

COMMUNICATIONS TECHNOLOGY AND EDUCATION¹

The acceptance and use of mass communications in daily life and their lack of acceptance and use within education is a paradox of our times. For most Americans the technologies of mass communications have become necessities as well as luxuries. For example, the explosive growth and spread of television in the U.S.A. since World War II is well known. Today over 95% of American households in all regions of the country and of all income levels own at least one television set.

Although television has received the most attention as a medium of mass communications, the other media have also grown. Radio, once thought to be doomed by television, has developed new formats for music, news and talk programs. Radio now serves many extremely loyal audiences. The number of radio stations serving the country has more than doubled since 1950—going from 2,800 to over 7,000, while the number of radios in use has grown even faster—from about 100 million in 1950 to over 370 million.

Motion pictures, once thought to be doomed by television, have become a mainstay of the television diet. Moreover, they are doing well in many motion picture theaters. In addition to this, films have become an art form for every man thanks to the availability of relatively inexpensive hand-held cameras, some now with built-in sound. The rise in high school and college courses for filmmaking has been spectacular. The recording industry has also pros-

pered. Vast numbers of records are manufactured and distributed—popular and classical music, poetry and drama. Video cassettes for use on home television sets—only recently available at competitive prices—make the home set even more versatile.

Although it is not often thought of as such, the computer has also become part of the communications technology surrounding us. The techniques by which we can communicate effectively with computers have steadily been improved to the point where there are now computer languages for many purposes. Some of these computer languages can be learned easily by elementary school students. As techniques of timesharing are making it possible for many people to use the computer at one time, the computer is becoming a medium of mass communications.

Newer technologies are still being developed. Cable antenna television is now installed in more than 10% of American homes, and satellite communication for television and other purposes is rapidly coming. Apparently there is no end to the development and proliferation of mass communication technologies for recreation and for business.

Although these same technologies have been widely heralded as having great educational potential, they have made comparatively little impact within education. The computer provides a typical example of what has happened. However, this example could be almost duplicated by case studies of the use of radio, television or video cassettes within education. During the 1950's and 1960's when the computer was being developed as a great tool for the sciences and business, many thought it also held great promise for education. There was also widespread initial enthusiasm among teachers and administrators at all educational levels. Computer manufacturers suggested that

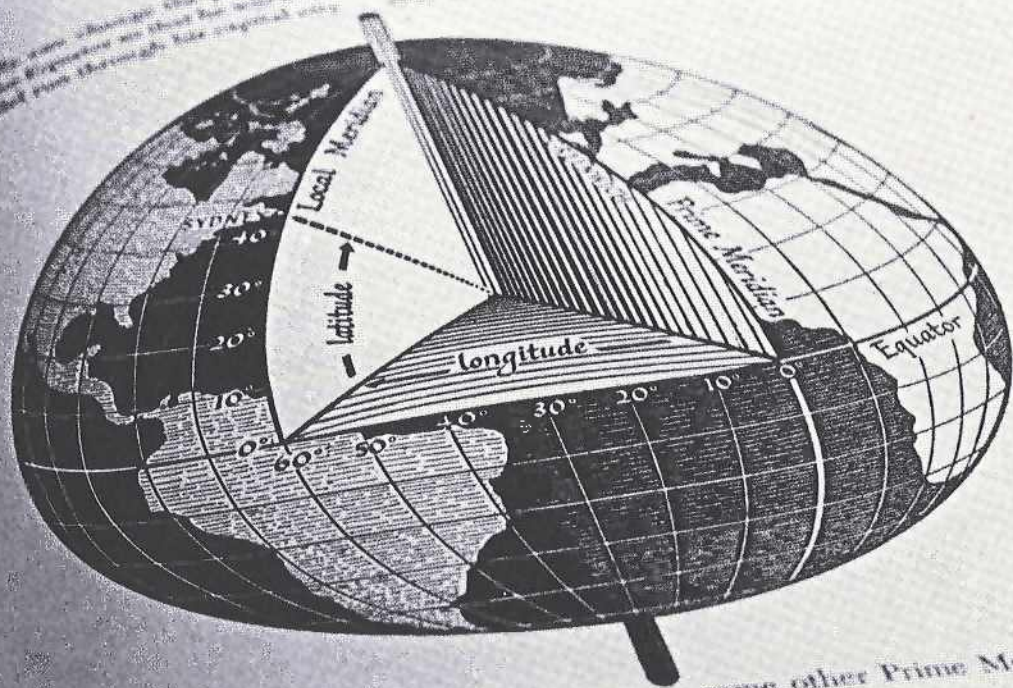
¹Based on part in Morrisett, Lloyd N., "Technology, Humanism and Higher Education," in *Increasing Productivity in Higher Education*, Educational Testing Service, 1974.

the computer would have broad application within education, and a few early practical uses were planned. Unfortunately these were frequently underfinanced and inadequately planned. Subsequently it was realized that the computer did not fit conveniently within the typical school system. Computers were considered difficult to use; they were expensive; they were hard to maintain properly. After the initial enthusiasm many educational administrators became disillusioned. The few successful uses of communications technology within education are unfortunately not the rule. One must conclude that the new communications technologies have had relatively little impact thus far.

Some evidence continues to suggest that communications technologies may have an important future role within education. The triumphs of electronic technology outside formal education are constant reminders to educators of a seemingly limitless potential. A few successful, though limited and isolated, uses within education show that practical results are possible. A new way of looking at communications technologies and education may help resolve the present paradox of acceptance in daily life and apparent rejection within education.

THE TECHNOLOGY OF EDUCATION

The debate about greater use of modern communications technologies within education often misses the point. On the one side are those who insist in the name of efficiency and science that educators should make greater use of modern communications technologies. The other side replies that they have tried without much success. The issue can, however, be put quite differently. Education today can be viewed as being based on a single technology—that of print. The question then becomes whether or not new technologies should be added to or integrated with the present print technology of education. If the issue is seen as



and thus give prestige to his nation. It is not an arbitrary line.

But the Prime Meridian has a mind to put it where he had it pass through Madrid. And Spain has had it pass through Madrid. And when her explorers sailed westward they reckoned longitude from the Madrid meridian. They can't blame them; they wanted to know how far they were from home, and that was the Prime Meridian used by Americans in the days that passed through Greenwich, England.

some other Prime Meridians you may see on foreign maps:

- Athens
- Berlin
- Copenhagen
- London
- Madras
- Paris
- Peking
- Rome
- Stockholm
- Tokyo

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the integration and addition of new technologies to a traditional technology, rather than adopting something new in place of the traditional, different questions can then be examined.

Before looking at these issues it is necessary to have a very clear understanding of what is meant by "technology." The definition given by Harvey Brooks, Dean of Engineering and Applied Science at Harvard, is instructive: "...technology is essentially a specifiable and reproducible way of doing things. It is not hardware but knowledge, including the knowledge not only of how to fabricate hardware to predetermined specifications and functions, but also of how to design administrative processes and organizations to carry out specified functions and to influence human behavior toward specified ends. The key element in all technology is the capacity to specify how to do something in a publicly communicable and reproducible way. The term, 'technology,' does not specify the whole domain of human action but only that part which can be communicated and specified in a replicable way. Thus it excludes many human skills and arts which at least at the present time cannot be codified but must be learned from experience and by doing."¹

When this definition is applied to education we find that education has a very highly developed technology. It is based on print combined with lectures and discussions. The textbook, teacher's manual, or other form of printed material is at the heart of this technology. A part of this technology is the publishing industry with its editors, publishers, salesmen and administrative organizations necessary to procure, manufacture and distribute books. The authors who supply materials for educational publishing are also a part of the technology, as are the teachers who use the material.

¹Brooks, Harvey, "The Technology of Zero Growth" in *Daedalus*, Fall 1973, "The No-Growth Society," p. 139.

At the college level, the campus bookstore and the library are another part of this technology of print-making available texts and reading material to students and professors alike. At the elementary and secondary school level there are similar ways of getting textbooks in the hands of the students who need them. It is not the purpose here to analyze systematically the technology of print as it spreads across the entire educational system. It is only necessary to see that if technology is considered as knowledge in Harvey Brooks' definition, then all formal schooling is, practically speaking, organized around the technology of print. The school, the library, the bookstore, the publisher, are all complementary and reinforcing structures within this technology. It is highly developed and the various parts of it reinforce each other as well as serving the whole.

This technology is certainly not new. Until the invention of the printing press in the fifteenth century, instruction was verbal. Once printed materials could be acquired, the tradition of verbal instruction began to incorporate the newer print technology. In the succeeding four hundred years this evolution has led to a highly sophisticated and developed technology in which verbal instruction is closely allied with and dependent upon print technology.

When technology is considered as the knowledge that leads to a specifiable and reproducible way of doing things, it can readily be seen that technology is vital to education. Without a technology, education would be entirely a hit or miss affair. There would be no way of training teachers to do their tasks. Rather, each teacher would have to approach his job afresh without the benefit of the experience of those who have gone before him. He would not be supported in his task by a publishing industry or a teacher-education industry. Not only would this be extremely difficult from the

teacher's point of view, it would be impossible from the point of view of society. Society is intent upon seeing that there is a certain degree of uniformity in the education of young people. This implies a technology which allows education to proceed in a reproducible manner.

Understanding that education is based on a highly developed and sophisticated technology, we can begin to ask what are some of the inherent advantages and limitations of the present technology. This approach lets one explore the possible advantages and limitations of new technologies that might be integrated with the present technology of education. If the present technology is adequate for the full range of educational objectives and is at least as inexpensive as any other technology, then there would be little reason to change. If, however, it is found that the present technology of education is not fully adequate or is not as efficient as it might be, then there would be reason to explore carefully the advantage of adding new technologies to the present system.

THE DOMAIN OF EDUCATION

According to Lawrence Cremin's definition, the concept of education is broad. He defines it as ". . . deliberate, systematic and sustained effort to transmit, evoke or acquire knowledge, attitudes, values, skills, and sensibilities."¹ All institutions of education aspire to accomplish at least part of what Cremin calls education, but they vary greatly in the direction of their aim and their ability to achieve it. For example, casual examination of college catalogs shows wide differences in emphasis on knowledge, attitudes, values, skills and sensibilities. The research of the past fifteen years on institutions of higher education bears out these

¹Cremin, Lawrence A., *American Education: The Colonial Experience-1607-1783*. New York: Harper and Row, 1970, p. xiii.

differences although not always confirming what the college catalogs say.

For the most part, the residential liberal arts college takes the transmission of attitudes, values and sensibilities as a more serious part of its effort than does or can the commuter college or the correspondence school. Two-year vocational colleges take the transmission of skills more seriously than the liberal arts institutions. Colleges with religious orientations and traditions often place more emphasis on attitudes and values than do their secular counterparts. These differences among colleges are mirrored in the differences among elementary and secondary schools.

Of far greater importance than these differences among institutions of education is the fact that all of them utilize a single common technology and, as a result, base their approach to learning on a verbal model. The medieval teacher talking to his students has become the modern professor or teacher lecturing to his class and assigning readings. The teacher presents a verbal codification and abstraction of experience to his students. Even though we might agree that experience is the best teacher—allowing learning and understanding in unequalled breadth, depth and richness—it is impossible, impractical and inefficient to try to have students fully experience history, economics, mathematics, social studies, science and the other subjects of education. We, of necessity, codify experience in verbal form for its transmission to students. In the process of verbal codification some things are more fully captured than others. The verbal codification of experience deals more easily with knowledge defined as information than with values, attitudes and sensibilities. Words can transmit knowledge about values, attitudes and sensibilities but the values, attitudes and sensibilities themselves are something apart from and different from knowledge about them. The

philosopher, D.T. Suzuki, said, "The intellect is after all the spectator and when it does some work it is a hireling for better or worse."¹ Choosing a verbal model for the transmission of knowledge has meant some inherent loss in the capacity to transmit other human qualities. The ideal of the liberally educated person has never been simply that of the knowledge machine but rather a person who combines knowledge with values, attitudes, skills and sensibilities and is able to employ his intellect in the service of his own and others' humanity.

The technology of print and lecture is highly efficient in the transmission of knowledge. As we have seen, it is also a technology that is extensive and sophisticated in its development and extremely familiar to all involved in the educational process. This very familiarity tends to blind us to some of its limitations. The verbal tradition of education is like the air we breathe. We don't notice it unless we catch a cold or the pollution level becomes so high that our attention is directed in detail to the air and our breathing apparatus.

Each of the new technologies of communications is very likely to have its own set of characteristics and these will be different in some degree from the characteristics of the technology of lecture and print. Just as there is some possibility of loss when a lecture is translated into print, there would be the possibility of other losses if lectures or texts were simply translated into television, radio, or other terms. The textbook transmits knowledge more efficiently than the teacher, but textbooks are notoriously dry, and dull, and ineffective in transmitting skills and sensibilities. The lecture broadcast by radio or recorded on a cassette omits the visual image of the teacher and along with it some of the ability to transmit nonver-

bal aspects of experience. The television broadcast captures the visual image of the teacher but does not allow the interaction, both verbally and nonverbally, between the good teacher and his students. The computer can interact to a degree with the student, but it cannot deal with an individual's emotions.

Relatively few people argue that radio or television or film should be used simply to record the teacher or the textbook though these simple and direct applications of technology have been made--occasionally quite successfully. Sitting in front of a television set at a convenient time to watch a good lecturer can be a more satisfactory experience than sitting in the back row of a large lecture hall listening to the same lecturer in person at eight o'clock in the morning. The highly motivated student who needs to review a critical demonstration that he has missed may be more than glad to listen to a recorded version of the demonstration available in the library. Factors of motivation, convenience and necessity may all contribute to make the student resigned or, indeed, pleased to have the opportunity for learning in this way through technology rather than through the direct experience of his instructor.

THE POTENTIAL OF NEW TECHNOLOGY

The new technologies of communication can, however, be more than this. These technologies allow one to record, edit, and mix sources. They can thus add very substantially to what the instructor does in the classroom or what is put into a textbook. These additions to the instructional process can possibly combat some of the ineffectiveness of words in transmitting skills, attitudes, values and sensibilities. Where words alone convey only poorly the excitement, fear and sudden rush of the stomach into the throat from a ride on a roller coaster, a super-wide screen and associated sound effects can do it very well. A text of John Kennedy's inaugu-

¹Suzuki, D.T., *Essay on Zen Buddhism*, London: Luzak and Co., 1927 in Karen Horney, *Neurosis and Human Growth*, New York: W.W. Norton, 1950, p. 183.

ral speech conveys little of the drama and impact of the occasion. When this history is presented through a recording or a televised presentation, understanding and experience are greatly enriched. In a recent issue of the Yale Alumni Magazine Michael Lesy discussed his work in joining photographs with words. He wrote, "Pictures are just a level of data which to me is awesome—and which has a completeness which astounds me. But they are still incomplete. I mean I can show you a photograph of the World War II surrender on board the Missouri, but unless I can lay on you the diplomatic cables that were involved, you still won't understand it. The whole thing is arrangement—the whole thing is the choice of those details which put together will call up the smell, the sunlight, the sound, the thought, the predictions, the whole shebang...."

Although we are aware that each of the new technologies is likely to have its own characteristics and we can understand vaguely what these characteristics may be, we have very little real knowledge of the details and what they imply for education. Most research on the use of television or radio or computers in education has not been very analytic. It is not very helpful, for instance, to study whether or not a television lecture will be as effective as a lecture given in person. We will never begin to realize the potentials of the new technologies if we look only at their present applications within the field of education. In addition we must look at how these technologies have been developed in their most advanced uses. For example, the potential of computers and their unique characteristics are best understood by those who have a thorough knowledge of their scientific applications. The characteristics of television are best understood by those who are thoroughly familiar with the creative applica-

¹Lesy, Michael, "The Mystery of Time Past," Yale Alumni Magazine, April 1974, p. 15.

tion of television in its entertainment and news forms. These applications of technology outside the field of education are not in themselves sufficient to determine how the technologies might be applied within education. Commercial television or the scientific applications of computers are, however, indicative of some of the inherent characteristics of television and computers. Moreover, commercial television and the computer as used in the sciences show us these technologies at their most sophisticated level of development.

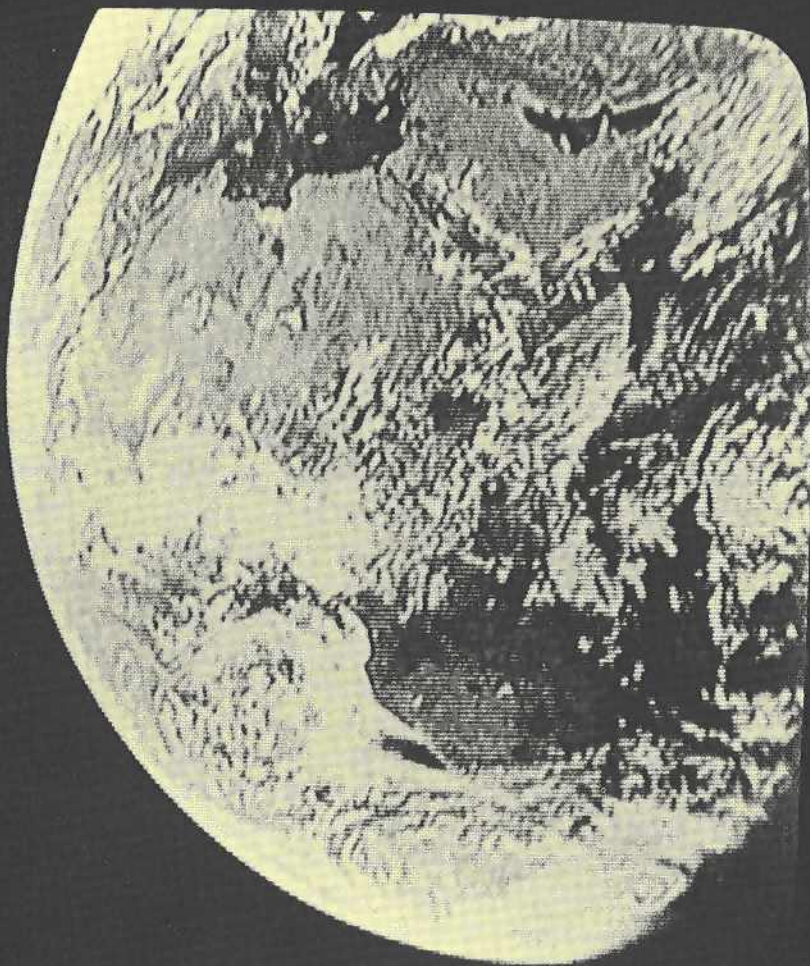
The children's television program "Sesame Street" is one example of an attempt to adapt the entertainment form of commercial television to educational purpose. Gerald Lesser has recorded the history of "Sesame Street" and some of the research on it in Lessons from Sesame Street.² In doing so he has catalogued some of the characteristics of television that might be applied to education and how these characteristics might be used. As a beginning, Lesser points out that all communications media have their own conventions. Books have their conventions. They are written in sentences that in the Western world read from left to right and from the top of the page to the bottom. The sentences are combined in paragraphs and the paragraphs in chapters usually indicating convenient places for the reader to pause without losing the development of a thought. The conventions of print operate to organize the material for the reader and allow the reader to anticipate certain regularities. The same is true with the conventions of television.

Some television conventions are extremely commonplace as, for example, loud music or music in a minor key, dramatic pauses, the camera zooming in, or the motion stopping at a given point. The producers of "Sesame Street"

²Lesser, Gerald S., Children and Television: Lessons from Sesame Street, Random House, 1974.

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REMOTE



heavily on the transfer of information. Only limited attempts are made to deal with other areas of education, such as the development of values, skills, sensibilities and attitudes. If education is to make a serious attempt to accomplish its goals, it must make not only the best use of teachers but also the best use of modern technology. Bringing images, sight and sound into the classroom will help teachers approximate experience and remove some of the abstraction and unreality that can pervade the schoolroom. Teachers and technology in combination can better expose students to the wide range of stimuli necessary to fully develop skills, attitudes, sensibilities and values, as well as knowledge.

It is often suggested that a greater use of new technology will mean a substantial loss in educational quality. Behind this claim is the idea that technology is a dehumanizing agent in education and that its widespread use will increase the alienation that is already too prevalent between students and teachers. It must be recognized that to some extent the use of any technology in education is dehumanizing. The codification and abstraction of experience in some form of technology is absolutely necessary for a system of education, but its use is a substitution for direct experience. As a result some of the human qualities of experience are likely to be diminished.

The relatively efficient transmission of knowledge is gained at the cost of reducing capacity for the transmission of other human qualities. The best teachers, by their manner and example, are able to transmit or evoke those qualities of education that tend to be lost in mere words. This ability is precisely one of the things that sets apart the master teacher—the person who is a bit of a poet, a performer, an actor, a mimic—from the person who is unable to add very much to the words he uses in his teaching. The argument made here is that different qualities are lost in different tech-

nologies and that by using the full panoply of technology, rather than limiting education to one or a few, less will be lost. It is up to the schools to make the best use of all available technologies in order to educate insofar as possible across the full domain of information, attitudes, skills, sensibilities and values.

A closely related reason for the failure to make greater use of new communications technologies in education is a strong tendency to accept present standards of performance as well as the limitations of present procedures. We must see if present standards can be raised and present limitations overcome. It must be admitted that we know relatively little about what is lost in the verbal transmission of information and how these losses can be overcome. More attention should be paid to the inherent limitations of verbal education. As this area is studied and clarified, we will be able to remedy deficiencies.

Very practically, one problem in using the new communications technology is that it may not be appropriately designed for educational use. Since the current educational market for new communications technology is relatively small, little attention has been given to designing hardware and software for the educational market. A simple example would be the use of television in the classroom. The normal television set is designed for home use. It is to be viewed by one or at most five or six people who sit close by. In the ordinary classroom there may be twenty or more students. The home television set is not appropriate for classroom viewing. The deficiency is often made up by the use of several television sets in the same classroom. This, too, is not the optimal viewing situation. If the television signal were amplified and projected onto a large screen, it could be viewed simultaneously and conveniently by many people. There are some of these television projection systems in use, but they are new and have not been developed to the point where they offer reliable and high quality pictures.

Not only is it necessary to design communications technology specifically for educational use, but it is also important to achieve high standards of quality. Communications technology used in the classroom must be extremely reliable and of high quality so that its use facilitates and does not interfere in the educational process. The breakdown of a projector or a television set in the classroom can destroy an otherwise well prepared hour or day of instruction. Just as there are military grade specifications for technology that are higher and produce greater reliability than similar specifications in the civilian sector, so educational grade specifications are needed for new communications technology if it is to receive wide acceptance in the educational system. Given our widely dispersed and autonomous educational units at every educational level, this is an area in which the federal government could play a vital role. The federal government might well stimulate the necessary research and development into the production of appropriate educational technology and set performance specifications.

MARSHALLING THE RESOURCES

All the foregoing arguments imply that the effective use of new communications technologies in education will require substantial investments in its development and in the exploration of its potential. These heavy investments will come in money, in manpower, and in a time perspective that will allow full exploration of the potential uses and appropriate integration of new technologies with the present technology of print and lecture. Although it has become trite to make comparisons between federal education budgets and expenditures for military defense, the problems are not dissimilar in this case. A time span of five to ten years is often adopted for the development, funding, acquisition and implementation of a new defense system. If new educational technology has the potential that many people think it

does, similar time spans and similar investments will be needed. It cannot be expected that cities, school districts, or colleges and universities can cope with the long time periods, make the investments, or do the necessary planning. If new technology is to be used effectively, then it is vital that the federal government take responsibility and plan appropriately. This will mean new mechanisms of federal planning and action as there is little past history of effective federal involvement in this area.

In many ways this seems like an inopportune time to discuss the use of new communications technologies in education. Educational budgets are under severe strain in times of rising costs, inflation, and resistance to increased taxation. The greater use of new communications technologies will inevitably mean new costs, and these are not easily assumed in times of budgetary stringency. Particularly, they are not easily assumed when there is little to suggest that the new technologies will be helpful. We have also entered the time of teacher surpluses, so there is not the same pressure to increase educational output through the use of technology that existed only a few years ago. Now many teachers fear job loss. The proposition that the new technologies will make education more efficient is seen as a threat to their position. It has been argued here that while new technology may improve efficiency in education, its more important use is to allow education to proceed more effectively across its full range of goals.

Our society is committed to education as a way of life. This commitment makes it of fundamental importance to examine carefully whatever promises increased quality or efficiency in education. So far the new communications technology has promise, but the promise has not been fulfilled. In our own interests and the interests of those who are to be educated in the future, this potential deserves the most careful investigation.

