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Electronic Information in School Libraries

ABSTRACT

Microcomputers have progressed from toys to tools in managing school libraries. Equipment inventory, circulation, online catalogs, acquisitions, and serials management/check-in have all been affected. In addition, high technology has presented new possibilities for educating young people, and school librarians are faced with a role change as they rise to meet this challenge.

INTRODUCTION

Picture the faculty of the College of Education at the University of Arkansas in 1979 gathering for a symposium that is to explore the possibilities of the microcomputer in education. Since almost none of the faculty has seen a microcomputer, they are anxious to attend and see what this new technology has in store for education. The presenter is introduced to this august body—an expert from out of town—a person with as much experience with microcomputers as about anyone in the country. (Remember, it is 1979 and the Apple microcomputer has just made its appearance on the market.) Our expert is Bryan Burdick from Kansas City. He is 10 years old. The professors come unglued.

As the era of high technology has dawned upon education in the past 13 years, three phenomena are evident:

1. Microcomputers and high technology have progressed from toys to tools in managing school libraries.
2. New possibilities for educating young people with high technology have developed.
3. School librarians are faced with yet another role change as they rise to meet the potential that high technology brings to the education of young people.

The purpose of this paper is to explore these three areas of interest from the perspective of the school library as it fits into the larger perspective of education.

MICROCOMPUTERS AS A TOOL FOR MANAGING SCHOOL LIBRARIES

Educators in virtually every school in the country have adopted the microcomputer as an administrative tool for the three basics: word processing, databases, and spreadsheets. Such things as mass letters to parents, inventory, scheduling, and budgets are commonplace. School librarians have been a little slower to adopt these same tools partly because administrators innovated first, but also because librarians tended to purchase computers for instructional purposes first and only learned of management possibilities second. Betty Costa was one of the first to produce a handbook for the school librarian about using microcomputers as a management tool, and her book remains a classic in the field (Costa & Costa, 1991). Standard uses of microcomputers as tools in school libraries in 1992 include equipment inventory, circulation, online catalogs, acquisitions, card catalog production, serials management/check-in, and general management.

Equipment Inventory

Librarians/principals use both homegrown databases and sophisticated programs to track audiovisual equipment and furniture owned. Sophisticated programs track original vendors, equipment description, model and serial numbers, location of the equipment, maintenance records, lists of replaceable parts (such as lamp numbers for overhead projectors), and equipment condition. Such programs provide information for security and insurance purposes including projected costs of equipment repair and replacement.

Circulation

Librarians used microcomputers early to circulate equipment and specialized materials such as periodicals. Homegrown overdue systems

were also popular in the early 1980s. The earliest commercial programs for school libraries were those designed to circulate books using a bar code system. Hundreds of systems were sold to school libraries that tracked patrons, books in circulation, and overdues. Today, the early adopters of circulation systems are envious as they see the features of the fully developed online catalogs for the school library. These people face automating twice with all the attendant problems of school politics, new equipment and software costs, and in some cases, the reinputting of an entire collection.

Online Catalogs

Online catalogs utilizing mainly MS-DOS systems are now common in school libraries. Popular system names include Follett, Winnebago, Mandarin-Media Flex, and Dynix. Systems generally use the MARC format, are individually school based (they do not share data with other schools or libraries), and contain catalog, circulation, and acquisition components. Catherine Murphy (1992), who has conducted one of the few dissertation studies to date about online systems in school libraries, has recently pulled together some of the most current articles that describe these systems and ways to select, implement, and evaluate them. As she was collecting the articles on school library automation, each article had to be sent back to the original author for a major update, even when the article had been published the previous year—an indication of the rapid rate of change in this area.

A typical online public access catalog (OPAC) for a school library provides author, title, and subject searches plus Boolean searching of all data fields. A few systems are beginning to provide such things as "interactive search assistance, error-correction features, and additional information about the contents of materials" (Hooten, 1992, p. 145). Catalog records for these systems are being purchased from vendors or downloaded from commercial CD-ROMs.

Two major issues for school OPAC systems are the quality of subject access and user friendliness for the child. When catalog records are downloaded into a school library catalog, a number of quality control problems emerge. Many commercial retrospective conversion companies have not cleaned up their databases. This means that classification numbers and subject headings reflect only the editions of Dewey and Sears/Library of Congress (LC) used at the time of cataloging. Thus, conflicting classification numbers and a mix of LC or Sears or AC subject headings are transferred into the OPAC, making it no better than its card form counterpart. Only if the system has global change capabilities and if the school librarian has enough expertise to recognize and deal with consistency does a better product emerge. Sloppy data delivered

by computer are still sloppy. Boolean and keyword searching helps by locating common terms that children know, but subject searches with high recall rates are the exception rather than the rule, and shelf order is not improved at all. It is not surprising to sit at a school OPAC and find an author's name spelled several different ways requiring that the user look in several places to track an author's works. Errors abound if a combination of local input and downloading from commercial services has been utilized.

Vendors of OPACs for schools are making plans for higher quality cataloging data now that basic automation features are refined. For example, a program could be written to automatically present changed numbers from one Dewey edition to another, allow the librarian to accept/reject the change, print out a bibliography of those changes, and print the spine labels that could be applied to books in a few minutes. As the librarian approved these global changes, she could override national suggestions in favor of local preferences. Thus, sports biographies could be classed with the biographies or with the sport, and if with the sport, each sport would have a consistent number.

In subject cataloging, troublesome headings such as NEGROES, BLACKS, or AFRO-AMERICANS could be easily changed to a consistent term. Modules creating a cross-reference structure for the OPAC could be created and sold as add-ons so that consistency could be assured. Consistency in information systems is more important to children than it is to adults. Adults have a higher developmental level, are more flexible, and, one hopes, are more tolerant.

Early studies of children using OPACs are quite negative. Children do not seem to be able to use computer catalogs any better than printed ones. Edmonds, Moore, and Balcom (1990, 1992) found that Piaget's concrete operations probably apply to the use of OPACs just as they apply to other information or learning tasks. Thus, designers of screens and searching procedures for OPACs need to constantly investigate and utilize the research dealing with how children see and interpret information. Much needs to be done with picture subject searches and automatic transfer from misspelled words to the correct word form or to a "kid-known" synonym. Voice requests to OPACs need to be designed. If a child asks the computer for a Dr. Seuss book, the computer might print out a map showing the shelf location and pictures of some of Seuss's book covers and their spine labels.

As results of experiments with young children are forthcoming, many potential improvements will become apparent. Then again, perhaps it is too much to expect a child under age 9 or 10 to navigate a complex information system without the assistance of an older child

or an adult. Are commercial companies willing to design information systems with children in mind? Librarians must demand such features and be willing to pay for them.

One of the more exciting aspects of quality cataloging for school libraries is the sharing of in-depth analysis of books. For example, one high school on Long Island analyzed every one of its play collections and made the amplified cataloging records available to all libraries in the area. Online indexes not only to plays but to poems, collective biographies, and songs are but a few of the possibilities that make small collections serve patrons to their full potential.

One barrier to school library automation is the lack of a networking capability that would connect schools and libraries to other schools and libraries. Although a few states such as Pennsylvania have produced statewide CD-ROM catalogs of holdings in school libraries, generally school libraries have yet to become a part of national systems such as OCLC (there are exceptions).

Acquisitions

Although OPACs may contain acquisition modules, these systems are not usually sophisticated enough to do any type of collection analysis and acquisition assistance based on collection segments. This author has proposed a simple system of collection mapping that chunks the collection into segments that support the curriculum of the school. Thus, a school library would have a general collection (providing breadth) and several to many specialty collections (providing depth) designed to serve special topics studied by the students. Even if the designer of the system has not planned for collection segmentation, the librarian can "cheat" the system. Using any field that has some form of user control, the librarian can control collection segments through a coding system.

For example, suppose the librarian wishes to build an in-depth collection of dinosaur books because the topic is studied by several classes and grade levels of students each year. The librarian assigns a code in a controllable data field to the "dinosaur collection," scans all materials relevant to that collection (both print and audiovisual), and then maintains this special collection in the OPAC or automated circulation system. Items deleted from the collection are automatically deleted from the emphasis collection. Each time the topic is studied, the librarian prints out the dinosaur collection bibliography, assigns the dinosaur code to any new materials, scans and deletes any irrelevant materials, and in a few moments has complete control of this emphasis collection. Use/circulation statistics can be analyzed easily helping with decisions such as when to add duplicate titles and when to discard

outdated or unused titles. This information can also be used as the basis of collection building in that emphasis area. The author's book *Computerized Collection Development for School Library Media Centers* describes this system of collection building using manual, simple database managers or OPAC systems (Loertscher & Ho, 1986).

Card Catalog Production

Librarians still using card systems can purchase quite sophisticated programs that will produce card sets from original input data or will print out card sets from CD-ROM databases. Catalog cards, spine labels, circulation cards, and card pockets can all be printed from these programs.

Serials Management/Check-in

Several commercial programs exist to manage a periodical collection that would not only be used in check-in but in claiming, weeding, subscription renewals, and circulation.

General Management

Popular programs such as AppleWorks or Microsoft Works are used by school librarians to write letters, generate reports, keep statistics, track and prepare budgets, keep address files of suppliers, and manage a myriad of other files that are better kept on computer than in card files.

School librarians have been quite slow to become computer literate enough to make the computer a useful management tool. The same fear and trepidation that confront a generation of people who grew up in the manual world prevent librarians from taking advantage of the computer. At our company, we still get many calls from persons who cannot use the ubiquitous Print Shop program and the graphic disks we market. We are amazed at the number of people who don't know how to turn a computer on or accomplish even the simplest of tasks electronically.

Both the word processor and the database manager are the school librarian's best friends. Once these programs are mastered, school librarians are extremely creative in using these tools to save time and to manage their centers more effectively. Every year, Libraries Unlimited publishes a number of products, usually indexes created by these "hacker" librarians. Examples are indexes to multicultural projects, science projects, or specialized bibliographies of wordless picture books or reference books about Indians.

Librarians who want to succeed with computers in managing their libraries must not only become computer literate, they must learn several major programs in depth. Whether it requires being tutored by a knowledgeable person, taking computer classes, or teaching oneself, the time investment in learning about computing pays major dividends. Librarians must keep current with developments in computing including hardware and software. A few suggestions include the following:

- Read several popular computing journals each month such as *MacUser* or *PC World.* If you don't understand the articles, at least read the ads.
- Read several library-oriented computing journals such as the *ALUG Newsletter* (free from Apple Computer, Inc.), *Library Hi Tech,* or *Computers in Libraries.*
- Find a friend who is interested in computers and "talk shop" on a regular basis.
- Share computer stories and concerns with other librarians facing similar problems. Ideas and solutions to common problems can save hours and days of frustration.
- Attend computer sessions at conferences. If vendors conduct the session, don't believe all you hear.
- Never buy a computer software package or hardware without comparing features with other programs/machines that will do similar tasks. Be careful about being one of the first to try out a new "library package." We would never have good systems for libraries without those willing to experiment, but one can always expect new applications to have problems that will take a great deal of time and effort to fix.
- Companies go in and out of business in the computer software and hardware business. Try to choose the most solid companies that support their sales and are likely to be in business for a few years.
- Discussions about computers with other school, public, and academic librarians will provide news on developments both local and national.
- Don't overlook the expertise of students who are knowledgeable about computers. They will often provide hundreds of hours of assistance in exchange for the excitement of building a system that makes a positive contribution to the library.
- Invest in a computer for the home and use it daily. Many software packages require constant practice if they are to be mastered.
- Finally, developing political contacts with administrators will provide opportunities to update equipment and software as funds become available.

Like their counterparts in business, school librarians cannot sit back and wait for computerization to solve their management problems like magic. They must continually increase their skill and computer knowledge if the payoff is to come.

TECHNOLOGY AND EDUCATION

Since the appearance of Edison's motion picture projector in 1910, there has been a great deal of interest in technological devices that could be used in education. Wave upon wave of interest has been given to each new technology, and many have been labeled the saviors of education. The motion picture projector, the filmstrip projector, the opaque projector, the 8-mm single concept loop projector, the overhead projector, radio, television—all and more have had their "day in the sun." The history of this entire movement is best documented in Saettler's (1990) *The Evolution of American Educational Technology.*

The major drawback with technology is that none has been developed specifically for education. Generally, a technology has been created for a business or scientific purpose, then educators try to figure out how students can benefit. The cart has always been ahead of the horse. After a technology is created, a company will try to market that technology to schools. Modifications to suit students' needs are often made after some period of adoption in the education market. Such modification is expensive and time-consuming thus limiting the spread of the technology.

For example, the motion picture projector was developed as an entertainment technology first and as an educational one second. School teachers hated 16-mm projectors because they were never easy to thread, they were tricky to handle when they malfunctioned, and they required total environmental control to use in the normal classroom.

In the past few years when videotape, also an entertainment technology, became cheaper to own than 16 mm, teachers rushed to adopt a technology they could operate both at school and home, and a technology that did not require a darkened room. Teachers did not care that the picture size, color, and clarity were inferior; they wanted a technology that worked and one they could operate without help. Today, film companies are having a hard time staying in business, not because they cannot produce videotape instead of film, but because of unit pricing. Consumers are so accustomed to buying a videotape in the store for $30, they think educational videos should be comparatively priced. Film companies have usually charged $300 to $900 per film

print, and films were purchased only by school districts or film libraries. It takes sales of thousands of prints at $30 to individual schools to recoup the production costs film companies need to stay in business.

A second problem with technology in education is that producers generally have made outlandish claims for the contribution of their particular technology to learning. The 16-mm film was going to replace teachers. So was educational television. So were teaching machines. Research projects by the thousands documented the power of these media to teach. Sometimes research results were positive in favor of the particular technology; most of the time, research results showed "no significant difference." Students learned equally well no matter the medium. It seems logical to assume that a fact can be learned from a book or a film or a microcomputer screen with equal ease.

What the research did not test was the amount of learning from the unique characteristics of each medium. For example, since a film uses motion, it should teach certain things as well as a book and other things better than a book when a concept is motion oriented. Conversely, the book should be superior to the film under certain circumstances—for example, for browsing. Today, educational technologists generally agree that a teaching medium should be selected based on its unique characteristics as well as its content. Teachers, however, usually choose a technology based on convenience first, content and characteristics second.

The research on educational technology does show that new or different technologies are popular with learners. Students who use a computer for the first time find it exciting, and they tend to learn more. Since students' primary objection to schooling is boredom, teachers and school librarians can exploit this novelty effect if they provide a wide variety of technological or media experiences rather than concentrating on a few. Variety is the spice of teaching and learning.

Because education is such a labor-intensive industry, the costs of educating a nation of students have risen astronomically in the past 20 years. Theorists have been trying to make the case that technology could replace some of the teachers and thus lower costs (Molenda, 1992). Within the past 10 years, a number of schools have been created that use banks of computers that provide hours upon hours of drills, tutorials, and simulations. These schools employ lower paid adult aides and a few teachers who are instructional managers. The computer system in these schools employs a technique of mastery learning where students must achieve criterion levels of learning before they can progress onto the next level of work. Such schools have high costs of investment in technology, support, and software and are not less expensive to establish and maintain. For example, WICAT Systems in Provo, Utah, has such a school. The tuition is comparable to an exclusive private school. They

do advertise, however, that their students perform much better on standardized tests than students in traditional schools.

Generally, technology is an add-on cost to schools. That is, the school will employ enough teachers to teach in the conventional 1-to-30 or 1-to-25 ratio and then provide technology as tools for the teachers to use. In this case, technology enhances what a human is able to provide. Such a plan provides a tremendous challenge to a school district where 90% of the money for education goes to teacher salaries. Technology must compete for a very small piece of the budget pie. If teachers do not adopt a technology in such a manner that students are benefiting from it in a demonstrable way, the technology is considered a frill.

Technology carries with it a tremendous temptation to use it as a "filler." The teacher may rest and let the machine take up some time. Then the teacher will attempt to compress the human teaching content into a smaller time frame. In the past few years, teachers have been assigned a greater and greater amount to teach in the same or decreased amount of time. These teachers reassess the time that a technology takes: Does it really teach as well as I can? Does it cover the content as fast as I can? Can I get relevant learning materials for the technology the school owns? Are the materials to be used on a technology of only peripheral value to the objectives currently being taught?

Many teachers are not comfortable using technology. They may not be able to operate the equipment. They may fear that when a piece of equipment fails, it will do so right in the middle of a class, and they will lose control of the presentation and the students. Many teachers opt not to use machines. They view technology as either an add-on responsibility or as irrelevant to the specific task at hand. They laugh when someone provides a single computer and no software for their classroom of 30 students and expects something magic to happen.

In an attempt to make technology and materials much easier to use, schools have been and are being designed around teaching stations. For example, in Chesterton, Indiana, the new high school building has been designed around technology. The building has been completely wired with optical cable. There is a telephone in each classroom. Each classroom has a computer/technology station complete with at least two large classroom television monitors. Teachers can command any number of technologies coming into their rooms at a moment's notice. They can call up a film at will, connect into a computer network, call pictures, text, or sound from a CD-ROM to illustrate their lectures, or use amplified telephone to talk with their class to experts anywhere in the world. If a malfunction occurs, they can send a message to the central media center operator on their computer, or they can call the person on the telephone.

This dazzling array of technology is impressive, but it is an add-on. The community is investing more dollars in each student's educational experience than in a comparable school using the textbook-lecture method. Currently, taxpayers are struggling. They are wondering how much to invest in education when scores on national exams are declining or at least are not improving significantly. There is no rush toward technology as "the answer."

THE SCHOOL LIBRARY AND TECHNOLOGY

During the 1960s, when technology first became available to education on a grand scale, school librarians were resistant to change. The 1960 Standards for School Libraries advocated the adoption of a multimedia center concept. At first, many schools hired audiovisual specialists to handle nonprint media, but with the passage of time, librarians became more comfortable with a wide range of formats and generally were put in charge of all media.

When microcomputers came along, many school librarians saw these machines as learning tools, were early adopters of the technology, and became computer leaders in their schools. Other librarians ignored computers, and so others were hired to set up and manage computers for both computer literacy coursework and computers as instructional tools. Without the benefit of a national survey (data will be collected in 1994), this author would guess that a minority of school librarians are considered to be microcomputer specialists in their buildings. With the advent of online technology and other high-tech equipment, school librarians again stand on the threshold of a role choice. Immersion into the high-tech world of information and media will provide new frontiers of information use/access for the youth of the nation. School librarians have a chance to prepare young people for an emerging information society, but only if they become leaders in the information technology that has and will appear.

To get a better picture of the potential of the new information technology as an education tool, let us explore the technology, not by type of hardware, but by the educational/information functions that it can provide to young people. Although we may briefly describe a specific piece of technology and what it does at this moment in time, the function that it performs is likely to outlast the current model of whatever gizmo is available.

Access to Bibliographic Information

Currently, bibliographic data are a well-known commodity being handled by all types of libraries. At first, data such as magazine indexes,

bibliographies, and other indexes were available principally via telephone lines; now much is available through CD-ROM or through locally created databases. Citations of articles or books are only helpful to a young person if there is easy access to hard copy through local public or academic libraries. Another problem concerns who pays for the bibliographies produced from remote online databases. A number of high schools have budgeted funds for online searching and do not pass these costs on to students. This policy limits the amount of searching that is done and requires extensive planning before searches are conducted (not a bad practice).

Still another problem is the relevance to children and young people of information on large commercial databases. In the past 10 years, the availability of databases has proliferated to such an extent that more and more is available for the younger set. That trend should continue. Of particular use are information systems containing abstracts of the books or articles indexed. This format helps students choose a few relevant articles, and at times the article can be cited in a research paper when the abstract contains an appropriate fact.

When the school library is connected to a local, regional, or national network, access to bibliographic data is very useful to young people. If they know that another school, public, or academic library in the community has a magazine or book they need, they can usually find a way to obtain the needed materials for their research. Through the school OPAC or a separate terminal, the young person can query the libraries in the area. In Denver, Colorado, any home or school that has a modem and a computer can access the CARL system. The user can dial into many libraries on the front range to check bibliographic citations and do keyword searches of collections throughout Colorado and beyond. The system is so simple that anyone who can read can use it.

Another example of networking for young people is Access Pennsylvania. The collections of hundreds of school libraries in Pennsylvania have been stored on several CD-ROMs. Young people can find specific titles or do subject searches and locate materials in their own school, neighboring schools, regional libraries, or the state as a whole. Access to distant libraries takes time—a commodity that young people often do not plan for.

School librarians are wise to seek the technology needed to connect their library to collections other than their own. They should teach young people how to access other collections and create a simple system of interlibrary loan. These are the same challenges faced by libraries of all types and come with the same attendant problems: How can we provide access? Who will pay? How can we support interlibrary loan? When shall we own an item or just borrow?

The Locally Produced Database

A number of school librarians have discovered database managers such as AppleWorks, Microsoft Works, Claris Works, and others. They begin to realize that many bibliographies and indexes to local collections can be created to make certain materials extremely useful. Examples might include the following:

- A song index
- A play index
- An index to science experiments
- A poetry index
- A biographical index to collected works
- A local newspaper index
- A speaker's index
- A famous person's address index

Libraries Unlimited has created a number of databases and bibliographies that can be used as local databases. For example, Mary Ann Pilger's (1992) *Science Experiments Index for Young People* is an index to over 2,000 science experiments books. This index is available in traditional print form or can be purchased as a database for use on Apple, Macintosh, or IBM computers. The print form of Pilger's database has the same drawbacks as other print indexes—first you find the experiment you want, but then you must try to locate the book in your own or some other library's collection. The database version has an advantage. The librarian searches which of the 2,000 titles the library owns, deletes the rest, and prints out the result. The new index becomes an index to the in-house collection. User success rates jump to near 100%. The master database can be kept so that titles can be added or deleted as the collection evolves or as an interlibrary loan source. Young people and student helpers can be taught how to add or delete from such an index. In this way, students can understand how an index is created and how it can be searched to advantage.

If a student can create an index, that student can use many types of electronic indexes easily and can begin to comprehend what electronic indexes can and cannot do, how they are built, and how they can be searched. Although some care must be taken when allowing young people to save and delete information in a master index, much good training can accrue. Both library and user benefit.

A second example of a local database is the book and database by Vandelia VanMeter (1992) entitled *World History for Children and Young Adults*. This source contains an annotated bibliography of all books reviewed in the past 10 years for world history. The printed version is interesting, but the database is much more valuable from

a collection-building perspective. Comparisons between what is currently owned and what is wanted can be done quickly, and purchase lists can be printed out. Better access to the books is also available through keyword searching rather than through the traditional subject index available in the print version. Bibliographies, both of owned materials and other sources, are easily printed out or included in reference lists for teachers for use in printed articles or lesson plans. For example, consider the request, "I need a list of books about the Vietnam War that have been published in the past 10 years that have been reviewed positively." Such a request takes moments to prepare either in print form or in data form that can be pulled into another document.

A third example of a locally owned database is one in which factual or narrative information is stored for instructional use. Such databases are available from commercial sources on CD-ROM or as databases that can be used with common database managers. Examples might be data about presidents, facts about endangered animals, weather data, address files, or astronomical data. Such databases are used by students to extract facts but also to do higher level thinking and for data manipulation. A few examples and their use include the following:

- In a database about the states, which states have the cardinal as their state bird?
- In a database containing weather information, what are the top 10 temperatures recorded in the United States, and where and when did these temperatures occur?
- In two databases, one containing incidents of communicable diseases and the other weather data, is there any relationship between the weather and the occurrence of certain diseases?
- In a database containing demographic statistics, do certain states have predominant religions? Are predominant religions regional in nature? What are the historical reasons for predominant religions being located in a region?

Students can be expected to use an electronic database in the same way they would use a reference book. The advantage of the electronic version is usually both speed and the type of questions that can be answered/computed in the electronic version. In printed reference works, the authors and editors must decide how the user is going to approach the data. In an electronic source, the designers can allow numerous approaches to the data without allowing the size of the data pool to increase exponentially.

Young children can learn how to search databases for answers they need to certain questions, but it is even more educational if young people can participate in database construction. There are numerous articles in the literature that describe the process of creating a database

with children. Ron Martin (1992) in Alaska recently described a database he had children create about dogs. Each child did research on a different dog, entered that data into a database Ron had created, and then the class used the database to help make decisions on what type of dog each of them might like to own, how dog breeds compare, and what breeds of dogs are common to certain areas of the country.

Children who learn to construct databases have many advantages. They learn to research certain facts; they must check those facts to see that they are as accurate as possible; they must learn how a database is structured; they must learn how data are entered into a database; they must learn quality control principles and how to think ahead as data are entered (do we enter the surname first or the given name?); and they must learn how to search a database to answer questions of varying degrees of difficulty. Such classroom activities provide simultaneous growth in subject competence and in information literacy. There are few better ways to teach young people the concept of databases.

Databases can be constructed on any microcomputer, even an old Commodore 64. Happily, database managers simple enough for even young children are readily available at affordable prices. It does not require a major investment to reap excellent results.

Children who can create databases can also learn how to chart the data they enter (budding Edward Tuftes?). Many programs allow a wide variety of charts and graphs to be constructed from simple data entered from a database manager or in its cousin, the spreadsheet. Because children are constantly tested to see if they can interpret chart and graph data, they can leap forward in standardized test scores if they know how to create their own understandable charts and graphs using a computer.

Data Gathering, Exchange, and Analysis

The American Association for the Advancement of Science is encouraging teachers to involve young people in more realistic science experiences. If the school librarian is informed about both data-gathering opportunities and high-tech possibilities, she can assist the science faculty in creating marvelous learning experiences. A few sample scenarios might be the following:

- Students gather data on acid rain as a part of National Geographic Kid Net. They can examine and analyze data from students in all regions of the country, make comparisons, look for cause and effect, and pose possible solutions to problems they observe.
- Students can gather data from their local streams and rivers as a part of a major statewide effort sponsored by a university to chart water availability, usage, and quality. Such cooperation can cultivate

student/expert relationships, provide career information, and help students participate in real-world and current scientific problem solution.

- Students might collect data in a cooperative agreement with another school somewhere in the world. Data can be sent by fax or electronically mailed back and forth for comparison and analysis.

A school librarian who is comfortable with numerous high-tech possibilities becomes a valuable team member as data-rich instructional experiences are designed and carried out. Not only can students gather data from their local environment, they can enter data from library reference sources for verification or comparison with the data collected locally. For example, does the sun rise when the almanac says it should? Why or why not? Data comparison, analysis, and criticism are the newer types of information skills students can experience as part of a high-tech library media center program.

Student Creative Output

In the past 13 years, a whole new world of production has emerged. Through the word processor, the video camera, CD-ROM, and digital audio/video, both adults and students can express their ideas and channel creative energies through a wide variety of media. When students were limited to transcribing ideas by pencil and paper or by using the typewriter, only the best students produced any sizable volume of work. Now, using the new technology, students can produce much more than they did in the same amount of time. Two factors account for this phenomenon: a high rate of efficiency and higher motivation through novelty. A few comments about the various forms of technology that stimulate student production are illustrative of these factors.

Word Processing

Research shows that students using word processors will write longer and better reports/papers. Students will revise more because of the ease of machine revision and the presence of spelling and grammar checkers, and thesauri allow students to create a higher quality product. These machine assists actually improve a student's grasp of the language because spelling, wording, and grammar changes must be approved by the user; they are not automatic. At first, teachers were hesitant to accept student work done on word processors because there was some feeling that, like a calculator in math, students might be getting an unfair advantage or might be cheating a bit. Most of this fear has been erased as teachers themselves have become processors of words. There are many good word processors for children and young adults. Some

of these programs can be used just as soon as a child can recognize letters and how they are used to create words. Many schools require word processing of all students as a part of their computer literacy classes. Typing teachers, who were at first very nervous about kids learning poor keyboarding habits, have resigned themselves to a new world.

Desktop Publishing

In the past five years, desktop publishing software has become available for children and young adults. One of the most popular programs is The Children's Writing and Publishing Center. If students can handle a very simple word processor, they can automatically handle a publishing program that allows them to create layouts and add graphics to their reports. The finished product can be so professional looking that students become interested in the creation of high-quality printed products. Young children can produce books, magazine articles, advertisements, posters, and illustrated reports and term papers. The school librarian who can envision the potential of desktop publishing should work with the teacher to plan research or topical studies, have a plentiful supply of relevant graphics, and provide an open lab for the creation of products. Students can be required to write more and better pieces complete with proper citations to print or electronic sources. Layout requirements can be accomplished through the use of templates or can be designed by the student depending on the sophistication level.

Desktop Everything Else

In the past three years, a wide variety of new technologies have emerged that link to a computer to produce not only print but sounds and images. Perhaps the first move in this direction was the creation of hypertext. Products like HyperCard for the Macintosh and Linkway for the IBM allow the user to create databases with buttons. These programs create something like a box of 3 × 5 cards that can either be viewed in sequence, or by adding "buttons" (places on the card to click with a mouse), the user can be linked to any card in the box. In addition, the user could be linked to both sound sequences and to pictures.

Even more recent technology allows students to link words to film clips or video clips or even to other databases by connecting the computer to a CD-ROM, a VCR, or a tape recorder. Multimedia reports can be created by young children with a minimum of instruction as long as the proper equipment, software, and materials are available. It is interesting to read or hear the technospeak that accompanies the descriptions of such technology:

> *Multimodality.* The new media are translatable. Words, images, and sounds can be placed in one document or can be edited from any other document to any other document. Information can be presented in text, graphic, animation, natural voice, music, and special effects on the same platform. Moreover, multimedia software provide for linking a segment of information, represented in any mode, to any other chunk of available information. Hypermedia allows for an omnidirectional search of information, a part of which may be stored on a CD-ROM or laser disc. The microcomputer drives the disc player to search and display the information. However, computers with advanced microchips and internal optical drives provide an even more powerful platform to designers and producers. Media computers provide an integrated hardware/software platform for production and display of instructional information. Digitized audio, video, and text can be stored and retrieved for the production of new instructional materials on the same system. Using total digital systems, such as DVI (Digital Video Interactive), educators are able to represent information in any mode on demand. Optical scanners and video cameras enable them to transform information from analog to digital form for editing into multimedia documents. Using image processing software, visuals can be edited, enhanced, and transformed products in a matter of seconds. Conducting such procedures in analog photography remains only in the purview of professionals in a fully equipped darkroom. Music[al] Instrument Digital Interface (MIDI) provides the same freedom of expression for music and sound effects. A keyboard puts composing, interpreting, and performing power of a full symphony orchestra, a jazz quartet, or a single instrument at the fingertips of instructional designers and media producers. (Saba, 1992, p. 129)

The advantages to students in this new multimedia world are quite simple to understand when a real-world example is given. A report on the Civil War can contain facts or narrative with accompanying pictures, stories with accompanying sound effects, or reenactments of battles complete with animated battle maps and simulated battle sounds.

There is a new term for this manipulation of media—re-purposing. That is, a student can take materials created in one medium for a single purpose and then edit or merge them into a new product with a new purpose—re-purposing. Although questions of copyright immediately emerge, the fair-use clause of the copyright law is generally thought to cover this manipulation as long as the product is created by students for educational assignments and the resulting product is not sold or used in public performance.

Teachers and librarians are likely to embrace such products because these products require the student to spend more time and effort and require much greater mastery of a topic than was true using either a pencil or a typewriter. The idea is that students become mini-experts about a topic as they create a very exciting high-tech product.

An example might be illustrative of the potential. Last year was the 25th anniversary of Fox-Fire, the oral history project done in the hill country of Georgia. Using high technology, students can now create, not only the magazine articles for which the students of Rayburn, Georgia, are famous, but they can combine commercial or original

videotape, commercial or live-recorded sounds, and still photographs to create their final product. One can imagine the impact of a multimedia oral history report on killing a hog or attending a mountain country funeral or even reporting a family reunion—country-style.

IMPLICATIONS FOR SCHOOL LIBRARIANS

In the age of high technology, school librarians must be very familiar with the storage, retrieval, and the production of information, sound, and pictures. This expanded literacy allows them, with teachers, to be catalysts in a whole new world of educational possibilities. Many school librarians are already living in this new world. Others are not even aware that a new world exists.

Librarians in public and academic libraries can easily recognize students who are comfortable with this new high-tech world. They will come into the library, look around, and then ask where all the technology is located. If the library does not have the technology they like, they will stomp out complaining about "this rinky-dink place." Students of this breed will not only be reluctant to use conventional technology, they may not know how. Being reduced from desktop publishers to pencil and paper or to the typewriter can be a humiliating and jolting experience. These students will want instant access to data, full-text articles, and easy access to fax or quick interlibrary loan. They will demand current data from the most authoritative sources. They will want access, not just to words, but to extensive collections of pictorial and audio material. They will have little patience with librarians who plead ignorance or poverty as an excuse. Those in academic and public libraries should be prepared.

In all our enthusiasm for high technology, however, we must be realistic. Technology must pay its own way if it is to be adopted widely. We can only expect taxpayers to pay for these expensive tools if

- students learn more than they would have by using traditional teaching and learning techniques;
- the technology releases students to be more creative;
- students are more information literate and can navigate and use information technology wisely.

There are lots of reasons not to use technology:

- its cost;
- the frustration it causes teachers, librarians, and users;
- the temptation to just be glitzy;
- the increased ability for children to waste time on an expensive machine.

School libraries are on the forefront of the information technology world. They are laying the groundwork for a whole new generation of information literate persons. Because they are often alone in a library media center, without help, they must be superhuman in their breadth of knowledge, their leadership skills, their technology skills, and their ability to make a technology pay a true educational benefit. Some of them complain that there is too much to know. Others dig in and are constantly refreshed by the excitement and challenge.

If we are truly creating an information society, then we all have a stake in what goes on in the schools of the nation. The college years are much too late to begin to build the information skills our society will demand.

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