DOCUMENT RESUME

ED 245 851 RC 014 784

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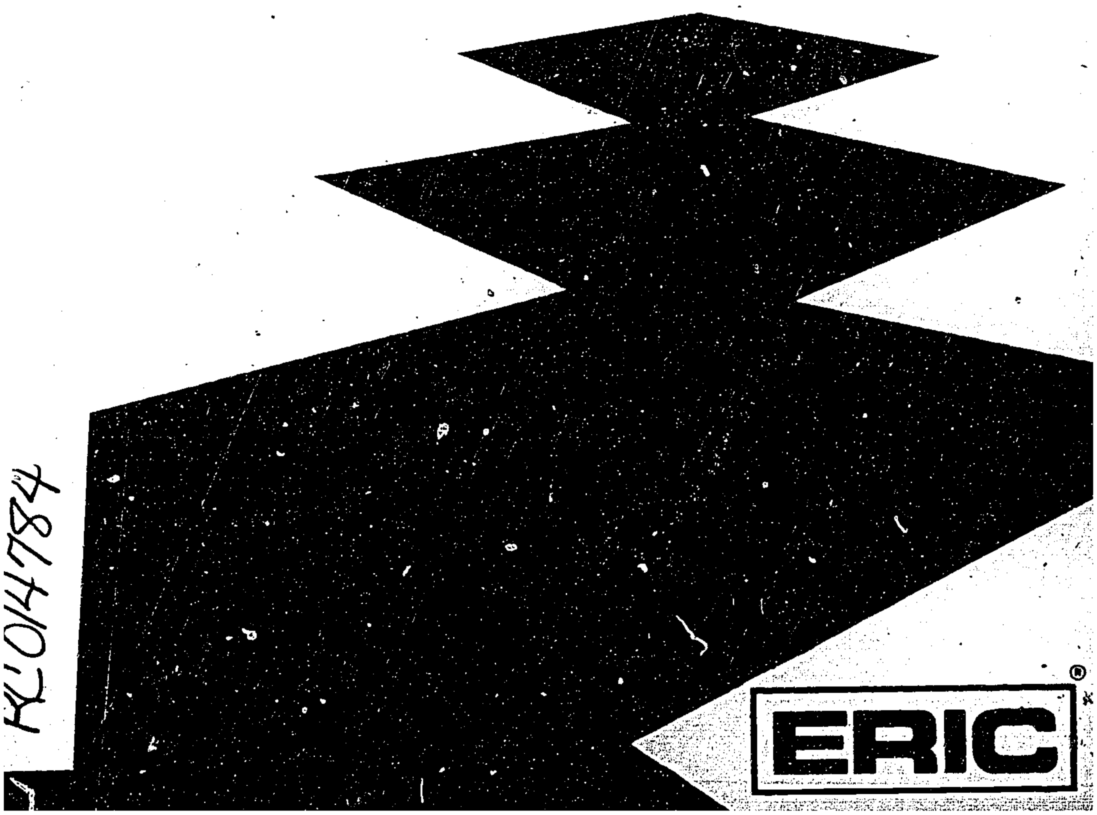
|---|---|
| AUTHOR | Hofmeister, Alan M. |
| TITLE | Technological Tools for Rural Education. |
| INSTITUTION | ERIC Clearinghouse on Rural Education and Small Schools, Las Cruces, N. Mex. |
| SPONS AGENCY | National Inst. of Education (ED), Washington, DC. |
| PUB DATE | Mar 84 |
| CONTRACT | NIE-400-83-0023 |
| NOTE | 42p.; New Mexico Center for Rural Education, Dept 4N, Box 3CRE, Las Cruces, NM 88003 ($7.50). |
| PUB TYPE | Information Analyses - ERIC Information Analysis Products (071) -- Reports - Descriptive (141) |
| EDRS PRICE | MF01/PC02 Plus Postage. |
| DESCRIPTORS | Access to Education; Computer Assisted Instruction; Computer Managed Instruction; *Computer Oriented Programs; Educational Innovation; *Educational Technology; Elementary Secondary Education; Instructional Innovation; *Microcomputers; *Rural Education; Rural Schools; *Small Schools; Technological Advancement; *Technological Literacy |


ABSTRACT

Effective utilization of computer technology can help rural and small school administrators and teachers overcome problems of time, distance, sparsity in course offerings and support personnel, and unequal funding through facilitation of communication and through the potential to replicate quality instruction. Tools that have implications for rural education include computer managed instruction (CMI), computer assisted instruction (CAI), interactive videotex, noninteractive videotex, and interactive videodisc instruction. Development of CMI systems requires defining curriculum in terms of specific objectives, developing placement testing systems, implementing monitoring processes, and revising instructional programs on the basis of pupil achievement data. The adaptation potential of small business data-base-management programs to CMI academic applications offers access to powerful management programs at modest cost. The portability, cost, and flexibility of CAI using microcomputers may provide the means to offer an urban equivalent delivery system to rural students, but the diversity of alternatives in products and implementation practices requires well trained teachers to apply available technology. Universal excellence obtained through CAI still appears to be more vision than substance. Videotex technology, already a major vehicle for information flow between farmers and the public and private sectors, should be present in rural schools, if only for the vocational training involved. (NEC)

# Technological Tools For Rural Education



# Technological Tools for Rural Education

by

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March 1984

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The National Institute of Education
U.S. Department of Education
Washington D.C. 20208

This publication was prepared with funding from the National Institute of Education, U.S. Department of Education under contract no. NIE 400-83-0023. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or the Department of Education.

Cover design by Debbie Guerrero.

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## FOREWORD

The compelling need for educational reform set forth by The National Commission on Excellence in Education's "A Nation at Risk" leaves little doubt that there are discernable inadequacies in American education. Response to that report has prompted all educators to re-examine their role in providing the best possible educational environment for their students.

Like other educators, rural educators want to provide their students with educational opportunities equal to the best offered anywhere. There are, however, problems of distance, sparsity, and unequal funding that hamper small and rural schools. In the competitive rush to hire exemplary teachers and administrators, rural schools can find themselves left behind their urban counterparts. Small schools are often hard-pressed to offer the variety of courses necessary to provide their students with adequate learning experiences. A lack of support personnel means that useful analyses of student and school progress are often not available.

Effective utilization of computer technology can help rural and small schools overcome these deficiencies. Computer-managed instruction offers a "helping hand" to administrators and teachers. Computer-assisted instruction not only expands the content areas available to rural students but experience gained in the process enhances student progress toward computer literacy, a necessary skill in today's information age.

Alan Hofmeister's overview affords a useful, understandable analysis of technology's potential in rural education. Teachers, administrators, and school board members who are not yet aware of the powerful assistance computers can provide for the management and enhancement of rural education will find Dr. Hofmeister's views particularly useful.

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## Summary

For the rural educator, the information age offers a set of technological tools that is relatively unaffected by the factors of time and distance. These technological tools will impact education through facilitation of communication and through the potential to replicate quality instruction and make such instruction available to all, regardless of geography. Tools that have implications for rural education include computer-managed instruction, computer-assisted instruction, interactive videotex, noninteractive videotex, and interactive videodisc instruction.

Developing technologies associated with the information age hold considerable promise for the rural educator. There are two major reasons for this optimism. The first is concerned with the information orientation of the new technologies, and the second is concerned with the notion of universal excellence.

Although it is fashionable to discuss developing technologies as components of the computer age, the reality is that the umbrella phenomenon is the information age, of which the computer is the major tool. This information orientation becomes very important when we study the problems of rural education and find that the difficulty of information transmission is central to many of our problems. Most educational practices were developed by individuals working in comparatively close contact, but many of these practices are not compatible with the problems of time and distance associated with rural education. The information age offers a set of communication tools that is relatively unaffected by the time and distance problems of rural areas.

## Instructional Management

One of the realities of teaching and administration in the small school is the increased level of self-reliance that must be developed. With few supervisors, peers, and models to provide feedback as to the appropriateness of their practices, rural educators require considerable confidence in their observations of the effects and value of their own practices. Any technological tool that provides decision-making support for the teacher or administrator must interest the rural educator. Of the different computer applications in the classroom, one of the most cost effective has been computer-managed instruction (CMI) (Stevenson, Edwards, & Bianchi, 1978). Burke (1982) has defined CMI as "the systematic control of instruction by the computer. It is characterized by testing, diagnosis, learning prescriptions, and thorough record keeping" (p. 188).

The need for help in the management of learning information appears obvious. A third-grade teacher may have 25 pupils in a basic skills curriculum of approximately 1,000 objectives. In a rural school, these information management problems may be compounded by the presence of several grade levels in one classroom. Thus, instead of directing pupils working through a curriculum with 1,000 objectives, the rural teacher may have to monitor pupil progress through 2,000 objectives. For the rural educator who is both teacher and principal, the information management problems are even greater.

### Comprehensive CMI Systems

The major steps in the development of a comprehensive CMI system are as follows:

a. The curriculum must be defined in terms of specific objectives. These objectives must then be arranged in a hierarchy. A common approach to a hierarchy is to use three levels, such as <u>area</u>, strand, and objective. For example, an objective on math facts would be in the computation strand, which would be in the math curriculum area, and might be designated by the code 2-4-25. The first number designates the area (mathematics); the second, the strand (computation skills); and the third, the specific objective (e.g., addition facts for digits 0 through 9).

b. Once the curriculum objectives have been defined and given computer numbers, a placement testing system must be developed. In the placement process the learner's skills are assessed to determine which objectives have been mastered and which objectives need to be taught. The outcome of the placement process should be an instructional prescription that specifies the instructional objectives that need to be taught to the individual learner.

c. Once an individual prescription has been developed for each learner, a monitoring process must be implemented. The purpose of the monitoring is to ensure that the learner is progressing through the instructional sequence defined by the prescription. If the learner is not progressing, then changes are made in the instructional procedures until effective instructional procedures are found.

d. The school's instructional program is revised on the basis of pupil achievement data. Just as individual teachers have an obligation to monitor the progress of each pupil in classes, so the school or district has a responsibility to analyze all pupil data to identify ways the district or school might improve its instructional program. Improvement could occur through changes in curriculum, teaching methods, instructional materials, and pupil-assessment procedures. This process of monitoring, analysis, and change is viewed as a continuous cycle. As one weak area is identified and remediated, other areas are selected for improvement. Figure 1 exemplifies the interactions among the different components of a CMI system.

## CMI Reports

Depending on the size and sophistication of the CMI system being used, the educator can request a range of computer-generated reports. The following are some examples of different types of reports:

a. Individual pupil progress reports. Each report on an individual learner shows the progress the learner is making in his or her individual program of study. The report usually identifies which skills have been mastered and the date the skills were mastered. Such reports are often used during parent-teacher conferences.

b. Class reports. Class reports usually contain the same type of information as the individual reports except that the class report combines all the information on one chart. A report of this kind is particularly useful for identifying the more problematic curriculum areas. The report is also helpful in planning and preparing for future instructional activities.

c. Class grouping reports. This report identifies those curriculum areas that several children may be working on at the same time. Such a report is particularly useful for a teacher who uses small instructional groups.

d. Instructional resource reports. Instructional resource reports cross-reference specific instructional objectives with instructional materials that a teacher or pupil might use in association with the instructional objective.

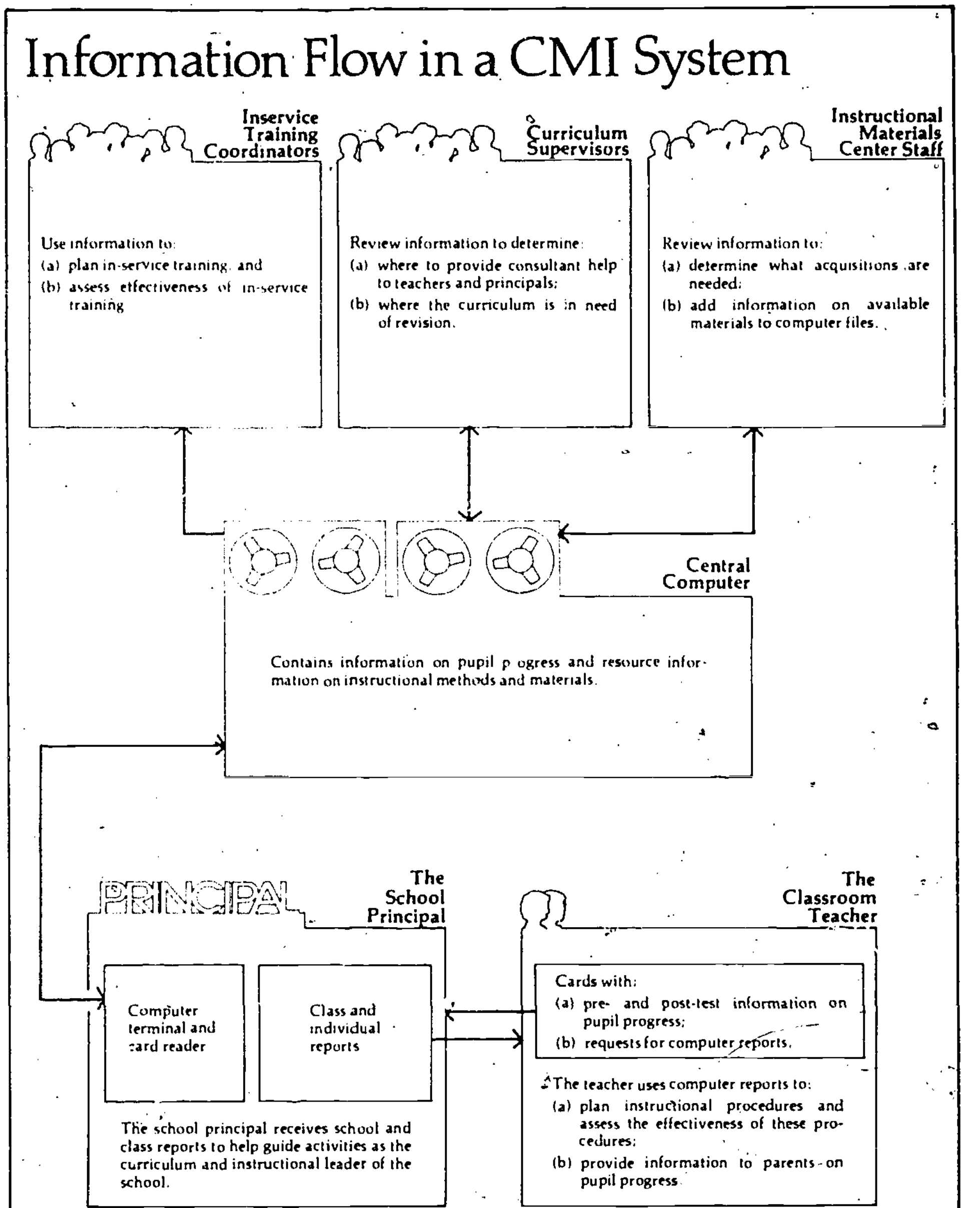
Information Flow in a CMI System
Inservice Training Coordinators
Use information to:
(a) plan in-service training, and
(b) assess effectiveness of in-service training
Curriculum Supervisors
Review information to determine:
(a) where to provide consultant help to teachers and principals;
(b) where the curriculum is in need of revision.
Instructional Materials Center Staff
Review information to:
(a) determine what acquisitions are needed;
(b) add information on available materials to computer files.
Central Computer
Contains information on pupil progress and resource information on instructional methods and materials.
PRINCIPAL
The School Principal
Computer terminal and card reader
Class and individual reports
The school principal receives school and class reports to help guide activities as the curriculum and instructional leader of the school.
The Classroom Teacher
Cards with:
(a) pre- and post-test information on pupil progress;
(b) requests for computer reports.
The teacher uses computer reports to:
(a) plan instructional procedures and assess the effectiveness of these procedures;
(b) provide information to parents on pupil progress.

Figure 1

e. Curriculum and instructional analysis reports. Many CMI programs provide for reports that identify the specific objectives that are being mastered and those that represent problems to significant numbers of pupils. These reports generally combine pupil data at the school or district level. This information can be invaluable for principals and curriculum supervisors, because such information can be used for making changes and evaluating their effect.

## Data-Base-Management Programs for Rural CMI Applications

For computer purposes, a CMI program is an inventory program. In the case of an individual classroom, there is a constantly changing inventory of the academic strengths and weaknesses of all the pupils. Because of the similarity of CMI activities to the inventory problems of small business operations, many educators have used data-base-management programs originally developed for small businesses to develop partial or comprehensive CMI programs. Data-base-management programs were originally developed for small businesses that needed inventory software but could not afford a computer programmer to develop and refine a custom program. Many of the data-base-management programs developed for microcomputers allow individuals with no computer programming experience to develop very powerful inventory programs. For the rural educator with a limited budget and limited access to the technical assistance necessary to develop software, the data-base-management programs offer a way for an individual to develop powerful management programs at a modest cost.

## Basic Functions of a Data-Base-Management Program

A data-base-management program organizes information into files. Each file consists of a series of records, and each record contains a number of fields. Each field is made of a number of characters. For example, a 30-character field could be established to hold a pupil's name. This field would then be a part of a record. Other fields on the record might be used to hold other demographic information as well as information on performance in the different curriculum areas under instruction. This record of an individual pupil would be an element in a file containing the records of all the children in the school or district.

Depending on the sophistication of the data-base-management software and the type of information entered, it might be possible for an administrator to request a listing of all fifth-grade children who arrived in the district within the last three months and who had not mastered two-digit long division with remainders. Many of these data-base-management programs allow the educator to develop individual and group reports.

A major advantage of data-base-management software is that it allows the individual teacher or principal with no computer programming experience to develop very powerful record-keeping systems. While record-keeping systems of this type may not have all the features of large comprehensive CMI systems, their low cost and flexibility have made them very popular.

Three of the more popular data-base-management systems are P.F.S. (Personal Filing System), QuickFile, and D-B Master.

## CAI Practices and Promises

Computer-assisted instruction (CAI) is a technological tool with considerable promise. Indeed, the level of interest in this technology is so high that one might assume it is a developed and proven technology. For the rural educator looking for help in offering pupils high-quality content with an up-to-date instructional delivery system, CAI seems almost too good to be true. For rural administrators working to ensure that their pupils have the same opportunities as their urban peers, CAI is indeed attractive. When the pupil sits down to interact with a microcomputer-delivered lesson, the geographical site of the instruction ceases to be relevant. As rural educators look for ways to provide information-age experiences for their pupils and try to develop computer literacy through experience as well as through formal lessons, the attractiveness of CAI increases.

### CAI and Instructional Effectiveness

It should be remembered that CAI is an invention of educators, and its presence in the classroom must be defended on the basis of its instructional effectiveness and not on its role as a computer application. While CAI will add to the computer literacy experiences available to the child, this alone is not sufficient. A review of CAI implementation practices suggests that many educators were seduced by the superficial aspects of CAI. Indeed, the seduction was so complete that many of the early CAI software evaluation checklists did not even refer to validation data tied to instructional objectives and learner populations. There was, however, considerable emphasis on characteristics of the medium, such as graphics and immediate feedback.

It was often assumed that a CAI product would be successful if certain media attributes were present. The situation is made even more confusing when we consider that some of these attributes, such as immediate feedback, have been shown to have limited and even negative value in a CAI context (Barringer & Gholson, 1979; Rankin & Trepper, 1978). With regard to the use of graphics in CAI and in reference to a specific study with low-achieving students, one researcher reported that "Graphics may have served only to distract the students and draw them away from the real lesson at hand" (Fisher, 1983, p. 84).

The purpose in drawing attention to the above-listed concerns regarding CAI is not to suggest that CAI has no value, but rather to suggest that the current unquestioning emphasis on CAI is inappropriate in light of the present research (Hartley, 1977; Deaton, 1983; Alderman, Swinton, & Braswell, 1978; Bunderson, 1981; Fisher, 1983), current products, and associated implementation practices. For the rural educator, the future for CAI is promising because of its ability to collect data on its own effectiveness and then faithfully replicate each successive improvement, thereby resulting in progressive improvement.

If we are to capitalize on the potential of current CAI products, our training commitment must be extensive; further, we must take into consideration the complexities of the research findings and the fragmented and confused state of the universe of options. Fisher (1983) has noted that CAI success has occurred:

> When it is aimed at specific student-body groups; when it is fully integrated into the regular classroom curriculum; when certain subject areas are selected; and when the proper setting and scheduling is established. (p. 82)

The diversity of alternatives in both CAI products and associated implementation practices does not support commonly held notions that "technology will simplify instruction" or that "technology will replace teachers." Indeed, it appears that we will need even better trained teachers who can effectively apply the types of technology presently available.

## Universal Excellence and CAI

The notion of universal excellence was a motivation driving many early researchers using teaching machines, programmed learning, and computer-assisted instruction (CAI). As far back as 1966, in congressional hearings, advocates of computer-assisted instruction discussed the potential of this new tool to "do for every child what once could be done for only a few" (Hofmeister, 1983).

For some 20 years now, CAI researchers have looked to computer-assisted instruction as an important vehicle in developing universal excellence in the delivery of instruction. At this point in time, the notion is unfortunately still more vision than substance. In the spring of 1977, just as the first microcomputers with educational potential were being released, Schoen and Hunt asked:

> What happened? Why has CAI not been adopted wholesale in our educational institutions? Despite fantastic predictions by many people in the 1960's . . . there seems to be little evidence that their predictions will come true in the near future. (p. 73)

Although the portability, cost, and flexibility of the microcomputer have considerably increased the availability of CAI, there are still problems.

One of the greatest disappointments of CAI has been the failure of CAI developers to capitalize on the technology's potential for self-improvement through its ability to collect pupil data and consistently replicate each improved version. An early vision, as expressed by Schwartz and Long (1966), suggested that:

> The data collection and quick update capabilities have profound implications. . . . Once the initial version of the course has been written and administered to a small group of students, the author can interrogate the system and obtain a complete record of each student's performance. From this, he can then determine where changes are necessary. (p. 15)

In fact, however, the market has been deluged with large numbers of fragmented products, some of which were never even tested in an actual classroom before they were marketed.

## Videotex and Television in Rural Education

Videotex is the term used to describe any system which makes computer-stored information available via computer screens or a printing terminal. Videotex exists in two forms: interactive and noninteractive.

### Interactive Videotex

In interactive videotex the information usually moves via telephone lines. The user may interact through a personal computer, a terminal with a screen and keyboard, an adapted television set, or a printing terminal. Most interactive videotex systems are designed to allow the individual to conduct in-depth searches through large amounts of information. The individual can work in either a search mode or an interactive mode in which the individual adds information to the system as well as retrieves information.

One of the most common ways an individual adds information to a videotex system is through the use of electronic mail. Electronic mail is the term for the electronic distribution of messages. While most forms of telecommunications are "real-time" communications, electronic mail is not. Messages are sent and stored until the recipient wishes to read them. This facility has some of the advantages of the normal postal service, among them the freedom to choose when to read or respond but adds the benefits of the speed of electronic communication. Electronic mail systems usually include electronic bulletin boards where messages of general interest can be posted. A number of states have developed statewide videotex systems which include bulletin boards for special educators, for curriculum specialists such as the math and language arts teachers, for employment information, and for information for school administrators. Most of the large electronic mail systems allow messages to be copied and/or sent to several individuals at once. When a message is received, the recipient can often forward it to others with a single "copy" command.

Computer conferencing occurs when several individuals use the electronic mail facilities of a videotex system to communicate on a specific topic over a period of time. For example, several teachers in different parts of a state might conduct a computer conference over a 2-week period to develop an agenda for a statewide professional meeting.

Nationally, educators are participating in interactive videotex systems of three major types: general purpose systems such as CompuServe and the Source; SpecialNet, which was developed specifically for special educators and provides for electonic mail, bulletin board services, and computer conferencing; and emergent specific state systems, which are developed by state offices of education and designed to serve all public school educators in the state. Aside from offering electronic mail services, the general purpose videotex system also provides a large information base that includes such other information as wire services, stock market reports, restaurant guides, transportation schedules, and bibliographical search facilities that allow the educator to query data bases such as ERIC.

## Noninteractive Videotex

Noninteractive videotex is usually transmitted in association with television signals. A television signal that is received in the home is capable of carrying more information than is presently being transmitted. If a television set is modified, additional information can be accessed. One example of this capacity for extra information transmission is the captioning service available for the deaf, a noninteractive videotex service. Noninteractive videotex information bases are usually limited to several hundred pages of information; while individuals with modified televisions can select from among the available pages of information, they cannot enter information into the system. These noninteractive videotex services often duplicate some of the offerings of the daily newspaper and carry information that can be updated daily or more frequently.

The pages of information offered by these noninteractive videotex services are purchased in a manner similar to that in which advertising space is sold on television. This means schools can command a number of the available videotex information pages to keep the community informed on school events and educational offerings.

One of the reasons videotex should attract the rural educator is its acceptance by other members of the rural community. Videotex is a major vehicle for information flow between the farmer and the public and private sector (Chartrand, Carr, & Miller, 1983). If videotex continues to develop as a communication and decision-making tool for the farming community, the rural educator should include videotex experiences in the curriculum, if only for the vocational training involved.

In a paper on innovative rural school programs, Barker and Muse (1984) reported as follows:

> The Spring Valley School District in Wisconsin (784 students) described a vocational education class in dairy cattle management that emphasized practical application of microcomputers to help in record keeping, balancing dairy rations, determining feed rotation, etc. The class was also open to area farmers who wished to utilize the benefits of microcomputers in helping manage their dairy operations.

It is a relatively small step from the use of local microcomputer applications to the use of remote information banks to facilitate farm management.

## Television

In many ways videotex is an enhancement of earlier instructional television efforts in rural areas. With regard to instructional television, some clarification of terms is necessary. Educational television usually refers to informational programming that often appears on commercial and public television. This material is instructional but is not a part of formal courses of study. Instructional television can involve one- or two-way transmission, and the programming focuses on more formal courses of study. When two-way, or interactive, instructional television programming is presented, a variety of technologies is usually involved. Some of the combinations include public television (with audio questions by telephone from the audience), low-power television and microwave, cable and microwave, microwave only, and fiber optics.

There has been considerable interest in the use of microwave and fiber optics because of their potential to support a wide range of computer and television technologies. Microwave technology appears well-suited to sparsely populated areas where there is some high terrain on which to place towers. In areas where distances are not so great and where there are existing power lines, fiber optics may prove to be a low-cost, reliable technology because the fiber optic line can be strung on existing power poles (Education Computer News, 1984).

## The Electronic Cottage

Alvin Toffler, in The Third Wave, described the "electronic cottage." In an electronic cottage all members of the family stay at home and work, learn, and participate in recreation with the aid of computers and electronic communication. The idea of children staying at home and learning through electronic communication is not at all new. There have been numerous examples in education where pupils have been linked to remote teachers via phone lines.

As far back as the 1930s and 1940s, pupils in the Australian Outback interacted with the teacher via shortwave radio, powered by pedal-driven electric generators.

A number of corporations have experimented with allowing employees to work at home and communicate with work colleagues via computer terminals. Although such practices have been implemented, there is some question as to their popularity with the worker. In a poll conducted by *Time* magazine (Friedrich, 1983) some 73 percent of the respondents stated that they believed the computer would enable more people to work at home; however, only 31 percent said they would prefer to do so.

## Electronic Information Sources and the Teacher

When the move is made from direct contact to contact via electronic information, the importance of time and distance as problem variables is dramatically changed. When communication takes place electronically, the important variable is terminal access. Once the two individuals who wish to communicate have access to terminals, the distance between them ceases to be of major importance. Figure 2 exemplifies some of the electronic information exchanges that presently occur between a classroom teacher and other individuals in the education system.

The newer information-age technologies are particularly well-suited for the provision of "on-line" assistance to the rural teacher with problems that need immediate attention. Parrett, Johnson, & Amundsen (1983), in a discussion of sources of personal and professional frustration for rural teachers, made reference to the "lack of professional resources for consultation." With the aid of newer technologies, the teacher not only discusses problems with a resource person but transmits printed documents, such as test results, that allow a remote consultant to be more effective.

# Electronic Information Sources for the Teacher

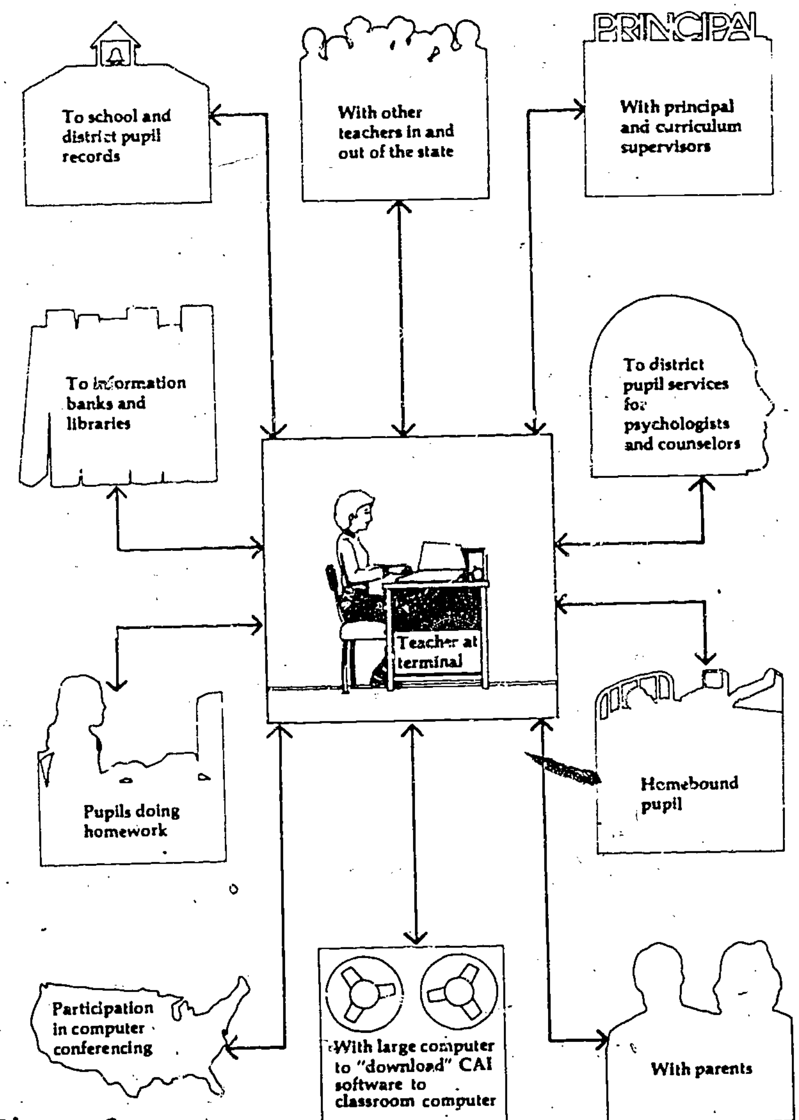


Figure 2

Electronic Information: Problems and Issues

Participation and the technology. All th electronic information exchanges presented in figure have been either implemented or planned for the nea future in a number of school districts in the Unite States. However, the fact that the potential to such things already exists does not mean that suc electronic information exchanges should or will occu in great numbers.

While children appear to be adapting quit readily to the hardware of the information age, mar administrators, teachers, and teacher trainers do no share the enthusiasm of some of the younger citizens

Balance between electronic and personal contac Electronic information cannot and should not repla all other forms of communication. Even if we were become highly committed to electronic informatic exchange, we would still have to work at determini what balance was needed between direct persona contact and contact via electronic information.

Fiscal resources. It was earlier noted that t problems of time and distance are minimized electronic information exchange. However, it was al noted that availability of equipment becomes a mu more important issue. One of the most persiste problems is the limited fiscal resources of rura districts. If it is determined, for example, th pupil learning is facilitated when households ha ongoing electronic communication with the teache then there must be concern for those families that not have the financial resources to communica electronically with the school.

Availability and use. The fact that an ele tronic communication channel exists does not guarant its use. For example, if inexpensive and flexib electronic communication systems between teachers a parents are developed, the communication channels m achieve very little use unless there has been planni for using them in a systematic and productive manner. While the value of parent communication, parent involvement, and parent training is constantly discussed, supported, and validated through research (Hofmeister, 1977), the fact is that many educators do not systematically plan for or place a high priority on these tasks, even though some relatively low-cost communication channels, such as the telephone, are already available.

## The "Omnibus Medium"

Kleibacker (1983), in discussing the communication industry, noted:

> Once segmented into separate, distinct entities--newspaper, books, magazines, film, radio, television--each with their own markets, today [these entities] are merging into one giant electronic circuitboard. Newspapers are going online. Books are being converted from handbooks and paperbacks into floppy disk "softbacks." Film and records are being digitized and magazines are becoming videoized to fill a supermarket of cable and microwave channels. (p. 1)

Of interest to educators is the convergence of technologies to form a single device with the characteristics of several media. In the Science and Technology section of the April 1983 issue of the Economist, reference was made to the plans of Matsushita to market a "read and write" videodisc system. Such a system has the potential to function as a microcomputer, but with a massive increase in speed and storage, and as a videotape system, but with better video and audio characteristics. The read-and-write videodiscs should make a hardware device available to the CAI developer that would be a complete generation ahead of present devices.

Videodisc systems that can present video and respond like a computer are being field tested in classrooms (Hofmeister & Thorkildsen, 1983). A restriction of present interactive videodisc systems is their "read only" limitation. The computer code and video information stored on the disc cannot be changed once it is put there. A read-and-write videodisc allows for the changing of both computer and video information. The presence of this omnibus medium may bring the dream of universal excellence in instruction a little closer to reality.

The cost of videodisc technology has been one of the major reasons interactive videodisc technology has not made a larger impact on the public schools. The technology has been well received in other fields, such as in medical training and in technical training in the Defense Department. There are more than 250 videodisc-based inservice training centers in hospitals in the United States. The U.S. Army, an agency concerned with the problem of delivering quality instruction to remote sites, has recently made the interactive videodisc the delivery system of choice for individualized instruction.

The recent, significant reduction in the cost of videodisc technology now makes it possible to purchase an interactive player for approximately the same price as an extra disc drive for a microcomputer. With the recent reduction in hardware costs, there should be an effort to remove the final obstacle--the lack of courseware. Within the past 12 months the percentage of school districts with videodisc players jumped from 2 percent to 16 percent. Some states are already planning for a time when intelligent, interactive video technologies will be an important part of the instructional delivery systems. Rural high schools in Utah are being designed to take advantage of technologies that will allow for the simulation of expensive science lab and vocational shop training activities. The floor plans of these rural high schools show a reduction in lab and shop space in favor of space for individualized, interactive learning stations.

In an article reporting on the accelerating decline of school science labs, Tinker (1984) made the following observation:

> With the advent of computer software designed to simulate laboratory experiments, opponents of lab education

have in the computer a safe, compact, and economical alternative to the impractical ritual of the past. (p. 24)

When a highly specialized facility, such as a science lab, is replaced with a facility capable of simulating a wide range of activities, including science experiments, the value of that instructional space is dramatically changed. The flexibility offered by instructional delivery systems that can simulate a wide variety of activities is consistent with the needs of rural schools concerned with their limited range of instructional options. The rural school is also very concerned with the multipurpose nature of school facilities. The school's physical plant and instructional resources have to meet the lifelong learning needs of the adult community as well as the school-age community.

To some extent the ongoing debate over the comparative value of technologically delivered instruction and more traditional approaches (Fisher, 1983) ceases to be relevant when the incompleteness of the curricula in some small schools is considered. For many small rural schools, students will not have access to some courses unless technological support is used to deliver them (Smith, Gohs, & Mason, 1982).

In discussing the problems of recruitment of qualified teachers of advanced math and science classes in rural high schools, John Russell (Education Computer News, 1984) made the following observation regarding a plan to use two-way television:

> It is not the best situation, but it certainly is better than kids not being able to get the courses. We cannot take the place of a teacher being in front of every classroom, but the reality is that we cannot get those teachers. (p. 6)

## Cooperative Planning and Support Services

If rural schools are to remain current in an information age, they will have to receive support from outside the rural district. Issues that must be addressed are the supportive roles of state education agencies (SEAs), teacher training institutions, and other technological thrusts in rural areas.

### Specialized Personnel and Facilities

One of the characteristics of the information age is the rapidity of change. If an organization is to adapt to change, it must have mechanisms to detect and systematically plan for change. In small school systems there are rarely specialized units or personnel with full-time responsibility to monitor and plan for technological change. Hamilton and Casserly (1983), in their "Survey and Analysis of Technology in the Great Cities," reported that the large school districts already have dedicated units and personnel who are planning and monitoring the implementation of new technologies. The survey further notes that the percentages of "Great City" school districts implementing or planning to implement the newer technologies are as follows:

| | |
|---|---|
| word processors | 100 percent |
| telecommunications | 78 percent |
| electronic mail | 70 percent |
| optical scanners | 70 percent |
| cable | 66 percent |
| videodisc | 48 percent |
| robotics | 22 percent |

It is doubtful, however, that small schools will be able to afford extensive specialized resources. Nevertheless, the developing information age technologies should support rural multi-role personnel by supplying information and technical assistance that will allow rural schools to take advantage of technological changes. State offices of education and teacher training institutions should be planning to support and enhance the technological literacy of administrative personnel in small schools.

## Support Services from the SEAs

With regard to state office of education support services, Christen and Gladstone (1983) noted:

> As of October 1983, at least 27 state education agencies had at least one employee whose primary responsibility was to coordinate all of the educational computing activities within the state. Other states have actually set up entire departments, such as Alaska's Office of Educational Technology and Telecommunications, or the Educational Technology Section in Florida. (p. 40)

Among the technical assistance services supported by SEAs are the following:

1. Software evaluation reports
2. Newsletters
3. Assistance in planning conferences and workshops
4. Assistance in hardware acquisition
5. Establishment of central, regional, and local demonstration classrooms and resource centers
6. Advice in funding related to discretionary state and federal funds
7. Coordination of electronic communication systems

8. Public relations activities with parents and school boards

9. Management of itinerant services, such as mobile vans for demonstration and training activities

10. Management of software purchasing and licensing efforts

11. Consultation with other subject area specialists to facilitate integration of computer literacy components in instruction of basic skills subjects and areas, such as special education and vocational education

12. Monitoring of state and national statistics related to educational computing and sharing such information with state and local decision makers

13. Preparation and dissemination of a computer literacy curriculum and associated teacher guides

14. Development and dissemination of instructional software

15. Consultant services to planners and architects designing new school buildings

16. Development and support of educational user groups

**Cooperative Application of Technology**

One of the restrictions on the effective application of technology in rural areas is the lack of cooperation among the different elements of the education community. Gardener and Edington (1982) noted that "an ongoing inservice program is essential to the continued growth of rural educators and for better relations among the communities, schools, and colleges of education" (p. 19).

Most of the technologies previously mentioned have implications for inservice training of teachers and administrators. If this potential is to be realized, teacher training institutions will have to develop technology-based instructional delivery systems in cooperation with rural school districts. To date, teacher training institutions have been slow to face the implications of the information age (Hofmeister, 1984), and a number of these institutions have never had a record of cooperative planning with rural schools.

## Conclusion

There are unmistakable signs that the new information age technologies are becoming a pervasive part of rural life. Given the schools' responsibility to prepare their pupils for life, rural educators must be concerned with the technological tools of the information age. These tools are not associated with some passing "educational innovation" but are tied to major changes in the very structure of society as we move from the industrial to the information age.

The new technological tools offer immediate and future promises. The realization of these promises depends on the degree to which rural educators prepare themselves to capitalize on the advantages and avoid the problems associated with the new technologies. Because the new technological tools are communication oriented, rural educators have much to gain by developing their technological literacy. Unlike their urban peers, rural educators do not have the luxury of falling back on existing communication practices in education because many of these practices have not been well suited to the needs of rural educators.

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## Resources

CompuServe
5000 Arlington Centre Boulevard
P.O. Box 20212
Columbus, OH 43220

The Source
1616 Anderson Road
McLean, VA 22102
(800) 336-3366

SpecialNet
National Association of State Directors
of Special Education
1201 16th Street, NW
Washington, DC 20036
(202) 822-7933

## About the Author

Alan M. Hofmeister established an interdisciplinary research and doctoral program in technology and special education at Utah State University in 1970. Since then, he has been actively involved in a wide range of technological applications to education. In the 1970s he directed a large telecommunication project to bring instructional services to children and their families in remote areas.

He presently serves as Associate Vice President for Research at Utah State University and is actively involved in research in laser videodisc technology and the application of artificial intelligence to education. He has authored a wide range of books and scholarly articles. His most recent is Microcomputer Application in the Classroom published by Holt, Rinehart & Winston, 1983.