DOCUMENT RESUME

ED 371 728 IR 016 701

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TITLE Instructional Communication: Bridging the Gap between Education and Technology.
PUB DATE Feb 94
NOTE 25p.; Paper presented at the Western Speech Communication Association Annual Convention (San Jose, CA, February 23-27, 1994).
PUB TYPE Information Analyses (070) -- Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Comparative Analysis; Computer Assisted Instruction; Educational Development; Educational Innovation; Educational Methods; Educational Research; *Educational Technology; Elementary Secondary Education; Information Technology

ABSTRACT

This paper calls for a close examination of the interface between technology and education. First, it examines previous research in the field of instructional technology. Secondly, it critiques the current body of research, dominated by those in a rather separate field, educational technology. The bodies of research are compared, and a critical perspective is applied to several areas: the basic linear assumptions about learning; the link of technology to economic and social efficiency; and the decontexualized methods of the research itself. Thirdly, based on this critical analysis, the paper calls for more research, not from the perspective of technology itself, but rather from the newly emerging perspectives of instructional communication. The paper supports a more critically-oriented view of the role of technology as both a method and a curriculum. (Contains 53 references.) (JLB)

Instructional Communication: Bridging the Gap Between Education and Technology

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Presented at the Top Four Panel
Curriculum and Instruction Division
Western Speech Communication Association Annual Convention
San Jose, California
February 23-27, 1994

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Abstract

This paper describes previous research in instructional technology and compares it to the current research conducted the relatively separate field of educational technology. The bodies of research are compared and a critical perspective is applied to several areas—the basic linear assumptions about learning, the link of technology to economic and social efficiency, and the decontextualized methods of the research itself. The paper supports a more critically-oriented view of the role of technology as both a method and a curriculum.

Introduction

When the slateboard was invented in the late 1800s, it was thought to be a major event, signaling the move from individualized instruction to group instruction (George, 1991, p. 62). However, by far the most influential of the twentieth century teaching methodologies arrived at the 1939 World's Fair, appearing as an "oversized radio with a gray window on the front" (Gilder, 1992, p. 21). What became known as "television," "tv," and "the tube" would not only infiltrate every American home, but change forever the ways in which future generations live, learn, and communicate with one another. In the 1990s, the stream of technology has flooded its banks. Humans exist in a world of Virtual Reality, computers, multi and interactive media systems and networks. Technology has incredible potential to improve the overall quality of life for humans; however far less certain is the extent to which it may (or may not) enhance particular life processes.

One area profoundly affected by technology is education. America's schools have been faced with new technologies without fully realizing their implications for learning (Considine, 1990; Chen & Marsh, 1989).

> Few things are more important for our future than the education of the young, yet in our rush to embrace a new fad we risk overlooking long-term deleterious effects of what may appear to be a harmless or progressive new technology (Zajonc, 1985, p. 31).

Ironically, it appears that education is blamed for the ills of society, while technology is praised for solving the problems (Thorwaldson, 1993). Postman (1992) criticizes the prevailing logic that in order to improve the education of America's youth, the technologies of learning must be improved (p. 171). While acknowledging the potential benefits of

technology to society, this paper calls for a close examination of the interface between technology and education. The paper examines first the past research in the field of instructional technology. Secondly, it critiques the current body of research, dominated by those in a rather separate field, educational technology. Thirdly, based on this critical analysis, the paper calls for more research, not from the perspective of technology itself, but rather from the newly emerging perspectives of instructional communication.

Early Research on Instructional Technology

As communication scholars, we are committed to look at not only the curriculum within the language, but also the language within the curriculum. Traditionally, the word *technology* denoted "know-how" or method. It was only with the Great Exhibition of 1851 that the word became almost exclusively associated with machines (Davies, 1978). At the turn of the century, progressivism challenged the "formal, mechanical and lifeless instruction" of classrooms (Cuban, 1986). Learning was defined as "acquiring, through practice, patterns of behavior that one has not previously carried on" (National School Public Relations Association, 1967, p. 14). Thus, increased learning depended upon simply boosting productivity and efficiency through the use of technology:

> Efficiency engineers applied specially constructed score cards filled with quantitative measures for school districts hungry to embrace current innovations targeted at cutting costs while boosting productivity (Cuban, 1986, p. 11).

The primary role of technology at this time was to simulate the teacher. Early instructional film experiments (Sumstine, 1918; Lacy, 1919; Weber, 1922) stimulated further research on the impact of films in motivating

students to learn (National Education Association, 1946). Furthermore, the advent of readership surveys, audience surveys, public opinion polls, and propaganda studies of the 1920s and 1930s spawned mass media research in universities. Sidney Pressey of Ohio State University developed a "teaching machine." Initially a test-scoring device, it evaluated students' responses and then provided them with the correct responses to the questions. Researchers hastily concluded that the student "learned" simply by taking the test (Knirk & Gustafson, 1986). The limitation of this research, of course, was its basic assumption that recall is the most significant form of learning and that the student has learned if (s)he produces the "correct" answers.

After World War II, teachers were in short supply. The educational potential of technology was believed to be a solution for this teacher shortage, poor teacher training, and overcrowded schools (Liebert, Sprafkin, & Davidson, 1988). The Fund for the Advancement of Education, and later the Ford Foundation, supported experiments specifically designed to increase teacher efficiency (i.e. teacher aides, television, teaching machines)(Murphy & Gross, 1966). As a result, in the late 1940s to 1950s a large volume of instructional media research was funded by the United States Army, Navy, Air Force, the motion picture industry, and several philanthropic foundations (Saettler, 1968). Military training devices were developed to teach skills by individualized self-instructional methods. Similar to the early teaching machines, these devices were called "phase checks" that were designed to teach and test simultaneously. Each step of a skill (i.e. assembly-disassembly of a piece of equipment) was organized on the assumption that student selection of pre-programmed responses coupled with immediate feedback had special learning value. This

established concept of machine learning was continuously applied to new technologies.

In the 1950s, television was perceived as an efficient new source of information, similar to books, records and radio. Research measured the effectiveness of television as a transmitter of information (Barrow & Westley, 1959a, 1959b). In line with the emergent communication theories of the day, teaching and learning were thought of as the transmission and acquisition of information: the television as the *sender* of the information, the classroom as the *channel*, and the student as the *receiver* (Shannon & Weaver, 1949). However, during this decade, research was unsuccessful in demonstrating any measurable advantages of televised over live instruction (Kumata, 1960; Schramm, 1962).

During the late 1950s and early 1960s, B. F. Skinner produced some of the first programs and teaching machines, influencing the mainstream of developments in programmed instruction (Skinner, 1958). Skinner asserted that the most efficient control of human learning required "instrumental aid" and that steps should be taken to correct the shortcomings of traditional instructional practice by developing a "scientific technology of instruction" (Skinner, 1958, p. 72). Skinner's concern lay with continuous and immediate reinforcement. Behavioral technology such as this would dominate the research for years to come (Davies, 1978) and become the foundation for educational technology research (Axelrod, 1992). The National Science Foundation poured millions of dollars into curriculum development in the basic sciences and mathematics (Duke, 1984), resulting in an influx of new textbooks, workbooks, and other learning materials, but little in the way of improvements in student achievement or teaching. The federal

government introduced research programs and projects on instructional media research under Title VII of the 1958 National Defense Education Act (Seattler, 1968). James Finn of the University of Southern California was instrumental in promoting legislation passed by the United States Congress in the late 1950s and 1960s that allocated research funding for the training of instructional technologists. Despite these efforts, teachers in the early 1960s were not using much technology in their teaching.

The Midwest Council on Airborne Television Instruction (MCATI)(1961) was formed in response to the growing concern of educators in the Midwest with regards to:

> ...the challenge to provide sufficient quantity of educational opportunity for a fast-growing school population, along with increased quality of instruction, and to provide both quantity and quality within feasible costs (MCATI, 1961, p. ix).

"Studio teachers" worked with consultants, graphic artists, and production specialists. The instructional programs featured the "talking head," a teacher giving a lesson in front of a blackboard. The courses were broadcast on videotape from an airplane flying at high altitude over east-central Indiana to schools and colleges throughout six states in the Midwest. The Council's emphasis on quantity (and quality) was unsuccessful, however. A content analysis of these and other educational television programs conducted by the National Educational Television and Radio Center (1960) concluded that the unpopularity and limited viewership of programs was a result of poor production quality and unappealing programs. Once again, the research failed to demonstrate any learning advantages to using televised rather than live instructors. In 1965, the federal government responded with the establishment of the

Carnegie Commission on Educational Television. Its goals were to "expand and strengthen educational or 'public' tv as a way to improve content" (Carnegie Commission, 1967). The Commission also suggested the formation of a trust fund, derived from a tax on the sale of new television receivers (Liebert, Sprafkin, & Davidson, 1988). In 1966, after yet another unsuccessful attempt to increase the quantity and quality of instructional television, the Subcommittee on Economic Progress of the Senate-House Joint Economic Committee of Congress assessed automation and technology in education in the United States. Maurice Mitchell, president of Encyclopedia Brittancia, Inc. of Chicago, and also a former school board member, acknowledged:

> There is already a mountain of research, but we need more, and need especially to learn how to use it...the product of this [research] is a kind of spastic [sic], unconstructive groping which gives up unrelated chunks of data that seem to have value, but which are not created as part of any long-range plan designed to help direct us to where we want to go in the future (National School Public Relations Association, 1967, p. 10).

One of the primary outcomes of the hearings was the conclusion that due to the vast amounts of information to be learned, no student could possibly learn it all in the time frame allocated to schools, and no single technological device can provide all the steps in the learning process (p. 15). Furthermore, warnings were issued to those too eager to exploit the new technology in the classroom before it was adequately tested. The 1966 hearings ended with a call for more research into how an individual learns and less focus on specific program content.

Post-1960s research on the effectiveness of technology in education has found that it is as effective as conventional instruction *in terms of standardized test scores* (Kincaid, 1974). In Spring 1971, the Ford Foundation initiated a study of the current and possible future uses of instructional technology. Researchers examined the different interpretations, techniques and devices used in instructional technology, and some of the major applications in the developed and developing nations (Armsey & Dahl, 1973). The conclusions were twofold: First, instructional technology was basically a "moving target" (p. ix) because of technology's changing nature; and secondly, the interpretations of technology's effectiveness and importance widely varies. For example, some perceive instructional technology as supplementary to the teacher; others, anticipating a more active role, still view it as a potential replacement for the traditional teacher. As of 1974, the role of technology in education was still unclear:

> It is an indictment of our present state of knowledge that we know neither how to assess the psychological effects of these technologies nor how to adapt them to the purposes of education. The impact of technologies both ancient and modern on children's learning is either negligible or unknown (Olson, 1992, p. 6).

In 1986, during a time of mounting concern for the nation's economic strength, the Carnegie Commission reassessed the quality of American education. The Commission asserted "the primacy of education as the foundation of economic growth, equal opportunity and a shared national vision" (p. 7). A mandate was issued for a more effective use of technology in schools, thereby increasing the schools' productivity (p. 94). These

economic goals undergird the current scholarship in the field of educational technology.

Current Research in the Field of Educational Technology

Given the tradition of instructional technology research—its linear assumptions about communication, its restricted definition of learning, and its strong ties to business — it is not suprising that the current research follows the same path. The majority of studies on technology in education are generated by those in the relatively separate field of educational technology. The body of research essentially focuses on technology itself rather than on the meaning of technology within the educational environment (Heinich, 1984). In this respect, the current research does not address the implications of technology, but rather is committed to the applications of technology. Although this type of research produces information that is quite useful in gaining endorsement and financial support for educational technologists, it does not contribute much to the intellectual conversation concerning technology's influence upon education.

In response to the various calls for global reform, IBM Educational Systems Division in 1990 awarded the International Society of Technology in Education (ISTE) with a grant for the purpose of preparing a set of recommendations to educational decision-makers concerning the role technology might play in the restructuring of the educational system in the United States. This project (cited in Braun, 1993) concluded that all children learn "more" and "learn better" when they have access to technology in an intelligently-designed environment (p. 11). The study called for a restructured approach to educational technology, consisting of a complex system of variables (i.e. a new role of the student as active learner; a change in school schedules; and a switch to shared decision

making). ISTE's criteria for a good school system consists of (1) preparing its students for their future role as productive citizens; (2) exciting students and teachers about their participation in that system; and (3) organizing the system for change and the flexibility to undergo a continual process of change. At-risk students are said to benefit the most from this program because they are surrounded by "technology and good, supportive teachers, and are encouraged to use both" (Braun, 1993, p. 12). Therefore, the researchers argue:

> When we observe the dramatic reductions in dropout rates which are being realized in many school settings where technology is being used intelligently, we conclude that introduction of technology into our schools can be accomplished without increases in school budgets (p. 11).

In a similarly optimistic vein, educational technologists view learning as a systematic process. They encourage students to "reach out to sources of knowledge, information, and expertise wherever they may be located" (Braun, 1993, p. 14). This implies learning is essentially obtaining information from somewhere outside the learner rather than actively engaging in the creation of knowledge. Not only is knowledge presented as obtainable by database retrieval, but there is another implicit message that social harmony is obtainable by these same methods:

> Teenagers tying into electronic bulletin boards from their bedrooms can interact with eminent scientists, business and academic leaders, not to mention other teenagers. When not engaging in electronic conversations with other persons, they can tie into extensive knowledge bases through both telecommunications and CD-ROM drives

(Kurzweil, 1991, p. 62).

Other areas of human life become more efficient as a result of technology. Technology is presented here as the tool for students to achieve similar social and economic goals. Furthermore, technology is discussed in a rather nonchalant way. It seems to be taken for granted as a natural part of life. For example, the research does not address the question of whether technology should play a role in education, but rather assumes its place and instead addresses the ways in which technology is assumed to be of benefit to education. In this sense, technology is reduced to a mere tool for learning that can be picked up and put down at will. It is surrounded with an image of innocence, and with the uncontested view that technology will solve a multitude of problems. This is only a short step away from the dangerous view educational technologists hold as "gatekeepers, protecting and watching over what materials make up each student's educational process" (Cory, 1990, p. 50). These examples suggest that there are rhetorical themes that pervade the literature of educational technology at present. When values and power structures are disguised as educational theory, an approach is needed to offset the potentially disastrous effects. A critical perspective is needed to question such values and imbalances of power. Therefore, the question to be explored is not so much "What are educational technologists saying?" as it is "What are they *not* saying?"

A Critical Perspective on Current Educational Technology Research

Educational technologists view technology as a valuable classroom tool, an "electronic textbook" (Cohen, 1978, p. 96) that will lift education to its most efficient level. This sense of global efficiency is achieved through

properly designed educational software, immediate feedback, and interaction (Kurzweil, 1991, p. 62). Despite this apparently more contextualized approach to technology in education, the research essentially compartmentalizes learning into a closed system of variables. There are various ways in which the research manifests these ideas.

First of all, as previously mentioned, the current research seems to operate on the foundation that technology is an accepted and desirable part of education. The term educational technology itself is treated as non-negotiable, not open for discussion. Therefore, the question of whether to implement technology in education is relatively nonexistent. The dominating question in the research continues to be: Is technology-based learning effective? (Bork, 1991).

Secondly, learning is presented as a linear process—the acquisition of information from a source outside the learner. Programmed learning is one example: a set of questions is posed by the teacher, text, or machine with the intention of leading the student to the "right" answers. As stated in the research, students are encouraged to "reach out to sources of knowledge" (Braun, 1993. p. 14). Learning is reduced to locating and receiving information and technology is the tool which expedites this process. Learning is therefore "efficient." Whether in the form of 1940s teaching machines, or 1990s multimedia, the linear assumptions of early research continue to be widely accepted and relatively unchallenged.

Thirdly, in addition to the linear assumptions about learning, the current research assumes technology to be the major cause of the decrease in drop-out rates (Braun, 1993). The question is framed from an economic standpoint:

"Scrimping on educational resources is a bad bargain.

In the long run, a poor education costs more than a good one" (p. 11).

An economic theme is embedded within the language of current research and unites the goals of education with that of business:

> ...as a society which values every individual, we cannot accept the loss of human potential represented by dropouts; as a society which values its position in international commerce, we must invest in all our students. When both may be accomplished without added investment, the decision is easy (Braun, 1993, p. 15).

The loss of human potential is linked with the loss of profits in industry. Technology is woven into the conversation as a good investment, a type of low-cost economic/human life insurance. A current example of this technological investment are "magnet" and "academy" schools that focus upon science, technology, and mathematics. These schools are heavily financed by business and industry and offer two-year accelerated programs, tailored to the demands of the job market. The mission statements of these institutions are geared towards preparing students for leadership in the areas of science, mathematics, and technology (Lewis, 1991, p. 149). This illustrates technology as an ideology implemented through the curriculum. The economic metaphor is repeated by the use of slogans. "Buy now or pay later" is the argument of educational technologists. Responding to this sense of urgency, schools that have hit virtual bankruptcy as they race to purchase the newest technologies despite the lack of conclusive research to support its educational worth. An additional problem is posed by the "obsolescence" curve (Finley, 1993) in technology. Once a piece of equipment or software is purchased, it very quickly becomes outdated and bows down to newer technologies. The use

of technology turns out to be, in this case, inconsistent with the concepts of "efficiency," "productivity," and a return on one's investment.

Fourthly, the term "efficiency" is used not only in a business sense, but also in describing the potential social rewards for those who have achieved computer literacy. As previously mentioned, teenagers are described as participating in "electronic conversations" with eminent scientists, academic leaders, and extensive data bases. Boundaries of social status are removed and communication is presented as stimulating and relatively effortless. All this is available with technology, and the teenager does not have to leave the bedroom. Unaddressed are the questions concerning deprivation to the student in areas such as social interaction, "real world" experience, and the ability to communicate in an oral fashion. Technology is again reduced to a "tool" that aids in achieving, in this case, social success:

> ...I have a wonderful husband. My family life, including my parents, is wonderful and my children are happy again. [Attending the Heald Institute of Technology] was the best thing I could have done (Thorwaldson, 1993).

Finally, educational technologists do sometimes appear to advocate a systematic restructuring of education. For example, in differentiating among key terms in the field, one group wrote:

> Educational technology is often confused with instructional technology. It is a subset of education. [Instructional technology] is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems...in situations in which *learning is purposive and controlled* (AECT, 1979, p. 2-3).

However, the variables outlined in the previous section are in fact discrete and isolated system components. In fact, the school schedule, student motivation, and the flexibility of the school system cannot be easily separated out from a much wider, more complex social, political, and economic system. A more contextualized approach recognizes the learning environment as comprised of layers upon layers of meaning, difficult if not impossible to operationalize.

The research in educational technology does not address the educational environment as a whole. Current pedagogical uses of instructional technology in California colleges and universities illustrate the decontextualization of learning. Campuses are using technology to physically expand and educate more students with less money (Kurtzman, 1993). For example, "telecourses" reach those students who have a difficult time making it to campus. These courses are taped in linear format ahead of time and are not constructed for student-participation. A math teacher commented, "Part of getting students over math anxiety is the friendliness of the right" classroom (Kurtzman, 1993). The "right" classroom then becomes a negotiable term.

In summary, the education of youth is thought to be improved by improving "learning technologies" (Postman, 1992, p. 171). A considerable number of parents and educators are mistaken in their believe that the computer will revolutionize the classroom and their children's chances of a better life (Apple, 1986). The idea exists in the world of technology that "a single person can replace a skyscraperful of support staff" and that a computer is the best possible way to achieve economic and well as social independence (Finley, 1993).

Instructional Communication as the Bridge Between Education and Technology

This paper has argued that an understanding of instructional technology requires more than the study of only machines, or only process, or only people; it requires the study of the complex interactive relationships of these components (AECT, 1979; Slack, 1989). From this perspective, then, the classroom is not a predictable, systematically controlled environment. Technology is not seen as an end unto itself, but as situated within the context of social, political, and economic ideologies. Through this process of contextualization, scholars are given the option to debate the underlying layers of meaning created by technology's presence in education. For example, in the previous section, researchers were cited as saying that technology is beneficial when used in an intelligently designed environment along with good, supportive teachers. The point is not that these statements are untrue, but that "technology" and "intelligently designed environment" become contested terms. How are they defined? Who has the authority to define them? Who has the power to implement technology in such as way? What are the political and social implications? These are a few of the questions a critical-interpretive approach to research would address. Schools, then, would be evaluated not as merely sites of instruction, but rather as dominant and subordinate cultures, each ideologically linked to the power they possess (Giroux, 1988).

Realistically, educational technologists cannot be expected to respond to the call for a more critical approach to their own field. It is simply not in their best interests:

Those who set the agenda--in business, government, academia,

and the mass media--turn debate about social and economic trends to the most effective restructuring of society around a vision of high tech growth. Critics are not expected to reexamine the evidence with a different set of values (Kahane & Oram, 1989).

It is communication research, rather, that acknowledges the idea that if humans are to use technology responsibly, we must not hesitate to frame critical pedagogical and ethical questions concerning the use of new technologies in education (Zajonc, 1985). Recent scholarship in the communication studies field supports a normative-contextualist theory of technology (Woodward, 1993). From this perspective, technology is perceived in terms of serving or impeding the goals of identity, orientation, self-knowledge, and community. Despite this recent expansion of theory, however, the research in the instructional communication subfield has until recently relied heavily on process-product models of instruction and quantitative research methods. Sprague (1992) has argued for an expansion of the research agenda—one that encorporates multiple layers of meaning.

One of her points is that education, as well as all of life's activities, is conducted through language. In this sense, neither education nor technology can be neutral because they present a particular view about the world and how people learn about the world (Bruner, 1986; Heath, 1983). Even in the publications of the speech communication discipline, technology is presented as a tool for learning. A recent Speech Communication Association (SCA) publication described C-Span:

> If it is true that experience is the best teacher, what better way to learn how the process works than by witnessing an event first hand? [through C-Span]...the challenge is to get students to

think about the network as an information tool (Whillock, 1992, p.18-19).

In fact, the use of C-Span as a teaching "tool" was repeated throughout the entire journal—six times in this article alone. The communication studies field supplies a different approach to the inquiry about educational technology—one that looks at meanings, and more specifically, the meanings behind such words as "tool."

A second project instructional communication might do is rather than addressing at technology as a method, or "tool" of instruction, a critical-interpretive approach addressestechnology as the actual curriculum to be studied. After all, originally, the purpose of technology was not to advance knowledge necessarily, but rather to solve a technical problem. Therefore, in the actual classroom setting, discussions are focused on issues of "the way in which technology is defined, which in turn dictates the physical setting in which it is taught (classrooms? laboratories?), by whom (the science teacher? social studies teacher? technology teacher?), and what resources (textbooks, equipment, machines, instruments, etc.) are required" (Lewis, 1991, p. 144).

In this sense, all scholars are invited to participate in the potentially "fruitful dialogue" (Woodward, 1993, p. 159) about technology, and to incorporate a variety of conceptual frameworks within the discussion. Students would then be able to examine technology from both a critical perspective (i.e. technology as disempowering workers) in addition to the traditional perspective of technology as automation. As a result, students will be less likely to engage in what Holmes and Lynch (1967) refer to as "see learning." With this type of learning, students cannot adequately describe what it is they have learned with the response, "I can't describe

it, you have to see it" (p. 423). Technology can be the center of active learning via a critical curriculum that includes explicit discussions with students about how, why, and what they learn (i.e. via computers, video, etc.). Such a curriculum would not only encourage the development of essential communication skills, but would teach students to view in an active and critical way how media shape their lives.

Conclusion

Nearly a century has passed since the initial inquiry into the use of technology in education. The discourse on educational technology has been restricted to relatively technical issues—questions of "how to." The scholarly discourse requires the voices of those in other fields, such as instructional communication, in addressing such questions as "why" and "for what purpose?" The full implications of technology will not be uncovered if education researchers continue to study technology as if were an electronic textbook.

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