

   Undesirable: Frequent or extended teacher intervention is required for successful use of the program.

Reporting/Management Features

1. Progress Reporting:
   Desirable: A useful summary of student performance is provided (ie. scores, percents, and/or messages).
   Undesirable: No useful performance data is reported to the user.

2. Summative Feedback:
   Desirable: Program has provisions for assisting the teacher in making decisions for sequencing related activities or tasks.
   Undesirable: Inadequate or no management information is given.

3. Record Keeping:
   Desirable: Records of student progress/performance are stored in a data file for easy retrieval and use by the teacher. Data may be obtained in printed form.
   Undesirable: Performance data is nonexistant or difficult to obtain. Set-up and maintenance of management features is too time-consuming.

Support Materials

1. User Guide:
   Desirable: Documentation should be complete and easy to use. Good documentation includes most of the following: Suggested prerequisite skills and level, instructional objectives, target audience, strategies for use (lead-in, direct instruction, and follow-up activities), and worksheet masters.
   Undesirable: Inadequate or no documentation or support materials are provided.

2. Supplementary Materials:
   Desirable: Student workbooks and other instructional aids are available. References are made to appropriate, supplemental learning materials.
   Undesirable: Little or no supplemental materials are identified.

Recommendation

Placement: Recommend for placement if the program meets minimum local school criteria. Seek assistance from computer consultants in establishing your criteria.

Specific Evaluation: Recommend for more specific evaluation if your school has a need for and has established additional evaluation criteria.

Project SEED EVALUATION INSTRUMENT

Date submitted: _____ State Contact Person _____

Evaluator: _____

PART I.

Producer: _____ Copyright Date: _____

Title: _____

Content Area: _____ Presentation Mode: D/P ____ P/S ____ CMI ____

Specific Topics: _____ SIM ____ GA ____ TU ____ CAI ____

_____ Other _____

Program Scope: K 1 2 3 4 5 6 7 8 9 10 11 12 Adult

A. INDIVIDUAL PACKAGE CONTENTS:

No. of Disks _____ Package Price: _____

Guides _____ Network Version Available _____ _____
yes no

Manuals _____ Network Version Price _____

Other _____

Documentation Available: Complete _____ Partial _____ None _____

Series Title (if any): _____

Packages in Series: _____ Series Price: _____

B. SYSTEM REQUIREMENTS:

Computer Make/Model _____

Computer Versions Available: _____

Computer Version Operating System: _____

Memory Size: Minimum _____ Desired _____

Peripherals and Special Devices: Required (R) or Optional (O).

Color Monitor _____ Printer _____ 80-column card _____

Serial cards _____ Joysticks _____ . Koala Pad _____

2nd Disk Drive _____ Other _____ _____

Other _____ _____ Other _____ _____

C. OTHER INFORMATION:

Preview Policy _____ Backup Policy _____

Copy Protection _____ Licensing Agreement _____

PART II.

A. ACCESS: After entering the program, how does the user select lesson/activity?

Menu _____; Pretest _____; Other _____: (describe) _____

Pretest by Teacher. _____: Other _____: (describe) _____

B. DESCRIPTORS:

INSTRUCTIONAL OBJECTIVES:

INSTRUCTIONAL PREREQUISITES:

POTENTIAL USERS/USES:

MAJOR STRENGTHS:

MAJOR WEAKNESSES:

C. SUMMARY AND RECOMMENDATION:

Recommended _____ Not Recommended _____ Recommended, but with reservations _____

TO MY KNOWLEDGE, NO **ATTEMPT** HAS BEEN MADE TO COPY THIS PROGRAM.

Date	Signature of Evaluator	Phone Number

Project SEED Evaluation Instrument Explanation Sheet

****

Note: All responses on the Evaluation Instrument are to be NEATLY printed or typed.

Instructions: The following information is to be used as a guideline for the completion of the project SEED Evaluation Instrument. Each item identified on the Evaluation Instrument is discussed to aid understanding.

****

1. Date Submitted: State the date the completed Evaluation Instrument is submitted to the State Contact Person.

2. State Contact Person: This is the individual identified by your state to receive the completed Evaluation Instrument.

3. Evaluator: Provide your name as the Evaluator.

PART I.

1. Producer: Identify the name of the company producing the materials--not necessarily the vendor/salesperson. Check both the written material and the diskette for concurring information.

2. Copyright Date: The latest copyright date shown should be used as a response. If the copyright date of the written material differs from that of the diskette, then BOTH dates should be entered in the following manner: Copyright Date: Written/XXXX; Diskette/XXXX.

3. Title: The full title of the package should be stated, including any series indication. Check the written material, the outside wrapper, and the diskette for concurring information.

4. Content Area: Use the following labels to indicate the appropriate content area(s) of the material. Note: If your particular area description is not listed, select a label that best matches that designation rather than label an item "Other." Use "Other" if no match is possible.

AE	Arts Education	MA	Mathematics
BV	Business/Vocational Education	PE	Physical Education
CC	Career Planning/Counseling	SC	Science
CT	Computer Literacy/Technology	SS	Social Studies (History, Geography)
EC	Exceptional Child	TS	Traffic Safety
FL	Foreign Language	UP	Utility/Productivity Tool
HS	Health/Safety	Other	(Specify) _____
LA	Language Arts		

5. Presentation Mode: Check the most appropriate mode(s) for the software. Two modes may need special attention: CAI and CMI. In the case of CAI, if the material is computer-assisted instruction, but does not clearly match any of the other modes, check CAI. However, if an item is distinctly drill and practice, only check D/P. However, in the case of CMI, s package may be both drill and practice and computer-managed instruction in that student responses are collected. Use the following descriptions to identify the appropriate presentation mode.

   D/P - Drill and Practice: Provides activities/exercises to reinforce or practice concepts and skills already taught or learned.

   SIM - Simulation: Provides models of situations or events too complex, dangerous, expensive, or inconvenient to reproduce in the classroom. Student analyzes situation, makes decisions, and is informed of the results.

   TU - Tutorial: Presents new concepts or skills by means of examples and questions often providing tests and remediation.

   P/S - Problem Solving: Requires the student to analyze a situation or a problem, make a decision by applying accepted principles or rules, and continue the process in solving the problem.

   GA - Game: Uses a variety of game formats and elements of competition to motivate students to apply skills they have mastered to accumulate points/scores.

   CAI - Computer-Assisted Instruction: A comprehensive term for computer software that performs an instructional function.

   CMI - Computer-Managed Instruction: A possible component of instructional computer software that assists in managing instruction by collecting, storing, and retrieving student skill-mastery/progress data.

6. Specific Topics: Even though you have specified a general content area, identify as specific topic(s) any subcategories that the material specifically addresses. For example: If science is the "Content Area," then biology-photosynthesis might be the "Specific Topic"; if matn is the "Content Area," percent/decimals might be the "Specific Topic."

7. Program Scope: The response will indicate the recommended target audience by grade levels. Therefore, circle (with one circle) all the grade levels for which the material would be appropriate, including the adult level. For example: . . . 5 6 7 8 9 . . .

A. INDIVIDUAL PACKAGE CONTENTS:

1. No. of Disks: Indicate the number of diskettes that actually sre boxed with the material. If one is a master and one a backup, specify this in the following manner: 1/M ; 1/B. If diskettes in the package are for different levels/programs, indicate by number: 15/L or 5/P.

2. Package Price: Check the material documentation and packaging to determine the correct and complete price. If the cost differs for a school single package, a school lab pack, or a home package, record this information in the manner listed below:
   $XXX/SCH ; $XXX/SCH-LAB ; $XXX/H .
   Circle the cost and identifier of the package evaluated.

3. Network Version Available: Indicate yes or no.

4. Guides: Guides should be identified as printed documentation that explains the primary use of the material and provides sufficient instruction for operation. List the number of guides packaged with the software. To distinguish between teacher and student guides, follow the number indicating the quantity of each type with either a T for teacher or an S for student. For example: 1 T/ 1 S or just 1 T or 1 S.

5. Network Version Price: Record the cost of the network version of the software (including any special cards, chips, etc., that are sold with the software and that are necessary to use the network version).

6. Manuals: Manuals differ from guides in their instructional orientation appropriate for a teacher to use. Typically, manuals would be more extensive, perhaps including transparency masters, student worksheets, and classroom management guides. Record the number of manuals provided in each software package.

7. Other: If any other items (wall charts/posters, ditto masters, game materials, transparencies, etc.) are included as separate items in the package, specify how many of each type of item are included. For example: 1 8"x12" poster, 5 ditto masters.

8. Documentation Available (Complete/Partial/None): Even though you have separate items to indicate the type and quantity of information included, this section needs to be completed also. Check "Complete" if the documentation includes all of the manuals and guides that are referenced in the description of the package. If some of the printed documentation items are missing or in draft form, check "Partial." A response to "Partial" does not involve your judgment of the quality of the documentation, just of its existence or lack of such. If no documentation exists, check "None."

9. Series Title: Respond with the complete series name that was included with the title information in Part 1.

10. Packages in Series: Packages include all materials packaged (shrink-wrapped) with the diskettes. Indicate, if known, the number of packages in the series. This information may or may not be available in the individual package.

11. Series Price: List the series price. Series price refers to the total for the different packages in the series. It does not refer to a lab pack of the same item.

B. SYSTEM REQUIREMENTS:

1. Computer Make/Model: Specify make and model. For example: IBM PC, Apple IIe, Commodore 64, etc.

2. Computer Versions Available: List versions available, if this information is furnished by the publisher. If this information is not given, show N/A (not available).

3. Computer Version Operating System: Specify name and version. For example: DOS 3.0.

4. Memory Size: Specify minimum memory size needed and then memory size desired.

5. Peripherals and Special Devices: Denote whether specific peripherals/special devices are Required (R) or Optional (O). Indicate additional items not listed on the form in the "Other" category.

C. OTHER INFORMATION:

1. Preview Policy. Information may or may not be available. If this information is furnished, indicate "Yes" or "No" and where the information is found. If information is not available, show "N/A."

2. Backup Policy. Information should be found in the package or documentation materials. If this information is furnished, indicate "Yes" or "No" and where the information is found. If information is not available, show "N/A." Do not attempt to make a backup copy unless necessary to operate the program.

3. Copy Protection. State type of copy protection documented and where found.

4. Licensing Agreement. Information may or may not be available. If this information is furnished, indicate "Yes" or "No" and where the information is found. If information is not available, show "N/A."

PART II: (Explanation of terms in Section A.)

A. ACCESS: Defines the method by which the user selects a program segment after entering the program.

1. Menu. A list of choices that appear on the monitor that the user can select from to command the computer to execute a specific program segment.

2. Pretest. Quiz executed on the keyboard that, after completion, branches into options to be selected by the user.

3. Pretest by teacher. Based on the results of this noncomputer or external quiz given by the teacher, students are directed to select specific choices displayed on the monitor.

4. Other. Describe: Method other than menu or pretest by which the user enters the program.

B. DESCRIPTORS: (Items listed below are examples to stimulate your thinking. Evaluators are encouraged to state specific factors in brief sentences or phrases.)

1. INSTRUCTIONAL OBJECTIVES: Specific statement(s) of learner responses listed for the computer program(s) that give evidence of instructional results. Examples: Clearly stated. Specific. Logically integrated into content. Correlated to curriculum goals, texts. Appropriate to level of instruction. Measurable. Prescriptive. Feedback provided to student/teacher.

2. INSTRUCTIONAL PREREQUISITES: Prior learning and/or experiences needed in order for program users to give desired learner responses. Examples: Specific content skills identified. Grade and reading levels defined, compatible. Target audience clearly identified. Placement options/ multiple levels/tutorial available.

3. POTENTIAL USERS/USES: Examples for users: Appropriate for individuals/group(s) (large/small) etc.

   Examples for uses: Appropriate for remediation with some guidance. Enrichment. Motivational purposes. For additional practice after teacher has introduced concept. Self-instruction. Totally covers a concept, etc.

4. MAJOR STRENGTHS (Desirable Features): Related to Users/Uses. Add specific features, for example:

   Ease of use: Automatic start-up. Menu-driven. Offers help, tutorial, review features. Little or no teacher intervention required. Controllable pace/level. On-line documentation. Adequate printed documentation. Offers several examples. Directions are clear, concise, and appropriate for intended user. Provides help. Easy access and exit. Presentation (sound, graphics, etc.) does not disturb user. Can be interrupted and saved.

   Content/Design: Factually accurate. Current information. Significant, clear, concise information. Content appropriate for computer. Exploits branching capabilities of computer. Uses language, terminology correctly. Pedagogically sound. Requires active participation. Requires decision making. Provides immediate and appropriate feedback/ reinforcement. Provides motivational responses. Uses color, sound, graphics appropriately. Optional sound. Appropriate speed of presentation. Appropriate recovery from errors, unexpected responses. Appropriate length, complexity for intended use/audience. Can be interrupted/saved. Allows choice of number of trials/problems.

   Display/Screen Presentation: Attractive. Legible. Consistent. Appropriate spacing and timing. Proper integration of color, sound, graphics.

Report System: Collects significant, usable data. Stores student data. On-line report to student. Data easily retrieved on-/off-line.

Support Materials: Appropriate guides, workbooks, other ancillary materials. Supplementary materials referenced. Technical documentation outlines program modification process. Scope and sequence chart provided. Support materials for teachers are provided and should be reviewed before assigned.

5. MAJOR WEAKNESSES: Be specific. Examples include: Technical errors. Factual (content) errors. Lack of instructional purpose. Distracting features. Inappropriate feedback. Continues only on correct response. Inappropriate speed. Does not provide for review. Sound, graphics tend to distract. Screen appears cluttered. Print is small. Does not distinguish instructions from practice examples. Reinforcement slow, inappropriate for students. Requires follow-up by teacher. No means for recording correct/incorrect scores. Other (consider the inverse of each major strength).

C. SUMMARY AND RECOMMENDATIONS: The appropriate recommendation should be checked by the Evaluator. The recommendation checked must be justified by comments specified in the Descriptor section of Part II. Due to space limitations on the Evaluation Instrument, the Evaluator is encouraged to:

1. State, in 2-3 concise sentences or phrases, a brief description of the software on a separate sheet of paper.

2. This separate sheet could also be used for continuing any part of Part II for which there was inadequate space for listing comments. Be sure to designate those parts that are continuations.

3. Staple the additional sheet to the Evaluation Instrument. Please include the name of the software and the Evaluator's name on this sheet.

Short Form Software Evaluation

Program Name: _____

Subject Area: _____

Grade Levels: _____ Ability Levels: _____

1. What specific content or instructional objectives are addressed? (Use back of form if necessary)

2. Has the program been tested or validated for a classroom setting?

   ( ) No ( ) Yes _____

3. Is program correlated with test materials? ( ) Yes ( ) No

4. Are test materials required for program use? ( ) Yes ( ) No

5. Description and cost of text materials _____
   _____

6. Is program available for review before purchase?
   ( ) Yes ( ) No

7. Computer Requirements:
   Brand & Model _____
   Memory Requirement _____K. Operating System _____
   ( ) Individual Computer ( ) Network
   Peripherals required: ( ) Printer ( ) Joy Stick
   ( ) Disk drives (How many?) _____ ( ) Color monitor
   ( ) Graphics tablet ( ) Other _____

8. Media on which program is available:
   ( ) Disks (size & type) _____
   ( ) Cassette/Cartridge tape (type) _____
   ( ) Other _____

9. Producer: _____

10. Price: $_____ Vendor: _____

    _____

Comments:

Appendix I

Software Publishers and Distributors

The following listing of software publishers and distributors is presented in alphabetical order. The major contact information for catalog ordering is listed, along with a quick reference guide to the educational skill areas in which the companies have published software. In addition, the microcomputer brands which each company supports is indicated. It does not include every educational software producer but the list should give you a good start on finding software products in the skill areas and your desired brand of microcomputer.

This is a list of general education software publishers as well as special education producers. It is designed to give you the information you will need to contact producers directly.

How to Use This Directory

Each product or distributor is listed with name, address, city, state, zip code and telephone number. In addition, the microcomputer brands supported by the individual publisher are listed. Following each company are a string of Xs in the appropriate boxes representing the academic skill areas of software production. If you are looking for Language Arts programs for the Apple, check the companies with Xs in the second column (Language Arts) and refer to the last line of each listing for the Apple software producers. Using this method will give you a comprehensive list of companies publishing material in the skill areas you are interested in for your brand of microcomputer.

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
APX (Atari Program Exchange) P.O. Box 3705 Santa Clara, CA 95055 (800) 538-1862 Atari	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Abbott Educational Software 334 Westwood Avenue East Longmeadow, MA 01028 (413) 525-3462 PET-64		x	x																			x	
Academic Software 22 E. Quackenbuch Avenue Dumont, NJ 07628 (201) 385-2395 Apple, TRS-80, PET, Vic, Atari	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
Activity Resources Company, Inc. P.O. Box 4875 Hayward, CA 94540 (415) 782-1300 TRS-80, Apple, PET	x																						
Addison-Wesley Publishing Co. Reading, MA 01867 (617) 944-3700 Apple, IBM, TRS-80-III																				x		x	
Ahead Designs 699 N. Vulcan, #88 Encinitas, CA 92024 (619) 436-4071 Apple		x		x												x							
American Micro Media. P.O. Box 306 Red Hook, NY 12571 (914) 756-2557 Apple, Pet, TRS-80	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x
Apple Computer, Inc. 10260 Bandley Drive Cupertino, CA 95014 (408) 996-1010 Apple	x	x		x			x			x	x					x	x			x	x		
Applied Educational Systems RFD 2, Box 213 Dunbarton, NH 03301 (603) 774-6151 Apple, Pet, TRS-80																						x	
Applied MicroSystems P.O. Box 832 Roswell, GA 30077 (404) 371-0832 Apple, IBM		x			x							x								x	x	x	
Aquarius Publishers, Inc. P.O. Box 128 Indian Rocks Beach, FL 33535 (813) 595-7890 Apple, TRS-80	x	x	x		x	x	x	x						x		x			x		x		
Artra Inc. P.O. Box 653 Arlington, VA 22216 (703) 527-0455 Heath/Zenith H-89																							x

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
Atari Home Computer Division P.O. Box 50047 San Jose, CA 95150 (800) 538-8543 Atari				x		x	x		x	x	x	x		x		x	x	x		x	x		
Athroid Digital, Inc. P.O. Box 1385 Tittsfield, MA 01202 (413) 448-8278 Apple		x	x	x								x					x	x			x		x
Avant-Garde Creations P.O. Box 30160 Eugene, OR 97403 (503) 345-3043 Apple, IBM, Atari	x	x	x	x	x			x		x	x	x	x		x	x					x	x	
Banana, Inc. P.O. Box 2868, 3400 Executive Pky. Toledo, OH 43606 (419) 531-7100 Apple, Atari, IBM	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Bank Street College of Education 610 West 112th St. New York, NY 10025 (212) 663-7200 Apple, Atari, Commodore 64																	x						
Basics and Beyond, Inc. P.O. Box 10, Pinesbridge Road Amawalk, NY 10501 (914) 962-2355 Atari, TRS-80 I & II	x	x		x	x	x	x	x	x	x	x					x	x	x	x	x			
Bell & Howell Microcomputer 7100 N. McCormick Road Chicago, IL 60645 (312) 673-3300 Apple	x	x	x	x	x					x	x		x		x				x	x	x		
Borg-Warner Educational Systems 600 W. University Dr. Arlington Heights, IL 60004 (800) 323-7577 Apple, TRS-80	x	x	x	x			x													x			
BrainBank, Inc. Suite 408, 220 Fifth Avenue New York, NY 10001 (212) 686-6565 Apple, TRS-80, PET		x	x		x	x	x			x													
Broderbund Software 1938 4th Street San Rafael, CA 94901 (415) 456-6424 Apple, Atari																x							
COMP.O.S.E. 6500 W. 95th St. Oak Lawn, IL 60453 (312) 599-5550 Apple																					x		
COMPress P.O. Box 102 Wentworth, NH 03282 (603) 764-5831 Apple	x				x		x				x				x				x	x	x		

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
California School for the Deaf 39350 Gallaudet Dr. Fremont, CA 94538 (415) 794-3666 Apple															x					x			x
Charles Mann and Associates 7594 San Remo Trail Yucca Valley, CA 92284 (619) 365-9718 Apple, IBM																			x		x		
Comaldor P.O. Box 356, Postal Station O Toronto, Ontario Canada M4A2N9 (416) 751-7481 PET	x	x	x	x	x		x		x		x		x	x							x		x
Comm Data Computer House, Inc. P.O. Box 325 Milford, MI 48042 (313) 685-0113 Commodore	x	x		x																			
Compu-Tations, Inc. P.O. Box 502 Troy, MI 48099 (313) 689-5059 Apple II, Atari 800	x	x		x							x	x		x	x		x			x			x
Compumax, Inc. P.O. Box 7239 Menlo Park, CA 94025 (415) 854-6700 Atari				-											x								
Computer Advanced Ideas, Inc. 1442A Walnut Street, Suite 3 1 Berkeley, CA 94709 (415) 526-9100 Apple, IBM											x				x								
Computer Software/Books R US 16 Birdsong Irvine, CA 92714 (714) 559-5120 Apple, Atari, Pet, TRS-80, IBM, CP/M																				x			
Computer Station 11610 Page Service Dr. St. Louis MO 63141 (314) 432-7019 Apple			x																				
Computers to Help People, Inc. 1221 West Johnson Street Madison, WI 53715 (608) 257-5917 Apple II Plus																							x
Concept Educational Software P.O. Box 6184 Allentown, PA 18001 (215) 266-1679 TRS-80 Mod I or II	x	x			x		x																
Conduit 100 Lindquist Center Univ. of Iowa P.O. Box 388 Iowa City, IA 52244 (319) 353-5789 Apple, TRS-80, Atari, PET	x	x			x	x			x		x	x											

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
Control Data Publishing Co. P.O. Box 261127 San Diego, CA 92126 (800) 233-3784 Apple, Atari, Texas Instruments	x											x											
Convergent Systems Inc. 245 E 6th St. St. Paul, MN 55101 (612) 221-0587 TI, Apple	x	x	x	x				x			x	x								x	x		
Cow Bay Computing P.O. Box 515 Manhasset, NY 11020 (516) 365-4423 PET, Comm-64	x			x	x						x					x					x	x	
Cross Educational Software P.O. Box 1536 Ruston, LA 71279 (318) 255-8921 Apple				x	x						x			x			x				x	x	
Data Command P.O. Box 548 Kankakee, IL 60901 (815) 933-7735 Apple, TRS-80 I & III		x	x								x												
Developmental Learning Materials One DLM Park Allen, TX 75002 (214) 248-6300 Apple IIe, TI-99/4A	x	x		x							x	x		x		x							x
Dormac, Inc. 8034 S.W. Nimbus Beaverton, OR 97005 (800) 547-8032 Apple																							x
Duxbury Systems, Inc. 77 Great Road Acton, MA 07120 (617) 263-7761 CP/M																							x
Dynacomp, Inc. 1427 Monroe Avenue Rochester, NY 14618 (716) 442-8960 Apple, Atari, IBM, TRS I&III, PET-64	x			x	x			x			x		x	x			x	x	x	x	x		
Joseph Nichols Publisher P.O. Box 2394 Tulsa, OK 74101 (918) 583-3390 TRS-80 Model III				x																			
Project C.A.I.S.H., Gocio Ele. Sch. 3450 Gocio Road Sarasota, FL 33580 (813) 355-3567 Apple II																							x
Project REACT 66 Malcolm Ave. SE Minneapolis, MN 55414 (612) 379-0428 Apple II														x									x

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
Carl Geigner 1603 Court Street Syracuse, NY 13208 Apple II																							x
EDIS Systems, Inc. 422 Main St. Lafayette, IN 47901 (317) 742-1787 Apple II, TRS-80, Mod III																					x		
EISI 2225 Grant Road, Suite 3 Los Altos, CA 94022 (415) 969-5212 Apple, Atari, TRS-80, TI, PET	x	x	x	x	x	x	x	x			x	x	x		x	x	x	x	x		x		
EX-ED Computer Systems, Inc. 71-11 112th St. Forest Hills, NY 11375 (212) 268-0020 any running CP/M																					x		
Early Games Educational Software Shelard Plaza North, Suite 140C Minneapolis, MN 55426 (612).544-4720 Apple II, Atari, IBM, TRS-80	x			x						x	x			x									
Earthware Computer Services Box 30039 Eugene, OR 97403 (503) 344-3383 Apple					x						x												
Edu-Comp, Inc. 14109 S. E. 168th St. Renton, WA 98055 (206) 255-7410 Apple																					x		
Edu-Soft 4639 Spruce St. Philadelphia, PA 19139 (215) 747-1284 Apple II, Atari, TRS-80	x	x			x						x			x					x	x	x		
Edu-Ware Services 28035 Dorothy Drive Agoura, CA 91301 (213) 706-0661 Apple, Atari, IBM	x	x	x	x	x						x	x		x		x			x	x			
EduTech 634 Commonwealth Ave. Newton Centre, MA 02159 (617) 965-4813 Apple	x				x						x												
Educational Activities, Inc. P.O. Box 392 Freeport, NY 11520 (800) 645-3739 Apple, PET TRS-80, Atari	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x		
Educational Computing Systems, Inc. 136 Fairbanks Road Oakridge, TN 37830 (615) 483-4915 Apple II	x	x	x								x			x		x					x		

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Educational Micro Systems, Inc. P.O. Box 471 Chester, NJ 07930 (201) 879-5982 TRS-80 I&III, Apple	x																						x
Educational Software Midwest 414 Rosemere Lane Maquoketa, IA 52060 (319) 652-2334 Apple																					x		
Educational Software and Marketing 1035 Outerpark Drive Springfield, IL 62704 (217) 787-4594 Apple, TRS-80 III																					x		
Educational Software, Inc. 4565 Cherryvale Soquel, CA 95073 (408) 476-4901 Atari, Comm-64, Vic	x			x				x	x	x	x		x			x			x				
Educational Systems Software P.O. Box E El Toro, CA 92630 (714) 768-2916 Apple											x									x	x		
Educational Teaching Aids 159 W. Kinzie Chicago, IL 60610 (312) 644-9438 Apple, Commodore, TRS-80	x	x	x	x							x												
Educulture 1 Dubuque Plaza, Suite 803 Dubuque, IA 52001 (800) 553-4858 Apple		x																					
Edupro P.O. Box 51346 Palo Alto, CA 94303 (415) 494-2790 Atari																				x			
Eiconics, Inc. P.O. Box 1207, 211 Cruz Alta Rd. Taos, NM 87571 (505) 758-1696 Apple															x								
Electronic Courseware Systems P.O. Box 2374, Station A Champaign, IL 60820 (217) 359-7099 Apple	x	x						x			x										x		
Elwyn Institutes 111 Elwyn Road Elwyn, PA 19063 (215) 358-6400 TRS-80 Mod. III																					x		
Encyclopedia Britannica Ed. Corp. 425 N. Michigan Ave. Chicago, IL 60611 (800) 554-9862																				x			

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Entelek P.O. Box 1303 Portsmouth, NH 03801 (603) 436-0439 Apple	x				x																		
Evans Newton Inc. 7745 E. Redfield Road, Suite 100 Scottsdale, AZ 85160 (602) 998-2777 Apple, PET, TRS-80																					x		
Financial Analysis Service P.O. Box 1937 Hiram, Ohio 44234 (216) 569-3201 Apple																					x		
Fireside Computing, Inc. 5843 Montgomery Road Elkridge, MD 21227 (301) 796-4165 TRS-80 I or III															x								
Follett Library Book Co. 4506 Northeast Highway Crystal Lake, IL 60014 (800) 435-6170 Apple, Atari, Comm, TRS-80	x	x	x	x	x	x	x			x	x	x		x		x	x	x	x	x	x		
Fullmer Assoc. 1132 Via Jose San Jose, CA 95120 (408) 997-1154 Apple	x	x	x	x	x	x	x				x					x		x			x		x
Funk Vocab-Ware 4825 Province Line Road Princeton, NJ 08540 (609) 921-0245 Apple II		x																					
GRAFex Company P.O. Box 1558 Cupertino, CA 95015 (408) 996-2689 Atari	x	x		x					x	x	x	x		x			x	x			x		
George Earl Software 1320 South Gen. McMullan San Antonio, TX 78237 (512) 434-3681 Apple, TRS-80	x	x	x	x	x						x	x									x		
Gladstone Electronics 901 Fuhrmann Blvd. Buffalo, NY 14203 (716) 849-0735 Timex Sinclair	x																						
Green Valley Informantics 769 N. Sacre Lane Monmouth, OR 97361 (503) 838-1172 PET, CBM																	x						x
Grover and Associates 7 Mt. Lassen Dr. D116 San Rafael, CA 94903 (415) 479-5906 Apple II or II Plus																							x

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Harcourt Brace Javanovich 1250 6th Avenue San Diego, CA 92101 (800) 543-1918 Apple, TRS-80, Atari																						x	
Harper & Row 10 East 53rd Street New York, NY 10022 (212) 593-7000 Apple	x				x													x					x
Hartley Courseware, Inc. P.O. Box 431 Dimondale, MI 48821 (616) 942-8987 Apple	x	x	x	x		x	x							x	x	x					x	x	x
Hayden Book Company, Inc. 600 Sussolk Lowell, MS 01853 (800) 343-1218 Apple, Atari, PET	x	x	x	x	x	x	x				x			x			x	x		x			
Holt, Rinehart, and Winston 383 Madison Ave. New York, NY 10017 (212) 872-2000 Apple, PET, TRS-80																						x	
I.O.R. Enterprises Rt. 6, Box 20 Chapel Hill, NC 27514 (919) 929-4825 Apple II Plus																							x
Ideatech Company P.O. Box 62451 Sunnyvale, CA 94088 (408) 985-7591 Apple	x	x	x	x	x						x			x									
Information Unlimited Software 281 Arlington Avenue Berkeley, CA 94707 (415) 331-6700 Apple, IBM, TI				x	x											x		x				x	
Instant Software Peterborough, NH 03458 (800) 343-0728 Apple, TRS-80, TI, PET	x		x				x		x		x	x				x	x			x			
Instructional/Comm Tech Inc. 10 Stepar Place, Huntington Station, NY 11746 (516) 549-3000 Apple		x	x											x									
J & S Software, Inc. 140 Reid Avenue Port Washington, NY 11050 (516) 944-9304 Apple, TRS-80 I & III		x	x		x						x												
J. L. Hammett Box 545 Braintree, MA 02184 (800) 225-5467 Apple, Atari, IBM, PET, TRS-80	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	

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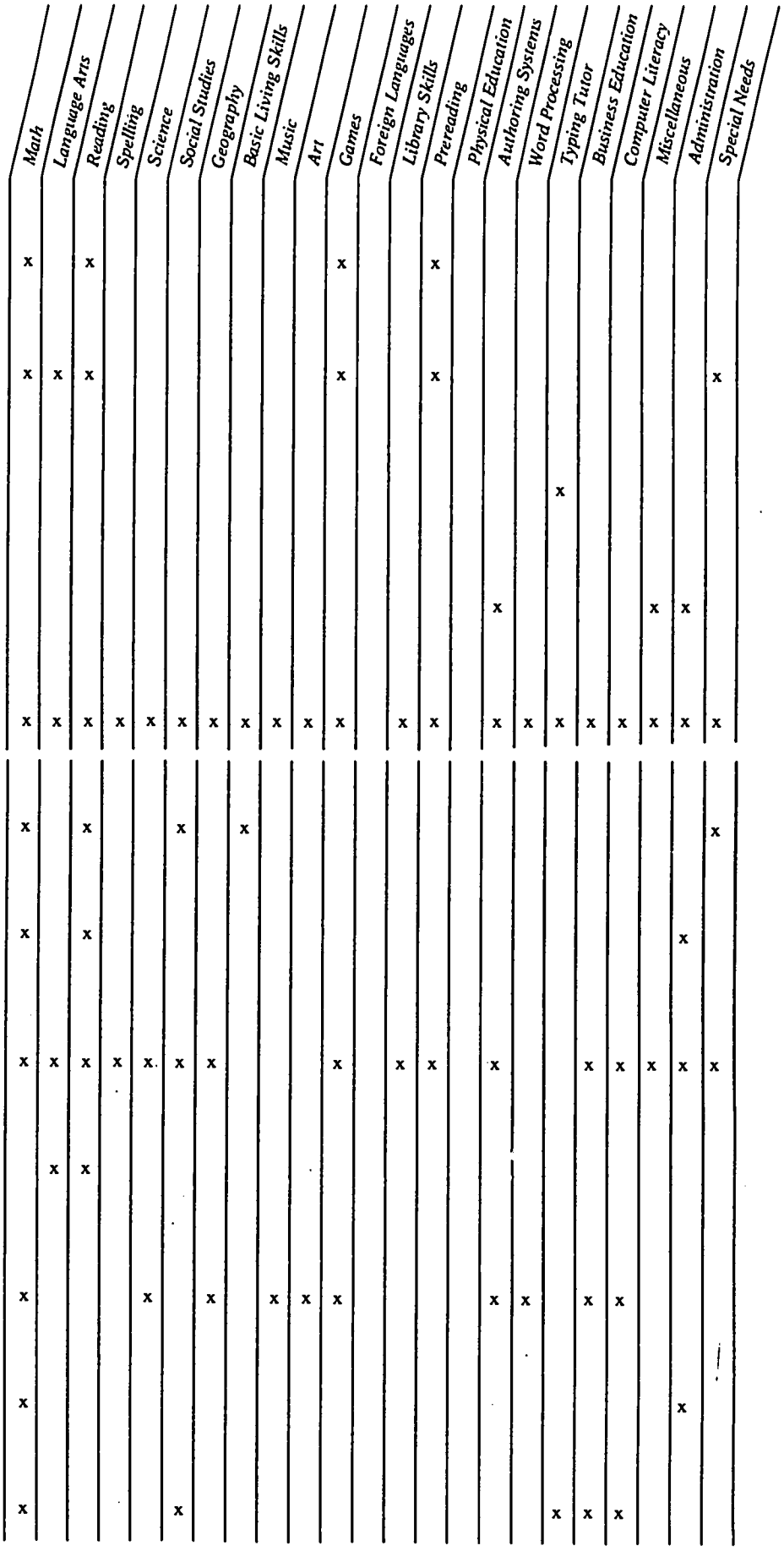
JMH Software 4850 Wellington Lane Minneapolis, MN 55442 (612) 559-4790 Atari, Commodore PET, Vic, 64	x	x	x	x	x	x			x		x			x							x	x	
Jagdstaffel Software 608 Blossom Hill Road San Jose, CA 95123 (408) 578-1643 Apple		x																					
Jamestown Publishers P.O. Box 6743 Providence, RI 02940 (401) 351-1915 Apple II & IIe		x																			x		
K-12 Micromedia P.O. Box 17 Valley Cottage, NY 10989 (201) 391-7555 Apple, Atari, TRS-80 I & III, PET	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Krell Software Corporation 1320 Stony Brook Rd Stony Brook, NY 11790 (516) 751-5139 Apple, Atari, TRS-80 I & III, Com. PET & 64	x	x	x		x	x				x	x			x						x	x		x	
Bruce Land & David Farmer 395 Brooktondale Road Brooktondale, NY 14817 Apple II		x																					x
Lara Software 980 Hunting Valley Place Decatur, GA 30033 (404) 634-7601 Apple		x																					
Laureate Learning Systems, Inc. 1 Mill Street Burlington, VT 05401 (802) 862-7355 Apple II		x												x								x	x
Learning Company 4370 Alpine Road Portola Valley, CA 94025 (415) 851-3160 Apple, Atari, TRS color	x	x		x	x						x			x							x		
Learning Systems P.O. Box 15 Marblehead, MA 01945 (617) 639-0114 Apple II, DEC, IBM, TRS-80																						x	
Learning Systems, Ltd. P.O. Box 9046 Fort Collins, CO 80525 (303) 482-6193	x	x																			x	x	
Learning Tools 686 Massachusetts Ave. Cambridge, MA 02139 (617) 864-8086 Apple II & III, IBM, DEC																						x	



Learning Tree Software, Inc.
Box 246
Kings Park, NY 11754
(516) 462-6216
Pet, Commodore 64

Learning Well
200 South Service Road
Roslyn Heights, NY 11577
(516) 621-1540
Apple II

Lightning Software
P.O. Box 5223
Stanford, CA 94305
(415) 327-3280
Apple, Atari, IBM-PC

Love Publishing
1777 South Bellaire St.
Denver, CO 80222
(303) 757-2579
Apple II

MARAC
280 Linden Avenue
Branford, CT 06405
(203) 481-3271
Apple, Atari, TRS-80, Comm.

MCE, Inc.
157 S. Kalamazoo Mall
Kalamazoo, MI 49007
(616) 345-8681
Apple II, IIe

MEAN (Ed. Turnkey Systems)
256 North Washington St.
Falls Church, Virginia 22046
(703) 536-2310
Apple, IBM, TI

MECC (Minn. Ed. Comp. Consortium)
2520 Broadway Drive
St. Paul, MN 55113
(612) 638-0627
Apple, Atari

MIND
50 Washington Street
Norwalk, CT 06854
(203) 846-3435
Apple II, TRS-80

MUSE (Micro Users Software Exchange)
347 Charles St.
Baltimore, MD 21201
(301) 659-7212
Apple, Atari

Mathware
919 14th Street
Hermosa Beach, CA 90254
(213) 379-1570
Apple II

McGraw-Hill Gregg Division
1221 Avenue of the Americas
New York, NY 10020
(800) 223-4180
Apple, TRS-80

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
McKiligan Supply Corp. Dist. 435 Main St. Johnson City, NY 13790 (607) 729-6511 Apple, TI, Atari, IBM, Comm	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	
Media Materials, Inc. 2936 Remington Ave. Baltimore, MD 21211 (301) 235-1700 Apple, TRS-80 III	x	x																					
Merit Micro Software Corporation 404 Texas Commerce Bank Bldg. Amarillo, TX 79101 (806) 353-7888																					x		
Merlan Scientific Ltd. 247 Armstrong Avenue Georgetown, Ontario Canada L7G 4X6 (416) 877-0171 Apple, PET	x				x																	x	
Merry Bee Communications 815 Crest Drive Omaha, NE 68046 (402) 592-3479 Apple		x		x					x		x			x									
Metrologic Publications 143 Harding Avenue Bellmawr, NJ 08031 (609) 933-0100 Apple, TRS-80, PET					x																		
Micro Computer Service, Inc. 2885 East Aurora Ave., Suite 14B Boulder, CO 80303 (303) 447-9471 CP/M																						x	
Micro Lab Learning Center 2310 Skokie Valley Road Highland Park, IL 60035 (312) 433-7550 Apple, IBM	x	x				x				x	x			x	x	x				x		x	
Micro Learningware P.O. Box 307 Mankato, MN 56001 (507) 625-2205 Apple, TRS-80 III, PET	x	x	x	x	x	x	x	x	x	x	x	x	x						x				
Micro Power & Light Company 12820 Hillcrest Road, Suite 224 Dallas, TX 75230 (214) 239-6620 Apple	x	x	x	x	x		x	x			x		x			x				x		x	
Micro-Ed, Inc. P.O. Box 24156 Minneapolis, MN 55424 (612) 926-2292 Apple, TI, Comm	x	x	x	x	x	x	x							x	x					x			
MicroGnome (Div. of Fireside) 5843 Montgomery Rd. Elkridge, MD 21227 (301) 796-4165 TRS-80, CPM						x										x			x				

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Microcomputer Workshops 103 Puritan Drive Port Chester, NY 10573 (914) 937-5440 Apple, Atari, TRS-80, PET, Comm 64	x	x			x							x											
Microcomputers Corporation P.O. Box 8 Armonk, NY 10504 (914) 273-6480 Texas Instruments																					x		
Micrograms, Inc. P.O. Box 2146 Loves Park, IL 61130 (815) 965-2464 Pet, Vic																					x		
Micromatics, Inc. 181 No. 200 West, Suite 5 Bountiful, UT 84010 (801) 292-2458 Apple, TRS-80	x	x																	x			x	
Microphys Programs 2048 Ford Street Brooklyn, NY 11229 (212) 646-0140 Apple, TRS-80, PET, Comm 64	x	x		x	x						x											x	
Microsoft Services P.O. Box 776 Harrisonburg, VA 22801 (703) 433-9485 TRS-80 III																						x	
Microsoftware Services P.O. Box 776 Harrisonburg, VA 22801 (703) 433-9485 TRS-80 III																					x	x	
Midwest Software Box 214 Farmington, MI 48024 (313) 477-0897 Apple, Pet												x										x	
Milliken Publishing Company 1100 Research Blvd. St. Louis, MO 63132 (314) 991-4220 Apple, Atari	x	x	x	x							x			x									
Milton Bradley 443 Shaker Road East Longmeadow, MA 01028 (413) 525-6411 Apple, TI	x	x	x																			x	
Mount Castor Industries 368 Shays Street Amherst, MA 01002 (413) 253-3634 Apple, TRS-80, Comm.																						x	
Msss D, Inc. 3412 Binkley Dallas, TX 75205 (214) 522-8051 Apple															x				x				

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Musitronic P.O. Box 441, 555 Park Drive Owatonna, MN 55060 (507) 451-7871 Apple									x														
N.I.R.E., Don Selwyn 97 Decker Road Butler, NJ 07405 (201) 838-2500 TRS-80 I & III																x						x	
Nova Software P.O. Box 545 Alexandria, MN 56308 (612) 762-8016 Apple II	x									x				x									
Opportunities For Learning, Inc. 8950 Lurline Avenue. Dept. 26C Chatsworth, CA 91311 (213) 341-2535 Apple, TRS-80, Atari, PET	x	x			x	x		x	x	x	x	x						x	x		x	x	
Orange Cherry Media 7 Delano Drive Bedford Hills, NY 10507 (914) 666-8434 Apple, Atari, PET, TRS-80	x	x	x	x	x	x	x	x			x	·		x									
PIE, Inc 1714 Illinois St. Lawrence, KS 66044 (913) 841-3095 Apple																					x		
Personal Software Inc. (Visicorp) 2895 Zanker Road San Jose, CA 95134 (408) 946-9090 Apple, IBM																		x			x		
Potomac MicroResources, Inc. P.O. Box 277 Riverdale, MD 20737 (301) 864-4444 Apple II		x												x									
Powell Associates, Inc. 3724 Jefferson, Suite 205 Austin, TX 78731 (800) 531-5239 Apple CP/M, TRS-80 II & III																					x		
Powersoft P.O. Box 157 Pitman, NJ 08071 (609) 589-5500 Apple												x								x			
PracEd Tapes, Inc. 12162 SE 14th St. Bellevue, WA 98005 (206) 747-8485 Commodore	x																			x			
Precision People, Inc. P.O. Box 17402 Jacksonville, FL 32216 (904) 642-1980 TRS-80 I & III	x																						

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Problem Solving Through Strategy Oliva Public School Oliva, MN 56377 (612) 523-1031 Apple											x												
Program Design, Inc. 11 Idar Court Greenwich, CT 06830 (203) 661-8799																							
Programs For Learning, Inc. P.O. Box 954 New Milford, CT 06776 (203) 355-3452 Apple, TRS-80, PET					x																		
G. Evan Rushakoff New Mexico State University Las Cruces, NM 88003 (505) 646-2801 Apple II																						x	
Prentke Romich Company 8769 Township Road 513 Shreve, OH 44676 (216) 567-2906 Apple II																x						x	
Program Design, Inc. 11 Idar Court Greenwich, CT 06830 (203) 661-8799 Apple II, Atari	x	x	x	x					x		x			x						x			
Quality Educational Designs P.O. Box 12486 Portland, OR 97212 (503) 287-8137 Apple, TRS-80, PET, Comm 64	x																						
Queue, Inc. 5 Chapel Hill Drive Fairfield, CT 06432 (800) 232-2224 Apple, Atari, Comm., TRS-80	x	x	x	x	x	x		x	x		x	x	x		x		x	x			x	x	
Radio Shack (Education Division) 1600 Tandy Center Fort Worth, TX 76102 (817) 390-3302 TRS-80 all models	x		x		x	x					x			x	x	x			x		x		
Raised Dot Computing 310 S 7th Street Lewisburg, PA 17837 (717) 523-6739 Apple																x				x		x	
Random House School Division 400 Hahn Road Westminster, MD 21157 (800) 638-6460 Apple, TRS-80	x	x	x	x				x			x			x					x		x		
Readers Digest Pleasantville, NY 10570 (914) 769-7000 Apple, Atari, TRS-80	x	x																		x	x		

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Quality Educational Software P.O. Box 502 Troy, MI 48099 (313) 689-5059 Apple, Atari	x			x							x			x		x		x					
Reston Publishing Co., Inc. 11480 Sunset Hills Road Reston, VA 22090 (800) 336-0338 Apple, Atari	x									x	x									x			
Robert E. Stepp III Station A, P.O. Box 5002 Champaign, IL 61820 (217) 359-7933 Apple II																x						x	
Rocky Mountain Software, Inc. 214-131 Water Street Vancouver, B.C. Canada V6B 4M3 Apple II																x							
SEI (Sliwa Enterprises, Inc.) P.O. Box 7266, 2013 Cunningham Dr. Hampton, VA 23666 (804) 826-3777 Apple	x	x	x									x											
SLED Software P.O. Box 16322 Minneapolis, MN 55416 (612) 926-5820 PET				x																			
San Juan Unified School Dist. 6141 Sutter Ave. Carmichael, CA 95608 (916) 944-3614 Apple															x								
Scholastic Software 904 Sylvan Avenue Englewood Cliffs, NJ 07632 (212) 944-7700 Apple, Atari, PET, TRS-80, TI	x	x	x	x	x	x	x		x		x	x				x	x	x	x		x	x	
School & Home Courseware, Inc. 1341 Bulldog Lane, Suite C Fresno, CA 93710 (209) 227-4341 Apple II																x						x	
Science Research Associates, Inc. 155 North Wacker Drive Chicago, IL 60606 (800) 621-0664 Apple, Atari, TI	x	x	x	x	x	x						x									x		
Scott, Foresman Elec. Publishing 1900 East Lake Avenue Glenview, IL 60025 (312) 729-3000 Apple, Atari, TI	x	x	x		x						x	x		x					x	x	x		
Sensible Software 6619 Derham Drive West Blomfield, MI 48033 (313) 399-8877 Apple				x																			

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Serendipity Systems, Inc. 419 W. Seneca St. Ithaca, NY 14850 (607) 277-4889 Apple																		x			x		
Sierra On Line 36575 Mudge Ranch Road Coarsegold, CA 93614 (209) 683-6858 Apple		x	x								x			x									
Skillcorp Software 1711 McGaw Ave. Irvine, CA 92714 (800) 845-8688 Apple, PET, TRS-80	x	x													x								
Sof/Sys, Inc. 4306 Upyon Ave. So. Minneapolis, MN 55410 (612) 929-7104 Apple II, IBM																x							
Softswap 333 Main St. Redwood City, CA 94063 (415) 363-5470 Apple, public domain programs	x	x	x	x	x	x	x	x	x	x	x				x					x			
Software Connections, Inc. 1800 Wyatt Drive, Suite #17 Santa Clara, CA 95054 (408) 988-3704 Apple																				x			
Software Research P.O. Box 1700 Victoria, BC Canada VFW 2Y2 (604) 477-7246 Apple, IBM		x	x		x					x										x			
Software Technology, Inc. 3763 Airport Road Mobile, AL 36608 (205) 344-7600 Apple, IBM, CP/M																				x			
SouthWest EdPsych Services P.O. Box 1870 Phoenix, AZ 85001 (602) 253-6528 Apple	x		x	x							x							x			x		
Southeastern Educational Software 3300 Buckeye Road Atlanta, GA 30341 (404) 457-8336 Apple	x	x									x						x				x		
Southern Microsystems For Ed. P.O. Box 1981 Burlington, NC 27215 (919) 226-7610 Apple II & III, TRS-80 3, IBM																					x		
Spinnaker Software 215 First Street Cambridge, MA 02142 (617) 868-4700 Apple										x	x			x									

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Sterling Swift Publishing Co. 1600 Fortview Rd. Austin, TX 78704 (512) 444-7570 Apple	x				x	x						x			x				x				x
Stoneware 50 Belvedere San Rafael, CA 94901 (415) 454-6500 Apple																					x		
Strategic Simulations Inc. 883 Stierlin Road, Bldg. A-200 Mountain View, CA 94043 (415) 964-1353 Apple, Atari, TRS-80, IBM						x					x												
SubLOGIC Communications Corp. 713 Edgebrook Drive Champaign, IL 61820 (217) 359-8482 Apple, Atari, TRS-80, IBM				x		x					x												
Sunburst Communications P.O. Box 40, 39 Washington Ave. Pleasantville, NY 10570 (914) 431-1934 Apple, Atari, TRS-80	x	x	x		x	x							x						x	x			
Sysdata International, Inc. 7671 Old Central Ave., NE Minneapolis, MN 55432 (612) 780-1750 Apple II																					x		
T.H.E.S.I.S. P.O. Box 147 Garden City, MI 48135 (313) 595-4722 Apple, Atari	x	x											x										
TIES 1925 W. County Rd. B2 St. Paul, MN 55113 (612) 633-9100 Apple, Atari	x	x	x		x										x				x		x		x
TYC Software 2128 West Jefferson Road Pittsford, NY 14534 (716) 424-5453 Apple, TRS-80	x	x	x	x	x	x	x				x	x									x		
TYCOM Associates 68 Valma Avenue Pittsfield, MA 01201 (413) 442-9771 PET	x	x									x	x											
Tamarack Software P.O. Box 247 Darby, MT 59829 (406) 821-4596 Apple, Atari, PET															x						x		
Teach Yourself By Computer Software 2128 W. Jefferson Road Pittsford, NY 14534 (716) 424-5453 Apple, TRS-80				x	x										x					x			

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
Teacher's Pet Software 1517 Holly St. Berkeley, CA 94703 (415) 526-8068 PET	x	x																					
Teaching Pathways, Inc. P.O. Box 31582 Amarillo, TX 79120 (806) 373-1847 Apple II & III, TRS-80 I & III																					x		
Technical Language Systems, Inc. P.O. Box 172 San Angelo, TX 76902 (915) 655-0981 Apple																					x		
Teck Associates P.O. Box 8732 White Bear Lake, MN 55110 (612) 429-5570 Apple	x	x	x	x						x	x			x		x		x					
Temporal Activity Products Inc. 1535 121st Ave. S.E. Bellevue, WA 98005 (206) 746-2790 Apple									x														
Terrapin, Inc. 330 Green Street Cambridge, MA 02139 (617) 492-8816 Apple																					x		x
Texas Instruments P.O. Box 53 Lubbock, TX 79408 (800) 858-4565 TI	x	x	x	x	x	x	x		x	x	x			x		x	x	x		x	x		
The Micro Center P.O. Box 6 Pleasantville, NY 11801 (516) 796-9392 Apple, Atari, Pet, TRS-80																					x		
The Professionals Workshop 1 Fletchers Mews, Neath Hill Milton Keynes, Bucks England Apple II											x												x
The Programmers, Inc. P.O. Box 1207 Taos, NM 87571 (505) 758-0576 Apple															x								
The Psychological Corp. 757 Third Avenue New York, NY 10017 (212) 888-3500 Apple, TRS-80	x		x																		x		
The Upper Room 907 6th Ave. E Menomonie, WI 54751 (715) 235-5775 Apple, Texas Instruments	x	x	x					x			x			x									x

	Math	Language Arts	Reading	Spelling	Science	Social Studies	Geography	Basic Living Skills	Music	Art	Games	Foreign Languages	Library Skills	Prereading	Physical Education	Authoring Systems	Word Processing	Typing Tutor	Business Education	Computer Literacy	Miscellaneous	Administration	Special Needs
Thos. Wiggers, U. of MS Med. Cntr. 2500 N. State St. Jackson, MS 39206 (601) 987-5942 Apple																					x		
UNICOM 297 Elmwood Avenue Providence, RI 02907 (401) 467-5600 Apple																					x		
USE, Inc 14901 E. Hampden Ave. Suite 250 Denver, CO 80014 (303) 699-0438 Apple			x																				
Universal Systems For Ed. Inc. 14901 E. Hampden Ave., Suite 250 Aurora, CO 80014 (303) 699-0438 Apple II			x																				
Visual Horizens 180 Metro Park Rochester, NY 14623 (716) 424-5300 Apple																				x			
Wadsworth Electronic Publishing Co. 20 Park Plaza Boston, MA 02116 (800) 322-2208 Apple	x																						
Walt W[illegible] 655 S. Fair Oaks, M213 Sunnyvale, CA 94086 (408) 733-6358 Apple II, TRS-80			x								x					x						x	

Appendix J

Software Evaluation Resources

The Best of Apple Software, Ltd.
The Best of Atari Software, Ltd.
The Best of Commodore Software, Ltd.
The Best of Texas Instruments Software, Ltd.
Publications International, Ltd.
3841 W. Oakton Street
Skokie, IL 60076
(312) 676-4370
$4.96 each
Each of these guides include an education section with 140 to 200 entries. Programs are evaluated by user groups and are rated on a scale of one to ten.

Conduit
P. O. Box 388
Iowa City, IA 52244
(319) 355-5789

Courseware Report Card
Educational Insight
150 W. Carob Street
Compton, CA 90220
(213) 979-1955
Price range: $22.50 - $95.00
Separate issues have been published for the Apple, Atari, Commodore, IBM and TRS-80 computers, as well as separate editions for elementary and secondary levels. Every issue contains evaluations and summaries.

Courseware Reviews 1984
SMERC Library Microcomputer Center
San Mateo County Office of Education
333 Main Street
Redwood City, CA 94063
(415) 363-5472
$10.00
Fifty programs in all curriculum areas are evaluated in this publication of the San Mateo Educational Resource Center (SMERC). These reviews, compiled by educators, describe each program and note strengths, weaknesses, student responses and a checklist of evaluator criteria.

The Digest of Software Reviews: Education
School and Home Courseware, Inc.
Suite C
1341 Bulldog Lane
Fresno, CA 93710
(209) 227-4341
$15.00/issue, $52.95/4 issues
The Digest profiles instructional software programs, including administrative programs for Apple, Atari, Commodore, IBM, TI, and TRS-80. Each issue reviews 50 programs which have been heavily reviewed in journals and newsletters.

DISC Compendium
Carol Klenow
Disk Project Manager
IICD, Oakland Schools
2100 Pontiac Lake Road
Pontiac, MI 48054
(313) 858-1895
$20.00
The DISC Compendium, produced by the interactive and instructional Computing Department of the Oakland County Schools, is a collection of 91 software evaluations and documentations for PET, Apple and TRS-80 computers.

Educational Micro Review
P. O. Box 14445
Austin, TX 78761
(512) 345-0001
$5.00/issue, $36.00/12 issues
Each month Educational Micro Review summarizes articles from more than 25 microcomputer publications and includes over 300 reviews. Areas covered include hardware, software, networks, robotics, books, films, tapes and information utilities.

Evaluation of Educational Software: A Guide to Guides
Publications Office
Southwest Educational Development Laboratory
211 East Seventh Street
Austin, TX 78701
$6.50 prepaid
This is a useful reference guide for teachers and administrators who are responsible for software evaluation. It provides information on 10 evaluation systems, including abstracts and sample forms from MicroSIFT, EPIE/Consumers Union, MECC, and the National Council of Teachers of Mathematics.

Evaluator's Guide for Microcomputer-Based Instructional Packages
International Council for Computers in Education
University of Oregon
1787 Agate Street
Eugene, OR 97403
$2.50
This guide was developed by MicroSIFT to be used with the MicroSIFT rating scale.

Guidelines for Evaluating Computerized Instructional Materials
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091
$3.00
This publication includes guidelines to use in reviewing software, a sample form to use in requesting software information from publishers and a sample form to use in evaluating documentation.

The Journal of Courseware Review
Foundation for the Advancement of Computer-aided Education
20863 Stevens Creek Boulevard
Building B-2, Suite A-1
Cupertino, CA 95014

Media Review
172 Holmes Road
P. O. Box 425
Ridgefield, CT 06877
(203) 438-2843
K-8: $69.00/10 issues
9-college: $60.00/10 issues
K-college $99.00/10 issues
Each issue of this monthly publication includes microcomputer software evaluations covering a specific subject area. Program reviews are cumulatively indexed by title, publisher and subject.

Micro CO-OP
P. O. Box 432
West Chicago, IL 60815
(312) 232-1984

Micro Courseware/Hardware Pro/Files and Evaluations
EPIE Institute
P. O. Box 839
Water Mill, NY 11976
(516) 283-4922
$360.00
Pro/Files are 2 to 4 page software evaluations covering all major curriculum areas and grade levels. These reviews include analyst's summary, capsule evaluation, user comments, sample frames, students' comments, and other reviews of the program, how the teacher and students use the program, instructional value and documentation evaluation. (These materials are available to each Georgia school system through instructional Media Services, Georgia Department of Education.)

Microcomputer Software and Information for Teachers (MicroSIFT)
Northwest Regional Educational Laboratory (NWERL)
500 Lindsay Building
300 SW 6th Avenue
Portland, OR 97204
(503) 248-6800

Microcomputers in Education
Queue, Inc.
5 Chapel Hill Drive
Fairfield, CT 06432

RICE (Resources in Computer Education)
BRS, Inc.
1200 Rt. 7
Latham, NY 12110
(518) 783-7251
(800) 833-4707
RICE is an on-line information database, part of the Northwest Regional Educational Laboratory's MicroSIFT project. By late 1983, the database included information on approximately 2,000 software programs for use in elementary and secondary schools. The RICE database is available to subscribers to Bibliographic Retrieval Services.

School Microware Reviews
Dresden Associates
P. O. Box 246
Dresden, ME 04342

The Software Exchange
Technical Education Research Centers
8 Eliot Street
Cambridge, MA 02130
(617) 547-3890
Contact: Tim Barclay

Software Reports
Allenback Industries,
2102 Las Palmas
Carlsbad, CA 92008
(619) 438-8694
(800) 854-1515
$59.95
The nearly 400 software programs listed in this directory have been evaluated by an independent team of teachers and administrators. Each entry includes a description of the program and vendor information. The directory is updated twice each year.

Softswap
c/o Ann Lathrop
San Mateo County Office of Education
333 Main Street Redwood City, CA 94063
(415) 363-5472
This is one of the best known educational software clearninghouses. The disks sell for $10 or you may go to their center and copy them free. You may also receive a free disk for disk of original material.

Whole Earth Software Review
150 Gate Five Road
Sausalito, CA 94965
(415) 332-4335
$5.00/issue; $18.00/4 issues
This quarterly guide presents the comparative surveys of software and hardware products that the Whole Earth research staff has tested and recommends. A compilation of the reviews can be purchased in the Whole Earth Software book published by Doubleday.

Appendix K

Educational and Technology Journals

AEDS Journal, Jerry S. Pehrson, 3302 Gorham Avenue, Minneapolis, MN 55426.

Apple Education News, Apple Computer Inc., 10260 Bandley Drive, Cupertino, CA 95014.

Apple Educator's Newsletter, 9525 Lucerne, Ventura, CA 93003.

Boston Computer Update, Boston Computer Society, Inc., Three Center Plaza, Boston, MA 02108.

BYTE, Byte Publications, 70 Main Street, Peterbrough, NH 03458.

Byte, P. O. Box 590, Martinsville, NJ 08836.

Classroom Computer News, P. O. Box 266, Cambridge, MA 02130.

Classroom Computer News, International Educations, Inc., 341 Auburn Street, Watertown, MA 02172.

Computer (Pet), 900 Spring Garden Street, Greensboro, NC 27403.

Computer Town USA!, News Bulletin, P. O. Box E, Menlo Park, CA 94025.

Computerworld, Weekly Newspaper, Circulation Department, 375 Farmingham, MA 01701.

Computers, Reading and Language Arts, P. O. Box 13039, Oakland, CA 94661.

The Computing Teacher, Computing Center, Eastern Oregon State College, LaGrande, OR 97850.

Creative Computing, P. O. Box 789-M, Morristown, NJ 07960.

C.U.E. Newsletter, Computer-using Educators, Dr. Sandy Wagner, Editor, 127 O'Connor Street, Menlo Park, CA 94025.

Dr. Dobb's Journal of Computer Calisthenics & Orthodontia, PCC, 1263 El Camino Real, Box E, Menlo Park, CA 94025.

EDU, Educational Products Group, Digital Equipment Corporation, 129 Parker Street, Maynard, MA 01750.

Educational Computer Newsletter, Educational Computer, P. O. Box 535, Cupertino, CA 95015.

Electronic Education, P. O. Box 20221, Tallahassee, FL 32304.

Electronic Learning, 730 Broadway, New York, New York 10003-9358.

Appendix L

Technology Staff Development

Outline

Following is one suggested outline for a staff development program for your school district. Feel free to use it as is or to modify it to suit your school district's needs.

I. Technology Awareness
   - A. Terminology
   - B. Concepts

II. Brief History of Technology (See Chapter II)
   - A. First Revolution
   - B. Second Revolution
   - C. Third Revolution
   - D. Fourth Revolution

III. Hardware Components and How They Work
   - A. Computers
   - B. Videodisk
   - C. Telecommunications

IV. Software
   - A. Operating System Software
   - B. Applications Software
   - C. Programming Software

V. Administrative Appliations
   - A. Word Processing
   - B. Data Base Applications
   - C. Electronic Spreadsheets
   - D. Shared Databases

VI. Instructional Support/Management Applications
   - A. Classroom Records Management
   - B. Testing/Scoring
   - C. Diagnosis/Prescription

VII. Direct Instructional Applications
   - A. Computer Assisted Instruction
   - B. Computer Based Instruction

VIII. Evaluating Software
   - A. Characteristics of Good Software
   - B. Evaluation Criteria
   - C. Evaluation Forms

IX. Programming Overview (In-depth instruction separate)
   - A. BASIC
   - B. LOGO
   - C. PASCAL

If you don't intend to train all staff at once, you may wish to modify this agenda to fit each audience.

Eisley, UGA.

Appendix M

Survey of Supervisor's Needs for Training in the Use of Educational Technology

Directions: Following is a list of topics pertaining to the use of technology, especially microcomputers, in education. In order to determine content appropriate for teaching school supervisors about educational technology, you are to rate each topic for its importance to the job of a school supervisor. Please use the following scale in rating each item:

1 = not relevant
2 = relevant but not really important to the job
3 = important for job performance
4 = very important but not essential for job performance
5 = essential to successful job performance

1.	History of computers and computing.	1	2	3	4	5
2.	Influence of computers on society.	1	2	3	4	5
3.	Future developments in microcomputers.	1	2	3	4	5
4.	How computers work - their operations.	1	2	3	4	5
5.	Components of computer systems.	1	2	3	4	5
6.	Programming in a computer language.	1	2	3	4	5
7.	Creation of computer language.	1	2	3	4	5
8.	Using word processing applications.	1	2	3	4	5
9.	Using database applications.	1	2	3	4	5
10.	Using educational applications.	1	2	3	4	5
11.	Using spread sheet applications.	1	2	3	4	5
12.	Evaluating microcomputer software.	1	2	3	4	5
13.	Teaching computer topics to pupils.	1	2	3	4	5
14.	Designing instructional applications.	1	2	3	4	5
15.	Altering or fixing ready-made programs.	1	2	3	4	5
16.	Limitations of computers.	1	2	3	4	5

17.	Using statistical applications.	1	2	3	4	5
18.	Using computers to teach problem solving.	1	2	3	4	5
19.	Using administrative appliations.	1	2	3	4	5
20.	Planning for utilization of technology.	1	2	3	4	5
21.	Evaluating technology programs in schools.	1	2	3	4	5
22.	Sources of educational applications.	1	2	3	4	5
23.	Research on computer use in education.	1	2	3	4	5
24.	Selecting and acquiring hardware.	1	2	3	4	5
25.	Using instructional support applications.	1	2	3	4	5
26.	Other topics (please list)					
_____		1	2	3	4	5
_____		1	2	3	4	5
_____		1	2	3	4	5
_____		1	2	3	4	5
_____		1	2	3	4	5

Appendix N

Who Needs Training for Which Competencies?

The next step is to ascertain which staff members need training for which competencies. This can be determined through a short self-report which can be distributed to all staff. A partial example of such an inventory follows.

Computing Skills Inventory

Name _____ Grade _____

School _____ Subject _____

In an effort to tailor staff development for improving our use of educational technology, the planners would like assistance in determining what should be included in the training program. Would you please help by indicating your strengths and where you feel additional help is needed in this vital area.

Competency	Skill Level high		medium		low	Need More? yes	no
To identify appropriate hardware.	5	4	3	2	1		
To maintain hardware.	5	4	3	2	1		
To operate equipment	5	4	3	2	1		
To select software	5	4	3	2	1		
To maintain software	5	4	3	2	1		
To use applications.	5	4	3	2	1		
To define a problem.	5	4	3	2	1		
To design a solution.	5	4	3	2	1		
To write a program.	5	4	3	2	1		
To understand impact of technology on society.	5	4	3	2	1		

Eisley, UGA.

Appendix O

Teacher Training in Computer Skills: A Call for a Redefinition

Hugo F. Sandoval

The prompt, eager, and positive response of educators to computers belies the legendary ponderousness of the profession when confronted with new ideas and technologies. The acceptance of computers by a profession largely recognized by its stodginess and reluctance to innovate is witness to the machine's power, attractiveness, and usefulness.

The uncharacteristically urgent and eager acceptance of computers by teachers, administrators, and other school personnel makes the days of opposition to language laboratories and instructional television seem the actions of a faraway era, of another people, and another discipline. The resulting scene of educators rushing to become computer experts can be described in the terminology of Margaret Mead[1] as the forced march of a post-figurative generation rushing to beat a pre-figurative generation to the technology of the day.

What Kind of Teacher Training?

Recognizing that the reasons for such positive response from educators to computers await the scrutinizing eye of researchers, one can ask the question whether teachers are now receiving the training in computers which will make a difference in the instructional process, resulting in increased learning. As with all new areas that have been incorporated into an existing curriculum, computer training for teachers has had to overcome the perennial problems of an already crowded program, an inelastic amount of time, and the lack of qualified faculty. The result has been computer training for teachers which is not teacher oriented, taking place outside of schools of education, mostly at the inservice level, and with little being done in undergraduate courses.

A general analysis of the computer courses offered in colleges of teacher education reveals their number to be meager and the content too heavily involved in programming, history of computers, and the output of business reports and mathematical/statistical applications of computers. The more appropriate areas of evaluation of commercially available software, uses of teacher utility programs, and the instructional design of courses incorporating computer-assisted instruction as a regular part of the instructional strategy are underemphasized or even absent. A similar situation is revealed upon examining the textbooks and materials used in these programs.

These conditions are all too prevalent, and better examples of teacher training courses in computers such as that described by Van Dusseldorp[2] at the School of Education of the University of Alaska are the exception, not the rule.

Tradition and Current Practice

Traditionally, teacher training has two general components: (1) training in a content area such as social studies, math, reading, etc., and (2) training in the methodology of teaching that particular content. The first training component contains the teaching of the history, basic principles, and current knowledge of the field, together with the names and contributions of prominent practitioners. The second component includes practica, field trips, and observation of teachers in the classroom as a way of learning the techniques and behaviors of teaching through modeling and observation.

In some cases, this second component may include information about the communication process, such as simple models of communication, communication techniques and instructional media, their uses and production, and some psychological principles applied to education. That part which deals with media is quite frequently the weakest in the training program, since it requires an instructional media center, projection equipment, facilities, materials, and instructors with expertise in the area—all of which require the expenditure of *money*.

In 1984, added to the many graduating teachers who were not taught to thread a projector, trouble-shoot a recorder, or even select and properly use mediated materials in their classes, are those who did not receive any training in computers or who received inadequate training in computer utilization. For example, a cursory examination of the course requirements for teacher certification in audiovisual media in the State of Tennessee reveals no course requirements in instructional design, computer-assisted instruction, or in any other area of instructional technology. Four of five Nashville metropolitan colleges require only a general course in media utilization. One offers a course related to

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computers, but since it is taught in the Department of Library and Information Sciences, it is oriented toward library networks such as OCLC, a smattering of BASIC, and a brief introduction to the computer. A Library Media Specialist's only required course in the area of audiovisuals can be, and quite often is, met by completing a three-credit, general theoretical review of media used in instruction.

Tennessee is not alone. In spite of efforts of professional organizations such as the Association for Educational Communications and Technology (AECT) to promote and achieve acceptable, meaningful, and relevant requirements in the area of educational technology, many states still do not make provisions for adequate teacher competencies in the selection, evaluation, and use of audiovisuals in instruction.

It is still possible to prevent teacher certification requirements in computing from becoming as neglected, confused, and meaningless as those for the audiovisual media. State requirements for teacher certification in computers vary, many focusing away from the main activities of a *teacher* (managing learning) and reflecting the common misperception of the computer as a calculating, computing tool, and ignoring its potential as an organizer of knowledge.

Confusion

Frequently, there is no distinction between *teachers of computers* and *teachers who use computers*. This results in certification requirements such as those of Tennessee, where certification in mathematics is a prerequisite to certification in computers!

This confusion persists even among the latest computer training programs for teachers, although as research[3] has concluded, the number of states which offer certification programs for inservice teachers increased slowly between 1975 and 1980. The teacher re-certification programs of Washington, D.C., and of the State of Florida are examples of recent programs which require every teacher to participate in a three-hour credit course in computers offered by their respective school systems in order to be re-certified. Both programs have the interesting proviso that not even current teachers of computers can be "grandfathered," but still do not make a distinction, in their content, between teachers of computers and teachers who would use computers as teaching instruments.

The matter of content is, again, another matter. The texts, topics, and focus of these courses are data processing oriented, with emphasis on the business applications of computers and little on *how to teach using computers*.

Another recent experience, that of Puerto Rico, illustrates once more the lack of distinction between preparing teachers of computers and teaching teachers to use the computer. The island's Department of Education arranged with the University of Puerto Rico to provide teachers with computer literacy courses. The University in turn asked the Mathematics Department (!) to organize the courses. Soon, teachers were asking for help because they found learning to use the computer to run calculus and advanced mathematical formulas irrelevant to wanting to use the computer to teach history, English, Spanish, and the other courses of the curriculum. The Department of Education now conducts its own computer training courses for teachers, after having "learned the hard way."

Part of the confusion regarding the content of teacher certification programs in computers comes about because those writing certification guidelines do not themselves have experience with computers. Unlike other teaching areas, where experienced practitioners write certification guidelines, among educators there does not yet exist a pool of practitioners from which to draw certification writers.

The confusion about what to teach teachers about computers is not limited to certification requirements and courses. The utilization of computers in the classroom reflects a similar situation. In many schools, computers are mainly reserved for the brightest or for the learning disabled students, while the average or regular student seldom has access to the machine. Many schools restrict their computer laboratories to the study of subjects like mathematics, algebra, and some of the natural sciences, and access to them is limited to the better students in those particular subjects. In other schools, only students with need for remedial work in the basic subjects can use the computers. And on some ocassions, the source of funds limits access to the computers, such as in cases where funds for programs for the learning disabled or remedial students require the computers be used only for students in these categories.

These discrepancies and confusion in teacher certification in computers and of computer utilization in the classroom reflect and in turn are reflected by how teachers are being trained in the area of computers.

"How to Teach"

Following the traditional scheme of teacher training, computers as instructional tools should fall within the "how to teach" part of teacher training. However, this is not the case with current programs and courses on computers for teachers.

Most teachers are being taught computers as computing or data processing tools. The content of inservice teacher workshops follows the content and design of traditional introductory courses in mathematical problem solving or data processing with computers.

These include: history of computers, the nature of computers, mathematical and logical operations with computers, report generation with computers and, yes (of course!), programming a computer.

Any teacher who wants to take a formal course in computers will have to do so in the Business or in the Math Departments, not in the Education Department.

Although to know about computers from the perspective of mathematical or business users is certainly better than to know nothing at all, the result of current teacher training is that computers are not being used effectively in the classroom as teaching tools.

Refocusing and Redefining Training

The highly desired and expected increase in educational quality and productivity which computers are predicted to facilitate will not occur until the present training of teachers in the use of computers in the classroom is refocused and redefined.

A distinction needs to be made between the teacher who knows and can teach about computers and the teacher who can use computers to facilitate the learning of any subject matter.

Schools of education need to reclaim that portion of teacher training which, by necessity, has been forfeited to other academic departments and to State Departments of Education.

Teacher knowledge of the computer for teaching can be classified in at least three levels: (1) knowledge about the computer, its development, uses, and potential; (2) knowledge about how to design and/or operate programs for computers; and (3) knowledge of the computer as a teaching device. The first and second levels include the subject matter currently being presented in teacher training seminars. But if teachers are to become expert users of computers in the exercise of their profession, *there is an urgent need to design education courses which will relate the uses of computers to the total teaching process.*

This means courses which integrate teaching strategies (questioning, reviewing, summarizing, presentation strategies, organization of materials, use of visuals), application of learning theories, classroom management, materials evaluation, and the evaluation of learning with a computer.

It also means teacher training programs with stronger components in the theories of learning, instructional design—especially programmed instruction techniques—needs analysis, learning analysis, and evaluation.

Teacher training programs conceived under this approach will focus on what is the central task of the teacher—the management of the environment to insure learning and on the computer as a tool at the teacher's disposal.

Just as one need not be a mechanic to become an expert driver, teachers need not be data processing experts nor computer scientists to be able users of computers in their classrooms. Needed are training programs with this new emphasis, which produce teachers able to operate systems intelligently, selecting from the commercially available software those packages best suited to their needs and conditions.

This redesign of teacher training in computers means developing teacher computer skills in at least three areas: (1) the systematic design of instruction integrating computers into the learning process; (2) the selection and utilization of available courseware; and (3) the design, preparation, and evaluation of original teaching materials with the computer as the medium. At some point teachers will learn programming and perhaps some internal computer operations, but neither will be the measuring standard of computer competency. Programs with this orientation will be designed systematically, focused on what the teacher does, can do, and needs to do with computers as teaching tools—not as derivations from data processing or math-oriented activities. Integration schemes such as the "infusion by bootstrapping" and intelligent, innovative faculties, such as those described by Van Dusseldorp, are needed to facilitate the re-claiming by schools of education of what belongs to them.

The end-result will be teachers from all specializations, *not just mathematics*, leaving their training programs as intelligent users of the powerful new educational tool which is the computer. □

Notes

1. Margaret Mead. *Culture and Commitment.* New York: Columbia University Press, 1978.
2. Ralph Van Dusseldorp. A Successful Boostrap Program for Infusion of Computer Competencies into a School of Education Curriculum. *AEDS Journal*, 1984, *17*, 9-13.
3. Harriet G. Taylor and James L. Poirot. The Certification of High School Computer Science Teachers. *Proceedings* of the 1984 Association for Educational Data Systems Annual Convention, Washington, D.C., 295-305.

EE

No-fail computer workshops

by Anthony Fredericks

There is one shocking item about the computer revolution. It may be the topic educators talk about most...not in hushed tones -- but with alarm and even indignation. It has, unfortunately, become as much a part of computer literacy as software evaluation, programming skills or problem solving. The subject: lack of adequate training for classroom teachers.

It may come as no surprise, but in our rush to computerize students we may have left a large number of teachers out in the technological wilderness. A recent study released by the Pennsylvania Department of Education indicated that 78.8% of all teachers in the Keystone State had received no training in CAI during the 1982-83 school year. It can reasonably be assumed that this statistic is not isolated to Pennsylvania, but may represent an undercurrent of insufficient teacher training throughout the country. In short, teachers may be offered little opportunity to develop and expand their professional skills -- particularly as they apply to the instructional uses of computers.

Many inservice programs, including those based on computer literacy, are seldom helpful, however. They don't provide new skills, offer few practical ideas and are often unrelated to the day-to-day affairs of the classroom. Workshop speakers, often recruited from local colleges or hardware vendors, may have little to offer the teacher who needs immediate classroom solutions.

There's an obvious answer, though. Teachers can "take the bull by the horns" and develop their own series of inservice workshops geared for their own needs. Staff initiated training programs offer a viable alternative to the mundane presentations usually associated with teacher training. Individuals desiring to effect a meaningful computer inservice program may wish to consider the following factors.

Success Factors:

A. Needs Assessment: Successful computer workshops need to be built upon a firm foundation of needs assessment. More workshops have failed because this element was not initiated than on any other single factor. The effective workshop is able to address the specific needs of participants, rather than the global needs of a presenter. The following factors should be considered as part of the needs assessment process.

1. Use a variety of assessment measures including, but not limited to, questionnaires, surveys, face-to-face interviews, attitude scales and group meetings. Consider a selection of both formal and informal devises to obtain information specific to an inservice program.
2. Use needs assessment measures both prior to and throughout the workshop sessions. It's important that individual needs are continuously assessed to gauge changes in attitudes or skills that may influence later sessions.
3. Involve the workshop participants in designing and interpreting the needs assessment instruments.

Group cohesiveness and success can be ensured when individuals have a hand in the development of a course -- a process that virtually guarantees their involvement.

B. Program Planning: Planning a viable computer training program includes the development of goals and objectives. Specifically, goals are the measured, desired results to be accomplished over a specific period of time. Objectives include what the program participants will be expected to do at the conclusion of the computer workshops. Objectives, to be successful, must be based on identified needs.

1. Give priority to a few selected needs. It may not be possible to address all participants' needs in any single series of workshops. A few well-documented needs developed into objectives should be planned and disseminated to potential participants.
2. Initiate a plan of action. Work with the potential participants to inaugurate an action plan that addresses different competency levels or degrees of knowledge. Constraints of time, money or facilities may also dictate the design of the course.
3. Develop a workable timeline. Effective workshops are not "one shot" efforts, but should last over an extended length of time. The timeline needs to include provisions for workshop variety, adequate pacing, a degree of

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flexibility and methods of evaluation.

C. Program Implementation: The process of implementing a [illegible]omputer workshops [illegible]e coordination of personnel, tasks and available time. As such, it needs to deliniate the responsibilites of those invloved as well as schedule the activities that allow for a high degree of participant involvement.

1. Participants will obtain the greatest amount of satisfaction and practical experience when they are provied with a variety of guided practices, simulations and role playing activities. On the other hand, the effectiveness of computer workshops is diminshed by an over-reliance on lectures, printed information or observations.

2. Involve a large number and wide range of individuals. Success can be maximized when administrators and other district personnel are involved in the workshops, too. Sessions geared solely for the classroom teacher will lack a foundation of support necessary for continuous and effective training in computer literacy.

3. Programs need to consider the practical applications of the computer within the entire curriculum. Provide opportunities for participants to extend their skills in a selection of curricular or administrative areas. In short, prepare them for the future.

D. Evaluation: Determining whether workshop goals have been met is an essential componant of any training program. Evaluation provides data necessary to the success of computer workshops. This information can be used to assess the need for further training as well as to modify componants of the original program.

1. Evaluation should not be scheduled only at the conclusion of a program, but should be ongoing. Information gathered during the course of a program can provide data important in altering program componants in line with increased skill levels.

2. It's important to include a variety of evaluation methods, both formal and informal. Involve program participants in the development of evaluation measures and solicit their input as a valuable componant of the entire process.

3. Evaluation should be considered, not as the termination of a program, but rather as the first step in a program's continuation. As such, it needs to be designed for a purpose -- to modify a current program or to make plans for a future workshop. CE

Dr. Anthony Fredericks is the reading specialist for the Catasauqua Area School District in Pennsylvania.

Appendix P

Suggested District Policy on Software Copyright

It is the intent of _____ to adhere to the provisions of copyright laws in the area of microcomputer programs. Though there continues to be controversy regarding interpretation of those copyright laws, the following procedures represent a sincere effort to operate legally. We recognize that computer software piracy is a major problem for the industry and that violations of computer copyright laws contribute to higher costs and greater efforts to prevent copies and/or lessen incentives for the development of good educational software. All of these results are detrimental to the development of effective educational uses of microcomputers. Therefore, in an effort to discourage violation of copyright laws and to prevent such illegal activities.

1. The ethical and practical problems caused by software piracy will be taught in all schools in the District.

2. District employees will be expected to adhere to the provisions of Public Law 96-517, Section 7(b) which amends Sectoin 117 of Title 17 of the United States Code to allow for the making of a back-up copy of computer programs. This states that ". . . it is not an infringe ment for the owner of a copy of a computer program to make or author- ize the making of another copy or adaptation of that computer program provided:

   a. That such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or

   b. that such a new copy and adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful."

3. When software is to be used on a disk sharing system, efforts will be made to secure this software from copying.

4. Illegal copies of copyrighted programs may not be made or used on school equipment.

5. The legal or insurance protection of the District will not be extended to employees who violate copyright laws.

6. _____ of this school district is designated as the only individual who may sign license agreements for software for schools in the district. (Each school using the software also should have a signature on a copy of the software agreement for local control.)

7. The principal of each school site is responsible for establishing practices which will enforce this policy at the school level.

Source: International Council for Computers in Education. University of Oregon 97403.

Appendix Q

Informational Technology and Its Impact on American Education

(Summary Report)

Foreword

Over the last decade, American education has come to face a number of new demands that must be met with limited resources. Many of these new demands arise from the growing dependence of our society on high technology as a basis for domestic economic growth, international competitiveness and national security. In October 1980, the House Committee on Education and Labor, its Subcommittee on Special Education, and the Subcommittee on Science, Research and Technology of the House Committee on Science and Technology asked OTA to examine the extent to which information technology could serve American needs for education and training.

This report documents two basic sets of conclusions:

1. The so-called *information revolution,* driven by rapid advances in communication and computer technology, is profoundly affecting American education. It is changing the nature of what needs to be learned, who needs to learn it, who will provide it, and how it will be provided and paid for.

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2. Information technology can potentially improve and enrich the educational services that traditional educational institutions provide, distribute education and training into new environments such as the home and office, reach new clients such as handicapped or homebound persons, and teach job-related skills in the use of technology.

The OTA report provides an overview of the issues relating to the educational applications of the new information technologies. It examines both the demands that the information revolution will make on education and the opportunities afforded by the new information technologies to meet those demands. Rather than focusing on a single technology, it examines the full range of new information products and services such as those based on the combined capabilities of computers, telecommunications systems and video technologies. Similarly, the report surveys a broad range of educational providers, and examines how the application of information technologies may affect their abilities to provide education and their respective educational roles.

OTA acknowledges with thanks and appreciation the advice and counsel of the panel members, contractors, other agencies of Government, and individual participants who helped bring the study to completion.

JOHN H. GIBBONS
Director

Informational Technology and Its Impact on American Education Advisory Panel

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Modern society is undergoing profound technological and social changes brought about by what has been called the information revolution. This revolution is characterized by explosive developments in electronic *information technologies* and by their integration into complex information systems that span the globe. The impacts of this revolution affect individuals, institutions and governments—altering what they do, how they do it, and how they relate to one another.

If individuals are to thrive economically and socially in a world that will be shaped, to a large degree, by these technological developments, they must adapt through education and training. Already there is evidence of demands for new types of education and training, and of new institutions emerging to fill these demands. The historical relationship between education and Government will be affected by the role that Government plays in enabling educational institutions to respond to the changes created by these technologies.

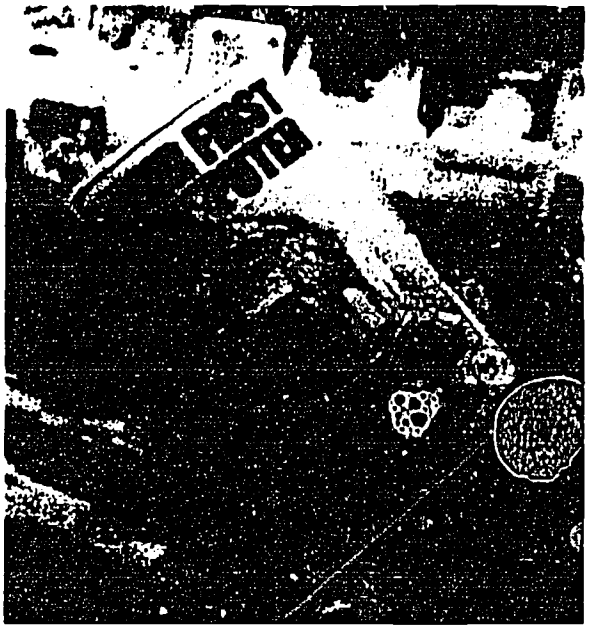
Background

Historically, the Federal Government's interest in educational technology has been sporadic—rising as some promising new technology appeared and falling as that technology failed to achieve its promise. Attention was focused, moreover, on the technology itself and not on the broader educational environment in which it was to be used. In the late 1960s, for example, the Federal Government funded a number of research and development projects in the use of computer-assisted instruction (CAI). Interest in the projects waned, however, given the high costs of hardware and curricula and the failure to integrate computer-based teaching methods into the institutional structure of the school.

Computer-based education is the use of computers for educational purposes. It includes:

1. *Computer-Managed Instruction (CMI).*—Wherein learning takes place away from the computer, while the computer scores tests, interprets results, advises the student what to do next, and manages student records and other information.
2. *Computer-Assisted Instruction (CAI).*—Wherein the student receives individualized instruction by interacting via a computer terminal with the instructional material logic stored in a computer.

Over the last decade, Federal funding for research and development (R&D) in educational information technology has dropped precipitously. At the same time, development and applications of information technology have advanced rapidly in many sectors. Public schools, beset by problems that such technology might mitigate, have lagged behind in adapting to technological changes. In view of this situation, OTA was asked in October 1980 to reexamine the potential role of new information technology in education. The assessment was initiated at the request of: 1) the Subcommittee on Select Education of the House Committee on Education and Labor; and 2) the House Subcommittee on Science, Research, and Technology of the Committee on Science and Technology.



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This report examines both the demands the information revolution will make on education and the opportunities afforded to respond to those demands. Included in its scope are a survey of the major providers of education and training, both traditional and new, and an examination of their changing roles. The full range of new information products and services rather than any single technology is examined, since the major impact on education will most likely stem from the integration of these technologies into instructional systems.

For this report OTA has defined *education* to include programs provided through a variety of institutions and in a variety of settings, including public schools; private, nonprofit institutions that operate on the elementary, secondary and postsecondary levels; proprietary schools; training and education by industry and labor unions; instruction through the military; and services provided through libraries and museums or delivered directly to the home. *Information technology* is defined to include communication systems such as direct broadcast satellite, two-way interactive cable, low-power broadcasting, computers (including personal computers and the new hand-held computers), and television (including video disk and video tape cassette).

The assessment was premised on three initial observations and assumptions:

- The United States is undergoing an information revolution, as documented in an OTA assessment, *Computer-Based National Information Systems.*
- There is a public perception that the public schools are "in trouble," and are not responding well to the normal educational demands being placed on them. Public schools in many parts of the country are faced with severe economic problems in the form of rapidly rising costs and reduced taxpayer support. These pressures are forcing a new search for ways to improve the productivity and effectiveness of schooling.
- A host of new information technology products and services that appeared capable of fulfilling the educational promises anticipated earlier are entering the marketplace with affordably low cost and easy accessibility.

Findings

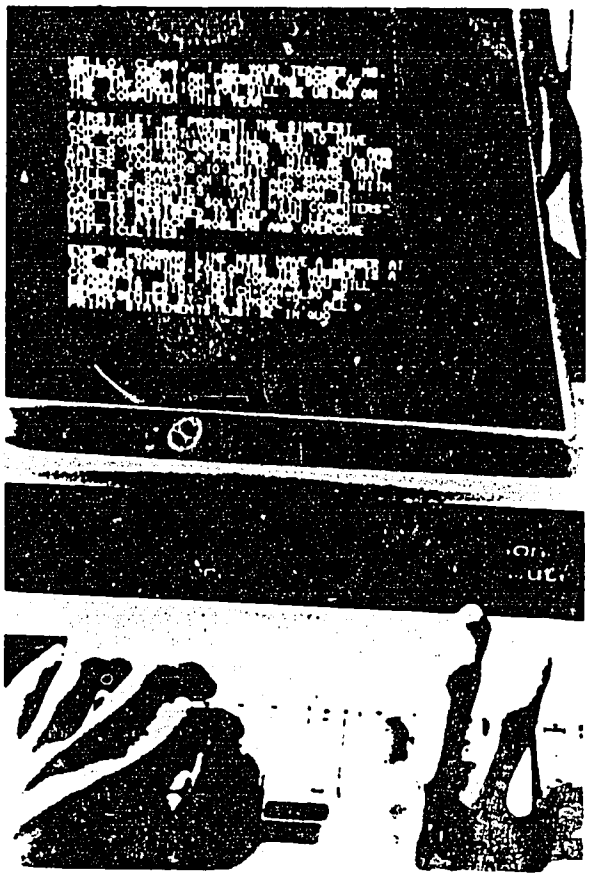
OTA found that the real situation is far more complex than assumed above. In summary, the assessment's findings are:

- The growing use of information technology throughout society is creating major new demands for education and training in the United States and is increasing the potential economic and social penalty for not responding to those demands.
- The information revolution is creating new stresses on many societal institutions, particularly those such as public schools and libraries that traditionally have borne the major responsibility for providing education and other public information services.
- Information technology is already beginning to play an important role in providing education and training in some sectors.
- Information technology holds significant promise as a mechanism for responding to the education and training needs of society, and it will likely become a major vehicle for doing so in the next few decades.
- Much remains to be learned about the educational and psychological effects of technological approaches to instruction. Not enough experience has been gained with the new information technology to determine completely how that technology can most benefit learners or to predict possible negative effects of its use. Given this insufficient experience, caution should be exercised in undertaking any major national effort, whether federally inspired or not, to introduce these new technologies into education.

The Information Society

Role of Information

For the foreseeable future, information technology will continue to undergo revolutionary changes. The microprocessor—an inexpensive, mass-produced computer on a chip—will become ubiquitous in the home and office—not only in the easily identifiable form of the personal computer or word processor, but also as a component of numerous other products, from automobiles to washing machines and thermostats. High-speed, low-cost communication links will be available in such forms as two-way interactive cable, direct broadcast from satellites and computer-enhanced telephone networks. New video technologies such as video disks and high-resolution television will be available. These technologies will be integrated to form new and unexpected types of information products and services, such as videotex and on-line information retrieval systems that can be provided over telephone or air waves directly to the home.



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Personal-type computers are used for instruction in many classrooms throughout the nation.

It is impossible to predict which of these technologies and services will succeed in the competition for consumer dollars, or which will appeal to particular markets. It is, however, reasonable to conclude that they will radically affect many aspects of the way society generates, obtains, uses and disseminates information in work and leisure.

The growing importance of information itself drives and is driven by these rapid technological changes. Until a few decades ago, the information industry—that industry directly involved with producing and selling information and information technology—was relatively small in economic terms. It is now becoming a major component of the U.S. economy. While most economists still talk about the traditional economic sectors—extractive, manufacturing and service—some now have begun to define and explore a fourth, the information sector. One analysis has shown that this new sector, if defined broadly, already accounts for over 60 percent of the economic activity of the United States.

Many firms involved directly with information are large and growing. Two of the largest corporations in the world, AT&T and IBM, principally manufacture information products and provide information services. Moreover, business in general is beginning to treat information as a factor of production that takes its place beside the conventional factors of land, labor and capital. In addition, the Government is beginning to treat information as an important element of national security. While defense officials have always been concerned about the disclosure of military information—such as troop movements or weapons design—they are now also concerned about the international leakage of more general U.S. scientific and technical information that other countries could conceivably use to pursue economic or military goals that are in contrast to our own.

In addition to serving as an economic good, access to information is becoming increasingly important for individuals to function in society effectively as citizens, consumers and participants in political processes. Relations with government at all levels are becoming more complex—whether they involve dealing with the Internal Revenue Service, applying for social benefits and services, or seeking protection from real or perceived bureaucratic abuse. Individuals are confronted with the need to evaluate more sophisticated choices and to understand their rights and responsibilities under the laws and regulations intended to protect them in the marketplace.

Information Technologies

The rapid evolution of the following technologies in the last few decades has shaped the information revolution:

Cable

Cable systems—wherein data and programs are transmitted over a wire rather than through airwaves—are growing rapidly. The newer systems offer more channels, and some offer two-way communication.

Satellite Communication

Satellites have stimulated development of new types of television networks to serve cable subscribers and earth station owners with specialized programming.

Digital Telephone Network

The shift to digital transmission will allow telephone lines to carry more information at higher speed and with greater accuracy, providing better linkage of information between computer terminals.

Broadcast Technologies

Some distribution technologies in the entertainment market may also have important potential educational uses. For one, the *direct broadcast satellite* can transmit a program directly to a home or office, bypassing a cable system. For another, *low-power stations*, which restrict transmission to a limited geographical range, provide a low entry cost to licensees and are subject to less regulation than are traditional broadcast stations.

Computers

The design and uses of computers have advanced to the point where there is now a mass consumer market for computers and computer software. Moreover, networks that link privately owned computers have expanded access to information. *Desktop computers* are becoming more common in the home, the small business, and formal educational settings. The use of *hand-held computers*, cheaper and more portable than desktop computers, has also increased. Along with computer development have come advances in the interface between humans and computers—input/output technology. Input technology is the process of putting information into the computer—either by typing it, speaking to the computer or showing the computer pictures. Developments in output technology, or "peripherals," are occurring in the areas of low-cost printers, graphics (particularly color graphics), and voice.

Storage Technology

Data programs are stored on a variety of media for use in the computer: silicon chips, floppy disks and hard disks. Improvements are being made in such technology for both large and small computers.

Video Technology

Significant developments in several areas of video technology are likely in this decade. *Video cassette recorders* are already important consumer devices. The *filmless* camera, which combines video and computer technology to "write" a picture on a very small, reusable floppy disk, may soon be available.

Video Disks

Resembling a phonograph record, a disk that stores television programming is of considerable interest to

educators. It is durable, inexpensive to produce, and capable of storing a large amount of data and programs.

Information Services

Several of the aforementioned information technologies are now being integrated into information systems. For example, several countries now use the existing television broadcast medium to bring information services to homes and offices. Using a *teletext* system, the user can select a page for special viewing as it is transmitted in segments over the air. In a videotex system the user can preselect a page from the central system for immediate viewing. Closely related to videotex are the *information networks* that provide owners of desktop computers and terminals with access to computer and data services and to one another over communication networks. Through *electronic conferencing*, geographically separated individuals can participate in meetings. Variations include *audio conferencing*, which uses telephone lines; *video conferencing*, which supplements the voice connection with television images; and *computer conferencing*, which involves transmitting messages through a central computer that then distributes them as requested.

Impacts on Institutions

Impacts from the information revolution are being felt by government at all levels and by the military, industry, labor unions and non-profit service institutions. Traditional services provided by these institutions now overlap in new ways and offer a wide variety of new services based on information technology. For example, firms as diverse as investment houses and retail stores now compete with banks by providing a variety of financial services. Banks, on the other hand, are beginning to compete with computer service bureaus in providing more general on-line information services to businesses and homes.

The U.S. Postal Service, along with Congress and a variety of Federal executive and regulatory agencies, is considering the degree to which it should compete with private telecommunications firms in the provision of electronic mail services. Large computer firms such as IBM are moving toward direct competition with traditional telecommunication common carriers such as AT&T for the provision of information services. Telephone companies may offer "electronic yellow pages" that could rival the classified advertising business of newspapers.

Those institutions principally concerned with the collection, storage or transfer of information will feel the greatest effects. They include both private sector firms —in fields such as publishing, entertainment and communications—and public or nonprofit organizations such as libraries, museums and schools. How they handle their product—information—may differ from the handling of tangible goods by other institutions because information has characteristics that differentiate it from tangible goods. For example, information can be reproduced easily and relatively inexpensively. It can be transported instantly worldwide and presumably can be transferred without affecting its original ownership. Thus, copyright or other forms of protection for intellectual property—data bases, programs or chip designs—is important to the growth of the information industry.

While the business of selling information has always existed in some form—e.g., book publishing, newspapers or broadcasting—the growth of this sector and its movement into electronic forms of publishing will create conflicts with traditional societal attitudes about information. The concept of information as a public good whose free exchange is basic to the functioning of society is inherent in the first amendment to the Constitution and underlies the establishment of public libraries and schools. This concept conflicts with the market view of information, which recognizes that there are inherent costs in the provision of information. Adopting new information technologies will entail extra costs that must be borne somehow by the users of those technologies.

The conflict between the view of information as a market good and the view of it as a "public good" affects public institutions in a number of ways. Public nonprofit institutions find themselves increasingly in competition with private profitmaking firms that offer the same or similar services. Institutions such as libraries, schools and museums are beginning to feel pressure to incorporate both nonprofit and income-generating offerings in their own mix of services. To the extent that previously free or very low-cost and widely available information services such as education move into the private marketplace, access to them may become limited, either because of their cost or because of their restricted technological availability. Periodicals previously available at newsstands, for example, may be available in the future only via computer or video disk.

New Needs for Education and Training

The information revolution places new demands on individuals, changing what they must know and what skills they must have to participate fully in modern society. It may also be increasing the social and economic prices that will be paid by those who do not adapt to technological changes. For instance, spurred by increasing domestic and international economic competition, U.S. industry is expected to adopt computer-based automation in a major way. Computer-aided design, robotics and other new computer-based manufacturing technologies will, in the next decade, transform the way goods are manufactured. Automation will not be restricted to the factory, however. Office automation will, according to some, have an even more revolutionary effect on management and on clerical work in business. Over the longer term, even the service professions, such as law and medicine, will be transformed.

While some sociologists suggest that the effect will be to "deskill" labor by lowering the skill requirements for workers, more anticipate that a greater premium will be placed on literacy, particularly technological and information literacy. The latter argue that an increasing number of jobs will be in the information sector or will require the use of information systems. Moreover, new forms of production and information handling will create new jobs requiring new skills. Vocational education and industrial training programs will be needed to teach the skills for jobs such as robot maintenance or word processing.

An advanced information society will place a premium on skills oriented toward the creation of new knowledge and the design of new technologies. Thus, while there is some current debate about a possible surplus of college graduates, generally speaking many experts see a growing gap between the demand and supply of graduates in engineering and science, and particularly in computer engineering and science.

A key element in all of these educational needs is that they will constantly change. In a rapidly advancing technological society, it is unlikely that the skills and information base needed for initial employment will be those needed for the same job a few years later. *Lifelong retraining is expected to become the norm for many people.*

Case Studies on Information Technology

In addition to using existing information for this assessment, OTA undertook case studies designed to gain insights into the successful application of information technology in education. Accordingly, OTA examined well-established programs in public school systems, industries, libraries, museums, the military, special education and direct to the home markets nationwide. These case studies are presented in the appendix of the full report. Many of the findings presented in this assessment reflect observations made in these studies. *The most important of these observations is that information technologies can be most effectively applied to educational tasks when they are well integrated in their institutional environments.*

Potential Technological Solutions

OTA found little evidence of current hardware limitations that would limit the applicability of technology to education and, hence, call for major research efforts. Continuing research in the general fields of computer science and engineering, coupled with innovative private sector development, will provide the necessary hardware base. The only exception is the area of technology for the handicapped, where it is not clear that the opportunities for developing specialized technology could be met without some Federal support for R&D. There does appear to be a need, however, for R&D focused on developing new techniques and tools for software development, human/machine interface, and improving the understanding of cognitive learning processes.

If properly employed, information technology has certain characteristics that suggest it will be invaluable for education. For one, information technology may be the only feasible way to supplement teaching capability in schools faced with reduced teaching staffs and larger class sizes. For another, information technology is capable of distributing education and training, both geographically and over time. Services can be provided in the home, at work, in a hospital, or in any other location where and when they may be needed.

Many of the electronic media, such as video disks or microcomputers, allow learners to use them at their convenience, instead of being locked into specifically scheduled times. Computer-based analysis, combined with a flexible, adaptive instructional system could diagnose and immediately respond to differences in learning strategies among students and, hence, could be more educationally effective. Finally, much work has been done on using information technology to improve the ability of foreign students and the physically and mentally handicapped to communicate.

Some experts suggest that the use of computers by students teaches them new ways of thinking and new ways of solving problems that may be more appropriate in an information age. They suggest that a generation that grows up with computers will have a significant intellectual advantage over one that does not.

Photo credit: © Ted Spiegel, 1982.

Many educators criticize such a view as being too technology-centered. At the very least one can predict, however, that computer and computer-based informa-

tion services will be ubiquitous by the next century, and that learning how to use them effectively is a basic skill that will be required for many and perhaps most jobs. (In response to this view of future skill requirements, many schools have placed a high priority on computer literacy as the first instructional use of the computer.)

Although experience with educational technologies has demonstrated that they offer a variety of potential benefits, it has also demonstrated that technology cannot, by itself, provide solutions to all educational problems, nor should it be imposed on an educational system without sensitivity to institutional and societal barriers that could prevent the realization of educational benefits. These barriers include:

Institutional Barriers

New educational technology must be designed for ease of integration into the schools and other educational institutions that will use it. Some adaptations of curricula, schedules and classroom organization will be needed, but the changes are not likely to be extreme.

Teacher Training

Widespread use of technology in the classroom will require that teachers be trained both in its use and in the production of good curriculum materials. Too few teachers are so qualified today. Schools maintain that they are already faced with a shortage of qualified science and mathematics teachers (those most likely to lead the way in computer-based education). Furthermore, there is little evidence that most of the teacher training colleges in the United States are providing adequate instruction to new teachers in the use of information technology.

Lack of Adequate Software

OTA found general widespread agreement that, with few exceptions, the quality of educational software—curriculum material designed for educational technology—now available was, in general, not very good. Curriculum providers do not yet use the new media to full advantage for several reasons. In the first place, many of the technologies are still new. It takes time to learn how to use them, and the early attempts suffer from this learning process. Second, production of high-quality educational software is expensive. Some large firms that have the necessary capital to produce educational software hesitate to risk developmental money in a relatively new and uncertain market.

Third, the programmers and curriculum experts qualified to produce educational software are in short supply. Finally, some firms cite the lack of adequate property protection—e.g., copyright, patents—for their information products as a barrier to investment in development.

Skepticism About Long-Term Effects

Some educators are seriously concerned that the long-term effects on learning of substituting technology for traditional teaching methods are not sufficiently understood. While acknowledging that computers or other technologies may have some limited utility in the classroom for drill and practice, or for instruction in computer literacy, they fear that any widespread adoption of technology for education could have deleterious effects on the overall quality of learning.

Cost

Even though the cost of computer hardware and communication services is dropping, investment in educational technology still represents a substantial commitment by financially pressed schools. Costs of software are likely to remain high until a large market develops over which providers can write off developmental costs. In some cases the cost of information products and services may be passed on to users for the first time.

Policy Issues and Options

Issues

The impact of information technology on education will confront Congress with a number of important policy decisions in several areas:

- *Education and training for economic growth:* OTA found that trends in automation and the growth of the information sector of the economy will probably present the United States with severe manpower training problems over the next decade. These will include a persistent shortage of highly trained computer scientists, engineers and other specialists; a need for retraining workers displaced by factory and office automation; and a need for a more technologically literate work force. Congress must decide what Federal response to these national needs would be both appropriate and effective.
- *Redressing inequities:* In both the OTA study on national information systems and in this assessment, OTA found concern that a significant social, economic and political gap could develop between those who do and those who do not have access to, and the ability to use, information systems. People who cannot make effective use of information technology may find themselves unable to deal effectively with their government and to obtain and hold a job. Both social and economic concerns may motivate Congress to take action to improve literacy in American society.
- *New institutional roles:* OTA found that many public educational institutions are under severe strain, to the extent that many question their survival—at least in their current form. Actions directly related to the use of information technology could also have important impacts on these public educational institutions, both by enhancing their productivity and by helping them offer a modern, computer- and communication-based curriculum.

Although the States have primary responsibility for control of the public schools, decisions and policies set at the Federal level have influenced the nature of public education and will continue to do so.

Options for Federal Action

Assuming that Congress decides there is a significant need for Federal action to address these issues, there are a number of possible actions it could take.

- **Direct Intervention**

  Congress could take action to increase and improve the use of information technology in education. Most of the following options would principally affect the schools. A few would have a broader effect on the provision of education and training in other institutions.

  —*Provide tax incentives for donations of computers and other information technology:* H.R. 5573 and S. 2281 are examples of such initiatives. They are intended to accelerate the rate at which schools install computer hardware and to respond to possible inequities in the abilities of school districts to direct funds to equipment acquisition. However, some experts have noted that the personal computer industry is on the verge of moving to a new generation of more powerful machines that may have much greater potential for educational application on a more sophisticated level. Donations of older equipment could freeze the schools into dependency on obsolescent systems. Moreover, such incentives do not address problems such as the need for software, teacher training or institutional barriers to effective use.

  —*Subsidize software development:* OTA found that the most-often cited barrier to current educational use of technology was the lack of adequate educational software. There may be a role for the Government in reducing the risks software producers currently see that inhibit major investment in quality courseware (educational software). Many of the existing successful packages, such as the Sesame Street programs for television and the PLATO computer-aided instruction system, were developed with partial Federal support. On the other hand, good software may be forthcoming if the producers see a sufficient quantity of hardware in the schools to provide them with a viable market.

  —*Directly fund technology acquisition by the schools:* The Federal Government could directly underwrite the acquisition of hardware and software by the schools. Such a program would create a market for educational products that would attract producers, and it would accelerate the introduction of technology into the schools. On the other hand, it may promote premature and unwise purchases of technology by schools that are unprepared to use the technology effectively. Such a program is also counter to some current trends and attitudes in Congress concerning the proper Federal role in education.

  —*Provide support activities:* The Federal Government could assume a leadership role in encouraging the educational system to make more effective use of information technology by funding demonstration projects, teacher-training programs, and the development of institutions for exchanging information about successful implementations. OTA found evidence of a high degree of interest and motivation by both schools and parents that could be more effectively channeled with appropriate Federal leadership. Such a program would not address the financial limitations that currently prevent many institutions from acquiring technology and software.

- **Adapt a General Education Policy**

  Congress is considering various forms of education-related legislation that may affect, and in turn may be affected by, the new informational needs of society. Examples are bills concerning vocational education, veterans' education, education for the handicapped, and foreign language instruction. Such legislation, if drafted with the intent to do so, could encourage the development of more effective and economical technological alternatives to current programs.

- **Support R&D**

  Federal civilian agency support of R&D in educational technology has decreased substantially over the last decade. OTA found that, to make the most effective use of technology, there was a need for R&D in learning strategies and cognitive development, methods for the production of effective and economical curricular software, and the long-term psychological and cognitive impacts of technology-based education. Congress could consider policies to: 1) directly support R&D in these areas, 2) encourage private sector investment from both foundations and industry, or 3) encourage a combination of both by using Federal funding to leverage private investment.

- **Elimination of Unintended Regulatory Barriers**

  Some legislation and regulation not specifically directed at education may create barriers to the effective application of educational technology. Telecommunication regulation, for example, can affect the cost of technology, access to communication channels, and the institutional structure of education providers.

  Moreover, protection of intellectual property, principally copyright law, was identified as a major determinant of the willingness of industry to invest in educational software. The current state of the law was seen by many industry experts as inadequate and, hence, as creating a barrier to the de-

velopment of novel and innovative software. However, to the extent that such a barrier does exist, it is not clear whether its removal lies in new legislation or in the gradual development of legal precedent in the courts.

NOTE: Copies of the full report "Informational Technology and Its Impact on American Education," can be purchased for $8.00 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, GPO stock No. 052-003-00888-2.

General Information

Information on the operation of OTA, the nature and status of ongoing assessments, or a list of available publications may be obtained by writing or calling:

Office of Congressional and Public Communications
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END

The Future with Educational Technology

When planning becomes a regular activity associated with technology, equipment purchase is ongoing, software is routinely evaluated and technology training is an integral part of system staff development, you should begin to see evidence that technology does make a difference in the education of students. Since the task of planning is ongoing, educational planners need to prepare for the future and the impact technology will have on students as they become adults — the impact it will have on their lives and careers.

"Informational Technology and Its Impact on American Education," found in Appendix R, was developed for the U.S. House of Representatives Committee on Education and Labor and the House Committee on Science and Technology. It should assist administrators and planners in thinking about and preparing students for the future.

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