

# Implications of Instructional Technologies for the Future of Education

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One method of predicting the future involves the extrapolation of past trends to the present and projecting them into the future. In looking at the past of instructional technology, a rich audiovisual heritage is found. When using this extrapolation method to look into the future (to the early 2000s), some very curious trends become evident. After describing these extrapolated projections, a second futures forecasting technique, the scenario-construction projection technique, is used to examine current pressures and recent innovations to determine what impact they may have on the future of education.

## **Straight-Line Projection of Trends**

In the 1960s a great deal of excitement was evident in education. The Department of Audio-visual Instruction (DAVI-NEA), the major educational audiovisual organization, became the Association for Educational Communications and Technology (AECT), and grew steadily during the 1960s and 1970s. During the 1980s the organization began to rapidly decrease in size as funding for public school-oriented media equipment and materials production was drastically reduced and fewer media coordinators' positions were funded in schools. The membership pattern in AECT for the

above period follows a bell curve and suggests a continued decline. Related professional organizations which are more oriented toward industrial and military training, such as the National Society for Performance and Instruction, the Association for the Development of Computer-based Instructional Systems, the Society for Applied Learning Technology, and the Human Factors Society, are growing.

Graduate instructional technology programs in the 1960s focused on the preparation of public school media personnel and college professors. Today these programs are increasingly oriented toward training industrial and military "trainers" and decreasing their preparation of public school "educators."

In 1960 the population in the United States spent 20% of their lives in schools, but by 1974 this figure had declined to 16% and is still declining somewhat today. One possible reason

for the decreased public emphasis and involvement in education today, as measured by the amount of time the average citizen spends in a formal learning environment, is that a greater percentage of our attention and funds for social activities is going to health care and social programs for our aging population.

In the 1960s many films, filmstrips, slide-tape programs and other materials were produced by Coronet, McGraw-Hill, Encyclopaedia Britannica Films, and other media producers. These materials required many new projectors and amplifiers. Programmed instruction materials were developed and language laboratories were installed in secondary and post-secondary schools.

The 1980s show a decline in the production and availability of elementary and secondary school-oriented audiovisual materials and equipment. The federal funding programs (e.g.,

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the Elementary and Secondary Education Act and the National Defense Education Act) which helped school districts to buy equipment and which provided training for media personnel have virtually disappeared. The second largest public school district, Los Angeles, put its entire film library into old military bunkers in the early 1980s and has not significantly added to its collection. Most university film rental libraries are in financial trouble. Except for some computer software and textbooks, little "courseware" is even being produced for educators.

The large educational projects and programs of the 1960s such as the Midwest Project for Airborne Televised Instruction (MPATI); the Hagerstown, Maryland, television project; O. K. Moore's Talking Typewriter Project, which were funded by the Ford Foundation and others, have declined and almost disappeared.

These trends, when extrapolated into the future, are not very promising for public school-oriented media professionals. In the future suggested by these trends, the lecture will be enhanced by few aids and almost no media-based alternatives to learning will be tried. The future appears more promising for business and military-oriented media personnel.

### Future Scenarios

Another way of trying to outguess the trends as predictors of the future is to identify new ideas or other pressures which may significantly change educa-

tion. These new pressures can be placed into projected snapshots or scenarios and studied to determine how they might affect our future. Trend extrapolation is used to examine evolutionary change. Scenario construction is used to consider revolutionary change; enough pressure can dramatically and abruptly change individual or organizational behavior. Following are some possible scenarios which may change the future of education and the media professional by the end of the century.

### SOCIAL SCENARIOS

*Pressure:* There will be few people coming into the workforce as the baby boomers retire near the end of the century. The year 1992 is projected as the year in which the need for major adjustments will become apparent to employers.

*Response:* Middle managers and professionals (e.g., teachers) will be given incentives to work until after age 65. Women's expected roles will merge with those traditionally expected of men and inequalities will disappear. Military planners are so concerned about the lack of availability of manpower beginning in about 1992 that they are considering urging Congress to institute a draft for men and women and even hiring foreign mercenaries.

*Pressure:* About 50 million adult Americans will need retraining by the year 2000. Naisbitt (1985) estimates that

by that year the expected lifespan of a job will be seven years.

*Response:* A major focus will be on proprietary schools to train new skills, and other organizations will focus on the retraining of managers. Management training will change from a process of an individual manager with the answers telling others what to do (an industrial manager model) to one where a facilitator creates a positive growth environment for workers. Attracting, retraining, and retaining personnel will require a positive work environment.

*Pressure:* Even with the declining value of the dollar, the United States cannot compete in the production of goods with foreign competition.

*Response:* Employee retraining will focus on service occupations.

### EDUCATION SCENARIOS

#### Teacher Education

*Pressure:* The Carnegie Commission Report on Higher Education, the Holmes Committee report on higher education, and other recent studies of colleges recommend elimination of undergraduate education programs.

*Response:* Following attainment of a Bachelor's degree in the arts and sciences, future teachers will pursue professional teacher preparation in graduate university programs or in training programs funded and directed by unions and school districts.

*Pressure:* Specialization among educators will occur to a much greater extent than it does today because of the requirement for more graduate education.

*Response:* Highly trained "master teachers" or "lead teachers" will be common in schools. More teachers will specialize in the design and production of widely disseminated materials, thus reducing the cost of designing these high-quality materials. While a national curriculum will not evolve (in part because of the "local control" requirement), textbook publishers, software developers, and instructional materials producers will become much more essential to the instructional process.

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*Pressure:* State-wide teacher competency examination requirements will be implemented in most states.

*Response:* This focus on specific teaching skills will result in a restructuring of teaching environments in state-mandated continuing education courses similar to the programs for accountants, optometrists, pharmacists, physicians, social workers, and veterinarians. Today it is believed that teacher education skills are intangible ("teaching is an art") and do not lend themselves to periodic recertification. This will change. Teacher accountability will result, and teaching will become a profession with an identifiable, research-based, foundation. This structure will be based on a research-based technology of teaching. A knowledge base involving categories of learning (learning procedures, skills, knowledges, attitudes) and learners (attitudes toward the content and general learning, processing skills) is currently evolving. This foundation will permit objective evaluation of a teacher's ability. "Master teachers" will be financially well rewarded, with a differentiated salary program.

*Pressure:* Inservice teacher growth and development often occurs at conventions.

*Response:* The "hi-tech, hi-touch" phenomenon, discussed by Naisbitt in *Megatrends* (1983), will promote an increased need for human interaction and personal contact at conventions, as opposed to electronic communication which reduces travel and personal interaction. Increasing travel costs, however, may result in many of the large national meetings breaking into

smaller regional meetings which may seem more personal.

Associations are needed as part of the teacher growth and certification pressures discussed above. Many more professional associations or organizations will evolve for those with specialized interests.

### Elementary/Secondary Schools

*Pressure:* John Naisbitt (1985) has written that the schools have failed. He says we have to completely reconceptualize our educational system in order for it to survive.

*Response:* One possible solution involves the "voucher system." In this way the schools would compete for students and quality could evolve.

*Pressure:* Stating this point more strongly, Lewis Perelman (1986), president of Strategic Performance Services, says: "The age of schooling is over. A new, post-industrial 'learning enterprise' is about to replace the outworn infrastructure of industrial-age education" (p. 14). Perelman states that education today compared to that of the twenty-first century is like the horse and buggy compared to today's transportation system.

*Response:* Perelman concludes that: "The nation that is first to adopt a high-technology consumer-based learning system will enjoy a permanent competitive advantage in the global economy of the information age" (p. 15).

*Pressure:* The cost for training and education is more than \$300 billion a year (Naisbitt, 1986). As an institution

it is rivaled in size and rate of growth only by health care and defense. Per-pupil spending on elementary and secondary students grew by 22.5% during the past decade, when real income per capita increased by only 6.5%. The investment by employers in training is some \$800 billion a year, comparable to all formal higher education, and is projected to grow by 25-30% by 1990.

*Response:* Education is increasingly expensive. Today the federal government provides nearly half of America's college students with aid from federal programs, but is expected to decrease its support. The states already spend one-third of their budgets on education, so there will be more pressure to decrease spending for public education. The demand for cost-effective alternatives (including instructional technologies) is about to explode.

*Pressure:* The average cost of classroom instruction in K-12 schools nationwide is about \$1.25 per student hour. Equivalent quality computer-based instruction costs \$1.10 per student hour. People costs continue to increase, while computer costs are decreasing.

*Response:* CAI represents an alternative to the labor-intensive lecture. A computer hard disk can hold as much information as 20 encyclopedias, and can be accessed and updated with ease.

*Pressure:* Better communications systems will result in increasing divergence in student experiences, abilities, and goals.

*Response:* Each adult student may have a curriculum tailored to his or her own background, interests, and skills. Computers will assist in permitting this. Teachers will increasingly assign students to course work based on their knowledge and skills.

*Pressure:* Marvin Cetron, president of Forecasting International, suggests that by the turn of the century, adults will be working a 25 to 32 hour week (Cetron, Soriano, & Gayle, 1985). During the time they are not working, many will be preparing for their next job. On the other hand, students will have longer days.

*Response:* Public schools will be open longer. Year-round programs will evolve, with buildings being open 12 hours per day serving day-care functions. It may be that the school year will

increase from 180 to 210–240 days per year to match schools abroad.

*Pressure:* Technological advances in brain self-regulation are occurring (Hutchinson, 1986).

*Response:* Users will be able to observe their emotional states and change them at will in order to control stress due to social problems, test anxiety, and other influences.

*Pressure:* Retention of information can be dramatically increased using the association and visualization techniques taught in memory classes (Hutchinson, 1986).

*Response:* Trained teachers will employ these memory enhancing techniques in their classrooms so that the average student will be capable of far greater feats of learning, remembering, and creating than is currently imagined.

*Pressure:* The use of chemicals to enhance perception and increase retention may be possible in the near future (Hutchinson, 1986; Bylinsky, 1986). Health science investigators at Creighton University have identified a compound which apparently improves memory processes, PRL-8-53. The drug appears to improve one's ability to remember lists of nonsense syllables, reproduce sets of geometric figures, and supply missing letters in incomplete words.

Apparently long-term memory is laid down in the brain in the form of a chemical code. In order to effect a synthesis of the informational molecules for long-term memory, it may be necessary to effect a transition from the short-term memory code. This process appears to depend on the mediation of another chemical system using noradrenaline as a chemical messenger. PRL-8-53 has been shown to enhance recall over a considerable dose range, which decreases the probability of accidental overdosing.

Another drug, Piracetam, has been studied by Dr. Stuart Dimond and E. Y. M. Brouwers at University College in Cardiff, Wales. Sixteen psychology students were given a battery of memory tests, including one for verbal memory. Subjects had to memorize six lists of nine two-syllable words. Based on the test results, the students were divided into eight matched pairs. One member of each pair took three 400-mg

Piracetam capsules every day for two weeks. The other students took placebos. After one week, and again after two weeks, the students took the memory tests. After the second week the students taking Piracetam improved markedly. This drug has also been used with some success on animals, chronic alcoholics, and individuals suffering from senile dementia.

The National Institute of Mental Health has identified a chemical which seems to improve memory and learning. The substance is visopressin, a hormone secreted by the pituitary gland. A synthetic relative of this hormone, called DDAVP, was tested on animals and then on humans. The drug was administered by a nasal spray for several weeks. College students scored 20 percent higher on retention tests related to categories such as fruits, cities, etc., by listing the words according to category. It is suspected that the chemicals may affect motivation and pleasure, important aspects of learning.

Neuroscientists Amy Arnsten and Patricia Goldman-Rakic, of the Yale Medical School, have worked with Clonidine, a drug prescribed in the United States for lowering blood pressure. They find that it enhances the memory of elderly monkeys and people with Korsakoff's syndrome, a memory disorder (Carpenter, 1986). Neurologist William McEntee of Brown University and psychologist Robert Mair of the University of New Hampshire found that Clonidine improves the ability of individuals to learn new information.

*Response:* Until the moral and ethical ramifications of using mind enhancing or altering drugs is resolved, little school use of drugs can be expected. However, if proven safe, the drugs may prove to be useful in the treatment of forgetfulness common to elderly people (and absent-minded professors). Soon after the year 2010, memory pills may be used to aid students to perceive or retain information for rapid recall.

## MEDIA-RELATED SCENARIOS

*Pressure:* Teleconferencing is not really interactive and does not provide the creative exchanges students desire.

*Response:* Teleconferencing will not be a significant factor in professional communications.

*Pressure:* Teletext/electronic telephone directories systems, like the French Teleco system, will mimic the interactivity of two-way videotext at a fraction of its cost.

*Response:* Advertisers will reassess and reduce their support of newspapers (McManus, 1986; Brand, 1987). The American Newspaper Publishers Association has been so upset by this trend that they successfully lobbied Congress to prohibit the telephone companies from entering the publishing business until 1989. The French now have some 3,000 services available on Teleco at about \$9 per hour: home banking, home shopping, weather, airline and hotel reservations, games, TV schedules, real estate listings, maga-

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zines, dating services, and so on. The change in where consumers go for purchasing information, and thus where advertising dollars are spent, will create an increase in the cost of newspapers (80% of newspaper revenues now come from advertisers). This will result in a decrease in newspaper circulation, which in turn may result in lower quality newspapers by the year 2000.

Immediate access to information via teletext will result in the capacity of capable individuals to acquire immense power, insofar as knowledge is power.

### Software/ Courseware

*Pressure:* As computer software or supportware becomes more refined, it will become more "invisible" and user friendly as the function of the software becomes more central than the hardware medium.

*Response:* Voice interaction (analysis and synthesis), the ultimate key to a friendly, transparent computer, will become widely adopted and used since it requires no user training.

*Pressure:* Computers in the future will be interactive (Knauer, 1986). They will facilitate people discovering interrelationships between data and rules; the user (student/accountant) provides the data while a spreadsheet provides the rules. In some cases, people will provide the rules and the computers the data. The human brain is a "spreadsheet" or rule-generator template with inherent/genetic and encoded/experiential formulas. Unlike a spreadsheet forecasting financial trends, the human "spreadsheet" de-

The computer pressures discussed above will result in inexpensive, easily available, high-quality, software-based "teaching machines" with micro-processors. Much of this software will be focused on the home market, but its low cost will permit its increased use in the classroom.

*Pressure:* Computers will allow the development of new teaching approaches called behavioral engineering (Knauer, 1986). Software can be developed permitting behavioral engineering through neuro-linguistic programming.

*Response:* Strategies for learning will be taught rather than rote repetition and memorization. These learning strategies will enable individuals to more effectively gain access to internal (mental) and external data bases and therefore to "think better." Math training would involve presentations of "mnemonic association," drawing heavily on visualization.

### ECONOMIC SCENARIOS

*Pressure:* As discussed above, there will be a shortage of qualified personnel by 1992.

*Response:* Teacher salaries will be raised on an annual basis to within 10% of parity with other professions requiring college degrees.

*Pressure:* Less than 1% of the national school budget is currently spent on library materials, textbooks, school supplies, or instructional media and

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## ...educators will be more concerned with developing a learner's rule generator and much less with environmentally specific data.

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materials. A greater percentage of the funds goes into teacher salaries today than in the 1960s, so that few funds are left to purchase teaching aids. This shortage of funds for traditional media has had a profound impact on classrooms, and points to a bleak future for media enthusiasts.

*Response:* Many states are augmenting their education coffers with lottery funds. California has said that these substantial funds will not be used for new facilities or teacher salaries, but for instructional materials. Assuming this policy is adopted by other school districts, libraries can be rebuilt, media coordinators can be re-introduced into schools to assist teachers in locating group and individualized materials, shop programs can be rebuilt, and science laboratories can be updated so that integrated circuit theory can be taught with something more recent than tube or transistor-based laboratory materials.

*Pressure:* As the nation "grays" there will continue to be pressure to

keep public school costs "under control" (that is, low).

*Response:* With funds from paramutual windows and lotteries supporting education in many states, there is an opportunity for those of us in instructional technology, provided we actively fight for those dollars.

*Pressure:* It appears that the relative impact of an innovation is very important to its rate of adoption.

*Response:* In summarizing studies of innovations, Nelson and Sieber (1976) observe that popular, low-quality innovations which have relatively little impact on the overall system are more apt to be adopted than low-cost, high-quality innovations which have a significant impact on existing practices, such as continuous progress programs and independent study programs. Nelson and Sieber's conclusion is that practitioners are constrained to adopt expensive, low-impact practices due to the organizational problems posed by high-impact practices.

## Conclusion

We can't accurately predict the future, but we can make some good guesses and approximations to help us plan for it. As individuals and organizations, we want to be on a winning team and use our energies to support good ideas. Good projections of the future will help us to make better decisions. Let us hope that by attempting to get a clearer picture of the future we will be able to participate more fully in it.

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