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ABSTRACT

Based on the findings of a content analysis of representative literature on educational technology, this report examines the trends in educational technology from October 1, 1990 through September 30, 1991. Ten trends for 1991 are identified and discussed: (1) the creation of technology-based teaching/learning products is based largely on instructional design and development principles; (2) evaluation has taken on greater importance as the concept of performance technology has been further developed; (3) the number of educational technology case studies is growing and provides general guidance for potential users; (4) distance education is evident at almost every educational level in almost every sector; (5) the field of educational technology has more and better information about itself than ever before; (6) computers are pervasive in the schools as virtually every school in the United States has microcomputers; (7) telecommunications is the link that is connecting education to the world; (8) the teacher's role in the teaching and learning process is changing as new technologies are introduced into the classroom; (9) there is increasing pressure for the schools to consider the adoption of technology while, at the same time, concern is expressed for the impact of technology on children in the society at large; and (10) professional education of educational technologists has stabilized in size and scope. An analysis of trends since 1988 and an explanation of the methodology used in this study conclude the monograph. Copies of worksheets, definitions, and additional data are appended. (49 references) (BBM)

Trends in Educational Technology

by

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with

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PREFACE

This is the third monograph in the series *Trends in Educational Technology.* Covering the period October 1, 1990-September 30, 1991, this study follows those of 1988 (Ely, 1989) and 1989 (Ely, 1990), with a hiatus in 1990. Henceforth, this series will be published every other year, alternating with its companion study, *Trend and Issues in Library and Information Science,* also published by the ERIC Clearinghouse on Information Resources. The most recent edition of that publication (Eisenberg, 1991) covers the year 1990.

The past editions of this monograph have built a baseline from which trends can be observed. A one year content analysis can only describe what has been written that year. It does not have the perspective of time that is required by conventional trend analysis. For the first time, this report states the trends that are evident from the 1991 literature, and devotes a section of the monograph to an analysis of the trends since 1988. This longer view permits confirmation (or modification) of trends that were initially identified in 1988 and 1989.

One change in the 1991 trends publication is the omission of the "issues." Issues are contentions drawn from the trend analysis. There is no doubt that there are issues revolving around most of the trends. However, the trends seem to be more important. The issues identified from the 1988 and 1989 editions were rarely mentioned in reviews and citations and seemed to detract from the major purpose of the analysis: to identify trends. Therefore, no issues appear in this year's report.

A complete report of the methodology is included. The procedures have not changed much. There have been minor changes and these are indicated in the text. If readers are familiar with the procedures, there is not much reason to read this section. One important addition is the list of definitions used by the coders as they reviewed the literature and attempted to place each item in one of the topical units. This list has not been included in previous editions.

As a research procedure is replicated from time to time, lessons are learned. These studies are no different. Concerns of the researchers and their critics are discussed and outcomes of those discussions are reported in the opening section of the monograph. For individuals interested in methodological matters, this section should be of some interest. However, if trends are of paramount interest, proceed directly to Trend 1.

INTRODUCTION

There are many ways in which trends could be identified: expert opinion, panels of specialists, or informed observation. This study uses content analysis as the primary vehicle for determining trends based on earlier works of Naisbitt (1982) and his inspiration (Janowitz, 1976). The basic premise of these works is that current trends can best be determined by what people are saying publicly, through newspapers and magazines. Naisbitt used actual counts of linear inches in key periodicals to determine trends. This study, and the two that have preceded it, used the same basic procedure: the identification of emerging topics in key publications over a period of one year. It is possible to determine trends by considering what people are saying publicly about matters within the field. There may be other trends that can be determined by such methods as counting sales of products or discovering where professionals are being placed and analyzing what they are doing. We have chosen to use the literature of the field as the best comprehensive coverage of current thinking and events in the field. We have carefully reviewed a selected body of literature using a team of educational technology specialists to determine the status of the field today and to indicate where it might be headed in the future.

A consistent methodology has been used from year to year. Basically, it follows the general principles of content analysis using a group of trained coders who make independent judgements about the literature being reviewed. Group discussion about findings has to reach a high interrater reliability for each item before it is placed in an agreed-upon category. The recording units remain constant (for the most part) each year. Additional subcategories are used as required to reach a higher level of specificity.

In reading this study, one must be careful not to extrapolate the trends too far into the future. It is often tempting to use trends as predictors of future developments. Actually, they are more like indicators that foreshadow the future. They are statements of current happenings in the field and, as such, must be considered ter tive movements that will bear watching as time goes on. They are usefu. because they represent current public statements of many professionals that have been systematically analyzed and reported.

Literature Sources

To maintain consistency from year to year, the same sources of information were used as in the 1988 and 1989 studies with a few exceptions. To aid in the selection of sources, the Moore and Braden (1988) report, "Prestige and Influence in the Field of Educational Technology," was used. This source reported the people, publications, and institutions of "high prestige" that were identified by a survey of personnel in the field. The highest ranking

journals and the dissertations produced by the universities that ranked the highest served as two major sources of literature. Additional sources of data were the papers given at major national and international conferences and the input to the ERIC database in the field of educational technology. Conferences are one of the most visible ways of presenting new ideas and findings to colleagues and therefore contribute to the trends. The ERIC system solicits unpublished materials such as reports, evaluations, studies and papers for review and, following evaluative criteria, selects the best for inclusion in the database. The Clearinghouse on Information Resources is responsible for the field of educational technology; therefore, documents selected from that source are likely to represent current developments in the field. The sources are presented in Figure 1.

Figure 1. Content Sources

Journals

British Journal of Educational Technology (United Kingdom)
Educational and Training Technology International (United Kingdom)
(Note: a replacement for the *Journal of Instructional Development* which ceased publication in 1989)
Educational Technology
Educational Technology Research and Development
(Note: a merger of the *Journal of Instructional Development* and *Educational Communication and Technology Journal*, both of which were analyzed separately in 1988)
TechTrends

Dissertation Sources

Arizona State University
Florida State University
Indiana University
Syracuse University
University of Southern California

Conferences

Association for Educational Communications and Technology
Educational Technology International Conference (United Kingdom)
National Society for Performance and Instruction

ERIC Input

All documents in the field of Educational Technology entered into the ERIC system.

The journal, *Education and Training Technology International*, was chosen to replace the *Journal of Instructional Development* and to provide a greater international perspective on the literature. All journals were published between October 1990 and September 1991. The conferences were held in 1991. The ERIC documents were entered into the system between October 1, 1990 and September 30, 1991.

Leading Topics

From the reviews of four coders, who analyzed more than 1,300 articles,documents, and other sources, came a list of "topics" that were most frequently presented in the literature. That list, together with the 1988 and 1989 numbers, is presented as Table 1.

Table 1. Rank Order of Content Analysis Categories

	1991	1989	1988
Instructional processes	1	1	1
Management	2	3	4
Technological developments	3	2	3
Research/theory	4	8	8
The field	5	4	5
Services	6	5	6
Society and culture	7	7	7
Personnel	8	6	2

Each of the categories has a series of sub-topics (or recording units) that were used to identify content more specifically. It is from the sub-topics that themes were identified. The themes later became trends. Table 2 shows the top 13 themes for 1988, 1989 and 1991.

The recording units offered a first indicator of trends. Further analysis of each category and subcategory revealed sharper distinctions. At this point the key literature was added to the mix. Key literature included policy papers, reports, and statistical data for each topic area that were published during the time period of the study. This literature came from professional associations representing large numbers of people within and outside the field of educational technology, state and national governmental agencies that speak with some authority, organizations of policy makers, and business/industry sources. This information, together with the content of the

literature reviewed, was studied by the author of this volume who, using personal observations (probably with some personal biases), drafted the trends and sent them for further discussion to the individuals who reviewed and categorized the literature. A copy of the final draft was sent for review to a recognized professional in the field and to a reviewer in the Office of Educational Research and Improvement of the U.S. Department of Education. Changes were made when compelling arguments were presented.

Table 2. Rank order of Top 13 Recording Units

	1991	1989	1988
Design and development (Includes message design, product development, individual differences)	203	259	448
Implementation	146	98	24
Evaluation (Includes process evaluation, product evaluation, cost/benefit)	144	99	97
Research/theory	91	38	51
Distance education	88	81	61
Status	80	95	61
Computer-related	65	90	82
Telecommunications	59	71	14
Curriculum support	51	79	25
Society and culture	45	71	72
Interactive learning	41	83	29
Artificial intelligence/expert systems	35	46	31
Logistics	3	32	43
Others	265	387	228
TOTAL	1316	1514	1338

Concerns about Previous Studies

As past editions of the *Trends and Issues* publications have been read and critiqued, four concerns have been expressed and were addressed before the 1991 version was prepared. First, whether content analysis is effective for large bodies of text; second, the validity and reliability of coding; third, the selection of the documents reviewed; and fourth, the translation of quantitative content data into descriptive trends. Each of these concerns will be addressed.

Content Analysis of Large Bodies of Data

Conventional content analysis looks at words and phrases in an effort to "tease out" substantive meanings. The approach followed here uses complete journal articles, doctoral dissertation abstracts, conference program descriptions, and ERIC document input. Weber (1990), in a new monograph on content analysis, says:

> Large portions of text, such as paragraphs and complete texts, usually are more difficult to code as a unit than smaller portions, such as words and phrases, because large units typically contain more information and a greater diversity of topics. Hence they are more likely to present coders with conflicting cues. (p. 16)

In following the "large portions of text" approach, the findings of this study must be tempered by Weber's caution. He also points out that "There is no simple *right* way to do content analysis. Instead, investigators must judge what methods are most appropriate for their substantive problems" (p. 13). Analyzing the periodical and document literature for a specified period of time still seems to be a useful procedure to identify the general trends or emphases that come from the literature of that period. Much of the value comes from the consistency of recording thematic units that had been used over the past four years.

The Validity and Reliability of Coding

The concern here is the stability, reproducibility and accuracy of the coding process (Krippendorff, 1980, pp. 130-154). Weber (1990) says: "Classification by multiple human coders permits the quantitative assessment of achieved reliability" (p. 15). Each year graduate students in educational technology are trained as coders. Definitions of categories are given together with practice items for each document type. The author provides consistency in reviewing by serving as an additional coder each year. The criteria level for intercoder reliability in 1991 was .75; that is, three of the four coders had to agree upon a category for placement of each item.

Content Selection

Journals, conference programs, doctoral dissertations and ERIC documents constitute a broad range of the literature generated by the field each year. There seems to be no stronger argument than that the content appearing during any given year is what professionals in the field are saying; hence, content units that can be counted provide a reasonable representation of the topics or themes that are emerging. One must be careful not to use these topics as *projections* since they represent what *has* already happened.

In selecting the journals, conferences, and universities, questions may arise such as, Why *these* and not others? The basic decision was based on the survey by Moore and Braden (1988) that reported the most prestigious journals and university programs. Beyond this criterion was another that eliminated journals or conferences that were devoted to a specific medium, e.g., computers in education. If articles about computing were found in the general literature, they were counted. However, a journal or conference devoted entirely to a subfield within educational technology would skew the findings toward one medium.

Translation of Data into Trends

This is a subjective step and probably the most difficult to defend since it ultimately relies on the judgment of one person. The number of articles, conference papers, dissertations and ERIC documents report the volume of information about specific topics by category. These numbers are then the basis for identification of the most frequent topics. The topics are the bases for selecting relevant documents in the policy literature that tend to confirm the topics identified. Policy literature includes statements, reports, "white" papers and other official publications of professional organizations, government agencies and influential bodies such as foundations and "think tanks." For each of the leading trends, the policy literature is searched for supporting statements to support the dominant trends. For example, in the past the study team has used publications of the Office of Technology Assessment of the U.S. Congress, the National Governors' Association publications about education, publications of the U.S. Department of Education's Office of Educational Research and Improvement (OERI), and publications of the various educational laboratories and research and development centers funded by OERI. Public statements and reports of the National Education Association and the American Federation of Teachers are used along with the publications of the Association for Educational Communications and Technology. Quantitative data from Quality Education Data and Market Data Retrieval provide consistent, reliable trend information on hardware and software. When the dominant themes from the primary literature sources are verified by policy state-

ments from responsible organizations, trends are confirmed and provide a reasonable rationale.

In Summary

Trends do not flow fully developed from the literature. Using a content analysis procedure that goes beyond the conventional word and phrase approach, the magnitude of general themes in the annual literature of educational technology are identified, counted and verified by the policy literature. The translation from quantitative summaries to qualitative trend statements is mostly subjective in nature.

Context

This publication should answer the question, "Where is educational technology headed?" Technology does not move alone apart from the society in which it exists. Information and communication technologies are being used in the home and workplace at all levels—local, state, regional, national and international. To separate them from the context is to highlight the products rather than their uses and impact. Therefore, much of the discussion in this monograph will involve the total fabric of technology in society rather than technology as an entity in itself. Technology is often referred to as a "tool" that incorporates the "media" of communication. The hardware and systems that carry information are often the primary focus with little attention paid to the audience, purpose and consequences of their use. Design, development, evaluation and diffusion are lost by the overpowering influence of hardware and software.

It is clear that educational technology is frequently used in the local school and, increasingly, in the home. Within the school, college or university, the individual teacher or professor is the single most important factor leading to appropriate implementation of media and technology for learning. That key individual is usually part of a system which, in turn, is connected to a larger unit—a state department of education or a university. National programs and initiatives are somewhat remote. International efforts seem even more distant.

Since the last study of trends and issues, there have been major national and international efforts to explore and promote the use of educational technology in the schools. In the United States, *America 2000* has been launched to focus attention on educational goals for the nation's schools. The New American Schools Development Corporation has been established as a further effort to build schools in visible locations where citizens can see educational restructuring, much of it enhanced by technology. The National Governors' Association continues to monitor programs in all the states with technology in the schools as one major focus.

A report of the International Association for the Evaluation of Educational Achievement, *The Use of Computers in Education Worldwide* (Pelgrum & Plomp, 1991) contains findings from a major survey of 19 countries worldwide. The ministers of education from 27 European states met to discuss *Education and the Information Society: A Challenge for European Policy* (Eraut, 1991). This meeting was "the response of European education systems to the development of an 'information society'" (p. ix). The World Conference on Distance Education held in Caracas, Venezuela, in October 1990 attracted the largest number of participants ever. Much of distance education is dependent upon educational technology applications. Educational technology has become more global than ever before.

One of the major outcomes of these efforts is linkage, between the schools and other entities, that has not been evident in previous times. *Networking* is being used as the codeword for the many connections that are being made—most of them new. Networking by definition is the linkage made between and among people held together by a common theme or connection. The *means* for networking uses both new and existing systems that permit "real time," "live" interaction between individuals and groups: telephone, FAX, e-mail, computers, cable and satellite television as well as face-to-face and traditional correspondence approaches. Other systems store information for use at a chosen time: videotape recordings, videodiscs, CD-ROM discs, "floppy" discs and audio cassettes. It is easy to be enthusiastic about these new media (and they dominate the literature) but voices of concern about cost, equity of access, skills required, and purpose still are heard and will have to be heeded.

Networks exist within the school; within the school system; within the region; within the state; and among the states. Networks exist between schools and business; schools and government agencies (state and federal); schools and universities; schools and public libraries; schools and professional associations; schools and broadcasting sources; and schools and home. There appears to be a movement to create networks where none exist and to connect networks that already exist. Passage of the High-Performance Computing Act of 1991, which authorizes the creation of the National Research and Education Network (NREN), is a significant move in this direction.

With all of these contexts impinging upon educational technology, it must be remembered that the trends which follow are more *internal* to the field than external to the settings in which they happen to reside. The literature reviewed is authored by people *inside* the field and the intended audience is mostly people *inside* the field. These are often practitioner-advocates who have agendas to promote educational technology and who use publications and conferences to do so.

At the same time, there appear to be stronger calls for technology in education by groups *outside* education, e.g., the state governors, business and industry executives, and newspaper education writers. The target of both the educational technologists and the influential critics seems to be mainline schools—the "establishment" that tends to perpetuate the status quo. Until there is openness to use technology among educators in general, calls for technology in the schools will be unheeded or accepted only in marginal ways.

This study focuses primarily on the K-12 schools in the United States. Some information will speak to higher and adult education. Information from other technologically advanced nations will be used when appropriate. Attempts will be made, wherever possible, to relate the trends to the educational goals set by the President and the nation's governors.

It should be noted that many trends in the field of educational technology are found outside the education settings that are featured in this study. New professionals graduating from the many graduate programs in the field are being placed in business and industrial training environments. There is another body of literature, not covered in this study, that relects the many new developments in non-school settings. That fact is, in itself, a trend.

Trends 1991

Using a content analysis of the 1991 educational technology literature, the following trends have emerged:

TREND 1

The creation of technology-based teaching/learning products is based largely upon instructional design and development principles.

There appears to be more evidence that materials developed for the purpose of teaching and learning use design principles that have their roots in cognitive psychology and instructional science. More than 15% of the items reviewed for this year's study were devoted to design and development. Major subheadings included message design, product development, individual differences, and course development. Less prominent were needs assessment and task analysis. Further, models and theories in support of specific design and development approaches are being proposed and hold a substantial place in the literature.

The term "constructivism" appears with increasing frequency. At least two major sessions at the 1991 conference of the American Educational Research Association were devoted to the topic, and two special issues of *Educational Technology* focused on constructivism. The concept of constructivism was first proposed by Bruner in the mid-1960s and builds on earlier ideas of Piaget. Basically, it holds that the learner develops (or "constructs") knowledge rather than the teacher, and that opportunities created for such "construction" are more important than "instruction" that originates from the teacher. This line of reasoning supports the work of Papert and other Logo advocates. It is fully explained in a new work, *Constructionism*, edited by Idit Harel and Seymour Papert (1991). The debate, which focuses on constructivism and educational technology, is thoroughly discussed in the special issue of *Educational Technology*, which was edited by Tom Duffy and David Jonassen (1991). The authors take sides "for" or "against" constructivism; those who are more negative toward the concept seem to emphasize the *design* element of *instruction* as a more appropriate position. There are those authors who would like to choose sides based on specific goals rather than on firmly held positions regarding "constructivism" or "instructionism."

As more research on *screen design* is reported, designers and developers are beginning to incorporate findings into the teaching/learning products. The

traditional concepts of message design, which follow earlier research in perception psychology, are being enhanced by new efforts aimed at the individual learner using a display surface, usually a computer monitor (visual display unit).

More than 10% of the 1991 literature was concerned with some aspect of evaluation: process evaluation, product evaluation, cost/effectiveness assessments and formative evaluation. *Performance technology* is appearing more frequently in the literature as a descriptor for instructional design and delivery that "works." It is being used more in business-industry-government settings than in school and college environments. It is based upon the conviction that training does not necessarily solve all performance problems in an organization. Rather, personnel selection, assignment, motivation, and environmental characteristics are as likely to be critical factors, as is a information.

ions from the 1991 educational technology literature that on seem to stress outcomes for decision-making rather than alone—the evaluation vs. research question. Topics that ve been studied using a research approach are now being uation is becoming a more important aspect of educational l ever before.

sion of evaluation is *product evaluation*—the assessment of aterials that have been recently produced and have some other settings. As more software for microcomputers has aluations have been published in journals and by organizamend instructional resources to schools, e.g., the Educa- Information Exchange (EPIE). *Only the Best: The Annual st-Rated Education Software, Preschool-Grade 12* uses 37 ucation evaluation services in the U.S. and Canada and re to receive two "excellent" grades or one "excellent" and vorable" grades to be published in this annual sourcebook.

uation has been an "add-on" in the field of educational more emphasis is placed on instructional design, it is tegral part of the process and, as such, is often an ongoing r process.

More than 11% of the literature reported on specific use of media and technology in teaching/learning settings. Almost all the case studies were "successful" and many could serve a models for potential users. Very few reported "failure" or negative outcomes. About one-half of all the case studies related to computer use in teaching and learning. Less than one-half reported on the use of telecommunications. There were almost no cases of traditional media use or instructional procedures that have been "proven" in the past.

In making the content analysis, the key words were "diffusion" and "implementation." Almost all of the this catgegory emphasized *implementation*. Implementation ; that educational technology ideas have been diffused and ıat there has been actual use of new media or technology in setting.

ase studies are not always fully documented. Most of them ıental in nature. Therefore, it is difficult to generalize about ɔecause they vary in substance and in presentation. Hownalysis of these items could create some general principles ıilar circumstances to follow.

TREND 4

Distance education is evident at almost every educational level in almost every sector.

Distance education (or distance learning) has become a major instructional force in American education. A recent estimate is that 25%-50% of the nation's students are reached by distance learning technology ("Technology: Wade right in," 1991). The National Governors' Association reported that "virtually all states" use distance learning (National Governors' Association, 1991). Distance education provides systematic instruction to individual learners who are physically separated from teachers. The delivery of instruction is usually by telecommunications and computer hardware and software, although not always. Learners sometimes work independently and sometimes in small groups.

A database of distance learning projects compiled by the U.S. Department of Education (Garnette & Withrow, 1990) reveals more than 100 projects that involve "live, real-time interactivity between student(s) and their teacher. . . in elementary and secondary school." The authors state that "specific projects were noted in 37 states [and] there appear[s] to be distance learning activities under way in every state with the exception of three states" (p. 520). Over 1,500 school districts are participating in some form of distance education, with some states sparsely represented and others including virtually every district. Specific numbers from the database help illustrate the extent of impact.

- Technologies used:

Satellite	56	Coaxial cable	21
Audiographics	15	Computer-based	13
Microwave	17	Fiber optics	11

- Of those projects that offer courses for students, half offer foreign languages, one third of the projects offer advanced mathematics and a quarter offer at least one science course.
- Half the projects offer teacher training or staff development as one component of the project.
- Less than 25% of the projects have had any kind of formal evaluation.
- Forty percent of the projects were initially funded by the states.
- Twenty percent of the projects involved collaboration between the school district and an outside agency such as the local telephone or cable company.
- Sixty percent of the projects have been in operation since 1986.

A final note regarding the breadth and variety of projects helps to confirm the magnitude of distance education efforts. The range of participation is "from one school producing and developing its own courses using telecommunications to the 780 sites in 32 states served by the Texas Interactive Instructional Network (TI-IN)" (p. 517).

State policies regarding distance education are evolving. Of particular note are the state programs in Kentucky, Oklahoma, Michigan, Minnesota, Texas, and Virginia. Also, Iowa is investing $50 million in a statewide telecommunications infrastructure. Missouri is taxing videotape rentals to subsidize distance learning. Minnesota has about 30 distance learning networks with over 150 schools participating. About 40% of the state's low enrollment courses share the networks ("Distance learning," 1990). The University of Texas at Austin is using two-way audio communication as a cost-effective delivery system for rural school districts. Telelearning classes are "live" as teachers and students talk with each other via telephone equipment that uses multiple source input and reception, connecting all participants in a manner similar to a telephone conference call. The cost of the courses range from $200-$400 per student per semester.

Many distance learning programs are course-based; that is, they offer complete courses with the teacher in a remote location. However, some users of distance learning are using this approach as a supplement to classroom instruction to enrich learning. The Northwest Regional Educational Laboratory's *Enhancing Instruction Through Telecommunications* (1991) describes federal resources in telecommunications (such as NASA's Spacelink bulletin board and satellite teleconferences); news by telecommunications (such as CNN Newsroom) and student/teacher connections by telecommunications (such as the AT&T Learning Network). Course-based distance education dominates higher education efforts.

There is probably no other single trend that encompasses the theory and practice of educational technology better than distance education. Its frequency in the literature confirms this observation.

TREND 5

The field of educational technology has more and better information about itself than ever before.

Eighty surveys about various aspects of the field were reported during the timeframe of this study. For example, studies of the most frequently published textbook authors, a list of current dissertations, the extent of microcomputer penetration in the schools, and other such reports help to paint a quantitative picture of the profession. They are found most frequently in documents entered into the ERIC system but also in journals and in conference presentations. Only one dissertation in 1991 was devoted to status.

These are reports of studies in which professionals are looking at themselves and the activities or facilities they administer. They tend to count things, people and activities. They survey the "state-of-the-art" in reference to a specific topic, e.g., Gustafson's *Survey of Instructional Development Models* (1991).

This trend also includes special publications about the field itself, usually by organizations with specialized interest in development and advancement of the field. Paul Saettler's *Evolution of American Educational Technology* (1991) is one such publication. This volume is the most comprehensive history of the field ever written. It goes beyond the events of the past and looks into the 1990s and beyond. The final chapter in this nearly 600-page volume includes state-of-the-art sections on instructional television, computer-assisted instruction, CAI software, instructional theory and design, interactive multimedia systems, and intelligent tutoring systems, and offers future prospects for the field. The International Society for Technology in Education (ISTE) published *Vision:TEST (Technologically Enriched Schools of Tomorrow)* (1991) as a set of recommendations to the profession and to other professional educators regarding the future of education in America and the potential role of technology in that future. The staff for the study consulted some 200 experts and visited 45 schools nationwide to find examples of teachers producing dramatic educational improvements through technology. The *Educational Media and Technology Yearbook* (Branyan-Broadbent & Wood, 1991), published in cooperation with the Association for Educational Communications and Technology (AECT), reviews events of the year, reports on educational technology activities in the states, lists organizations and associations in the field within North America, and provides an updated list of graduate programs in the field.

Even with all the information published in 1991, there is still some uncertainty about the definition of the field of educational technology—what is included and what is not—and what constitutes appropriate roles for

personnel serving in the field. The Definition and Terminology Committee of the Association for Educational Communications and Technology will issue a report in 1992. Perhaps some of these questions will be answered at that time.

Computer applications permeated the literature of educational technology in 1991. Purposely omitted from the analysis of trends and issues were 14 journals associated with computer assisted instruction (CAI) and conferences that focused on the computer as an instructional medium. Inclusion of such works would have skewed the data sufficiently to overshadow all of the other trends. Even with this omission, computers frequently emerged in the general literature, dissertations, conference programs, and ERIC input. Sometimes the items were directly se of computers in the classroom for direct subject-matter most referred to learning about the computer as a tool. ussed the resistance or "roadblocks" to the use of com-

ns surveyed the schools in 1990-1991 to determine the e of computers (and other technologies) in the schools. on Data, Inc., Denver, Colorado, has conducted annual 81 and includes in its most recent report (Quality Educa- results from 83,283 elementary and secondary public ited States. Market Data Retrieval's first-ever examination hnologies in the education market used responses from presenting nearly 50% of the total K-12 enrollment in U.S. Market Data Retrieval, 1991). The findings are not always often vary significantly. Therefore, in reporting the findnumbers, rather than percentages, will be used. Because on Data (QED) reports annually and comprehensively on hools, their data will be used.

density (students per computer) has been reduced from 4 to 20:1 in 1990-1991. The range is from 8,858 schools with lents per computer, to 7,082 schools with more than 90 nputer. The percentage of schools with microcomputers in dily increased for the past 10 years until it reached 98% in also reports "market share" for each company: Apple ntosh)—65.7%; IBM—14.1%; other MS-DOS—4.5%; Radio ommodore—5.4%; other—4.2%. Of the 81,203 schools that puters, 34,662 have 21 or more units.

onal Education Association embarked upon a campaign to puters available to its members (Merina, 1991). The NEA r was jointly developed by NEA and IBM. It is a "special 3/1 with a VGA color monitor, a 30 megabyte hard disk

preloaded with a computer-based grade book, a desktop publishing program, Microsoft Works, and IBM Linkway. A modem and printer are also part of the package. To make the computer package attractive to potential users, a price under $2,000 was established with the possibility of financing for under $50 a month with no down payment. The director of NEA's Center for Innovation said, "We're not going to have computer-using teachers until teachers become computer-using people" (Merina, 1991).

Universities have also been studied. The National Survey of Desktop Computing conducted by the Center for Scholarly Technology at the University of Southern California determined "that the *placement* of computers, rather than the total number is perhaps the key variable in defining access and assessing the deployment of institutional computing resources" (Green & Eastman, 1991). Access, or microcomputer density, in higher education institutions in general averages about 47:1 across all types of institutions.

A major comparative study, *The Use of Computers in Education Worldwide*, was published in 1991 by the International Association for the Evaluation of Educational Achievement (IEA). It summarizes the results for a survey of computer use in education in 19 countries (Pelgrum & Plomp, 1991). Major topics in the report, too complex to present here, involve the availability of computer hardware and software, the purposes for which computers are used, staff development, attitudes of principals and teachers toward computers, and gender equity in relation to computers.

The United States Department of Commerce, Bureau of the Census, studied computer use in the U.S. in 1989 and published their report in 1991 (Kominski, 1991). From the highlights of the findings, it is reported that 15% of all U.S. households had a computer, an increase from 8.2% in 1984. Among children 3-17 years of age, 46% used a computer at home or at school (or both), a rise from 30% in 1982. Of over 115 million employed adults, 36.8% said that they use a computer at work compared with 24.6% in 1984. By the fall of 1989, about a third of the U.S. population (74,884,000 people) used a computer in some way (Kominski, 1991).

All the surveys and statistics do not point to the *purpose* of computer use. In a preliminary paper for the IEA study, Plomp and Pelgrum (1990) discovered that the types of software programs most commonly used by teachers in the United States were: (1) word processing (93%); (2) drill and practice (92%); (3) educational games (91%); and (4) tutorial programs (81%). A study of computer-using teachers who have integrated computers into classroom practice discovered that software was used in the following manner: (1) text processing tools (95%); (2) instructional software (89%); (3) analytic and information tools (87%); (4) programming and operating systems ((84%); (5) games and simulations (81%); and (6) graphics and operating tools (81%) (Sheingold & Hadley, 1990).

As these data are considered, it would be well to recall Hawkridge's four major reasons for computer use in schools (1990):

The social rationale. Policy makers want to be sure that all children are "aware and unafraid of how computers work." Because "computers are pervading industrial societies and are likely to be important in all countries," learners should be prepared to understand computers and be aware of their role in society.

The vocational rationale. Learning to operate computers is an important competency. There will be employment opportunities for individuals who have the proper computer skills.

The pedagogic rationale. Students can learn from computers: "computers can teach." There are advantages over other traditional methods in using computers to learn.

The catalytic rationale. "Schools can be changed for the better by the introduction of computers." Computers facilitate change. They are symbols of progress. They encourage learning. "Computers are seen as catalysts, enabling desired change in education to occur" (Hawkridge, et al., 1990).

One of the next steps in studying the role of the computer in education is to discover the extent and role of computers in the teaching and learning process according to the social, vocational and pedagogic rationales. There is still very little evidence in the literature to support computer contributions to learning.

TREND 7

Telecommunications is the link that is connecting education to the world.

Telecommunications is an overarching term that describes electronic point-to-point-connections between individuals and groups. Translated into electronic delivery terms, telecommmunications technology includes connections that utilize existing telephone lines, dedicated lines, and cable and satellite transmission. Some messages are intended to be interactive, such as electronic mail (e-mail), computer conferences, and two-way audio and video conferences. Some are intended to be one-way, e.g., television directed to classrooms through cable and satellite systems. Usually broadcast radio and television are not included in the term, nor are prerecorded audio and video tapes that are distributed through nonbroadcast channels.

It is clear from the 1991 literature that the term *interactive* is rapidly becoming popular, especially in relation to telecommunications. Much of the interest stems from distance education applications when computers are used to establish networks between an instructor and students, or when satellite television is beamed to schools in a widely dispersed area. (Interactive video, another rapidly growing area, is usually not considered to be within the telecommunications "family" since it is usually delivered by self-standing, independent equipment. This trend is discussed in the next section.)

The dominant trend within telecommunications is networking, i.e., the electronic connection of individuals who have common interests. Basically, networking is conducted by electronic mail (e-mail) between one person with a computer terminal and another person with a cornputer terminal. Both individuals are participants in the same electronic mail system. Ehrmann (1990) describes four conversational models for networking: (1) direct instruction; (2) real time conversation; (3) time delayed conversation; and (4) learning by doing. Kurshan and Harrington (1991) summarize the state of networks today:

> Technological innovations have paved the way for new communities and collaborations to develop. While the modes of conversation have remained the same, the means by which these modes of conversation are carried out have not. Today, electronically networked communities employ all of these modes of conversation with varying technological sophistication. (p. 5)

Kurshaw and Harrington (1991) list the varied purposes for networking:

- Professional collaboration
- Student collaborative investigations
- Access to experts
- Information access
- Access to resources
- Collaborative development (electronic publishing)
- Teacher enhancement
- Online courses
- Networked community support

All of these applications are visible in the current literature. Each one is usually tied to a specific network. Some use commercial information utilities such as Compuserve and Prodigy. Others are part of education-specific networks like AT&T Learning Network and the NGS (National Geographic Society) Kids Network. Bulletin Board systems, such as FrEd-Mail and FIDOnet offer message sending/receiving capabilities at little or no cost for participation. State networks in New York (NYSERNET), Texas (TENET) and Virginia (VA.PEN) are further indicators of the rapid spread of networking within education.

At the Federal level, Congressional passage and Presidential approval of the High-Performance Computing Act of 1991 authorizes the creation of the National Research and Education Network (NREN). The network, which has been designated as America's "information superhighway" is expected to provide access to electronic information resources maintained by libraries, research faciltities, publishers, schools, universities, and affiliated organizations. The intent is to improve the information, computing, and communications infrastructure for the country's researchers and educators.

The other principal dimension of telecommunications is the use of television for teaching in a variety of settings. Whether the televison image in the classroom comes from a cable outlet, a satellite dish, or a videotape recording, it is the quality of the program that is the ultimate value for teaching and learning. Much of the literature speaks of the delivery systems that are being put in place and the applications of these systems for such uses as distance education. One must remember that it is possible to record on videotape any program that comes into the school, taking into account copyright restrictions and permissions. The recording provides flexibility in use and the possibility of reuse. Most of the 1991 literature was more concerned with getting the signal to the school than in its ultimate use.

Teachers are using television. In a study by Mann (1991), 96% of teachers in grades 6 to 12 expressed enthusiasm for televison in instruction and three out of four plan to use it more next year. About 60% of the schools had access to cable television, but about 45% of the teachers said that they had trouble getting equipment to use in the classroom. Some 56% of the teachers in the survey listed PBS as their prime source of programming, but there was considerable use of CNN Newsroom (12% use—the most frequently used cable program) followed by A&E Classroom, Assignment Discovery, and C-Span. The subject-matter area ranked first in use was current affairs (56%), followed by literature (38%), performing arts (37%), and history (33%). One surprising finding was that one out of eight classrooms did not have an electrical outlet!

Cable and satellite delivery systems reached new heights in 1991. The cable industry established Cable in the Classroom as a national project aimed at providing all junior and senior high schools with free cable service and at least one VCR and one monitor. Through cable access, many programs are entering the classroom. *A&E Classroom* is a one hour block of programming airing Monday to Friday from 7 to 8 am EST. The program is divided into subject areas focusing on history, drama and novels, performing arts, biographies, and anthropology and archaeology. *Assignment Discovery* is delivered through the Discovery Channel from 9-10 am every day. They report use by 438,000 teachers and viewing by over 8 million students. *CNN Newsroom* is a daily 15 minute news program specifically designed for school use. Access to *The Learning Channel*, a 24-hour television service, offers more than 20 programs for in-school use by teachers.

Channel One remains a controversial cable service because of the commercials that accompany the daily program. In 1991, the network reached over 10,000 schools (Skelly, 1991). Whittle Communications, the sponsoring organization, provides a satellite dish, two VCRs, and television monitors for each classroom. The news program is 12 minutes daily and includes two minutes of commercials. Various states have taken legal action to prohibit schools from signing on to the service. New York passed a law prohibiting use of Channel One in the schools. North Carolina judges ruled that the programs are supplementary and that the local schools boards do have the authority to accept the program. California tried, but failed twice, "to impose an overall statewide ban on 'electronic advertising'." ("Free to Watch TV," 1991)

The Monitor Channel produces Monitor World Classroom in English and Spanish, Monday through Friday, and airs it at 4 am for recording. Printed support materials for classes in geography, social studies, global issues, and international affairs are available along with complimentary copies of the *Christian Science Monitor*.

Satellite transmission is a vital link to telecommunications. A recent study of satellite dish uses in public schools (Quality Education Data, 1991) reported that 33% of the schools in the United States have satellite dishes (27,582 out of 83,281 schools). Hawaii, Kentucky, and the District of Columbia report that all schools have satellite dishes. More than 20 states have joined the Satellite Educational Resource Consortium (SERC). The purpose of SERC is to provide credit courses via satellite, microwave, or cable technology that would otherwise be unavailable. SERC also offers in-service and graduate courses for teachers.

States seem to be the organizing units for the delivery of telecommunications technology. For example, the Massachusetts Corporation for Educational Telecommunications (MCET) operates the Mass LearnPike, a satellite and computer-based network dedicated to improving the quality of learning in the state. The Kentucky Educational Network is linked by satellite to all of its 1,300 public elementary, middle, and high schools. One person in the United States is monitoring state policy issues for telecommunications. Richard Hezel, author of two previous reports on state coordination of telecommunications for the Annenberg/CPB Project, outlines current issues in an excellent 1991 publication, *Education Policy and Communication Technologies* (Sheekey, 1991).

Programming for telecommunications was enhanced by this year's announcement of a $60 million grant by the Annenberg Foundation to the Corporation for Public Broadcasting for a new national project designed to improve mathematics and science instruction at the elementary and secondary school levels. The project includes an array of technology media: computers, interactive video, laser discs, and electronic networks.

The present trends study emphasizes the use of technology in elementary and secondary education. Higher education is also active in its applications of technology to education. PBS Adult Learning Service indicates that 59% of all colleges and universities in the United States are using telecourses. Much of the activity is based in the two-year post-secondary institutions. The International Telcommunications Consortium, an affiliate of the American Association of Community and Junior Colleges, represents more than 400 educational institutions from the United States and Canada and sponsors professional development meetings, supports telecommunications research, and provides a forum for its members to share expertise and materials.

The many telecommunications sub-trends will have to be followed individually to keep up-to-date with the rapidly changing technologies. The technological developments outstrip the schools' readiness to adopt them. But, as this year's report shows, much progress is being made. In light of the restructuring movement that is inherent in the *America 2000* plan, it is likely that technology will have an active role to play.

TREND 8

The teacher's role in the teaching and learning process is changing as new technologies are introduced into the classroom.

"Teachers cannot be replaced by machines!" The cry has been heard since the invention of the printing press. The implicit threat of technology overtaking the teaching function has been ever present in the generally conservative education community. There have been several indicators that the tone of the protest has been calmed. One major factor is the growth of distance education programs in the schools and in higher education. In many distance education programs, instruction is delivered by a medium—a teacher surrogate—that is responsibile for the major portion of information presentation. Through videotapes, audiotapes, computer programs, programmed textbooks, and combinations of media, subject matter is systematically presented to the learner. Even when the teacher is remote, as in "live" telecourses, the local teacher has been "replaced" by the teacher at the end of the line—wherever that may be. In reality, teachers are not replaced in the literal sense; they change their role from that of a presenter of information to a coordinator of learning resources. Such a role frees the teacher to work more independently with individuals and small groups while leaving the formal presentations to another medium. When materials are designed for distance learners, it is the teacher subject-matter specialist who is the source of the information and often the designer of the presentation.

The dream of many technologists, and those who would change the role of the teacher, has been integrated learning systems (ILS). Known by such trade names as Computer Curriculum Corporation and Jostens and Wicat Systems, ILSs offer comprehensive coverage in terms of lesson plans and integration of electronic media. They generally make fewer demands on the teacher than do individual programs that treat small sections of the curriculum. According to *Inventing Tomorrow's Schools*, a newletter published by the Mecklenburger Group:

> ILSs are the fastest growing segment of the educational software industry . . . . There are more ILS vendors now than a few years ago—and most are financially healthy—to the point that they are an "industry" that is among the formidable forces that will shape the future of education. (Sherry, 1991)

The Educational Products Information Exchange (EPIE) has compiled a detailed report on ILSs that includes information on vendors, program descriptions, courseware evaluation, and visits to implementing sites.

Market Data Retrieval (1991) reports that ILSs are in use at more than 4,200 schools, 11% of the respondents in their 1991 study.

Much of the value stemming from the ILS and other technologically-based learning resources is not possible until teachers are thoroughly prepared to use the new systems. Sherry (1991) ends his ILS report by saying, "ILSs have a bright future, especially as vendors and schools alike pay the necessary attention to pre-service and in-service treacher training that encourages the full use of these ever-more-sophisticated resources." Some of the same issues are addressed by the Southwest Educational Development Laboratory in its newsletter, *New Things Considered*. In the August, 1990 issue, pertinent questions are raised about the new requirements for teachers. Examples:

> How do we prepare teachers if the traditional capabilties and applications will no longer be necessary, and we do not know which types of knowledge will be needed instead?
>
> The changes have happened so fast that relatively few teachers and teacher educators have had opportunity to become comfortable with using computers, much less other technologies. Consequently, there are few effective staff development programs to help teachers create ways to integrate technology into the curriculum("What curriculum," 1990).

The need for teacher involvement in technology is being recognized by one of the largest teacher unions in the United States—the National Education Association. Among its adopted resolutions for 1991-1992 was a key resolution related to educational technology:

Technology in the Educational Process

The National Education Association recognizes the advancement and application of instructional technology and high-technology devices and materials that provide new opportunities for developing skills, furthering research, and expanding knowledge in our society.

The Association believes that—

a. All education employees must be afforded the opportunity to explore the potential of emerging technology.

b. Education employees should have access to necessary technology for managing and advancing instruction. Further, they should be provided encouragement, time, and resources to experiment with and to research applications of technology in order to integrate technology into the curriculum.

c. Teachers must be involved in all aspects of technology utilization including planning, implementation and evaluation.

d. Teacher preparation in instructional technology must begin in college and university programs and extend through continuing opportunities for professional development.

e. Students must become aware of the social and economic impact of technology and must be provided with access to and instruction in the use of such technology. Further, technological education programs must provide equity in training, funding, and participation for all students, regardless of age, race, gender, socioeconomic level or geographic location.

f. All students and staff should have an understanding of copyright law and the responsible use of technological materials.

g. Effective use of technology requires a licensed teacher in every classroom. Instructional technology should be used to support instruction, but not to supplant education employees. (NEA, 1991)

Voices from diverse sources are calling for more active roles in the use of technology in the classroom. Terrel H. Bell, Secretary of Education, 1981-1985, in a 1991 book, *How to Shape Up Our Nation's Schools*, makes an urgent appeal for technology in schools according to *Washington Post* writer, Brent Mitchell. He says in a September 24, 1991, article about the book: "Schools are often the only places that children do not deal with phones, computers and video players, and the book suggests these innovations could occupy one-third of a student's day and free the teacher to give other children more individualized attention." Quoting Bell, "Look at the supermarket and high tech behind the checker today . . . . Now look at what we are providing teachers." Such a call naturally leads to the next trend.

This trend is a two-edged sword. Pleas for the use of technology in the schools, such as those of Dr. Bell, are increasing in frequency. Simultaneously, there are cries of concern over the impact of technology, especially television, on children and youth. Each matter will be considered separately.

Continued monitoring of the National Governors' Association project, *Results in Education*, reflects progress on one of the seven major themes: technology. The 1990 report shows very little progress in the implementation of technology to bring about major changes in the schools.

Despite the gains, technology's potential to transform and customize American classrooms remains largely unrealized. Most school districts still do not turn to technology to expand and diversify; nor has technology been integrated into the instructional assrooms. In short, little progress has been made toward iendation of the task force—to use state powers to help using technology and other means, so that they become effective (p. 35).

growth of computer and video-based technology in the rvation may seem contradictory. The discrepency is in the *uses* of the technologies in ways that bring about ole transformations in the schools. Use of media and plementary aids for enrichment does not improve ef- iave minimal impact on effectiveness.

Society for Technology in Education (ISTE) received a carry out a study of the potential that technology offers of the key purposes of the study was "to help education- s identify steps they must take to create educational e to the charge given to them by the President and the The complete report, which involved more than 150 levels of education, is called *Vision: TEST (Technologically Tomorrow)*. It spells out five major recommendations, iat involve the use of technology:

1. As a nation, the United States must recognize the need for improvement in its educational system and seize the opportunities offered by technology.
2. As a nation, the United States must provide every student with the opportunity to become what each is capable of becoming. It must provide each student with an environment that is conducive to learning.
3. As a nation, the United States must empower all teachers to provide the best education for every student in their classes.
4. As a nation, the United States must redesign its school systems to prepare its students for the twenty-first century.
5. As a nation, the United States must ensure that schools are managed effectively. (Braun, 1990)

Another perspective, removed from the K-12 focus of this study of trends, is the use of technology for adults. Nell Eurich's book, *The Learning Society: Education for Adult Workers*, is based largely upon the use of technology to train and retrain adult workers. It reports a variety of current activities in which technology is used to make learning more efficient and effective with this special audience. She concludes that "about one-third of the work force is getting trained. That leaves the majority of workers still to be reached, but at least many adults are learning under their employers' auspices" (p.18). In a case study-based chapter, Eurich provides rich rationale for the use of media and technology, concluding that "the potential gain could be enormous *if* we supply content of quality for the media and select the technological means wisely for the goal" (p. 38). It is curious that technology has made more impressive gains in business and industry than in the schools.

The National Engineering Consortium released the findings of a study on the usage, value and needs of technology in education in *Educational Technology in Kindergarten through Twelfth Grades* (Janowiak, 1990). This highly media-specific study found that videodisc and interactive multimedia systems were the most promising new technologies while more "traditional" technologies like microcomputers and video recorders had growth potential. An emerging trend seemed to be integrated multimedia systems combining video, data and sound to provide information on demand.

Turning to the impact of technology on children, there are continuing concerns expressed about the influence of television on children's behavior. One direct outcome of this concern was the passage of the Children's Television Act of 1990. The new legislation limits advertising on children's programs to 10 1/2 minutes an hour on weekends and 12 minutes per hour on weekdays. The Federal Communications Commis-

sion is instructed to carefully review the practices of each station up for license renewal to determine compliance and whether its overall programming "has served the educational and informat nal needs of children." The Act also establishes the National Endowment for Children's Educational Television, which is intended to stimulate the creation and production of educational programs for children.

To review the comprehensive research conducted by behavioral scientists over the last forty years on the influence of television on the lives of American children and adolescents, George Comstock has written *Television and the American Child*. The book identifies major topics that have been investigated and focuses on recent research that confirms or rejects the conventional wisdom about the effect of television on youth. There continues to be ambiguity in the findings of dozens of studies, but Comstock is able to put the findings into a perspective that permits the reader to apply the conclusions to specific conditions with specific types of young people.

There continues to be an undercurrent of dissatisfaction about the nature and quality of many commercial television programs even though many studies do not support the notion of gross negative influence of television on children.

TREND 10

Professional education of educational technologists has stabilized in size and scope.

There may not be much uniformity in the titles of academic programs that prepare individuals to serve in the field of educational technology (instructional technology, educational systems, instructional design, etc.), and the academic "homes" are not consistent from university to university but, in general, the field is holding its own. Programs tend to include similar content, are primarily offered at the graduate level, and prepare people for similar positions.

The *Educational Media and Technology Yearbook 1991* lists 63 doctoral programs in the United States. No new doctoral programs were instituted in 1991, but the East Texas State University program was eliminated due to economic cutbacks, and the University of Northern Colorado program was substantially revised. The *Yearbook* lists 195 Master's and 6th year degree programs, some of which are located at the institutions offering doctoral degrees. Programs were eliminated (or combined with other programs) at four universities in 1991. A third listing in the *Yearbook* includes 82 programs in educational computing, 32 more programs than in 1986 when the listing first appeared. Like the Master's degrees in educational technology, some of the Master's degrees in education and computing are also located at institutions offering doctoral degrees.

New and revised programs reflect emerging trends in the field at large. At Northwestern University, a Ph.D. program in the Learning Sciences has as its purpose "to advance the research and development of innovative educational structures and technologies." At the University of New Mexico, the Department of Training and Learning Technologies incorporates the areas of training and development, adult learning, and instructional technologies. The revised doctoral curriculum at the University of Northern Colorado is future-oriented, with emphasis areas in (1) instructional design/development, (2) interactive technologies, and (3) technology integration.

More professional conferences, conventions, and workshops feature specific media and technology applications to education and training. The largest is Commtex, which was held in Orlando, Florida, in February 1991, and attracted the largest number of participants in recent years. Other meetings tended to feature computer and telecommunications applications.

.... THE LONGER VIEW

With baseline data from 1988 and 1989, it is possible, using data from 1991, to begin to consider the trends over time. Five or ten years would be a better time span, but analysis can begin at this point and be adjusted in the years to come. A starting point is with the frequency of items in the literature, dissertations, conference programs, and ERIC input. Tables 1 and 2 reveal a relative consistency of content categories and recording units used in this study. Although there are several aberrations from year to year, they do not seem to alter the trends significantly. For all intents and purposes, the sequence of ten trends uncovered this year is as viable as the 1988 and 1989 lists. Therefore, this longer range view should go *beyond* the data and attempt to identify the more subtle trends that do not reveal themselves after following the replicable methodology that has been used in the three editions of this report.

This analysis of trends comes from the more personal views of the author, who has lived with this process over the past four years. It includes subjective data gathered while serving as Director (and later, Associate Director) of the ERIC Clearinghouse on Information Resources. As a participant in the document selection process for *Resources in Education* and journal article selection for the *Current Index to Journals in Education*, hundreds of items pass his eyes each year and a substantive judgement must be made about each one. As Professor and Chair of an academic department that prepares professionals for the field of educational technology, he also discusses many substantive issues about new developments in the field with faculty and students. Opportunities to serve as a consultant in other states and other parts of the world generate information about developments in the field that would not ordinarily come through the literature. In 1990, the author was a Visiting Professor for three months at the University of Twente in The Netherlands. He was a consultant for the Open University in Indonesia for two months in 1991. Also in 1991, the role of facilitator for the California Educational Technology Summit (Cradler, 1991) provided an opportunity to verify some of the trends that were being held as tentative.

Other signals also add to the mix of inputs that help to articulate the longer view trends. As the team reviewed the literature of 1991, using the same recording units as past efforts, it was clear that many new concepts were emerging that could not comfortably "fit" the existing categories. When some of these concepts, now translated into specific terms, continued to emerge, it became apparent that new categories would have to be created. In part, identification of "new" concepts may reflect a limitation in the old

schema, but the fact that so many new terms were independently assigned to items in the literature seemed to indicate that there were emerging ideas that had not been accounted for in the previous rounds. Likewise, some existing terms in the recording units were hardly used at all. They had fallen into disuse even though they had appeared more frequently in earlier efforts. For example, the following terms grew out of this year's review:

Integrated Learning Systems	Gender
Multimedia	Authoring systems
Presentation	Constructivism
Cross-cultural	Diversity
Cognitive Science	Instructional Strategies
Program Evaluation	Impact
Educational Technology	Networking
Competencies forTeacher Education	Hypermedia

Other indicators of movement within the field come from the placement records. Where are educational technology graduates going? What are they doing on the job? What is the demand for such people? Currently there is no systematic collection of data to answer those questions, but if someone is engaged in the process of helping Master's and doctoral graduates to find positions, it is likely that some feeling for employer needs is gained. Thus another ingredient is added to the mixture.

Recognizing the idiosyncratic sources, and the admission of subjectivity by the author, a list of trends that takes a longer view than the year-to-year reports is presented for the reader's consideration. These personal opinions may serve as a basis for further discussion among colleagues in the educational technology community.

- Educational technology is being shaped more by external forces than by the internal influence of its own professionals.

Calls for using technology to solve some of the problems facing schools come more from the business and industry community than from the schools themselves. The National Governors' Association has been advocating and monitoring the use of technology in education for the past five years. The New American Schools Development Corporation expects technology to lead the way in creating "break the mold" schools. A relatively small number of professionals within the schools and universities try to reach the vast number of teachers and professors in attempts to encourage the reluctant ones to try technology. There has been little impact. Some partnership ventures between computer companies and schools and cable companies and schools have led the way to greater infusion of technology.

Most of these events are isolated in local settings and do not have the impact that technology advocates claim. The potential for contributions to teaching and learning through technology are still waiting for breakthroughs that will reach each teacher in each school in the country.

- The use of traditional media resources has become routine in most elementary and secondary classrooms.

There are not many classrooms that do not have permanent overhead projectors available at all times. They have become as ubiquitous as the chalkboards that they often replace. Audiocassette recorders are easily available to most teachers, whether to introduce a story to pre-schoolers or to practice foreign language skills. Ninety-four percent of the nation's elementary and secondary schools have videotape recorders (Quality Education Data, 1991), and that means there are television monitors available as well for incoming programs on cable or from broadcast sources. Availability of equipment does not seem to be a major problem in most schools. Schools have gradually built-up a reservoir of equipment over the past 30 years. Its use is probably uneven just as the quality of teaching is uneven in the more than 80,000 schools in the land. It appears that teachers could use help in using even the basic hardware that is already available to them.

- There is little evidence to show that the computer has made major contributions to learning in the classroom other than to help learners know how to use it.

The novelty wears off. What starts as a new, exciting teaching/learning medium gradually becomes commonplace and, unless new software is acquired, the extent of computer use seems to be computer "literacy" and word processing. The studies of computer use in the schools continues but there is very little solid evidence that computers in the classroom make a difference in learning. Perhaps this is still the era of introduction when teachers and students are fascinated with the novelty and really do not learn much more than how to use the machine. It may be a function of software quality. Much has been written about the poor quality of software for teaching and learning. It seems to be getting better. Some commercial organizations are known for having higher quality software than others. There is some doubt as to where the computers belong in the school. Some classrooms have several units, but rarely enough for the entire class. Some schools have computer classrooms where an entire class comes to one room where two students can work together on one machine. Still other schools use the school library media center as the place where computers can be used or borrowed by teachers to take to the classroom. There appear to be no patterns regarding locale of use. There appears to be little integration of computer-based instruction with regular curricular efforts. It may be too

early to demonstrate contributions of the computer to learning, but researchers are still trying and the findings may be near.

- The self-contained classroom is the basic setting for the use of educational technology principles and practices.

The self-contained classroom, where most students follow their course of study, is usually the basic unit in most schools. One of the most popular statistics for most schools is the teacher:student ratio, usually expressed as 25:1 or 30:1 or some such figure. The understanding is that one teacher is responsible for "x" number of students. It is the teacher's responsibility to "engage" the students in learning activities during a specified period of time, perhaps 35 to 45 minutes as most "periods" are defined. The teacher is autonomous—alone with a syllabus and, hopefully, a repertoire of teaching techniques that will attract and hold attention so that learning will occur. Audiovisual media have been used for the past forty years as one technique to attract and hold attention. Most media are group-paced; that is, when something is shown, the entire class is involved. If a teacher wants to help an individual learner, or a small group, other activities must be created to engage the rest of the class. Very often such variations on the entire class theme are a logistic nightmare. Educational technology, properly used, can help to engage students individually or in small groups. Use of teacher aides or teaching teams can open new possibilities beyond the self-contained classroom. Until differentiated staffing arrangements are put in place and resource stations are installed and monitored, educational technology will not make the contributions that its advocates claim. Change begins in the individual classroom with the teacher.

- The field is shifting from the use of media and technology for enrichment to technology for replacement.

Ever since the post-World War II era, the use of media has been encouraged by contemporary educational change agents. The first term to be used was "audiovisual aids"—media for enrichment. The motto "Bring the world to the classroom" indicates the role of media during the early days. Some teachers used media to "fill time" while others tried to integrate the use of media with the curriculum. In almost every case, the medium was used for *enrichment*—to improve the quality of teaching. While this approach was admirable, it did not necessarily guarantee learning. Faint whispers of "replacing the teacher" were heard as each new medium was introduced: radio, motion pictures and televison. However, there were no documented cases of any teacher being replaced by any medium.

In recent times, the distance education movement has in fact replaced teachers. The replacement is actually a television or radio program, a computer disc, printed material, a laboratory kit, or a combination of several media. Teachers have put themselves and their ideas in a medium which replaces the face-to-face instruction that historically characterizes

most education. For example, when rural schools cannot find a teacher to teach a specialized subject, they can turn to one of the distance education organizations delivering television courses by satellite. When post-secondary students want to pursue a college degree but must maintain a full-time job, they seek "open university" courses offered at a distance. Teachers in their traditional roles in front of a class are replaced by teachers on tape, on film, or in written materials. This is truly an appropriate role for technology in education.

- Instructional development is being practiced more in non-school settings than in schools.

Instructional development is the process of systematically designing materials and procedures for learning using a variety of media for delivery. The process is an outgrowth of earlier efforts to create replicable learning packages or modules that guaranteed results. One of its earliest examples is programmed instruction. As business, industry, government, the military, and medical communities discovered the cost/effective results of instructional development, they moved to create training packages and programs for their employees. Principles from the field of educational technology worked well in these training environments and soon many non-school organizations were deeply involved in using these principles. However, schools and universities continued to be reluctant clients and users of media for enrichment, if they used media at all. The graduates of professional graduate programs in educational technology currently obtain employment more in the business and industry sector than in education. This trend began over a decade ago, and there are prospects of it not only continuing but growing, despite the pleas of both educational technology professionals and advocates from business (Bowsher, 1989).

- Distance education has become an operational analog of educational technology.

Distance education and educational technology are congruent concepts. Distance education encompasses virtually every aspect of educational technology. From a basic concern for the individual learner to a complete treatment of instructional design and development procedures, educational technology is apparent. The use of multimedia delivery systems in a variety of dispersed settings requires replicable materials that will insure attainment of learning objectives by every learner. Evaluation is central, as is feedback to the student. The entire system must be managed well in order to facilitate learning and to insure proper record keeping.

- Cognitive science provides the best source of theoretical principles that underlie instructional design.

There is a trend toward the use of cognitive science as a basic underpinning for the process of instructional design and development. Even though the

remnants of behavioral psychology still dot the landscape, especially in training programs, cognitive psychology seems to be the theoretical direction in which the field is moving. There is some controversy regarding its application among the constructivists and non-constructivists. The concepts and empirical findings are helping to guide instructional design toward new understandings of how people learn and how to design instruction for optimal results.

- Evaluation is valued but infrequently used.

Almost every instructional development model includes evaluation, yet there is not much evidence that it is widely used in practice. Evaluations of products, such as computer software, are published regularly, but evaluations of the instructional development process seem to get lost in the rush to implement a newly developed course. It seems that the "trouble" of evaluation provides an excuse for moving ahead without much data regarding the products and processes developed. Most professional education programs preparing educational technologists do not offer a separate course in evaluation. The concept and procedures are incorporated into other courses, but they tend to have a minor place in the entire professional education curriculum.

- Educational technology continues to be perceived as a field concerned more with hardware and software than with its applications for teaching and learning.

No matter how much is written about the process of instructional design, development and evaluation, people working within the field of educational technology are perceived to be primarily concerned with the hardware and software used to deliver instruction. References are made to "the technology" when describing hardware/software systems. Most people who use the term, including many in the profession itself, do not fully understand the comprehensive meaning of the word, technology. Technology is the application of scientific principles to solve practical problems. It is a process; it deals with problem solving. It is *not* machines; it is not *software*. It is a systematic blend of people, materials, methods, and machines to solve problems.

The profession has tried to explain itself. The Association for Educational Communications and Technology (AECT), the national professional association for the field, published *The Definition of Educational Technology* in 1977. It was widely distributed. The Association finds it necessary to create an entirely new volume in 1992 based on reinterpretations of the field and its definition.

Perhaps the field will have to continue to explain itself through its actions rather than through its publications.

REFERENCES

Association for Educational Communications and Technology. (1977). *The definition of educational technology*. Washington, DC: Author.

Bell, T.H. & Elmquist, D.L. (1991). *How to shape up our nation's schools: Three critical steps*. Salt Lake City, UT: Terrel Bell & Associates.

Bowsher, J. E. (1989). *Educating America: Lessons learned in the nation's corporations*. New York: John Wiley & Sons.

Branyan-Broadbent, B. & Wood, K. (1991). *Educational media and technology yearbook*. Englewood, CO: Libraries Unlimited.

Braun, L. (1990). *Vision:TEST (Technologically Enriched Schools of Tomorrow)*. Eugene, OR: International Society for Technology in Education. ED 327 173.

Comstock, G., with Paik, H. (1991). *Television and the American child*. San Diego: Academic Press.

Cradler, J. (1991) *California Educational Technology Summit proceedings*. Sacramento, CA: California Planning Commission for Educational Technology. ED 338 215.

Distance learning usage climbs in Minnesota. (1990, July). *The Heller Report*, 1(10), 8-9.

Duffy, T.M. & Jonassen, D.H. (Eds.). (1991, September). Continuing the dialogue on the implications of constructivism for educational technology[Theme Issue]. *Educational Technology*, 31(9).

Ehrmann, Stephen C. (1990). Reaching students, reaching resources: Using technologies to open the college. Washington, DC: Annenberg/CPB Project. ED 327 171. Also: (1990, April). *Academic Computing*, 4 (7), 10-14, 32-34.

Eisenberg, M.B. (1991) *Trends and issues in library and information science*. Syracuse, NY: ERIC Clearinghouse on Information Resources. ED 335 061.

Ely, D.P. (1989). *Trends and issues in educational technology 1988*. Syracuse, NY: ERIC Clearinghouse on Information Resources. ED 308 859.

Ely, D.P. (1990). *Trends and issues in educational technology 1989*. Syracuse, NY: ERIC Clearinghouse on Information Resources. ED 326 212.

Eraut, Michael (Ed.).(1991). *Education and the Information Society*. London: Cassell PLC.

Eurich, N. (1990). *The learning society: Education for adult workers*. Lawrenceville, NJ: Princeton University Press.

Free to watch TV. (1991, November 20) [Editorial]. *Washington Post*.

Garnette, C.P. & Withrow, F.B. (1990). Analysis of the U.S. Department of Education's database of distance learning projects. *Journal of Educational Computing Research*, 6(4), 515-522.

Green, K.C. & Eastman, S. (1991, Summer). Access to computing: How many computers and where do we put them? *EDUCOM Review*, 59-61.

Gustafson, K. (1991). *A survey of instructional development models* (2nd ed.). Syracuse, NY: ERIC Clearinghouse on Information Resources. ED 335 027.

Harel, I. & Papert, S. (Eds.). (1991). *Constructionism*. Norwood, NJ: Ablex.

Harless, J. (1992). Whither performance technology? *Performance & Instruction*, 31(2), 4-8.

Hawkridge, D., Jaworski, J., & McMahon, H. (1990). *Computers in third world schools*. London: Macmillan Press.

High-Performance Computing Act of 1991 (P.L. 102-194, 9 December, 1991).

Janowiak, R.M. (1990). *Educational technology in kindergarten through twelfth grades*. Chicago, IL: National Engineering Consortium. ED329 221.

Janowitz, M. (1976). Content analysis and the study of sociopolitical change. *Journal of Communication*, 26(4), 20-21.

Kominski, R. (1991). *Computer use in the United States: 1989*. Current Population Reports, Special Studies, Series P-23, No. 171. Washington, DC: U.S. Department of Commerce. ED 338 210.

Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Beverly Hills, CA: Sage Publications.

Kurshaw, D. & Harrington, M. (1991). *Creating communities: An educator's guide to electronic networks*. Washington, DC: National Science Foundation.

Mann, D. (1991). *How teachers and media specialists grade cable TV*. New York: Teachers College, Columbia University.

Market Data Retrieval. (1991). *Education and technology*, Shelton, CT: Author.

Merina, A. (1991, February). Introducing NEA EdStar. *NEA Today*, 9(6), 25.

Mitchell, Brent. (1991, September 24). Educator urges speed in revitalizing schools; Standardized tests, high technology backed. *Washington Post*.

Moore, D.M. & Braden, R.A. (1988, March). Prestige and influence in the field of educational technology. *Performance & Instruction*, 21 (2), 15-23.

Naisbitt, J. (1982) *Megatrends*. New York: Warner Books.

National Education Association. (1991, September). The 1991-92 resolutions of the National Education Association. *NEA Today*, 10(1), 15-25.

National Governors' Association. (1990). *Results in education: 1990. The governors' 1991 report on education*. Washington, DC: Author. ED 327 969.

Neill, S.B. & Neill, G.W. (1990). *Only the best, preschool-grade 12, 1991. The annual guide to highest rated educational software*. New York: R.R. Bowker.

Northwest Regional Educational Laboratory. (1990). *Enhancing instruction through telecommunications*. Portland, OR: Author.

Pelgrum, W.J. & Plomp, T. (1991). *The use of computers in education worldwide*. Oxford: Pergamon Press. Also: Pelgrum, W.J. & Plomp, T. (1991, April). *The use of computers in education worldwide*. Paper presented at the annual conference of the American Educational Research Association, Chicago, IL. ED 337 157.

Plomp, T. & Pelgrum, W.J. (1990). Introduction of computers in education: State of the art in eight countries. Paper presented at EURIT (Herning, Denmark, April 1990).

Quality Education Data. (1991). *Satellite dish usage public school districts 1990-91 school year*. Denver, CO.: Author.

Quality Education Data. (1991) *Technology in schools 1990-91 school year*. Denver, CO: Author.

Saettler, P. (1991). *The evolution of American educational technology*. Englewood, CO: Libraries Unlimited.

Sheekey, A.D. (1991). *Education policy and telecommunications technologies*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement. ED 331 497.

Sheingold, K. & Hadley, M. (1990) *Accomplished teachers: Integrating computers into classroom practice*. New York: Center for Technology in Education, Bank Street College of Education. ED 322 900.

Sherry, M. (1991, November). The future of integrated learning systems. *Inventing Tomorrow's Schools*, 1(1), 6.

Skelly, M.S. (1991, August). Classroom television: Should schools tune in? *School and College*, 22-27.

Technology: "Wade right in," manager tells educators. (1991, November). *School Tech News*, 8(9), 1.

Weber, R.P. (1990) *Basic content analysis* (2nd ed.). Beverly Hills, CA: Sage Publications.

What curriculum for the 21st century? (1990, August). *New Things Considered*, 6,1.

METHODOLOGY USED IN THIS STUDY

Introduction

The Educational Resources Information Center (ERIC) is periodically charged with synthesizing the literature from various disciplines contributing to the field of education in order to provide an indication of trends and issues in these fields. The ERIC Clearinghouse on Information Resources at Syracuse University specializes in the fields of educational technology and library and information science. During 1988, this Clearinghouse conducted two parallel studies of trends and issues using this methodology. Findings from these studies are reported in IR-81, *Trends and Issues in Library and Information Science 1988*, in IR-82, *Trends and Issues in Educational Technology 1988* and IR-86, *Trends and Issues in Educational Technology 1989*. All are available from Information Resources Publications, 030 Huntington Hall, Syracuse University, Syracuse, NY 13244-2340.

Each study had three main goals: (1) to identify trends in the field of educational technology; (2) to continue a "baseline" for future studies by extending the database started during the 1988 study; and (3) to refine the methodology used in the previous study. A *trend* is considered to be a cumulative indicator of activities or products that shows direction.

The Methodology

Content Analysis as a Research Methodology

Bernard Berelson, in a classic work on the content analysis methodology, described content analysis as "a research technique for the objective, systematic, and quantitative description of the manifest content of communication" (Berelson, 1952). Any form of communication can be used as a source of data. While written materials are usually used, other forms such as music, pictures, or even gestures are likely candidates for analysis using a content analysis methodology (Borg & Gall, 1983). The main criterion is that the communication must be observable. Janowitz (1976) applied the content analysis methodology in a study to determine socio-political trends in the United States. As a data source, he used a sample of American newspapers.

Studies using content analysis usually aim at achieving one of the following objectives: (1) producing descriptive information; (2) cross-validating research findings; and (3) testing hypotheses (Borg & Gall, 1983). This study is an example of the first objective, as it synthesizes various sources of information in educational technology in an effort to identify emerging trends and issues.

Planning a content analysis study involves the following steps:

(1) specify objectives; (2) locate the data relevant to the objectives; (3) gather contextual evidence (involving the establishment of an empirical link between the data and the inferences to be made—a link which justifies the use of the data sources selected); (4) develop a data sampling plan; (5) develop coding procedures; and (6) plan analysis procedures (Borg & Gall, 1983).

Content Analysis Adapted for this Study

The procedures used in this study parallel those outlined above. The methodology was adapted for particular use in this study. While traditional content analysis involves the analysis of smaller units of the data sources, this study used the author's topical emphasis in writing the article or paper as a basis for classification. Given time and personnel constraints, it was not possible to analyze the large volume of material used in the study as would have been done using a traditional content analysis procedure. Thus, rather than concentrating on the length of discussion or particular use of concepts, the number of times that certain concepts were mentioned was used as a prime source of data.

The steps used included:

- *Revision of the conceptualization of recording units/categories used in the earlier studies.* Chisholm and Ely (1976) discussed the functions performed by media personnel and developed a conceptual scheme reflecting the definition of educational technology used by the Association for Educational Communications and Technology (1977). This conceptual scheme provided the basis for a new scheme which was developed for recording content units. The general areas included in the new scheme are: the Field, Personnel, Management, Technical Developments, Instructional Processes and Services, Information Services, and Research and Theory. These broad areas were used as content units during the 1991 study.

  Most of the content units were subsequently expanded into subcategories. For example, the "personnel" content unit was subdivided into roles and responsibilities, recognition, certification, leadership, and professional education. The deductive approach was used in selecting content units at the beginning of the study to increase the efficiency of the data collection process. It is important to note, however, that significant revision of the conceptual scheme followed as the data collection process got underway. One major content unit, "Society and Culture," was added during the 1988 study. Experience with the 1988 scheme suggested further revisions for the 1989 study (see Appendix C). For example, the "design and development" subcategory under the "instructional processes and services" concept unit was itself subdivided into seven categories: needs assessment, task analysis, individual differences and learner characteristics, message design, course development, product

development, and motivational strategies. This change helped to increase the specificity of content and facilitated the final analysis of the data. Minor changes were made for the 1991 study. (See Appendix B).

- *Determination of sources to be reviewed.* Journal articles, dissertation abstracts, ERIC documents, and professional conference programs were selected as the primary data sources. These sources report on activities that have actually been completed, and are considered to be a more valid data source than key informants' projections.

  The journals selected were those that had been identified by Moore (1981) and Moore and Braden (1988) as five of the "most influential" journals in the field: *Tech Trends, Educational Technology,* and *The British Journal of Educational Technology.* Also included was *Educational Technology Research and Development,* a journal resulting from the merger of *The Educational Communication and Technology Journal* and *The Journal of Instructional Development,* which were also included in Moore and Braden's "top five." For 1991, *Educational and Training Technology International* was added.

  Dissertations included in the study were those produced at the universities identified by Moore (1981) and Moore and Braden (1988) as being the "most prestigious institutions" in the field of educational technology: Arizona State University, Florida State University, Indiana University Syracuse University, and the University of Southern California.

  Input to ERIC's *Resources in Education* represents the most timely document literature produced by professionals with a wide range of interests within the field of educational technology. ERIC is an internationally recognized information system for Education.

  It was expected that conference presentations would represent the latest developments in the field. The gap between submission and publication of journal articles is eliminated in conference presentations. Three conference programs were included: the Association for Educational Communications and Technology (AECT), the National Society for Performance and Instruction (NSPI), and the Educational Technology International Conference (ETIC). The AECT and NSPI conferences are considered to be the most prestigious in the United States. The AECT Conference is attended by those with academic interests in the field of educational technology, while the NSPI Conference is attended primarily by practitioners in the training industry. In order to provide a more global outlook, the ETIC Conference, held annually in the United Kingdom, was included.

All data sources have passed through careful review processes before being included. Journal articles are typically reviewed by editorial boards before they are published. Conference papers are refereed before they are included in conference programs. Input to ERIC's *Resources in Education* also passes through a careful selection process by content experts. Dissertations are reviewed carefully by dissertation committee members and outside readers, including methodologists and content area specialists.

- *Revision of instruments from the 1988 study.* Three instruments were developed for the study. The "Content Analysis Recording Sheet" (Appendix A) was used for recording all journal articles. The "Recording Units: Trends and Issues Study" instrument (Appendix B) reflects the revisions made to the 1989 version of the conceptual scheme. This instrument was used as a guide for the data collection process and to tabulate data from all sources for final analysis.
- *Data collection procedures.* The data analysts, graduate students in the Syracuse University School of Education Instructional Design, Development, and Evaluation program, participated in a training session which focused on locating the data sources; identifying the main purpose of an article by reading the introduction, abstract, and conclusions; using the recording units instrument to reliably classify the data sources; and using the appropriate tabulation instrument. To insure maximum inter-rater reliability, it was decided that each data analyst would designate two categories for articles that seemed especially difficult to classify according to the conceptual scheme. Regular meetings were held with the senior author of this report, who served as the referee. In cases where the data collectors disagreed, the referee offered his opinion and discussion followed until consensus was reached. In some cases, both categories were retained and those items were so designated. The final tabulation reflects this decision, which is a revision of the earlier procedure in which only one category was used.
- *Data analysis.* Upon completion of the data collection phase of the study, the data collectors tabulated results separately for each group of data sources (dissertations, journal articles, *RIE*, and conference programs) to facilitate the analysis of the data across sources. Final tabulations took the form of frequency counts for each concept unit.

  The senior author of this monograph used the tabulations and factored in the findings of major reports and position papers released within the time period of the study when writing the manuscript.

Comparison of the Methodology with Other Studies to Reveal Trends.

Allen's study (1970) for the ERIC Clearinghouse on Educational Media and Technology at Stanford University was designed to determine trends and

problems in instructional technology. An open-ended questionnaire was sent to media and technology leaders and was completed by 40 respondents. The responses were studied and tabulated, and the summaries sent to an advisory council which met in Washington, DC. Using the questionnaire responses as a point of departure, the panel discussed educational technology trends, issues, and problem solutions. Questionnaire responses and advisory council discussions were used to write the final report.

Although the study made no claim to using a random sample of respondents, some efforts were made to insure the quality and representativeness of responses. Respondents were key informants, including officers of professional organizations, journal editors, and department chairs. Using a referential sampling procedure, younger informants were identified in order to avoid an "old guard, establishment" bias.

While key informants in Allen's study were asked to make projections of *anticipated* trends, the approach used in this year's study is to examine what has *actually* been produced.

Lard (1979) studied trends in educational technology over the 20-year period from 1956 to 1976 using a content analysis procedure. Like the present study, Lard's study relied on published sources. Lard examined *Audiovisual Communications Review (AVCR)* and *Audiovisual Instruction (AVI)* (the official journals of the Association for Educational Communications and Technology at that time) and educational technology dissertation abstracts cited in *Dissertation Abstracts* from five institutions, i.e., Indiana University, University of Southern California, Michigan State University, Syracuse University, and Florida State University.

Lard's goal was quite different from that of the present study. She set out to trace the development and evolution of three paradigms that had been identified from the literature: learning resources (media movement), systems technology, and learning behavior (behavioral technology). While it provided a gross description of trends, the study provided little information on the "units" contributing to each of the paradigms that were traced.

Strengths of the Study

- The sources sampled for this study represent work that has actually been completed. Unlike the Allen study, it does not rely solely on projections which may or may not have been realized. The distinction between a *trend* and a *projection* is an important one; by establishing a baseline and doing follow-up studies at regular intervals, it is possible to limit the inquiry to a specified time period. Determining trends implies the comparison of two sets of data and making a determination as to what has changed. The Allen study was not built on such a baseline. This study extends the original baseline that was started in 1988.

- The study relies on the work of a large number of individuals rather than on a selected few key informants. All of the material reviewed has been evaluated before inclusion in conferences and journals.
- "Cutting edge" topics are included by virtue of using sources such as dissertations, conference presentations, and ERIC's *RIE* input. The usual one- to two-year delay associated with publication of journal articles is compensated for by the inclusion of these alternative sources, as the delay between receipt of a document and dissemination for *RIE* is from 6 to 8 months, and delays for conference presentations are about the same.
- This study provides a more detailed profile of trends than did the Lard study. While Lard's approach suited her goal of tracing paradigm shifts, it did not allow a detailed account of specific concept units. The present study examined not three, but 49 distinct concept units. In addition, it sampled a wider variety of materials. Lard's study relied exclusively on journal articles.
- The study benefits from the fact that the methodology itself is in its third iteration. Based on experiences with the last study, some revisions have been made. New concept units have been added to refine the classification process. While much of the conceptual scheme was generated deductively, it was also recognized that a number of recording units would emerge as the process continued. The methodology allowed for the inclusion of emerging categories, resulting in somewhat more precision and reliability. It is safe to say that this year's revisions represent an inductive generation of concept units.
- The sampling plan emphasized "general" rather than "specialty" publications. It avoided journals devoted exclusively to such topics as computer applications so as not to present a heavily-skewed account of trends and issues. In some cases, "general" publications devoted entire issues to special topics, e.g., hypermedia and training of teachers in technology applications. Because the decision to produce such special issues was motivated by the recognition of the critical importance of certain topics, these "special issues" were thought to represent real trends, and they were not eliminated from the sample.

Limitations of the Study

The limitations of this study include:

- The methodology employed was not that of a traditional content analysis. While some 46 conceptual units were identified and followed during the review of data sources, the methodology permitted no more than a simple tabulation. For example, while it was possible

to say that 15 conference papers dealt with some aspect of interactive video, the data does not permit the further analysis of the topic. For example: What were the specific applications of interactive video? What were some of the major problems? What were the major successes?

- Despite efforts made to insure inter-rater reliability, only three data analysts were used. While much of the data collection process was done in collaboration with the senior author serving as referee (resulting in four separate judgments), his participation in all phases was not possible due to time restrictions.
- Most of the sources reviewed represented the interests of academic applications of educational technology The Performance and Instruction Conference Proceedings is the only source that exclusively represents the interests of those working in the training field in business and industry. The result may be a bias in favor of academic applications.
- The use of conference programs in a content analysis study has no precedent. Some of the conference presentations were difficult to classify, as in some cases, novel titles of presentations were the only information available. These items were eliminated.
- The study relied almost exclusively on a single methodology. The author's factoring in of major position papers may have been useful in cross-validating the findings, but could not compensate for the limitation.
- A final limitation of the study results from the effort to improve the methodology. By adding new concept units to enhance the scheme used in the 1989 study, it becomes difficult to make some detailed comparisons between the earlier studies.

Recommendations for Follow-up Studies

- Further refinement of the conceptual scheme used to classify data will eliminate some of the difficulties experienced during the preparation of earlier versions of the study. Content units with exceptionally low frequencies in both were eliminated from the scheme.
- Consideration of the data sources may be in order. The use of more sources would provide a more representative account of trends and issues. The inclusion of a journal such as *Performance and Instruction* would better represent business and industry applications of educational technology. The inclusion of a greater variety of international sources would present a more global account, but the language barrier remains a problem.
- The use of other methodologies would be useful in cross-validating the data.

- The availability of more data analysts would further increase the inter-rater reliability. Rather than having two data collectors working in collaboration, the use of two separate teams working independently would increase the confidence in the data.

References

Allen, William H. (1970). *Trends in instructional technology.* Stanford, CA: ERIC Clearinghouse on Educational Media and Technology. ED 043 242.

Berelson, Bernard. (1952). *Content analysis in communication research.* Glencoe, IL: Free Press.

Borg, Walter R., & Gall, Meredith D. (1983). *Educational research. An introduction. Fourth edition.* New York: Longman.

Chisholm, M.E., & Ely, D.P. (1976). *Media personnel in education: A competency approach.* Englewood Cliffs, NJ: Prentice-Hall.

Janowitz, M. (1976). Content analysis and the study of sociopolitical change, *Journal of Communication,* 26 (4), 10-21.

Lard, Henrietta. (1979). *Evolutionary changes in educational technology.* Unpublished doctoral dissertation, Syracuse University.

Moore, D.M. (1981, February). Educational media professionals' perceptions of influence and prestige in the field of instructional technology. A national survey, *Educational Technology,* 21 (2), 15-23.

Moore, D.M., & Braden, R.A. (1988, March). Prestige and influence in the field of educational technology, *Performance and Instruction,* 27 (3), 19-22.

APPENDIX A

Content Analysis Recording Sheet

Journal Issue _____ Issue _____

Article title	Category 1st Choice	2nd Choice

APPENDIX B

RECORDING UNITS: TRENDS AND ISSUES STUDY
TRENDS
The Field
History
Status
Future
Ethics
Legal Aspects
The Standards
Personnel
Roles/Responsibilities
Leadership
Professional Education
Management
Organization
Logistics/Operations
Procedures/Policies
Facilities
Finances/Budget
Planning Processes
Diffusion/Dissemination
Implementation
Technical Developments
Computer Related
Telecommunications
Video
Audio
Multimedia

Instructional Processes/Services
Distance Education
Simulations/Games
Problem Solving
Interactive Video
AI/Expert Systems
Design and Development
Needs Assessment
Task Analysis
Indiv.Differences/Learner Characteristics
Message design
Course Development
Product Development
Motivational Strategies
Evaluation
Product evaluation
Process evaluation
Cost-effectiveness Evaluation
Formative Evaluation
Services
Curriculum Support
Skills Instruction
Information Services
Research and Theory
Research Methodologies
Theory and Model Construction/Application
Society and Culture

APPENDIX C

Definitions Of Recording Units

THE FIELD

History - previous developments that have influenced the current status of the field.

Status - any item that reports the current state of educational technology professionals or activities in which they are involved.

Future - those items that indicate future developments within the field.

Ethics - professional activities that relate to values or morality in professional decision-making.

Legal Aspects - matters of law pertaining to the field.

The Standards - refers to the AASL/AECT publication, *Information Power,* which spells out standards for school library media programs.

PERSONNEL

Roles/Responsibilities - professional activities of educational technologists and their relationship to colleagues and to an organization.

Leadership - recognition of qualities or performance that provide evidence of advancing the field.

Professional Education - preservice or inservice preparation of educational technologists; curriculum; certification; training or evaluation of competencies.

MANAGEMENT

Organization - administrative arrangements for operating an educational technology program within an organization.

Logistics/Operations - providing the right material and equipment to the right place at the right time.

Facilities - physical plant or instrructional space including classrooms, media centers, library study spaces and equipment associated with such spaces.

Finance/Budget - anything pertaining to money, funding or finance and its use in an educational technology context.

Planning Processes - program planning at any level for current or future operations.

Diffusion/ Dissemination - transfer of ideas and processes from one source to another; the communication of an innovative idea or procedure; the spreading of information to sources that are perceived to be new.

Implementation - the adoption and actual use of an idea or procedure by an individual or an organization.

TECHNICAL DEVELOPMENTS

Computer-Related - items that focus on the computer as an instructional delivery system or use the computer in conjunction with other media or methods.

Telecommunications - the use of communications technology for transmitting information; includes television, satellites, cable, ITFS, teleconferencing, telelecturing, and point-to-point transmission with two-way communication.

Video - any item about moving visual images, usually captured on videotape or motion picture film, and distributed by videocassettes or film on reels.

Audio - radio or sound recordings including interactive radio for instruction, language laboratories and all types of audio delivery media: CDs, audio cassettes, disc recordings.

Multimedia - the presentation of more than one visual and/or audiovisual stimuli controlled by a computer or other device.

INSTRUCTIONAL PROCESSES AND SERVICES

Distance Education - teaching and learning in settings where the instructor and learner are removed from each other in time and space; includes telecourses, correspondence study, computer-based teaching/learning as part of a comprehensive system of education or training that culminates in completion of an assignment, course, curriculum or training program.

Simulations/Games - the design and conduct of instructional games in which individuals play roles of people who are located in simulated settings.

Problem Solving -	the process of teaching and learning whereby the individual is confronted with a simulated or real dilemma, problem or issue that requires resolution.
Interactive Video -	the design and use of a process that requires learner response to visual stimuli usually delivered by a computer and laser disc; this item focuses on *process*, not on the equipment.
Artficial Intelligence/ Expert Systems -	the design and use of computer-based software that emulates human performance; the emphasis is on the software.
Needs Assessment -	the procedure that precedes the actual design or instruction usually focused on the learner.
Task Analysis -	the procedure that attempts to simplify complex activities by determining the discrete steps involved in proper order.
Individual Differences/ Learner Characteristics -	analysis of the special characteristics of individuals who will use materials that will be designed.
Message Design -	the sequence and configuration of text, images and sound in the instructional process regardless of medium; uses principles of visual design as well as psychological principles determined by research and experience.
Course Development -	at a macro level, the design process that considers the entire course as the unit of development.
Product Development -	the process of designing, producing and evaluating a specific item of instruction in any medium; two subsets that appear frequently in the literature: (1) *courseware design* which is a special case of product development related to computer-based instruction and (2) *hypermedia*, a special case related to the heirarchically developed instructional materials that are delivered by computer and peripheral equipment such as a videodisc player.
Motivational Strategies -	those designated procedures or activities that are intended to stimulate and maintain interest in an instructional event.
Product Evaluation -	assessing the worth of an instructional material or package of resources.
Process Evalution -	assessing the worth of a procedure.
Cost-effectiveness -	determining value in specific financial terms for the purpose of providing data for decision-making.

Formative Evaluation - the procedure that precedes the actual use of an instructional material or process.

SERVICES

Curriculum Support - those items related to the use of media and technology in specific curriculum areas at any level; the focus should be more on the media and methods than on the content but content is essential in this category.

Skills Instruction - the teaching of pyschomotor skills including procedures and media that are specific to skill acquisition.

Information Services - aspects of educational technology resources that provide unique information about the field to users; services that provide awareness of and access to educational technology resources specifically intended for instructional use.

RESEARCH AND THEORY

Research Methodologies - those items that focus on the research methodology, not on the research findings.

Theory and Model Construction/ Application - theory or theoretically-based analysis including items on instructional models or evaluation models that provide hypothetical generalizations that can be applied in a variety of settings.

SOCIETY AND CULTURE

the impact or potential impact of media and technology on learners; these items are the "big" questions about the value (and sometimes the moral dimensions) of technology in society.

NOTE TO RATERS: Many of the items reviewed could be placed in several categories.Try to find the *dominant* theme and a secondary theme. Ask "Where is the author placing emphasis?" Record the first *and* second choice on the Content Analysis Recording Sheet. Discussions will be held on each item reviewed.

APPENDIX D

TRENDS BY TOPIC AND SOURCE

	Journals	Dissertations	Conferences	RIE	Total
THE FIELD					
History	0	0	2	3	5
Status	11	1	19	49	80
Future	1	0	4	2	7
Ethics	2	0	2	1	5
Legal Aspects	0	0	5	4	9
The Standards	0	0	0	0	0
PERSONNEL					
Roles/Responsibilites	2	0	11	1	14
Leadership	0	0	1	0	1
Professional Education	1	1	28	1	31
MANAGEMENT					
Organization	1	0	3	0	4
Logistics/Operations	1	0	1	1	3
Procedures/Policies	1	1	3	3	8
Facilities	2	0	14	3	19
Finances/Budget	0	0	0	1	1
Planning Processes	4	2	5	8	19
Diffussion/Dissemination	7	0	16	17	40
Implementation	20	1	58	27	106
TECHNICAL DEVELOPMENT					
Computer Related	7	8	18	32	65
Telecommunications	11	0	23	25	59
Video	0	0	17	9	26
Audio	0	0	1	4	5
Multimedia	7	0	15	7	29

TRENDS BY TOPIC AND SOURCE (continued)

	Journals	Dissertation	Conferences	RIE	Total
INSTRUCTIONAL PROCESSES/SERVICES					
Distance Education	4	4	28	52	88
Simulations/Games	1	1	12	3	17
Problem Solving	4	2	7	6	19
Interactive Video	7	4	15	15	41
AI/Expert Systems	7	0	12	16	35
Design and Development					
Needs Assessment	1	0	8	0	9
Task Analysis	0	0	5	0	5
Individ. Differences/ Learner Characteristics	8	7	20	6	41
Message Design	9	5	14	43	71
Course Development	3	0	18	3	24
Product Development	22	0	21	10	53
Motivational Strategies	2	4	13	0	19
Evaluation					
Product Evaluation	8	0	15	16	39
Process Evaluation	18	2	35	31	86
Cost-effectiveness Evaluation	1	1	5	2	9
Formative Evaluation	1	0	5	4	8
SERVICES					
Curriculum Support	8	0	9	34	51
Skills Instruction	0	0	2	0	2
Information Services	2	0	9	14	25
RESEARCH AND THEORY					
Research Methodologies	3	0	9	9	22
Theory and Model Construction/Application	37	2	27	25	91