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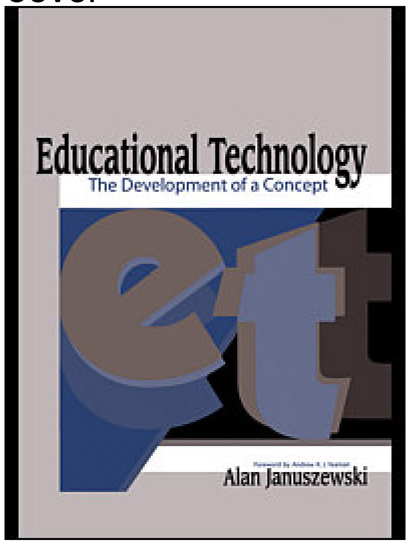

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Educational Technology
The Development of a Concept

Alan Januszewski

Foreword by Andrew R.J.Yeaman

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Foreword

Andrew R.J.Yeaman

"You seem very clever at explaining words, Sir," said Alice. "Would you kindly tell me the meaning of educational technology?"

"Let's hear it," said Humpty Dumpty. "I can explain all the educational technologies that were invented—and a good many that haven't been invented just yet."

Carroll, 1872/1990, p. 254

I think it is fair to begin by reminding readers that, along with their declared functions, the historical definitions of educational technology have the qualities of propaganda.1 They tell us what the facts are and what questions about those facts are acceptable. Like Humpty Dumpty, meanings are given word by word and there remains, as with the complex texts produced by most committees, at least some vagueness—possibly because the social purpose is to gain consensus. There is an insistence on people joining together to support a good idea that should not be opposed. Although both Al Januszewski and I strongly advocate educational technology, we also believe that, as a deliberate invention, the concept deserves analysis and is open to being evaluated and interpreted.2 Nevertheless, the book in your hands is not at all propagandistic but does advance educational technology by reviewing its tradition.

I have known the author since he was a Syracuse doctoral student about 13 years ago. He is a thinker and, like the protagonist in the epigraph, he is inquisitive and takes matters seriously. With the direction of his professors, notably Don Ely, he interrogated the educational technology establishment—literally, a few shelves of library materials—and dug in to penetrate the Humpty Dumpty-like aspects.3 Since then, his research has continued, and his reputation as a scholar has grown to include recognition in *ETR&D* (Driscoll and Dick, 1999). He has given many excellent research presentations at conferences, has a solid publication record, and was elected as president of the Association for Educational Communications and Technology's (AECT) Research & Theory Division for the year 2000. Now he has produced a history book on how educational technology has been defined. It is a landmark work of inquiry.

What we find in this book is not the latest dubious agenda for digital evangelism, but the beliefs of the past being analyzed. As a result of investigating the deliberations behind the educational technology definitions, the modern fog of unity, inevitable progress, and stability fades away. When the air clears, we see that people and their ideas changed with time, technologies, funding, events, and contexts. Learning the causes behind these developments is one of the major reasons why people are interested in history. Much of life, including the life of institutions as well as our personal lives, may be fragmented and incoherent, but we desire patterns showing continuity and we search to find them.4

Methodology and Intellectual History

With our technological orientation toward change and the future, it would be a great mistake to ignore history. It is the hottest topic going: How can you plan for tomorrow without understanding yesterday? Current analyses of the past should make some difference to our future and Al Januszewski's investigation implies there are potential benefits from further studies.

Consider the sad state of history as the most unpopular subject in high school (Loewen, 1995). History classes are often biased by textbooks and other instructional materials that support dogma,5 thereby making the topics dull, boring, and disempowering. An alternative is pedagogy based on current history research methods dedicated to making the past relevant to the present and to the future. Freeing history in this way breaks up the authority of monolithic stories and legitimizes multiple points of view (Yeaman, 1998). It is an approach that is interesting, motivating, and more truthful.6

As an intellectual history, this book is supported by a recognized theory for authentic historical research. The goal of this accepted approach is to present the stories behind an idea. Archival documents and periodic and book publications about educational technology were reviewed and analyzed to trace the development of the concept across time. It is obvious that the author's scholarly efforts were rigorous, effective, and professional.

The primary quality distinguishing professionals in any endeavor is the ability to resist popular myths and to be able to think things through properly. Discipline is needed when untangling the past because memory is notoriously unreliable. Retrospective reports by the actors involved in historical affairs contain mistakes, distortions, and imaginative responses in tune with the needs of the present audience. Statements are wrongly attributed. Complicated events are simplified, details are abbreviated, and, in hindsight, diverging actions are converged toward a single result. Conclusions are neatly aligned to remove ambiguity and justify an outcome. Difficult transitions take only a few months instead of several years. Political manipulations and personal disagreements are smoothed over, perhaps because they are still embarrassing, have been forgiven, or no longer seem to matter. Examination of testimony given by witnesses after time has passed needs confirmation by objective data.

Retrospective accounts of educational technology usually tend to lack scholarship. Published articles and chapters either are memoirs and reminiscences without corroboration from records or are collections of subjectively selected facts and unsorted details connected by a chronology. Succeeding generations have fabricated their own propaganda from “I was there” stories and gadget timelines. Upon encountering words like, “In the early 1920s many teachers took ‘visual aids’ to be eyeglasses,” the buzzing of your professional smoke detector should alert you that you are being exposed to conjecture. It is often with statements that are neither provable nor disprovable that the past is officially remembered. For scholarly excellence, wariness of the viewpoint put forward by authority is necessary. In my judgment, there has, overall, been continual endorsement of the existing state of affairs as the pinnacle of achievement—with more wonderful progress just around the corner—if we could overcome the latest crisis by working harder.

In contrast, this book has a sound theoretical foundation and was written according to a disciplined method endorsed by historians. *Educational Technology: The Development of a Concept* lucidly covers and analyzes a single theme. It can be assumed that readers will make comparisons for themselves and observe the superiority.

Seeking the Glue That Holds Words to Their Meanings

Al Januszewski tells how educational technology became a profession through defining its field of work as a specialty. He reports the internal discussions toward professionalization via the formal adoption of successive definitions. Readers familiar with U.S. history will contemplate these academic debates about educational technology against a background of population expansion, world wars, urbanization, and the spread of industrial employment. These situational factors enabling mass instruction by technological means also contributed to educational technology as a social idea.

By the middle of the twentieth century, the experts in *audiovisual* (AV) considered themselves in charge of their own domain. To build their profession and gain recognition and respect, the AV factions joined together under a new concept: *educational technology*. The most successful tactic of the alliance was to make educational technology distinguishable from traditional education centering on classroom teachers.

Group efforts at identifying the meanings and functions of educational technology were supported by definition committee appointments, conceptual publications, and debates scheduled at annual meetings. These efforts were repeatedly effective in promoting methodology and professional status.[7] Discussions about how educational technology should be defined served to support the jurisdiction of the educational technology profession.[8] The definition had to support each constituency in the coalition.

Expansion also coincided with commercial innovations in communication media. Economic growth was supported by legitimizing educational technology as a reputable technique. Formally defining educational technology in 1963, 1972, 1977, and 1994 was influential in setting the stage for the present scene, where the U.S. national expenditures for educational technology amount to an annual market estimated to be billions of dollars.

The definitions staked out much more than the delivery of instruction by AV media. The definitions argued for systematic instruction over the obscurantist traditions of teaching and training. In that comparison, instructional design and development were seen as humanizing because of their rational foundations. There is logic in procedures such as systematic planning, programmatic construction, standardized methods, objective evaluations, and feedback loops for redesign.

In sociological terms, the words chosen by groups serve the purpose of establishing control over territory (Abbott, 1988; Gieryn, 1995). By defining educational technology, the professionals working in that field claimed their turf (Yeaman, 1997). However, teachers as subject-matter experts could not accept being told how to teach by the technologists who had left the National Education Association (NEA). Teachers wanted to be in charge of their own areas, and they defended them from encroachment by confirming their authority. Experts in each subject began developing protocols for teaching with technology. Their national councils established that only they could understand teaching and learning with technology in their respective discipline, whether English, science, or math. Rather than accepting the technologists' models of instructional design and development, teachers rejected them in favor of using technology for teaching and learning. It is a hardware-based notion where technological means are accepted as self justifying.

Today, no one can teach or train successfully without involving educational technology, but the widespread adoption of hardware and software has not been accompanied by an equally massive diffusion of the systematic approach to designing instruction. Despite the latest definition (Seels and Richey, 1994), one persistent trend is for educational technology to regress into AV (Yeaman, 1997). Through computerization, the superstitions of AV and the traditions of education have endured.9 Politics determine the meaning and usage of communication media, and classroom teachers do have some power. In terms of Ludwig Fleck's study of *Spirochaeta pallida,* there is neither scientific proof nor overwhelming agreement in support of the causative effects of educational technology (1935/1979). The quality concerns driving the proponents of instructional systems remain because it is not unusual to observe technology without technique.

Humpty Dumpty

The official defining processes for educational technology have a heritage like Alice's confrontation with Humpty Dumpty in *Through the Looking-Glass* (Carroll, 1872/1990). When he listens to Alice reciting the Jabberwocky poem, Humpty Dumpty answers by explaining each of the "hard words" so they can be decoded. Although this is somewhat helpful, in keeping with his eccentric character, Humpty Dumpty evades telling Alice almost anything about the *meaning* of the poem.10

Similarly, it is my impression that the definers of educational technology used their authority to reduce its content and simultaneously keep its form complex. For example, each of the definitions has a glossary of factual terms attached. They were also intent on keeping the professional details of educational technology flexible.

This double strategy inhibited the search for social and cultural understanding. It emphasized rationality because the definers believed that the key to spreading their innovation was that it had some practical functionality and they perceived it as good, logical, and an improvement.11 By emphasizing the definition of specifics but simultaneously maintaining fluidity, general interpretation was neglected. In this way, large areas of dispute and social conflict have been hidden. This is contiguous with the tradition of educational technology as a common sense thing to be taken for granted. The flexibility of the historical definitions holds out hope for the future.

Conclusion

This history of how the educational technology concept came into existence and how it grew is likely to be placed on bibliographies of classic texts for master's degree students. It is certain to be read in advanced-level seminars. In many programs it will be on the required reading list for doctoral students, who may be quizzed on its content in their oral exams. In making connections with the past, it will be referenced in professors' lectures and cited in scholarly articles for its authoritative statements on the foundations of educational technology.

A secondary readership interested in the origins of educational technology is anticipated among working professionals such as technology coordinators, instructional designers, school library media specialists, training directors, and technology teachers. Education selectors for research and academic libraries will want to acquire this book because it fills a vacant niche in their collections. Although educational technology is taken for granted today, there has been almost no exploration of how the concept developed over several decades.

There is no other book like this one that closes the gap in knowledge about how educational technology originated and how it has grown. Unlike propaganda, this intellectual history will encourage members of the profession to reflect on who they are, where they are situated, what they believe, what they do, who they do it for, who they do it to, who is in control, and who else performs their tasks. It will agitate the Humpty Dumpties who accept educational technology at face value and believe it should stay taken for granted.12 However, the eventual effect of *Educational Technology* may be self-realization in a social sense and a further step up the tall ladder that leads to professional maturity.

Notes

1. In my imagination, I can hear the voices of those who lived through the events narrated here, "Tell us why Al Januszewski's book isn't just more propaganda, Andrew." They are encouraging, "Let the readers know right away it isn't merely the latest stuff piled on top of the heap." My immediate response is to say that Chomsky's words on effective propaganda come to mind:

You want to create a slogan that nobody's going to be against, and everybody's going to be for. Nobody knows what it means, because it doesn't mean anything. Its crucial value is that it diverts your attention from a question that *does* mean something: Do you support our policy? (1997).

Over time I have talked individually with Bob Casey, Lida Myers Cochran, Dave Crossman, Don Ely, La Verne Miller, Gerry Torkelson, Bob Wagner, and Paul Welliver, among other AECT members who were there on the scene. My questions were informal, "What was it like back then? What happened? How is it things turned out the way they did?" There is no perfect alignment among the answers given, but my feeling is they experienced a time of realization. It was becoming recognized that, without rational procedures for learning activities to produce intended results, AV would be almost worthless. No matter how large the budget, AV could never be any better than hit-or-miss.

Disagreements between people seem normal to me, and I should point out that some colleagues are more accepting than others about educational technology being a *social event,* to use Fleck's phrase (1935/1979). Regardless, this list of names is not meant to indicate endorsement but as thanks and appreciation for those who have been generous with their time and whose challenging answers I still listen to in my head.

Educational technology, as a technological concept does, of course, mean something. The topic being considered in this book does have substance. Nevertheless, educational technology is not pure but is contaminated with the real world and, whatever you say it is, it must perform in social terms.

2. Is the picture loud and clear? Visual literacy is a concept closely related to educational technology. One of the major fallacies of AV was that motion pictures would be effective by showing all learners the same thing and telling them the same thing. The visual literacy movement developed in answer to the naive optimism that visual messages would produce identical thoughts in people. Visual literacy proved that people need to know the conventions behind what it is they are seeing. That knowledge has to be learned, and it is argued that visual literacy ought to be incorporated into all curricula. For instance, "Is the picture loud and clear?" contains a mixed metaphor illustrating that literacy is not only verbal but also visual.
3. I am thinking about false reassurances, such as technological change being sure evidence of improved understanding about technology and proof of social progress. What the book brings readers to think about seems part of its reason for existing. Consequently, my purpose in writing here is not to provide a synopsis for readers, but to generate interest with an appreciative and speculative essay.

In writing this foreword, it should be clear I am emphasizing connections between the book and the world. These are my realizations, which come out of my own knowledge. For instance, I believe the visual-to-verbal and concrete-to-abstract descriptions of experience and instruction come out of the visual education movement of the 1920s (Yeaman, 1986). It seems to me, from a critical point of view, that these promises are reinvented for each generation's communication media. Overly optimistic beliefs are reproduced for every new 'technology' as if perpetuating a mythology of hope.

Neither debate nor discussion is going to replace Al Januszewski's research. Perhaps your background in U.S. history is different. Perhaps your experience in psychology leaves little room for social science. If so, then you will have other ways of looking at things. However, agreement and disagreement are of small consequence, because what matters is that we engage ourselves in thinking.

4. Finding connections is desirable but there is the danger of erroneous links. Comparing texts produced by different people from different places and different times will result in the identification of similarities. For example, it might be supposed that Shakespeare's tragedies continue in the tradition of *Beowulf* and that he had drawn inspiration and ideas from it just as he had adapted plots and characters from other plays and stories. Reading the texts as a test would result in finding similarity because they contain royal heroes who face uncontrollable forces. It is a theme consistent with their mutual descent from the *Aenid* and the *Old Testament*. However, the Old English poem had been lost in libraries for centuries. The sole surviving manuscript was not rediscovered, transcribed, and translated until more than 100 years after Shakespeare's death. It was first printed during the Regency Period. This lack of continuity demonstrates Type II error, whereby a false hypothesis is accepted. It is necessary to support lineage claims with indisputable evidence showing ancestral relationship.
5. Does your state government provide a history Web site? Promoting tourism is probably the first purpose; passing the dominant version of historic events on to schoolchildren is the second purpose. It is unlikely to be politically controversial and unlikely to encourage debate among the Web site's readers. It is also unlikely to cultivate discerning awareness of the state's past.
6. "More truthful" is relative but here is the truth of there being no better expression free of ambiguity. For discussion of related ideas, see *Deconstructing Communication* (Chang, 1996) and the necessity of multiple voices (Yeaman, et al., 1996).
7. The technological tie to management rather than classroom teaching, for instance, was part of the justification for separating the 10,000-member Department of Audiovisual Instruction from the National Education Association. It then became known as the Association for Educational Communications and

Technology (AECT). Within two years, the base of members and subscribers had more than doubled to 21,000 (AECT, 1972/1973). Current membership is under 4,000 (Driscoll and Dick, 1999).

8. For a contemporary sociology of how professions negotiate their jurisdictions, see Abbot (1988) and the relevant discussion in Yeaman (1997).
9. At first, computers were used to convey programmed instruction more than anything else. Learning by programming was popularized with the appearance of inexpensive microcomputers. Applications for word processing, database management, spreadsheet calculations, and telecommunications contributed to the move away from systematic instruction. Confusion that surrounds learning about “the computer” and incoherence about accessing the World Wide Web for “astronomical amounts of information” pass at present without rebuttal. The most forceful reason for this clueless computerism is that teachers greatly outnumber educational technologists. The rapidity of computerization corresponds with teachers regaining control of technology and remaking it in their teacherly frame. Although purposiveness is far from absent, technology possesses its own complex social discourse (Yeaman, 1997).
10. In his role as annotator, Martin Gardner aligns the following quotation from Carroll’s academic writing with the Humpty Dumpty-Alice dialog: “No word has a meaning *inseparably* attached to it; a word means what the speaker intends by it, and what the hearer understands by it, and that is all” (Carroll, 1872/1990). Carroll continues by remarking that the lower classes only make sounds but it is likely to be a tongue-in-cheek satire on snobbery. Aside from the haughty and aloof Humpty Dumpty, Alice meets characters from all levels in society. Their linguistic variations help make things entertaining.
    There are many ways to read Alice’s meeting with Humpty Dumpty. For instance, their encounter has some resemblances to the ancient scene where Phaedrus delivers Lysias’s speech to Socrates.
11. Also see Norman’s explanation of how the corporate emphasis on being the first to bring a technology to market contributes to things not working as well as they should (1998).
12. There is an ongoing dilemma in educational technology that Al Januszewski shared with me. This is the tension between emancipatory ideals for political change (Hoy, 1988) and the sociocultural aspects of neurolinguistics and technology (Johnson, 1988). Regrettably, difficult topics like this are neglected because it is easier to hope things might be what they have been named. Beyond industrial and corporate training—educational technology’s settled heartland—the dilemma affects the intended results of educational technology as a long-term project in social engineering.

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About the Author

Andrew Yeaman lives in Detroit and writes about technology, education, and society. He has edited special issues of *Educational Technology* (1994) and *TechTrends* (1998). His current research interests are in cultural studies with a focus on critical theory.

Introduction

Purpose

Whether we like it or not we can never sever our links with the past complete with all its errors. It survives in accepted concepts, in the presentation of problems in everyday life, as well as the language and institutions that we employ. Concepts are not spontaneously created or generated but are determined by prior thought.
Fleck, 1979

This book addresses the history of an idea. The idea is "educational technology." The purpose is to contribute to our conceptual understanding of educational technology. This will be done by tracing the development of the first three definitions of educational technology provided by the Association for Educational Communications and Technology (AECT). It identifies and analyzes the concepts, root ideas, and strands of thought that have existed in the definitions of educational technology since the first official definition was published in 1963. It explores the conceptual themes in the original definition, the themes that survived, and new themes that emerged in subsequent definitions published in 1972, 1977, and 1994.

The three definitions serve as "benchmarks" for comparing and analyzing the changing meaning of educational technology. In his book *The Struggle for the American Curriculum* (1987), Herbert Kliebard used the reports of groups like "The Committee of Ten" to "represent…a kind of weather vane by which one could gauge which way the curriculum winds were blowing" (p. x). Here, the statements of definition serve in a fashion similar to the way Kliebard used report documents. These definition statements reflect the important ideas and changes in the concept of educational technology at different points in time. The intent is to provide a history that analyzes the major currents of thought that contributed to the formulation of the AECT's early definitions of educational technology.

The very existence of three different definitions is evidence of disagreement about ideas of educational technology. If there were no disagreement about the idea of educational technology, it does not seem likely that three different definitions of educational technology would have been generated by the same professional organization in such a relatively short period. The definitions clearly differ. If the existence of different definitions of educational technology can be taken as evidence for the existence of different ideas or conceptions of educational technology at different times, then the question arises "Why has the idea or concept of educational technology changed?"

History is strongly connected with the concept of change in two ways. First, the study of history helps to show how things have changed and helps to explain why they are the way they are at present. Second, history provides the understanding that is an essential component of reflective thought. The study of history can help maintain traditions and help individuals to stick to their roots, if the roots are valued strongly enough. But historical analysis may also provide more options. A historical understanding can help us to break away from past patterns or shift emphases if it seems important to do so. History can greatly contribute to the conscious decisions that are made about change.

In addition to just describing them, the historical study of concepts can help us determine the significance of events and processes. Studying concepts can also reveal more subtle aspects, such as the emphasis that may be placed on certain words and actions. The subtle aspects included in certain concepts can affect professional practice. Frequently, particular ideas or conceptions are introduced into professional dialogue for personal reasons. Over time, this motivation becomes hidden as particular ideas grow in their acceptance. Historical investigations bring this hidden motivation to light. Historians of educational technology contribute to the self-awareness of the field. They do this by helping to make the lost and hidden purposes conscious ones. This will, in turn, open these purposes and patterns to a critical appraisal. And that may promote discussion, including discussion about the moral and ethical responsibilities of the profession.

There seems to be a general historical pattern that appears when studying the development of concepts (Fleck, 1979). This pattern shows that the meanings of many concepts pass through two periods: one where almost everything seems to be in strong agreement, followed by one where notable exceptions begin to appear (Fleck, 1979). This has occurred with the definitions of educational technology. First, there was a general agreement about the definition. Then the experiences and beliefs of people in the field changed. The professional association's membership was forced to reconsider its formal definition as more exceptions and challenges to the concepts and practices that were part of the old definition appeared and became more generally accepted by the field.

This broadening range of experience and practice that was conducted within the field provided an opportunity for the number of interpretations of the concept of educational technology to increase. Michael Eraut (1985) described multiple conceptions of educational technology. Unlike some analysts who suggested that a singular concept of educational technology was evolving (Saettler, 1990), Eraut argued that multiple conceptions of educational technology could exist at the same time. Eraut identified a "tools" concept, the "systems" concept, the "mass communications" concept, and the "interactionist" concept of educational technology. He thought these differing conceptions of the field often competed with each other. The possibility that there are competing notions of educational technology that exist at the same time has interesting implications. One very important implication is that educational technology is subject to political maneuvering at different levels. By "political," I simply mean the extent to which we seek to exert influence and perhaps even control actions around us (Rogers, 1977). In this sense, all human activity, including education, can be viewed as a series of political actions.

Background

In his effort to show the need for an official definition of "audiovisual communications," the predecessor term for educational technology, James D.Finn quoted Confucius:

"If the prince of Wei were to ask you to take over the government, what would you first put on your agenda?"

"The one thing needed," replied the Master, "is the definition of terms. If terms are ill defined, statements disagree with facts; when statements disagree with facts, business is mismanaged; when business is mismanaged, order and harmony do not flourish, then justice becomes arbitrary; and when justice becomes arbitrary, the people do not know how to move hand or foot" (Finn, 1963, p. iv).

Finn believed that if the audiovisual (AV) communications field were to survive and grow, it had to gain credibility with professional educators (Finn, 1953; 1956). He argued that establishing an intellectual territory for AV communications would accomplish this. The first step would be to set the groundwork by formally defining the AV communications concept. The second step would be to formally change the name of this academic area to instructional or educational technology.

Finn realized that formally defining any applied field of study would be difficult. In his introduction to the 1963 definition, he acknowledged this overall difficulty and the implications for those involved in a professional field like educational technology:

The problem of an applied field with reference to definition and terminology is infinitely more difficult than the same problem in a narrow and precise discipline. An applied field, by its very nature, draws upon so many sources for sustenance that the problem of definition and terminology is compounded many times…it can be argued that an applied field is subject to the winds of change that may mount to hurricane force and speed. The explosion of knowledge causes the narrowest discipline to change with great rapidity. A human profession making use of several disciplines thus has to live with multiplying change.

At bottom, the problem is even more complicated. Writers on science and even eminent scientists in recent years have created and maintained a myth that there is a one to one relationship between a science and any applied field depending on that science. That is, scientists advance new theories or discover new facts or processes about some aspect of the world, and engineers then apply these theories, facts, or processes directly handed down. In education, for example, there is talk about the science of learning and the art of teaching or the technology of instruction…the professional who has to do something in this world further complicates the problem of language, definition, and terminology because he adds terms, concepts, and ideas to those selected from supporting disciplines.

From the very beginning of the Technological Development Project, it was felt that an effort should be pressed to bring some order to chaos: A prime requirement was to draw up a statement of definition and terminology which even if not agreed upon entirely by the field would focus attention on the problem and would develop some consensus.

It follows, then, that definition and terminology in the expanded audiovisual field instructional technology, if you will, is of crucial importance to the educational community as a whole. Many of the terms defined and discussed in this monograph have already won partial acceptance, but few are completely understood (Finn, 1963, p. v–vii).

As part of his argument for a formal definition of “audiovisual communications instructional technology,” Finn provided the rationale “to bring some order to the chaos.” He wanted to focus on the problem of conceptualizing the “expanded audiovisual communications instructional technology field.” There is little doubt that, when the first official definition was published, many of the leaders in the field of audiovisual communications believed that “audiovisual” required reconceptualization (Ely, 1963). But Finn was quite clear about his desire to expand AV communications into a broader arena, an academic area that allowed for the introduction of the word “technology.”

It seems as if the attempt “to bring order to the chaos” by formally defining educational technology may have added more chaos than it alleviated. A metaphor that is hidden in the attempt to “bring order to the chaos” by defining educational technology is “definition is government.” The decision to formally define AV communications instructional technology presented the professional organization with the problem of determining just what this definition or government should be. This was a political problem.

Limiting the Analysis

One problem in writing a history of an academic field was described by Ludwig Fleck:

> It is very difficult, if not impossible, to give an accurate historical account of an academic discipline or a field of study. Many developing strands of thought intersect and interact with one another. All of these would have to be represented; first, as continuous lines of development and, second, in every one of their many intersections and connections. Third, the main direction of the development, taken as an "idealized average," would have to be described separately and at the same time. The continuity of the line of thought that has already been mapped out must continually be interrupted to introduce other lines of thought. The main current of thought would often have to be held up in order to investigate and explain any connections. Often, much has to be omitted to preserve the main current. Instead of a description of dynamic interactions one is often left with an artificial and arbitrary scheme (Fleck, 1979, p. 19).

Fleck is describing the difficulty in developing a historical document that follows a chronological order yet maintains a flow that keeps the reader's attention. He admits that many things are happening simultaneously. Ultimately, it is up to the discretion of the historian and writer to determine what content is included in the study and what the sequence of presentation will be.

This analysis faces the same problem. To tell the story of the definitions of educational technology and to conduct an analysis of that account, much of the history of the field has been left out. The scope of this study is an intellectual history of educational technology accomplished by analyzing the history of educational technology definitions. It is limited by necessity. This is not an intellectual history of the entire field of educational technology. The contributions of Robert Gagne and Leslie Briggs, for example, are not a primary subject of this account, nor is the work of Jerome Bruner, O.K.Moore, or Seymour Papert.

At another level, I have limited the analysis to the definitions of educational technology produced by the national professional organization, the Association for Educational Communications and Technology (AECT). It does not highlight the contributions made to definitions of educational technology by such scholars as Arthur Lumsdaine, Michael Eraut, or Cass Gentry.

Finally, the work of certain individuals who contributed to the definitions has been omitted to maintain the clarity and direction of this study. This includes much of Henry Bern's "Audiovisual Engineering," Thomas Gilbert's "Mathetics," many commentaries by Edgar Dale, and numerous models of instructional management and instructional development.

Methodological Considerations

This essay analyzes and interprets educational technology by looking at the development of the field through two distinct, yet related, filters or screens. Looking at educational technology through these two screens limits the scope of this study both by necessity and by definition. One simply cannot consider and give equal treatment to all of the factors that contribute to the development of an academic area of study (Fleck, 1979).

The first of these filters or screens was the intent and effort to professionalize the AV field. Many members of the field were interested in professionalizing and gaining status for the field, but James D.Finn spearheaded this movement (Ely, 1994). Finn wrote and spoke extensively about the need for AV specialists to become professionals. Finn formed the first academic department called Instructional Technology at the University of Southern California. He was instrumental in obtaining large amounts of funding to conduct conceptual and theoretical studies of the field, including the federally funded "Technological Development Project (TDP)." The 1963 definition of educational technology was supported by the TDP (Ely, 1963). Finn also sought funding to create an organization analogous to the "French Academy" for preserving the language inside the Department of Audiovisual Instruction of the National Education Association, the major professional organization of the field. The efforts to increase the prestige of the AV field were political. The concepts and ideas central to the field of educational technology were affected by these politics, so politics and political overtones are central to this study.

The second of these screens or filters, the influence of science and engineering on the AV education movement, is less overtly political. Conceptions of science and engineering influenced the interpretation of many of the concepts and ideas that were central to the field. These concepts and ideas were, in turn, included in the definitions of educational technology.

It is true that, in some instances, the desire to gain professional status caused some involved in the field to adopt particular conceptions of science and engineering in education. But there were many instances when the idea of gaining professional status for the field was not a driving concern to individuals practicing in the field. These individuals simply adopted a particular conception of science or engineering based on their own individual belief system or their academic background. As to influencing the activities of the field, there were still politics involved in these cases, but there was much less conscious thought and effort on the part of the members involved in this level of politics, decision-making, and action.

This book is divided into four distinct stages. The first stage provides a historical context for the idea of educational technology. In this stage, the three factors that influenced the concept of educational technology are examined: science, engineering, and the professionalization of the audiovisual education movement.

The second stage is an analysis of each definition of educational technology. In this stage, each definition is presented; the key words, themes, and "root ideas" of each definition identified and explained; and a historical account of each provided.

Then the themes and root ideas within each of the definitions are examined to see how they relate to each other. The third stage is a comparison of each definition in light of the prior definitions. This comparison includes identifying the similarities and differences between the definition under consideration and other definitions and an explanation of why the changes may have occurred. The second and third stages of this study are not as easy to distinguish from each other as are the first and fourth stages; they are intermingled in the body of the study.

The fourth stage provides conclusions based on the analyses and historical accounts of the three definitions. In this stage, themes common to all definitions are identified and problems that have arisen with the definitions of educational technology are identified and analyzed.

This book is not intended to provide any new prescriptions for action, nor is it undertaken with the aim of predicting what any new definition of educational technology might be. It is undertaken to bring some of the less obvious ideas involved in educational technology to a more conscious level and to make the members of the field more aware of some of their options.

At the end, I attempt to explain why educational technology is the way it is. The definitions are statements, sanctioned by the professional organization, that describe educational technology. Examining how and why leaders of the field see themselves and what they are doing seems to be a reasonable way to get there. In order to do that, one must also confront a question of the historiography of educational technology. That is, “if educational technology is a process, as the majority of the members of the AECT view it, then why does most of the history that is written about it focus on the hardware and equipment that is used in the field?” The development of hardware and equipment did not give rise to the process of educational technology. It was the process that allowed for the development of hardware and equipment.

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Chapter 1

Forerunners to Educational Technology

No one really knows who coined the phrase “educational technology.” The historian of educational technology, Paul Saettler (1990), admitted having difficulty identifying the source of the term. Saettler documented the use of “educational engineering” in the 1920s, and “educational technology” and “instructional technology” in the late 1940s, but he was unable to say with certainty who first used the term “educational technology.” Neither was he able to provide a precise date for its initial use.

Although the origin of the term “educational technology” has not been established, historian David Noble (1977) credits Jacob Bigelow, a physician who lectured at Harvard in 1829, with popularizing the term “technology” in the United States.

There has probably never been an age in which the practical applications of science have employed so large a portion of talent and enterprise of the community, as in the present. To embody… the various topics which belong to such an undertaking, I have adopted the general name of Technology, a word sufficiently expressive, which is found in some of the older dictionaries, and is beginning to be revived in the literature of practical men of the present day. Under this title is attempted to include an account… of the principles, processes, and nomenclatures of the more conspicuous arts, particularly those which involve applications of science, and which may be considered useful, by promoting the benefit of society, together with the emolument of those who pursue them (Bigelow, as quoted in Noble, 1977, p. 34).

Noble's analysis of Bigelow's treatise on industrial technology included the following points: (1) the "overriding imperative" for developing and using technology was to increase efficiency for "profitable utility" (p. 4); (2) technology included the "scientific investigation and the systematic application of scientific knowledge to the process of commodity production" (p. 5); and (3) technology was the result of extensive "research and development" (p. 5) rather than the direct and obvious applications of science alone to the mass production of standardized products. "From the start," Noble surmised, "modern technology was nothing more nor less than the transformation of science into a means of capital accumulation, through the application of discoveries in physics and chemistry to the processes of commodity production" (p. 4).

Noble's analysis of industrial technology raises questions about the field of educational technology. What is the relationship, if any, of educational technology to industrial technology? Why was an educational technology desirable? What does a technologically based education program look like?

Strong ties and parallels between industrial technology and educational technology were established early in the twentieth century (Finn, 1957; Heinich, 1984). Many of these ties were linguistic and conceptual because the predecessors of educational technology borrowed terminology and images from industrial technology. Concepts that were used in industrial technology, such as efficiency, standardization, and production, were introduced into the field of education early in the twentieth century. These linguistic ties can be thought of as conceptual bonds that link industrial and educational technology.

To demonstrate the existence of these bonds, we must look at the ideas that influenced and shaped the thinking of those who contributed to the development of educational technology as a field of study. Three major ideas seemed to be most influential in shaping modern educational technology: engineering (Bern, 1961; Szabo, 1968), science (Finn, 1953; Ely, 1970; Jorgenson, 1981; Saettler, 1990; Shrock, 1990), and the development of the AV education movement (Ely, 1963; Ely, 1970; Jorgenson, 1981; Saettler, 1990; Shrock, 1990). The way in which these three ideas influenced the field of educational technology was both related and interdependent: conceptions of engineering, science, and audiovisual education had to fit together in certain ways for educational technology to exist.

Engineering

The concept of engineering was central to Noble's (1977) thinking regarding industrial technology in the United States in the late nineteenth and early twentieth centuries. The term "engineering" described both certain acts of research and development and the efforts to put the technology that resulted from research and development into common industrial practice.

Shortly after the initial surge of technology into modern industry, the concept of engineering began to play a part in certain circles of education. Saettler (1990) stated that Franklin Bobbitt and W.W.Charters were among the first to use the phrase "educational engineering" in the 1920s, primarily as an approach to developing the curriculum. But before the popular curriculum work of Bobbitt and Charters, scientific management principles were being applied to the educational system in the United States (Callahan, 1962).

The theme of the *Twelfth Yearbook of the National Society for the Study of Education, Part I* (1913) was the application of scientific management in schools. The rationale for introducing scientific management in education was brought about by the skyrocketing enrollment in U.S. urban public schools, primarily because of the influx of immigrants from Europe and the industrial revolution (Callahan, 1962; Kliebard, 1987).

Scientific management was an industrial technique, developed primarily through the work of Frederick Taylor, in the early part of the twentieth century (Taylor, 1911). Scientific management was grounded in the application of measurement techniques from the newly developing sciences to the management of industrial plant production. Soon after the introduction of scientific management in industry, educators began to take hold of the concept (Callahan, 1962). Three individuals played key roles in introducing scientific management in education: Frank Spaulding, the superintendent of schools in Newton, Massachusetts; William Allen, the director of the New York City Bureau of Municipal Research; and James Munroe, an industrialist educator and Secretary of the Corporation of the Massachusetts Institute of Technology (Callahan, 1962).

James Munroe is of particular interest here. Munroe (1912) made the conceptual tie between scientific management in educational settings and educational engineering. Here Munroe not only provided the reasoning for implementing the techniques of scientific management in education; he introduced the term "educational engineering." Munroe argued that "we need *educational engineers* to study this huge business of preparing youth for life, to find out where it is good, where it is wasteful, where it is out of touch with modern requirements, where and why its output fails" (my emphasis) (p. 20).

Munroe used an industrial analogy to express his vision of how schools would operate. He explained that:

Such [educational] engineers would make a thorough study of (1) the pupils who constitute the raw materials of the business of education; (2) the building and other facilities for teaching, which make up the plant; (3) the school boards and the teaching staff, who correspond to the directorate and the working force; (4) the means and methods of instruction and development; (5) the demands of society in general and of industry in particular upon boys and girls, this corresponding to the problem of markets; and (6) the question of the cost, which is almost purely a business problem (Munroe, 1912, p. 21).

For Munroe, the problem of education could be viewed as a problem of industrial production. His answer to this problem was to introduce the assembly-line analogy in the schools.

Years after Munroe advocated the assembly-line notion of education, W.W. Charters (1945, 1951) refined the concept of educational engineering, specifically as it applied to the means and methods of instruction. Charters's writing underscored the deep conceptual bonds that he saw uniting technology, engineering, and education.Wary of skeptics and critical comments, Charters was cautious about using the engineering analogy for education. In the introduction to "Is There a Field of Educational Engineering?" he wrote:

For twenty years, the writer has been playing with an affirmative answer to the question posed in the title of this article. On occasion, he has spoken informally of curriculum "engineering." Curriculum planners carry out activities and have ideals that parallel those of engineering, but caution has always prevailed against the public use of the term. Always present has been the fear that educators might be accused of borrowing the prestige of the engineer (Charters, 1945, p. 29).

This article explored the parallels between education and engineering. Charters employed a definition of engineering from *The Engineering Profession,* (1941) by T.J. Hoover and J.C.L.Fish, which stated, "Engineering is the professional and systematic application of science to the efficient utilization of natural resources to produce wealth" (Charters, 1945).

Each element of this definition was used as a basis for comparing engineering and education. Charters's analysis of education and engineering served an important purpose for modern educational technology. It identified the basic characteristics of engineering and associated them with curriculum development activities. The concept of engineering discussed by Charters and the concept of technology outlined by Noble were similar in four ways: (1) they were systematic; (2) they were applications of science; (3) they emphasized the efficient utilization of resources; and (4) their goal was the production of wealth. The conceptual ties between engineering and technology in education became more apparent as educational engineering evolved from curriculum development into educational technology.

Charters explained how each of these four similar characteristics related to developing instructional methods and products. He argued, "The word, *systematic,* implies 'the thoroughness and impartiality with which the truth is pursued'" (p. 32). Although he admitted that there were few perfected techniques in education in 1945, he stated that "substantial beginnings have been made" (p. 32), and he further argued that continued efforts to thoroughly organize these successful techniques of instruction would inevitably result in their application in the schools. Charters believed "systematic" implied "thorough." Years earlier, Munroe had used the word "thorough" to describe the analysis that was required to successfully "engineer" the schools. The word "systematic" frequently appears in modern educational technology literature. Using the term "systematic" in educational technology may be derived from industrial technology, but its meaning was not always consistent in the literature of the field. In some instances, systematic meant thoroughness, but in others it was merely a step-by-step procedure.

Charters further stated that "the *applications of science* to problems" (p. 32) was an essential trait of engineering. He considered physics, chemistry, and mathematics to be the sciences that were basic to industrial engineering. Charters said that "[educational engineering's] basic areas are psychology, sociology, and mathematics" (p. 32). Charters was aware that the sciences he considered basic to education were not the same as the exact sciences of engineering. He believed this difference was because sociology and psychology were newer sciences and had yet to develop the quantitative rigor of physics and chemistry. However, Charters did believe that educational engineering, like industrial engineering, should derive its methods based on research from its own "basic sciences."

Charters then focused on the notion of efficiency. He argued that efficiency "is the pride of the engineer…. Whenever the engineer eliminates friction, invents shortcuts, increases manpower output, or decreases costs, he increases efficiency" (p. 33). Charters believed that educators should strive to be more efficient. He charged them to develop methods that would enable students to learn more in a shorter period.

Charters also believed that "engineering operates to produce wealth. This ultimate objective is widely conceived by the engineer. It does not imply money alone" (p. 33). Charters considered wealth to be "all those things which serve a useful purpose" (p. 33). He argued that "education also moves toward wealth as its objective" (p. 33), but admitted that educators used other terms to represent the idea of wealth. "They speak of satisfaction or growth or values of similar import" (p. 33). Charters concluded that "both professions have identical objectives; the resources used to achieve the ends are different" (p. 33).

Unlike Munroe (1912), who was interested in engineering the overall schooling process, the central tenet of educational engineering for Charters was the systematic development of instructional methods and products. It is important to note that Charters's discussion of educational engineering, while certainly different from Munroe's, was not in opposition to Munroe. In fact, Charters provides details for one area of education that Munroe identified as being an important subject of analysis for the educational engineer: the means and methods of instruction and development. The two views of educational engineering are complementary. Both view the instructional process in the language of systems.

Charters (1951) provided a description of how the educational engineer goes about the task of engineering instructional methods and materials. It consisted of five major activities:

The engineer will identify the idea to be worked upon, analyze it, and select promising hypotheses concerning its practical uses. He will experimentally play with plans for building a structure that will use the full value of the idea. He will build a unit, an operational technique, an instructional method. He will operate the tool and try it out in practice. He will test the results to measure the efficiency and practicality of what he has constructed (Charters, 1951, p. 234).1

Charters (1945) emphasized the attitude of engineering while describing the difference between the educational engineer and what he called "the idea man." He stated:

The core of engineering is an attitude. The engineer has a passion for building things and making them run…his happiness lies in devising a method, a structure, or a program that he hopes will work. The educational engineer, too, loves to plan, to organize, and to operate. In the administrative field, he is known as the organizer; in the laboratories, he builds instruments, sets up procedures, and puts them into operation; in the curriculum field, he starts with the function of an area and happily analyzes it, collects materials, organizes them, and tries them out…. To him the program is the thing. He gets pleasure, not from merely savoring an idea, but from building a structure and experiencing the satisfaction that comes from efficient operation. As the idea man is saying, "This is a grand idea," the educational engineer is saying, "These are masterly methods for carrying out the idea." "One loves to play with theories; the other loves methods. One enjoys argument; the other loves production" (Charters, 1945, p. 35).

This attitude, the passion for action, contributed to the way that educational technologists interpreted some of the concepts that were important to their field of study, specifically the concepts of science and engineering. Science and engineering were viewed in ways that would make them easy to apply in educational settings.

Charters anticipated four other ideas or issues that would be addressed frequently in the literature: (1) the prestige of the profession (Ely, 1963; Finn, 1965b); (2) educational engineering (or educational technology) as solving problems in education (Finn, 1960a; AECT, 1977); (3) the pattern of the scientific method (Banathy, 1968; Jorgenson, 1981); and (4) the idea that many individuals in education might be considered part of this new field (educational engineering or educational technology) because they perform some of the same tasks that are performed in the new field (AECT, 1972; AECT, 1977; Ely, 1982).

Finally, Charters argued that the engineering concept is a natural model for all people to adapt:

An engineer is a builder. He builds structures to fulfill functions. He is a solver of problems.... This is the essence of human intelligence the formal steps of reflection. It is the pattern followed in the scientific method and is the heart of the engineering method. It is the common possession of all people, the native pattern of intelligent life (Charters, 1945).

Two key concepts in this engineering analogy of education are reflection and scientific method. It is likely that Charters's discussion of reflection and scientific method was influenced by the writings of John Dewey, who was a contemporary of Charters. Although there are similarities between Dewey and Charters, there are differences as well. In 1929, Dewey argued "that, in concrete operation, education is an art, either a mechanical art or a fine art is unquestionable" (p. 635). Dewey further said that engineering is "in actual practice, an art. But it is an art that progressively incorporates more and more science into itself. It is the kind of art it is precisely because of a content of scientific subject matter which guides it as a practical operation" (Dewey, 1929).

However, Dewey also cautioned educators about the dangers of developing an attitude of engineering or engineering mentality toward the schools. Even though he felt that the engineering concept of education should not be immediately discarded, Dewey argued that if "the psychologist or observer and experimentalist in any field reduces his findings to a rule which is uniformly adopted, then, only, is there a result which is objectionable and destructive of the free play of education as an art" (p. 635).

Dewey was concerned about rigidity and standardization in the schools. Many proponents of science and engineering in education sought to identify and develop standardized rules for education. Dewey was concerned about the problems associated with developing standardized rules of teaching based on science. Dewey warned educators that:

…this happens not because of scientific method but because of departure from it. It is not the capable engineer who treats scientific findings as imposing upon him a certain course which is to be rigidly adhered to: it is the third or fourth rate man who adopts this course. Even more, it is the unskilled day laborer who follows it. For even if the practice adopted is one that follows from science and could not have been discovered or employed except for science, when it is converted into a uniform rule of procedure it becomes an empirical rule of thumb procedure just as a person may use a table of logarithms mechanically without knowing anything about mathematics (Dewey, 1929, pp. 635–36).

There are two major differences between Dewey and Charters on their views of science and engineering in education. First, Charters sought to engineer the systemization of instruction through a science that was intended to standardize processes and outcomes. Dewey opposed this algorithmic approach to a science and engineering of education.

The second major difference between the two centered on the scientific method and reflective thought. Charters (1945) equated the steps of scientific method and reflection with the method of engineering. Dewey (1929, 1933) and Charters (1945) agreed that there are five distinct stages in reflective thinking. For Charters, reflective thinking, as articulated in his engineering method, was a linear process, a procedure with definite starting and ending points. Dewey disagreed with the idea that reflective thinking was a linear procedure.

The five phases, terminals, or functions of thought that we have noted *do not follow one another in set order.* On the contrary, each step in genuine thinking does something to perfect the formation of a suggestion and promote its change into a leading idea or directive hypothesis. It does something to promote the location and definition of the problem. Each improvement in the idea leads to new observations that yield new facts or data and help the mind judge more accurately the relevancy of facts already at hand. The elaboration of the hypothesis does not wait until the problem has been defined and an adequate hypothesis has been arrived at; it may come in at any intermediate time. And…any particular overt test need not be final (my emphasis) (Dewey, 1933, pp. 855–56).

In addition to saying that there was no set order to the stages in thinking, Dewey further argued that "no set rules can be laid down on such matters" (1933, p. 857). He believed that reflective thinking "may be introductory to new observations and new suggestions, according to what happens in consequence of it" (p. 856). For Dewey, reflective thought and the scientific method were open processes. A process that allowed the problem under consideration or the hypothesis being tested to be revised based upon a preliminary consideration of the data that was gathered to solve that problem or test the hypothesis. Dewey also opposed the educational engineering advocated by Munroe (1912). He thought Munroe's "plant model" of education put practitioners in the role of industrial plant workers. Munroe's workers would use the methods generated by science and scientific management. Dewey wanted to have practitioners use their experience and reflective thought, as exemplified in his interpretation of the scientific method, to avoid falling into the trap of using standardized procedures in situations where they were not warranted.

Over the years, educational technologists have used the term "reflective thinking" but they were not often clear about what they meant by the term. Many of the early leaders were interested in generating "scientific" principles that would lead to replicable procedures that could be used to develop instructional methods and materials (e.g. Finn, 1960a; Sturlorow, 1961; Lumsdaine, 1964). Standardizing procedures is contrary to Dewey's conception of education as a "mechanical art" or engineering. In this regard, the early leadership of the educational technology field seemed to be more influenced by Charters's view of educational engineering than by Dewey's view of engineering in education or education as a mechanical art. This was an important step in generating the overall conceptual framework of educational technology.

Science

The second major influence on modern educational technology was the use of science in education. It is crucial to understand that there was more than one view of science in education because modern technology, and subsequently educational technology, is so closely associated with science. As such, it is important to understand which view of science had the most impact on the field.

Educational historian and curriculum scholar Herbert M.Kliebard (1987) identified three distinct views that were held by early twentieth-century educators regarding the purpose of science as it related to education. The first was to identify and study the "natural order of development in the child" (p. 89). This view of science, espoused primarily by G.Stanley Hall, posited that the educator should study children in their natural environment, collect and analyze data about these children, and then prescribe activities for their education based on the data that had been collected. The purpose of science here was to gather information about children so curriculum decisions could be better informed.

The second view of science in education was "Dewey's idealization of scientific inquiry as a general model of reflective thinking" (Kliebard, p. 89). Dewey was interested in using science as a model for teaching thinking skills (broadly conceived) to students. Here, science was to be both a basis for an instruction method and a primary subject matter to be taught. As subject matter, science was both a method and a body of knowledge generated by that method.

The third view "was a science of exact measurement and precise standards in the interest of maintaining a predictable and orderly world" (Kliebard, p. 89). There was no single person who acted as the primary advocate for this view; many scholars contributed to it. In this instance, science in education was a series of laboratory and experimentally derived methods that were used to screen and place students, establish the curriculum, determine the proper instructional methods, and test students. The object was to assure that the desired learning had occurred in an efficient and effective manner. The ability to predict and control the learning outcomes was the primary purpose of this view of science as it was used in education.

Arguments can be made that modern educational technology has, at one time or another, incorporated ideas and practices from all three of these views. For example, some might wish to argue that certain learning theories or instructional practices can be traced or attributed to Hall's "developmental science." Others might argue that the systems approach or the instructional development process is, in fact, a manifestation of John Dewey's view of the scientific method.

However, the view of science that is most representative in the workings of modern educational technology is the science of "exact measurement and precise standards in the interest of maintaining a predictable and orderly world" (Kliebard, 1987). This view is most evident in the early research in the field. However, the assumptions that accompany such an outlook are still present in much of the practice of the field today. Specific examples from the field include: the systems models, behavioral objectives, and task analysis used in front-end analysis; mastery learning techniques and criterion referenced testing; and the highly quantitative nature and design of experiments conducted by many researchers in the field. The purpose of science in education here is one in which outcomes could be predicted in advance, so as to minimize and control waste. In this way, the role of science in education begins to resemble the concept of educational engineering.2

Most individuals involved in formulating the field of educational technology have held that the purpose of science in education is based on prediction, control, and standardization (Finn, 1960b). This view of science was exemplified by the writings of James D.Finn, one of the acknowledged early leaders of the field of educational technology.

Finn came to prominence at the University of Southern California (USC) where he took a faculty position in 1949 after completing his doctoral work at Ohio State University under Edgar Dale. At USC, Finn played a key role in shaping the future of the field in at least four ways: (1) by leading the first academic department officially designated "Instructional Technology" in the United States; (2) by supervising the doctoral work of candidates, many of whom would go on to be influential leaders in the field; (3) by acting as a consultant to the U.S. Office of Education, from which he received funding to direct several major projects; and (4) by serving as a consultant to major national corporations.

Finn was also a prominent national speaker. In a speech delivered to the John Dewey Society (1962), he argued for the desirability of science in education. Finn used the example of Charters's work to respond to philosophical critiques of scientism in education.3

Scientism in those days was Charters and educational engineering and activity analysis; scientism today is B.F.Skinner and pigeons and programmed learning. Charters was demolished for inventing a system of curriculum making designed so it was charged to preserve the social status quo, and the measurement movement was subjected to blast after blast....

For those of you who follow Dewey, Bode and Kilpatrick, whose god was the method of science, this is, indeed a strange attitude. It was strange when they had it; it is stranger now...

Take...Charters theories of analysis...today, those theories are being used for identical problems by psychologists who never heard of Charters...analysis is needed in all sorts of programming, in the statement of objectives, and throughout the developing technology of instruction...

Analysis, in the sense that Charters used it and as it is being used today in a hundred ways, is, in part at least, the discrimination of details.... I suggest that because of a social bias characteristic of the 30's, the great exponents of the scientific method in education successfully struck down one of the great educational scientists of that generation and prevented a generalized scientific technique from becoming more effective in education (Finn, 1962, p. 72).

Finn is really arguing from the assumption that when science is applied in education, the result must be educational engineering. Furthermore, he assumes that a technology of instruction is desirable. Given his professional background, this is to be expected. But the reason that Dewey, Bode, and Kilpatrick opposed using analysis theories was that they did not believe that science, as represented by activity analysis, was equipped to determine educational goals (Bode, 1927; Saettler, 1990). They believed that goal setting in education was a philosophical and moral consideration. Although the scientific method is the basis for Dewey's conception of reflective thinking and although he viewed philosophy as reflective thought, he stands apart from using a "scientific" procedure to determine educational goals.

In his writing, Finn seemed to miss the point that there is, or was, more than one view of science in education. He accused Dewey, Bode, and Kilpatrick, "the great exponents of the scientific method," of striking down "one of the great educational scientists [Charters] of that generation." Here lies the importance of realizing that there are multiple views of science in education. Finn did differentiate between "exponents of the scientific method" and "educational scientists," but he does not account for the possibility that the view of science held by Dewey was much different from that held by Charters. In fact, it was. Charters believed that science could provide prescriptions for generating both the specific objectives and the definitive methods of education (Bode, 1927; Kliebard, 1987). For Dewey, clear and systematic thinking was the important objective of science in education. He was interested in using the scientific method to teach the scientific method (Dewey, 1916).

Finn was partially correct when he argued that a 1930s social bias opposed activity analysis as a way to build the curriculum. However, to attribute any disagreement about the role of science in education solely to social bias, excluding legitimate disagreements about "what science is," is to offer an incomplete argument. This is particularly true when the role of science in education is so crucial to the theory and practice that is advocated for the field. Finn also seemed rather oblivious to the fact that answering the question "what is science?" is a legitimate intellectual pursuit. He ridiculed the U.S. Congress and the National Science Foundation (NSF) for promoting the study of the philosophy of science.

As an amusing sidelight, the NSF has a brochure offering certain kinds of rewards to personnel in the various sciences and the "scientific" side of certain social sciences, for example, mathematical economics. Included, with approval, in the "scientific" studies is the subject of philosophy of science! To be fair, the NSF itself is probably not to blame. Congress and the conditions surrounding the use of funds have set these boundaries. The point, however, is still valid (Finn, 1960b, p. 143).4

Finn's writing is used here as an example. The purpose of the previous discussion is not to deride Finn but to show that individuals such as Finn, who were extremely influential in the early educational technology movement and in formulating the definitions of educational technology, held a limited and very specific conception of science and its role in education. To Finn, science was a "given." It did not have to be interpreted. It simply had to be discovered and directed toward practical tasks. The results then had to be tested and revised as necessary.

Audiovisual Education

The audiovisual education movement was the third major influence on the field of educational technology. Historically, the concept of "audiovisual education" had not been interpreted as widely as the concepts "engineering" and "science." Even for those individuals who called for the development of an educational technology, AV education was a concept that was initially based on hardware and equipment (Finn, 1960a). Much of this equipment for classroom use became readily available after World War II (Lange, 1969). Consequently, the popular belief has been that educational technology is the result of an evolution of the audiovisual education movement and is primarily a post-World War II idea (Lange, 1969; Saettler, 1990). This interpretation occurred despite the fact that the formal definitions of educational technology provided by the Department of Audiovisual Instruction (DAVI)

and the AECT were process definitions and had their roots in the educational practice of the progressive era.
One example of the belief that educational technology was an outgrowth of the audiovisual education movement is the work of the 1963 Commission on Definition and Terminology that was part of the TDP directed by James Finn. This group, led by Donald Ely, produced a definition of the field, then called "Audiovisual Communications," which later became the first definition of educational technology published by the DAVI (later the AECT). In the second chapter of the monograph (1963) the commission argued that "this analysis must begin with a consideration of the audiovisual field since it was here that the initial developments in the technology of instruction were largely concentrated. Audiovisual personnel were the first technologists in education." (Ely, 1963).
In his book, *The Evolution of American Educational Technology* (1990), Paul Saettler provided a detailed description of the effect the audiovisual education movement had on modern educational technology. The account of the AV movement provided here highlights the shift in the emphasis from the machine-based concept of the field to a systematic approach for improving instruction.
Although visual aids were used frequently in the nineteenth century (Anderson, 1962), educational technology literature states that the AV education movement began in earnest in the early 1930s (Ely, 1963; AECT, 1977; Saettler, 1990). In 1932, several professional organizations had merged into the Department of Visual Instruction (DVI) of the National Education Association (Ely, 1963; Saettler, 1990). This organization was primarily concerned with promoting and using visual aids in the schools. In the 1930s, visual aids were seen primarily as teaching aids, as enrichment for teachers' use in the classroom (Jorgenson, 1981).
The concept of the field as one of "teaching aids" gradually shifted toward an orientation of "audiovisual techniques to improve instruction" (McBeath, 1972). Charles F.Hoban, Jr. and Edgar Dale are generally credited as being two of the most important contributors to this shift in orientation (Ely, 1970; Jorgenson, 1981; Saettler, 1990).
Hoban received his doctorate under Dale's supervision at The Ohio State University. Hoban's 1937 text, *Visualizing the Curriculum,* which was written with his father (Charles F.Hoban Sr.) and Samuel Zisman, "was the most important textbook in the field in the 1930's because of its systematic treatment of the relationship between the concrete materials of teaching and the process of learning" (Ely, 1970, p. 84). This text also provided an often-cited definition of visual aids:
A visual aid is any picture, model, object, or device which provides concrete visual experience to the learner for the purpose of (1) introducing, building up, enriching, or clarifying abstract concepts, (2) developing desirable attitudes, and (3) stimulating further activity on the part of the learner.... Visual aids are classified according to general types along a scale of concreteness and abstraction (p. 910).

Hoban promoted a curriculum that included concrete learning experiences based on the use of visual aids. He offered many creative ideas for teachers to use in the classroom and also included a detailed discussion of how to integrate the instruction materials into the curriculum.
Dale advanced the case for diverse learning experiences in the classroom (Jorgenson, 1981). Dale originally came to the University of Chicago to study with Ralph Tyler. After several years, he took a position on the faculty at Ohio State University where he worked alongside Charters and Sidney L.Pressey.
In the first edition of his textbook, *Audiovisual Methods in Teaching* (1946), Dale explained his now famous “cone of experience.” The cone, he argued, served as a visual analogy to demonstrate the levels of “concreteness” of different teaching techniques and instructional materials (Dale, 1946). Dale believed that abstract symbols and ideas could be more easily understood and retained by the learner if they were built on a more concrete experience. “A well educated person has a mind stacked with a rich variety of concepts, grounded in concrete personal experiences. And such experiences are classifiable through a pictorial device a metaphorical ‘cone of experience’” (Dale, 1946, pp. 51–52) The cone represented a range of learning potentials from direct experience to symbolic communication: a concrete-to-abstract scale.
Dale’s cone of experience was a tool that melded the educational theory of Dewey and the ideas on learning posited by Donald Durrell (Dale, 1946). This was one of the first attempts by persons in the AV movement to build an instruction model that involved learning theory and AV materials and equipment.
The cone of experience became one of the most influential conceptual contributions to the growth of the AV movement (Saettler, 1990).
The cone was “perhaps one of the most useful, simple tools for media selection” (Briggs, 1980). Dale’s discussion of the interaction or dialectic between experiences, which included teaching methods and materials, provided a basis for investigating ways to help the learner understand increasingly abstract concepts. This discussion opened the door for further study of the methods and instructional techniques used by members of the AV field. It also signaled a movement away from the view that the field was solely concerned with “things,” or equipment, and production of instructional materials.
Hoban’s and Dale’s work did much to validate and promote the use of audiovisuals to improve instruction. Their efforts represent the beginnings of a subtle shift away from the view of the AV field as merely a teaching aid to a field involved in an integrated and systematically derived approach to using materials and methods in the classroom setting. Finn joined Dale and Hoban to produce an article for the 1949 Yearbook of the National Society for the Study of Education, titled “AV Methods of Instruction.” They stated that “audiovisual materials and devices should not be classified exclusively as ‘eye’ and ‘ear’ experiences. They are modern *technological* means of providing rich, concrete experiences for students” (my italics)

(Dale, Finn, and Hoban, 1949, p. 253). In the 1950s, Dale, Hoban, and Finn continued to steer the AV education movement away from an emphasis on equipment and things toward an emphasis on the means and processes involved in instruction.

Conclusion

By the 1950s certain ideas of engineering, science, and the AV education movement had begun to come together in both linguistic and conceptual ways. The writings of Dale, Hoban, and Finn had interpreted the AV concept as a technological means for improving instruction. This technological orientation was grounded in the production-oriented attitude of educational engineering and a science of education that focused on standardization and control. Attempts to establish a science of education gave rise to measurement- and prediction-based methods and outcomes that could easily be adapted to a procedural concept of educational engineering. The influence of engineering, science, and the AV education movement helped to shape the assumptions and goals of modern educational technology, particularly the early practice of the field.

Notes

1. For a detailed discussion of his engineering method in education, see Charters, 1945, specifically pp. 36–37, 56.
2. For specific examples, see Mager, 1962; Banathy, 1968; Bloom, 1968; and Saettler, 1990.
3. It is unclear if Finn is aware that “scientism” is a pejorative. He does not acknowledge this at any point in his text. Nor does he define his meaning of the term. However, to be fair, this article is based on a speech, and there may have been something in the delivery that is absent in the text.
4. It is interesting to note that while Finn disapproved of the NSF providing funding for studying the philosophy of science, he himself was not above using federal money, through the TDP, to fund the work of the Commission on Definition and Terminology that created the first formal definition of educational technology. It is not a long stretch to think that the entire conceptual study that was undertaken by the commission might fall under the rubric of the philosophy of technology! What is important here is that Finn must have believed that everyone knew what science was but not enough people knew what technology was.

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Chapter 2

1963—The Official Inception

The influences of science, engineering, and the AV education movement on educational technology can be seen in the formal definitions. The first in a series of three officially sanctioned definitions of educational technology was developed by DAVI's Commission on Definition and Terminology and supported by the TDP. It was published as a monograph by DAVI in association with the NEA in 1963:

Audiovisual communications5 is that branch of educational theory and practice primarily concerned with the design and use of messages which control the learning process. It undertakes: (a) the study of the unique and relative strengths and weaknesses of both pictorial and nonrepresentational messages which may be employed in the learning process for any purpose; and (b) the structuring and systematizing of messages by men [sic] and instruments in an educational environment. These undertakings include the planning, production, selection, management, and utilization of both components and entire instructional systems.
Its practical goal is the efficient utilization of every method and medium of communication which can contribute to the development of the learner's full potential (Ely, 1963, pp. 18–19).
Footnote five was part of this definition. It read: "The audiovisual communications label is used at this time as an expedient. Another designation may evolve, and if it does, it should then be substituted" (Ely, 1963, p. 18).
Audiovisual communications was the label used to describe the field in 1963, as it was evolving from the AV education movement to educational technology. Later, the leadership of the AECT acknowledged the 1963 definition as the first formal definition of educational technology, even though this statement was intended as a definition of audiovisual communications (AECT, 1977).

Theory and the Conceptual Shift

Three major ideas contributed to the formulation of this definition of educational technology as a theory. These three ideas demonstrate "conceptual shifts" or "conceptual reorientation" of prior views of the field. To understand how this definition of educational technology differed from prior views of the audiovisual field, one must understand the rationale supporting it. To understand the rationale, the commission stated that "it is necessary to reorient existing concepts which characterize the audiovisual field" (Ely, 1963).
The three major ideas were identified in the rationale for the definition as: (1) the use of a "process" concept rather than a "product" concept; (2) the use of the terms "messages" and "media-instrumentation" rather than materials and machines; and (3) the introduction of certain elements of learning and communication theory (p. 19).
Understanding these three conceptual shifts and how they acted on one another is crucial to understanding the idea of educational technology in 1963.
The commission believed that the traditional view of the field was product based. "The traditional product concept in the audiovisual field," the commission stated, "views the 'things' of the field by identifying machines, use of particular senses, and characteristics of materials by degrees of abstractness and/or concreteness" (p. 19). A technological concept of the AV field called for an emphasis on process.

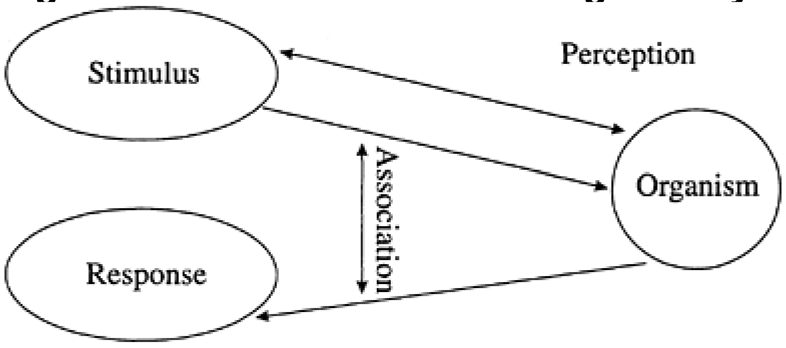
The commission preferred a process concept of the field that included "the planning, production, selection, management, and utilization of both components and entire instructional systems" (p. 19). This concept also emphasized "the relationship between events as dynamic and continuous" (p. 19). This process view made the product concept of educational technology untenable in a technological age.

To distance educational technology from its former product orientation, the commission chose not to use the terms "materials" and "machines" in its definition. Instead, it opted for the terms "messages" and "instruments." Materials and machines were identified as "things" or products. The commission argued that materials and machines were interdependent elements. "A motion picture and projector are inseparable as are all other materials requiring machines for their use" (p. 19).

One was of little practical use without the other. The commission used the concept of "media-instrumentation" to explain "instruments." "Media-instrumentation," the commission said, "indicates the transmission systems, the materials and devices available to carry selected messages" (p. 20). The concept of media instrumentation also included the people who used the instruments as well as the transmission systems in the educational environment. The thought that both people and instruments comprised media instrumentation was based in the concept of the man-machine system.

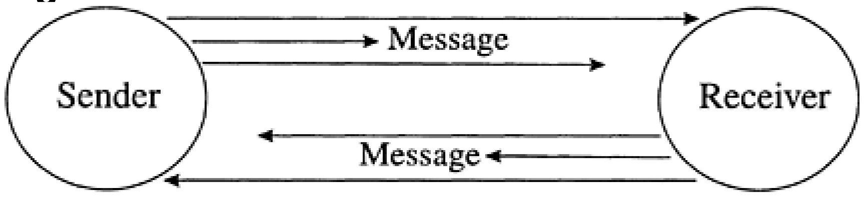
Finn (1960b), Bern (1961), and Hoban (1962) had advanced the man-machine-system view of the AV process. All three were associated with the TDP and the monograph produced by the DAVI Commission on Definition and Terminology. Finn had secured the federal grant that funded the project; Bern was a member of the commission that wrote the definition; and Hoban was a consultant to the commission. Sydney Eboch, also a member of the 1963 commission, used the term "media-instrumentation" instead of the term "man-machine system" in a conceptual study of the field (1962).1 The term "media-instrumentation" and the term "man-machine system" were used interchangeably in the literature of the field during this period. Man-machine system will be used here because, ultimately, it was more popular.

Figure 2.1. A Model of Learning Theory



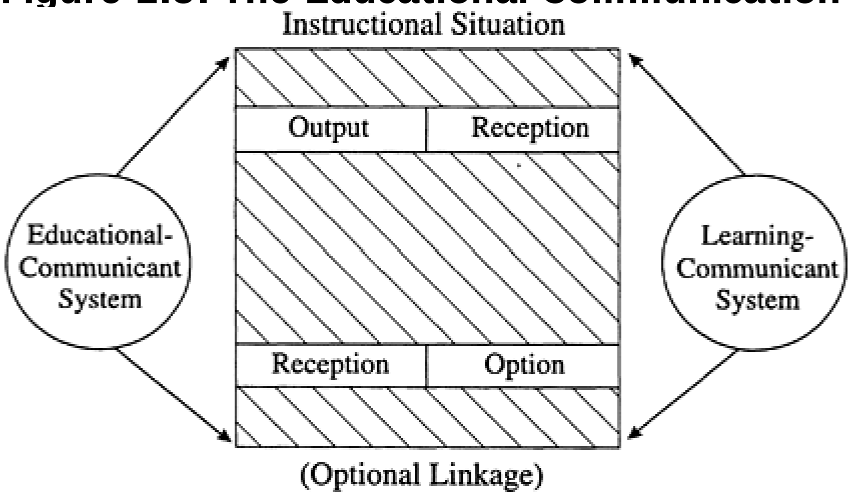
From Ely, D.P. (1963). The changing role of the audiovisual process: a definitionand glossary of related terms. *Audiovisual Communications Review*, 11(1), supplement 6.

Figure 2.2. A Model of the Communication Process



From Ely, D.P. (1963). The changing role of the audiovisual process: a definition and glossary of related terms. *Audiovisual Communications Review*, 11(1), supplement 6.

Figure 2.3. The Educational Communication Process



From Ely, D.P. (1963). The changing role of the audiovisual process: a definition and glossary of related terms. *Audiovisual Communications Review*, 11(1), supplement 6.

In discussing the relationship and integration of learning and communications theory to instructional technology, the commission stated that "certain elements of learning theory and communications theory offer potential contributions [to the field of educational technology]; e.g. source, message, channel, receiver, effects, stimulus, organism, response" (p. 20). The commission "integrated" (Ely, 1963) learning and communication theory into instructional technology by identifying and combining two systems that are basic to the process view of the field: the learning-communicant system and the educational-communicant system (see Figures 2.1, 2.2, and 2.3). These two systems use concepts from both the learning and communication theories. These theories delineated and specified the roles of the individuals involved in these systems. The learner-communicant system "refers to the student population" (p. 23), and the educational-communicant system "refers to the professional persons in the school" (p. 23). These two systems could be of any size, ranging from a single classroom to entire school systems (Ely, 1963). Merging these two communicant systems into a single model of the educational process provided the AV communications field with a theoretical framework (Ely, 1963), and allowed educational technology to be viewed as a theoretical construct (AECT, 1977).

The Theory

The fundamental tenet advanced by the writers of the first definition was that it was a "branch of educational theory and practice." The word "theory" was particularly important in this definition. Theory had a special place in the history of the audiovisual field. This was not necessarily because the word had a special meaning for those involved in the field, although later it acquired one (AECT, 1977), but because of the status that it conferred on the field. Numerous statements described the characteristics of a profession at the time the 1963 definition was written, but the one used by the field was written by Finn (1953). When considering the AV field as a candidate for possible professional status, Finn (1953) identified six characteristics of a profession:

...(a) an intellectual technique, (b) an application of that technique to the practical affairs of man, (c) a period of long training necessary before entering into the profession, (d) an association of the members of the profession into a closely knit group with a high quality of communication between members, (e) a series of standards and a statement of ethics which is enforced, and (f) an organized body of intellectual theory constantly expanded by research (p. 7).

Of these six characteristics of a profession, Finn argued that "the most fundamental and most important characteristic of a profession is that the skills involved are founded upon a body of intellectual theory and research" (p. 8). Having established the importance of theory and research for a profession, Finn further explained his position by saying that "this systematic theory is constantly being expanded by research and thinking *within* the profession" (p. 8). Finn was arguing that a profession conducts its own research and theory development to complement the research and theory development that it adapts or adopts from other academic areas.

Examining the possibility of an AV profession, Finn evaluated the field against each of the six characteristics. He determined that the AV field did not meet the most fundamental characteristic: an organized body of intellectual theory and research. "When the audiovisual field is measured against this characteristic…the conclusion must be reached that professional status has not been attained" (p. 13).

Whether one agrees with Finn's criteria and reasoning about professions in general, or the AV profession in particular, is not the issue here. What is important is that this argument was largely accepted by—and had a profound effect on—the leadership of the AV field.

Finn believed that the AV field was plagued by a "lack of theoretical direction" (1953, p. 14). He attributed this to a "lack of content" (p. 14) and the absence of "intellectual meat" (p. 14) in the meetings and professional journals of the field. In his argument promoting the development of a theoretical base for the audiovisual field, Finn warned:

Without a theory which produces hypotheses for research, there can be no expanding knowledge and technique. And without a constant attempt to assess practice so that the theoretical implications may be teased out, there can be no assurance that we will ever have a theory or that our practice will make sense (p. 14).

Finn dedicated his career to rectifying this deficiency in the field.

The claim that AV communications was a theory was an attempt to address the "lack of content" cited by Finn. Identifying the "undertakings" of audiovisual communications was a step toward providing some "theoretical direction" for the field. The commission identified "the planning, production, selection, management, and utilization of both components and entire instructional systems" (p. 19) as the tasks performed by practitioners in the field. These tasks were directly related to Finn's discussion (1953) of the "intellectual technique" of the AV field, his first criterion for a profession. Even though Finn was generally satisfied that "the audiovisual member does possess an intellectual technique" (p. 8), it was not clear just what that technique was. Finn described the technique as thinking "reflectively in such varied areas as the critical evaluation of materials, the visualization of abstract concepts, the improvement of instruction, and in many aspects of planning and administration" (p. 8).

When the commission identified the tasks performed by members of the AV field, it added some substance and direction to Finn's "to think reflectively." But Finn did not describe what he meant by thinking reflectively. It was not completely clear whether he was using the phrase as Dewey used it, or as Charters used it, or as something altogether different.

Dewey believed that reflective thinking was an open process where the problem or hypothesis could be reformulated based on a preliminary analysis of observations and data. Charters believed that reflective thinking was a linear process, the basis for the engineering method in education. Because Finn associated reflective thinking with a specific professional technique, one can infer that he was using the term as Charters had, as a basis for generating a definite procedure.

The first official definition of educational technology can be viewed as an attempt to bring together fragmented bits of theory, technique, and history, contained in the AV literature, into a coherent statement that would make up for the "poverty of thought" that characterized the AV education movement (Finn, 1953, p. 13). The development of AV communications (and later educational technology) as a theory added "intellectual meat" to AV practice (p. 13). Professional practice was strengthened when the commission merged the AV communications concept with the process orientation of the field into a new intellectual technique that was grounded in theory.

The Process

Many factors contributed to the development of the process view of educational technology, but two beliefs held by prominent individuals involved with the AV field were the most influential: (1) that technology was primarily a process (Finn, 1960b; 1961) and (2) that communication was a process (Gerbner, 1956; Berlo, 1960).

The idea that technology was a process was essential to the first definition of educational technology. The view that technology was primarily a process was a favorite theme of Finn (1957, 1960b, 1961, 1962). Although he was the acknowledged leader of the early "educational technology is a process" movement (Heinich, 1968; Ely, 1970; AECT, 1977; Jorgenson, 1981), Finn was not always consistent about the label that he used to describe what he meant by the complex processes involved in AV education.

Finn's earlier writings (1955, 1957) concentrated on the concept of automation in education. Analyzing the possibilities of automation for education, Finn wrote that "automation is not a manless [sic], machine-operated production. *Its primary characteristic is a process a way of thinking involving patterns and self regulation* (my emphasis). It is here that the educational implications are tremendous" (1955, p. 145).

Two years later, Finn produced the first in a series of three articles for *AV Communications Review,* "Automation and Education: General Aspects" (1957), about the potential for automation in education. In that article, Finn identified the important characteristics of automation and its associated processes as: "(a) the concept of systems; (b) the flow and control of information; (c) scientific analysis and long-range planning; (d) an increase in the need for wise decision making; and, (e) a high-level technology" (pp. 115–16).

Finn considered automation to be an expansion—an outgrowth—of technology (McBeath, 1972). The fifth characteristic of automation that Finn identified, that automation included “a high-level technology,” showed that at this point in his thinking Finn drew a distinction between automation and technology. Soon, however, this distinction became blurred. Finn frequently used the terms “technical” and “technology” in his early writings (1953, 1955, 1956). But it was in the early 1960s when Finn changed the focus of those educational processes that took him from automation to technology.

Finn spent a substantial part of his professional life trying to dispel the image that technology was just machines. In 1960 Finn wrote “technology, however, is more than an invention; more than machines. It is a process and a way of thinking” (1960b, p. 142). Continuing, Finn explained the relationship of technology to the instructional process by saying that

[one] must remember that, in addition to machinery, technology includes processes, systems, management, and control mechanisms both human and non human, and above all, the attitude discussed by [Charles] Beard a way of looking at problems as to their interest and difficulty [broadly conceived] of those solutions. This is the context in which the educator must study technology (p. 145).

In 1961, Finn made only minor revisions to his description of technology. In an article analyzing the AV needs for the preparation of teachers, he argued that “technology…is much more than machines; technology involves systems, control mechanisms, patterns of organization, and a way of approaching problems” (Finn, 1961, p. 209).

Opposing the view that technology is a device or series of devices, Finn argued that machines were “symbols…and must be thought of in connection with systems, organizational patterns, utilization practices, and so forth, to present a true technological picture” (p. 210). And later, as part of a speech delivered to the John Dewey Society in 1962, Finn said that “technology is not, as many of the technically illiterate seem to think, a collection of gadgets, of hardware, of instrumentation. It is instead, best described as a way of thinking about certain classes of problems and their solutions” (Finn, 1962, p. 70).

In 1957, Finn considered technology to be a necessary condition of automation. It is unclear if Finn consciously changed his position on this. His later writings, which focused on technology, may have been an attempt to clarify the concept of technology as a necessary part of the larger concept of automation. Or Finn may have simply decided to use the word “technology” instead of “automation” for reasons of his own. In either case, there are certain themes that continued to appear throughout his writing.

There is a great deal of similarity and consistency about the way in which Finn described automation and technology. He argued that automation was a process and a way of thinking (1955, 1957) and that technology was a process and a way of thinking (1960a, 1961). He further stated that automation included scientific analysis, planning, systems, and controls (1955, 1957) and that technology included systems, controls, and management and organization, or both (1960a, 1961). Finn's discussions of scientific analysis and planning in automation (1957) are very similar to his discussions of management and organization included in his references to technology (1961, 1962).

Although Finn's descriptions of automation and technology remained similar over the years, there is one important facet that did seem to shift within Finn's writing on technology: the relationship of technology to problem solving. In 1960, Finn viewed technology as "a way of looking at problems." In 1961, Finn stated that technology is "a way of approaching problems." It could be argued that "looking at problems" means defining problems, and that "approaching problems" also means defining them but includes the potential for taking some action to solve the problem as well. The phrases "looking at problems" and "approaching problems" both infer a way to begin to solve problems. Both words infer a certain "attitude" (Finn, 1960a) toward professional practice. It is the same attitude or love of action that was identified by Charters in his discussion of educational engineering (1945).

In 1962, there is a not-so-subtle shift in Finn's outlook that was carried on through his subsequent discussions (1965a, 1966) of technology and problem solving. It was his view that technology is "a way of thinking about *certain classes* (my emphasis) of problems." It is clear in this statement that he believed there were limitations to technology's problem-solving ability, that technology either could not solve—or should not be used to solve—all problems. Considering Finn's optimistic view of technology, one could easily conclude that his position before 1962 was that technology could be used to look at or approach all educational problems.

It is difficult to assess what prompted Finn to make this further clarification in his position. Perhaps it was the fact that this 1962 statement was part of his address to the John Dewey Society. The prospect of talking with educational philosophers may have provided Finn with a reason to reflect on his ideas concerning technology as a way of thinking. What is certain is that this shift in Finn's writing on technology remained for the rest of his professional life. The implication of this shift in Finn's writing is not recognized by those members of the field who describe educational technology as simply "a problem solving approach to education." Whether the particular subtleties are recognized and heeded or not, the view that educational technology was both a way of thinking and a process was established by the 1963 definition.

In a broad sense, the notion that educational technology is a process is firmly rooted in Charters's concept (1945) of educational engineering. The idea of educational engineering as a specific intellectual technique for the field of educational technology will be further examined in the "man-machine system" section of this chapter.

Communications
A fundamental starting point for studying the communications concept in me AV field was Harold Lasswell's discussion of the basic communication paradigm: "*Who* says *what* in which *channel* to *whom* with what *effect*?" (1948, p. 250). This is certainly not the first statement made about the communication process, but it had a marked impact on the thinking of the members of the audiovisual field (Finn, 1956; Hoban, 1956; Ely, 1963).
Ten years later, Lasswell said, "No change in the academic world has been more characteristic of the age than the discovery of communications as a field of research, teaching, and professional employment" (Lasswell, 1958). These statements were frequently referred to by those in the field whose studies focused on communications in education.
Communication theories and models were central to the early conceptions of educational technology. Briefly reviewing the different views of the communications process in the field of audiovisual communications will help illuminate why these early educational technologists adopted the view of communications that they did and what that decision meant for the field.
When the first definition of educational technology was formulated in 1963, the AV field already had a long association with the concept of communications. Discussing early textbooks, Jorgenson (1981) noted that "[Edgar] Dale had emphasized the importance of communication in his earliest teachings and writings. Indeed the first chapter of his 1946 text dealt with 'good teaching and communication'" (p. 35).
A more substantial link between the AV field and the concept of communications was forged in 1953 with the launching of the new professional journal: *AV Communications Review.* Contributors to the first issue included Charles F.Hoban Jr.; C.Ray Carpenter, one of the members of the President's Commission on Instructional Technology; Kenneth Norberg, a major contributor to the 1972 "Definition of Educational Technology" (AECT, 1972); James D.Finn, who authored the often-cited "Professionalizing the Audiovisual Field" for that issue (1953); and Edgar Dale, whose lead article was titled "What Does it Mean to Communicate?" In this article Dale argued that:
The launching of this Audiovisual Communications Review is a sign that we are seriously interested in audiovisual research and communication. The inauguration of this new journal is a sign that we are anxious to discipline our field by rigorous, analytic, systematic, objective study; that we think more time and energy should be given to the field of audiovisual research; and that this illuminating research will proceed best as it closely related to fundamental theories about *communication and learning* (my emphasis) (p. 5).

Dale accomplished two things in this article. First, he clearly stated that the AV field must be scientific in its research and studies. The view of science that Dale implied was one whose purpose was prediction and control, based on precise measurement of data, variables, and outcomes. Second, he set the tone for the theoretical and process-based activities that followed in the next ten years and provided part of the rationale was used to support the first definition.

There were two basic positions, or frameworks, for the theoretical study of communications in the AV field the social and the behavioral. These views may be considered as complementary. One way that social frameworks were distinguished from behavioral frameworks was by their philosophical perspective on communication and by the degree to which they described the communication act. Social frameworks accounted for more ideas. They viewed communication as being more complex than did behavioral frameworks. Social frameworks were more complete descriptions of communication than were behavioral frameworks. To some extent, the fact that one view was wider and the other more focused helped these two theoretical positions to better inform each other but it also led to some conflict.2

Social Frameworks of Communications

Social frameworks of communications in the AV communications field were represented by the writings of Edgar Dale and George Gerbner. Dale and Gerbner seemed to be more interested in the philosophical aspects of communication in education. Dale (1959) analyzed John Dewey's view of communication:

Communication is a process of sharing experience until it becomes a common possession. It modifies the disposition of both parties who partake in it. Dewey notes that the effect of such communication is "the improvement of the quality of experience." He also says that "by normal communication is meant that in which there is joint interest, so that one is eager to give and the other to take. It contrasts with telling or stating things simply for the sake of impressing them upon another, merely in order to test him to see how much he has retained and can literally reproduce."

The definitions suggest that effective communication is a two-way interaction in a mood of mutuality, that to communicate is to partake, to take part in an activity, not merely to inform but transform (p. 1).

Dale's interest in Dewey's discussion of communication and experience can be linked to his rationale for the cone of experience (1946). His theoretical framework drew heavily on the language and ideas of Dewey. Dale believed it would be easier for students to learn more abstract ideas if they could draw on their more concrete experiences and connect the two. One way to accomplish this is to present ideas in a very concrete form, something which can be easily and mutually experienced by students, and then move toward more abstract presentations of those and related ideas, to get at higher levels of meaning and complexity. For Dale, mutually sharing experience was the purpose of communication. And, he also believed, communication was a process.

George Gerbner completed his doctorate under James Finn's supervision at USC in 1955. Gerbner's model of communication was a rather detailed description of the communication event. He argued that a series of communication events are linked together to form the communication process. Discussing the possibility of a verbal model of communication, Gerbner (1956) wrote:

We can start with a communicating agent (source or destination) designated as *someone.* This communicating agent must perceive or have *perceived an event* of some kind in order to initiate or receive communication, and must *react* to the perception in some way. The nature of this reaction is influenced by the *situation* in which it takes place. The communicative reaction must be made through some mediating agents (channels, media) in other words *through some means*. It is transmitted in order *to make available* some communication *materials.* Materials must be *in some form* or pattern in order to carry a message. As the reaction to materials takes place in a situation, so every message is perceived *in a context*. All these aspects enter into the formation of *content*. And, finally, we can assume that *some consequences* always follow perceived content, whether or not it achieved a desired reaction (pp. 172–73).

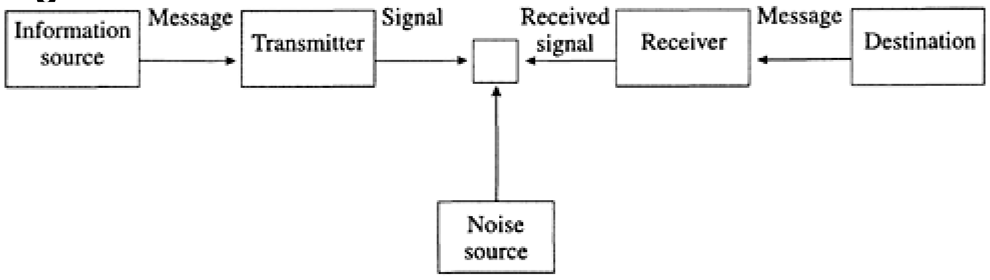
Gerbner's discussion of communication is less specific to education than was Dale's, primarily because Gerbner's interest in communication was more as an area of academic study in itself. This interest led Gerbner to the Annenberg School of Communications at the University of Pennsylvania, where he later became dean. Gerbner did, however, continue to contribute articles and chapters to edited books on communication in education throughout his career.

Gerbner's and Dale's analyses of communication in education are similar in that they both account for a context, a social situation in communication. Dale was interested in "a common possession," "sharing experience" and "mutuality." Gerbner wrote of "the situation in which it [communication] takes place," that it (communication) is "perceived in a context," and that "all these aspects enter into the formulation of content." Both of these discussions implied that the social setting plays a major role in the communication process in both perception and outcome.

Behavioral Frameworks of Communications
Communication frameworks labeled "behavioral" did not explicitly account for the role of social context in communication. These frameworks were represented by Claude Shannon and Warren Weaver's *Mathematical Theory of Communication* (1949) and David Berlo's (1960) sender, message, channel, receiver (SMCR) model of communication.

Shannon and Weaver's model was developed primarily for telephone and broadcasting technology (Saettler, 1990), but it was the basis for "almost every communication model which has been used in relation to instructional technology" (Ely, 1970, p. 85). Shannon and Weaver described communication as a linear, one-way process. The model replicated a communication system that involved external signal transmission and included the following parts: an information *source,* which produces a message; a *transmitter,* which relays the message over a *channel;* a medium used to transmit the signal; and the *destination* (the person or thing) for whom the message is intended. *Noise* was also an important concept in this model because it referred to interference with the intended message. "If noise is introduced, then the received message contains certain distortions, certain errors, certain extraneous material, that would lead one to say that the received message exhibits, because of the effects of the noise, an increased uncertainty" (Shannon and Weaver, 1949, p. 19) (see Figure 2.4).

Figure 2.4. Mathematical Model of Communication



Shannon and Weaver's "mathematical model" of a one-way linear transmission of messages. (From Shannon and Weaver, *The Mathematical Theory of Communication,* Urbana, IL, University of Illinois Press, 1949, p. 98.) Copyright 1949 by the Board of Trustees of the University of Illinois.

The presence of noise, or unintended information, was undesirable for the theorist or researcher because it could skew or present a confounding variable in a study. Noise was also undesirable for the practitioner who used such a communication model because noise reduced the certainty and control of the intended message. Although control relates to both science and engineering, here it was used in an engineering sense. It is a cybernetic view of control: that control takes place to ensure that a particular outcome, as the result of a particular process, occurs.

David Berlo, of Michigan State University, developed the SMCR model of communication that was based on the Shannon and Weaver model. It was the source of many communication concepts utilized by the field of educational technology (Ely, 1963; AECT, 1977). The concepts of sender and receiver used by Berlo were very similar to the concepts of source and destination used by Shannon and Weaver. The substantive difference between these two models was in Berlo's inclusion of the term "message" in the communication process and his explanation of "channel."

Berlo argued that the message was part of any communication scheme. The message was the content, the information to be transmitted. Shannon and Weaver's discussion of communication did not include the message as a central concept. Rather, their mathematical model focused on physical things, the source, the transmitter, the channel, and the destination. Physical things were easier to account for in mathematical/scientific study. Information was difficult to observe in quantifiable terms. Information could be conveyed, and sometimes represented by a particular physical channel or medium, but they were not one and the same.

Berlo's inclusion of message as a central concept in communication was so important to educational technology. Users of this model would have to account for the presence of messages as central to the communication process. If this model were to be generally considered by the AV field, messages had to be thought of as part of the communication process. And if the AV field aspired to become the AV communications field, then the new AV communications field had to come to grips with the concept of messages.

The 1963 Commission on Definition and Terminology addressed this problem by including the "design of messages" in the AV communications process, but left the task of message selection to others. It stated that "...*message selection occurs outside the context of the audiovisual design system.* This message selection might be considered as *one way of stating aspects of curriculum design*" (Ely, 1963). The commission seemed to believe that a division of labor between Audiovisual Specialists and Curriculum Specialists was desirable. This belief could be attributed to the commission's desire to remain true to the "systems concept" that was used to analyze the educational system, and then to determine the AV communications specialist's role in that overall system (Finn, 1956).

Berlo's discussion of channel was also a departure from the Shannon and Weaver model. Again, for Shannon and Weaver, a channel was a physical thing, such as a telephone. Berlo reoriented the concept of channel. Rather than consider a channel as a physical object, Berlo discussed channels in terms of the five human senses: seeing, hearing, touching, smelling, and tasting. The channel was no longer considered an object, but was seen in light of the human sense that would be used to decode the message.

This interpretation of the concept of channel was a process-based interpretation using attributes of the senses. The functions of decoding provided by human senses could be viewed as ongoing processes. These processes were central to communication but they alone were not sufficient to ensure that communication had taken place.

This interpretation of communication was of particular interest to the AV field because it could now view the communication process as more than just a series of mere information transmission experiences. This interpretation allowed the membership to design new and creative ways to combine messages and channels into educational experiences. This followed from Dale, Finn, and Hoban's (1949) discussion that AV education was more than just eye and ear experiences. Dale and Gerbner were involved in the AV field when the concept was being developed into educational technology. In fact, this interpretation supported the thesis advanced by Dale, Finn, and Hoban. Their discussions of communications were highly regarded by many of those involved in the educational technology movement (Finn, 1956; Hoban, 1956; Ely, 1963). But the subtleties and complexities of the implications of their work were not included in the discussions of communication that affected the 1963 definition, the first definition of educational technology.

Instead, AV communications and the emerging field of educational technology tended to adopt the communication structure of Shannon and Weaver (Ely, 1970). Rather than viewing communication as an attempt to share or move toward a convergence, AV communications was viewed as a one-way, linear act where messages were transferred from one individual to another. This was a view of communication as discreet and separate events rather than as a fluid process.

The reasons why the AV communications field tended to adopt the Shannon and Weaver and Berlo frameworks of communication could be attributed to the influences of engineering and the AV education movement on the field. The Shannon and Weaver model was a machine-based model of communication, and the AV education movement had been strongly associated with machines and equipment before 1963.

The Shannon and Weaver and Berlo models of communication were linear models and matched the linear process of educational engineering described by Charters. Shannon and Weaver hoped to minimize "noise" in the communication process, and this required controlling the process. The ability to control the educational communication process would result in more effective and efficient communication. Efficiency and effectiveness were considered important characteristics in the process of technology. An efficient and effective process required control. The Shannon and Weaver model and the Berlo model could be viewed as either descriptive or prescriptive models of communication. The Gerbner and Dale models were descriptive models. Like the Gerbner and Dale discussions of communication, the Shannon and Weaver and Berlo models described the communication process, but they could also easily be viewed as prescriptions for action; that is, follow these steps and you will communicate successfully. A model of communication that could prescribe specific action, when combined with an engineering approach, could become part of an intellectual technique of the field. According to the influential Finn (1953), a theoretically based intellectual technique was required for the AV field to gain professional status.

The prescriptive power of these models of communication also meant that they could help guide the activities of the "experimentation and development" phase of Charters's educational engineering concept. Charters thought that during this development phase something would be "built" or "constructed" (1945, 1951). Introducing a behavioral framework of communication ensured that certain considerations—such as channel and message—would be included in the product or process that was engineered.

The Gerbner and Dale discussions of communication offered a direction that few in the AV field seemed interested in pursuing. It was strongly implied in these models that the AV field would have to identify with such areas of academic study as sociology and anthropology, areas with which it had little or no past connection. The desire to become a profession, as stated by Finn (1953), required that the field focus on a specific technique, theories, and research. This specification called for intellectual specialization rather than academic diversity.

Learning Theory

Before World War II, the AV field was primarily interested in using machines and materials in the classroom (Saettler, 1990). After World War II, attention focused more on the process of learning, specifically the mediation of learning with instructional materials.

This shift in attention was influenced by the large number of psychologists and social psychologists who worked directly with propaganda efforts and military instruction during the war (Lange, 1969). Although there were advantages to the increased use of instructional materials in the schools, there were also problems. Military instruction had a level of specificity that schooling lacked. If precise behaviors could be identified, then the proper resources, methods, and tests could be used to gain that objective. Most of the psychologists that had recently come from the military required specific goals to develop and implement their research in terms of environments, performance, rewards, feedback, and outcomes (Lange, 1969).

Psychologists used several theories to investigate the connection between AV media and learning in the 1940s and 1950s. These included: perception studies, field theory, and developmental models (Saettler, 1968; Lange, 1969). However, the most influential research in the field was performed by behavioral psychologists (Finn, 1953; Ely, 1970; Saettler, 1990), especially the research into operant behavioral conditioning performed by B.F.Skinner (1953).

Learning theory and behavioral psychology influenced the AV field in three ways: (1) the development and use of teaching machines and programmed instruction; (2) the specification of educational goals into behavioral objectives; and, (3) the matching of concepts of operant conditioning with certain concepts in communication models (Ely, 1963).

Teaching Machines and Programmed Instruction

The advent of teaching machines and programmed instruction was influenced by three factors: the influence of science in education (Skinner, 1954; Saettler, 1990), the efficiency movement in education (Stolurow, 1961; Dale, 1967), and the desire to individualize the curriculum (Stolurow, 1961; Dale, 1967; Saettler, 1990). The first two factors are examined in this section of the study, and the third factor is considered in the section on individualized instruction in the following chapter, which discusses the central concepts of the 1972 definition of educational technology.

Skinner is often associated with the beginnings of the teaching machine, but it was E.L.Thorndike (1912) who provided the rationale for teaching machines and programmed instruction (Dale, 1967; Ely, 1970; Saettler, 1990). Thorndike addressed the foundational aspects of teaching machines and programmed instruction, such as individual differences, the organization of instruction, and the evaluation of learning (Dale, 1967; Saettler, 1990). Thorndike also understood the potential of instructional materials. In 1912 he wrote that:

If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print. Books to be given out in loose sheets, a page or so at a time, and books arranged so that the student only suffers if he misuses them, should be worked in many subjects (Thorndike, 1912, p. 164).

Thorndike was primarily interested in developing a science of learning. As such, he is rightly associated with the scientific view of education. Thorndike's view of science in education and his use of experimental studies and statistical methods place him in the group of educators who viewed the purpose of science in education as one that should deliver precise measurements and standardized results (Kliebard, 1987).

In addition to his desire to bring science to education, Thorndike was also influenced by the early efficiency and engineering movement in education. In his 1912 study he wrote that "great economies are possible by printed aids, and personal comment and question should be saved to do what it can do. A human being should not be wasted in doing what forty sheets of paper or two phonographs can do" (Thorndike, 1912, p. 167). Thorndike was not the first academic to view science in education as a way to develop a more efficient educational system; however, his scholarship did lend a great deal of credence to the proponents of the efficiency movement in education.

Thorndike was also well known for developing two laws of learning: the law of exercise and the law of effect (Leahey, 1980). The law of exercise held that:

Any response to a situation will, all things being equal, be more strongly connected with the situation in proportion to the number of times it has been connected with that situation, and to the average vigor and duration of the connections (Thorndike, 1911, as cited in Leahey, 1980, p. 294).
Thorndike's law of effect reads:
Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur (Thorndike, 1911, as cited in Leahey, 1980, p. 294).
Thorndike formulated these two laws while conducting laboratory studies on animals. He intended to develop and utilize a science of education based on controlled, experimental studies. He believed that these studies could be replicated through testing in the classroom.
The law of exercise was the basis for connectionism. As an application to education, connectionism was problematic for many of Thorndike's contemporaries for philosophical reasons. They believed that humans learn differently than animals. The law of exercise fell out of favor within 15 years of its initial publication (Bode, 1927). However, the law of exercise has been interpreted by some instructional designers as a partial scientific basis for the instructional strategy of "practice."
The law of effect became the foundation for Skinner's (1954) principle of reinforcement. The principle of reinforcement was, in turn, the basis for Skinner's theory of operant conditioning (Leahey, 1980). Thorndike provided the early theoretical reasoning behind teaching machines and programmed instruction, but it was Sidney L.Pressey who put Thorndike's ideas into operation by developing and testing one of the first mechanical instructional products.
Pressey has been credited with developing the first "teaching machines" in the early 1920s (Deterline, 1962; Dale, 1967; Saettler, 1990).3 Pressey adopted Thorndike's overall rationale for the use of materials in instruction as well as the law of effect in his instructional devices (Skinner, 1968; Saettler, 1990). The machines Pressey produced were "essentially multiple choice testing devices" (Deterline, 1962, p.9). These machines allowed for, but did not include, continuous instruction. The actual instruction was conducted separately from the use of the device. The device used multiple-choice questions to test a student's knowledge of a given topic. If the student answered the question correctly, the next question appeared. If the student did not answer the question correctly, the same question remained until it was answered properly. The machine recorded all the answers attempted by the student (Deterline, 1962; Saettler, 1990), providing a record of the right and wrong answers for each question. The machine provided immediate feedback to the student by changing the correctly answered question. It was also possible to attach a dispenser

to the instructional device that would give the student candy lozenges if a preset number of correct answers were provided by the student (Saettler, 1990). Pressey demonstrated that immediate feedback, paired with positive reinforcement, could enhance the learning process (Deterline, 1962).

Pressey, like Thorndike, believed that the purpose of science in education was to use the standardized and precise measurements of science to generate standardized and precise results in learning. The goal was to predict learning outcomes based on the learning theory and the teaching methods that were used.

Lacking funds, Pressey discontinued his work with teaching machines in 1932 (Saettler, 1990). Despite some improvements in the auto-instructional concept during World War II, the use of teaching machines and programmed instruction remained largely dormant until Skinner began his research in the 1950s (Deterline, 1962; Jorgenson, 1981; Saettler, 1990).

Following Thorndike's law of effect, Skinner's basic law of operant conditioning stated that "if the occurrence of an operant is followed immediately by the presentation of a reinforcing stimulus the strength probability (of recurrence) is increased" (Skinner, 1953, p. 37). This made reinforcement the central theme of the operant-conditioning strain of behavioral learning theory.

Skinner's position was that the relationship of operant conditioning to education was direct. He argued that "teaching is the arrangement of contingencies of reinforcement under which students learn" (Skinner, 1968, p. 64). It was not surprising then, that Skinner defined a teaching machine as "simply any device which arranges contingencies of reinforcement (and that) there are as many different kinds of machines as there are different kinds of contingencies" (p. 65).

Skinner believed that teaching machines were essential to the instructional process. He argued that "we have every reason to expect…that the most effective control of human learning will require instrumental aid…as a mere reinforcing mechanism, the teacher is out of date" (Skinner, 1954, pp. 21–22). This last statement put Skinner at odds with many in the teaching profession.

Skinner wanted to efficiently schedule reinforcements. To do so, he made them contingent on moving toward the desired behavior rather than waiting until after the terminal behavior had been reached. This was behavioral shaping. He argued that:

The whole process of becoming competent in any field must be divided into a very large number of small steps, and reinforcement must be contingent upon the accomplishment of each step…. By making each successive step as small as possible, the frequency of reinforcement can be raised to a maximum, while the possible aversive consequences of being wrong are reduced to a minimum (Skinner, 1953, p. 153).

In addition to providing more opportunities for reinforcement, dividing a terminal behavior into small steps was also a prerequisite for establishing proper sequencing for the instruction. "The segments must be arranged so that the student is properly prepared for each when he reaches it" (Skinner, 1968, p. 209). The process of organizing the instruction in this way became known as programming. The product that resulted from this process became known as the program (Deterline, 1962; Finn, 1960b; Skinner, 1953).

Operant conditioning was based on two important assumptions. First was the assumption that "when all relevant variables have been arranged, an organism will or will not respond. If it does not, it cannot. If it can, it will" (Skinner, 1953, p. 112). The second assumption was that all behaviors must be described in overt, observable terms. Any discussion of non-observable phenomena was unscientific and not worthy of further study (Leahey, 1980). These two assumptions soon became essential conditions for many who studied the learning process. The first assumption shows that proponents of operant conditioning viewed motivation as being primarily an external force. The idea had important implications for designing instruction.

Proponents of behavioral learning theory concluded that learning could be studied in a scientific manner and that learning occurred because the desired observable behaviors occurred. Teaching machines required that the learners develop and display answers to posed questions or problems before they were reinforced. This provided overt and quantifiable data for further study and generalization. These beliefs clearly revealed a view of science in education in which the purpose was to be able to predict and control learning based on experimental and laboratory practices.

Teaching machines introduced members of the AV field to the principles of operant conditioning (Lange, 1969). Soon after becoming familiar with this theory of learning, many members of the field became interested in the process of programming. Finn (1960b) pointed out that the AV field had long been affiliated with the programming concept. Finn argued that, even though there were different kinds of programming strategies and approaches used for different types of machines, they all shared certain fundamental principles, and it was the program that actually delivered the instruction and not the machine. Finn said, "the device per se is not important except as a vehicle for the *program*" (1960b, p. 203). Machines and devices were no longer essential to the programming process. Programmed instruction, a print-based medium, was gaining popularity.

Emphasizing the importance of programming, Finn continued that "the heartland is programming. He who controls the programming heartland controls the educational system" (p. 154). Finn pleaded with the membership to spend less time with "gadgets" and more time with the instructional principles that would be used to prepare the programming in machines and devices. Programming, based on scientifically derived instructional principles, would be both a source of research and theory for the AV field. Further, programming would also enhance the field's status as a profession by improving its professional intellectual technique.

Lawrence Stolurow (1961), who had been a graduate student with Skinner, claimed that the purpose of programmed instruction was to increase the efficiency of instruction. Stolurow admitted that a number of the principles involved in programmed instruction had been used previously and had failed to substantially increase instructional efficiency. Stolurow attributed this to the fact that these principles had not been properly organized into a complete method. He stated that his effort was based on a fundamental reexamination of the concept of instruction itself. Stolurow argued that this reconceptualization "proposes the integration of learning and instruction as provided by the systems concept, coupled with a direct effort to implement the emerging modern learning theory and results of current research by building them into the instructional system" (Stolurow, 1961, p. 4).

Stolurow explained this instructional system as "the teaching-learning process… as communication and control taking place between the components of a system. In this case, the system is composed of a teacher, a program of instruction, and a student, all in a particular pattern of interaction" (p. 4). Having finished reorienting the concept of instruction as a system, Stolurow completed his argument for the likelihood of increasing instructional efficiency by studying systems when he said that "the problem of efficiency now becomes one of optimizing man-machine functions, the basic problem of systems engineering" (p. 6). Stolurow's emphasis on using behavioral learning principles to increase learning efficiency pointed to systems engineering as the answer to instructional improvement. For Stolurow, science contributes the theory to engineering's problem-solving processes for educational advancement.

The interest by the field in operant conditioning, teaching machines, and programmed instruction (e.g., Lumsdaine and Glaser, 1960) demonstrated the influence of the predictive view of science in education, the construction view of educational engineering, and the AV education movement on the emerging field of educational technology. It also introduced two new thoughts to the field of AV instruction: (1) that educational technology was applied learning theory, specifically a verifiable learning theory (Lumsdaine, 1964) and (2) that product development required the systematic testing and revision of instructional materials (Finn, 1965a). These two ideas became linked and resulted in the general impression that scientific research and theory preceded technological research and development.

Behavioral Objectives

The fact that behavioral objectives grew out of curriculum development efforts in the early twentieth century was important to the field of educational technology because it connected educational technology to a theory of curriculum and some aspects of educational philosophy. It also showed that "technological development," in this case the development of behavioral objectives, did not always follow from scientific research and theory.

Lumsdaine and Glaser (1960) discussed the importance of behavioral objectives in developing an educational technology. They stated that "instructional materials and practices [that] must be designed with careful attention to the attainment of explicitly stated, behaviorally defined educational goals" (p. 572).

Contrary to a popular current belief, behavioral objectives were not a direct outgrowth of behavioral learning theory. They were the stated goals that the practitioners must have to apply behavioral learning theory. Although it is true that behavioral objectives were important to the development of teaching machines and programmed instruction, behavioral objectives grew out of the early studies of the curriculum (Washburne, 1925; Jorgenson, 1981; Saettler, 1990). They were used to develop curriculum before teaching machines existed.

The introduction of behavioral objectives as a way of organizing instruction has been attributed to the writings of Franklin Bobbitt and Charters (Callahan, 1962; Eisner, 1967; Kliebard, 1987). Bobbitt's book, *The Curriculum* (1918), provided a scientific and theoretical rationale for curriculum development, based on Frederick Taylor's (1911) concept of scientific management. Bobbitt advocated using the analysis techniques of scientific management to determine the goals and objectives to be taught in the schools. A major thrust of Bobbitt's approach was to standardize the subject matter of individual school districts. In this way, Bobbitt, like Thorndike, was an advocate of the science of education that was intended to standardize outcomes and increase efficiency. But their primary emphases differed. Thorndike was primarily interested in developing an educational science. Efficiency would be one outgrowth among many of a mature science of instruction. Conversely, Bobbitt was primarily interested in eliminating waste in schools. To this end, he advocated using whichever scientific techniques were applicable, to the end of making things more efficient in the schools.

Bobbitt's *How to Make a Curriculum* (1924) put this scientific theory of his earlier volume into operation. In this book, he identified the major areas of daily life skills and experience to be dealt with by the schools. He argued that the school should use objectives that were prespecified and exact. Bobbitt (1924) provided a list of more than 150 examples of the type of objectives that he advocated. A sampling of the range and type of objectives he provided as examples included:

- Ability to pronounce one's words properly (p. 11)
- Ability to spell the words of one's writing vocabulary (p. 12)
- Ability to avoid preventable accidents (p. 14)
- Ability to control sex functions in the interests of physical and social well being (p. 14)
- Ability, habit, and disposition to follow the leadership of the world's Men [sic] of Vision (p. 26).

Bobbitt viewed education as a preparation for life. He advocated a form of activity analysis as a tool for determining the objectives to be taught in the schools. The activities occurring in society were identified and studied. The abilities that were deemed necessary to perform the activities of society were then articulated into objectives. The objectives were then to be taught as the subject matter of the schools.

At least three things can be concluded about Bobbitt's work with objectives in education. First, it was an attempt to use objective science as a way to generate the goals of education. That is, he intended scientific analysis to be used as a method to determine educational ends (Bode, 1927; Kliebard, 1987; Saettler, 1990). Second, it was a socially conservative approach to education because it was primarily concerned with preparing individuals for current and existing social activities rather than preparing them for what may or should occur in the future of society (Bode, 1927; Kliebard, 1987). Third, the level of the objectives suggested by Bobbitt were not of the same level of specificity that was to develop later during the behavioral objectives movement of the 1960s.

Charters, like Bobbitt, was a proponent of applying science to education. Early in his career, Charters (1924) detailed the curriculum development steps that should accompany the identification of the "ideals" or objectives of education. At some points in his career, Charters seemed to follow Bobbitt's idea that objectives should be derived from scientific analysis (1921, 1926). But at other times, Charters took a different position. He argued that scientific analysis should occur after the direction of education has been established. "The philosopher sets up the aim, and the analyst provides only the technique for working the aim down into terms of a curriculum" (1924, p. 22). Charters did not provide a reason for this shifting in his emphasis, but it is likely attributable to his view of the difference between vocational and general education. It seems as if Charters believed that analysis should precede specifying objectives when preparing an individual for a "vocation" or determining a vocational education curriculum (1921, 1926). When preparing a general education curriculum he argued that the aims should be established by philosophy and that this should be followed by scientific analysis (1924).

The practice of breaking down large aims or goals into specific objectives is followed by many present-day instructional designers in what is called "task analysis" (e.g., Reigeluth, 1983; Dick and Carey, 1990). Charters often used the phrase "job analysis" for this practice (1921, 1924). Using the phrase "job analysis" demonstrated the conceptual ties between Taylor's industrial scientific management, scientific curriculum making, and engineering-oriented approaches to education.

Charters's method of analysis, or one much like it, was incorporated into Skinner's principles of reinforcement. Skinner required that basic competencies must be broken down into small steps so reinforcement could occur at frequent intervals. Breaking a competency into small steps through activity analysis would have to precede the application of the theoretical principle of reinforcement. Skinner's use of analysis techniques was an example of a science of education following from a technology rather than technology being the application of scientific principles.

Bobbitt and Charters were not the only educators in the early twentieth century writing about objectives in schooling. John Dewey (1916) also wrote about the objectives of education. But the sources and purposes of objectives in education for Dewey were much different from those of Bobbitt and Charters. Dewey considered education as growth in life rather than as preparation for life (Dewey, 1916). As such, in Dewey's opinion, objectives were intended to bring about the growth of the individual rather than preparation for the activities of society.

Ralph Tyler of the University of Chicago followed in the footsteps of Bobbitt and Charters. Tyler is best known for his book *Basic Principles of Curriculum and Instruction* (1950), which became a classic reference for developing and evaluating the curriculum based on specifying objectives. Tyler argued that "educational objectives should become the criteria by which materials are selected, content is outlined, instructional procedures are developed, and tests and examinations are prepared" (p. 3).

Tyler suggested a four-step sequence for developing the curriculum: (1) identify the objectives, (2) select the strategies and methods to attain the objectives, (3) organize these methods and strategies, and (4) evaluate whether the objectives have been met. Tyler also identified the three primary sources of objectives: the learners, society, and the subject matter. These objectives were then filtered through two "screens": (1) the philosophy of the school and (2) the principles of learning and child psychology. Before Tyler's work, the three sources of objectives had been identified by other educators (Bobbitt, 1918; Charters, 1924; Kilpatrick, 1925b; Bode, 1927), and the role of philosophy in determining educational objectives had been a subject of discussion (Dewey, 1916; Charters, 1924; Bode, 1927). Tyler brought these two ideas together and made them an important consideration in curriculum studies.

Tyler's two major contributions to the utilization of behavioral objectives in the schools were the development of a rational technique for developing a curriculum based on objectives and "screening" the principles of learning and child psychology.

Tyler's rational technique of developing the curriculum had similarities to Charters's (1945) discussion of the engineering method in education. Both are considered linear processes (Kliebard, 1987). They both began by setting goals or determining a problem, they continued by determining or developing a particular strategy to attain the preset goals, and they concluded by evaluating the results of the strategy to see if the goal was attained or the problem was solved. Both Tyler and Charters took great care to distinguish between the instructional goals or the instructional problem and the methods or strategies used to attain the goal or solve the problem. There was a clear means-ends distinction in the Tyler approach to curriculum construction and the engineering method in education.

In Tyler's view of science in education, there was less emphasis on prediction and standardization than with that of Charters. Tyler's rationale allowed for a psychology that included ideas based on the child development work of G.Stanley Hall and Jean Piaget. Including scientific principles based on psychology enhanced the role of science in determining the teaching of specific objectives. Techniques for analyzing activity were now accompanied by psychological studies to determine the best time to teach certain objectives and how those objectives should be taught.

Tyler is credited with coining the phrase "behavioral objectives." However, many of the objectives he believed in, such as appreciation and enjoyment, would not be considered valid or reliable by more recent advocates of behavioral objectives. Many behavioralists would have a problem with some

of Tyler's educational objectives because they could not be directly observed. This inability to measure outcomes interfered with the further development of a scientific approach to education.
Tyler is most often remembered for his statement, "Education is a process of changing the behavior patterns of people" (1950, p. 56). This statement has been taken literally by many involved with education, especially those interested in behaviorism. As a consequence, Tyler's rationale has been used extensively by those in the behaviorist camp (Jorgenson, 1981).
Robert Mager is considered by many to be the father of modern-day behavioral objectives (Briggs, 1977; Eisner, 1967; Popham, 1979). He is the person most responsible for associating the term with empirical and quantifiable outcomes. Mager developed his formula for preparing instructional objectives when he was working for the Air Force in the late 1950s. Mager's *Preparing Objectives for Programmed Instruction* (1962, later reprinted as *Preparing Instructional Objectives*) identified three components that must be included in good objectives: (1) the specific action or behavior that the learner will be performing when the objective is achieved; (2) the important conditions under which the specific behavior will occur; and (3) the criterion of acceptable performance.
The desire to further develop a standardized science of education made behavioral objectives a necessary aspect of programmed instruction and an important aspect of process-based educational technology. Behavioral learning theory required specific observable events to verify that learning had occurred. Behavioral objectives that met the complete specification of Mager's three components ensured that when learning occurred, it could be scientifically observed and measured. This resulted in an operational model that was based on theoretical principles. Mager's principles were widely accepted by professional educational technologists.

Linking Ideas from Learning Theory and Communication Theory

The concepts of learning and communication were linked in numerous ways in the early literature of educational technology. Learning and communication were both considered processes (Finn, 1960a; Ely, 1963; Berlo, 1960). Learning and communication could both be viewed in terms of systems (Finn, 1960a, 1961; Ely, 1963). Learning and communication were both fundamentally involved with "control" (Shannon and Weaver, 1949; Skinner, 1954; Ely, 1963). And the intent of both learning and communication was to modify behavior (Cook, 1959; Carpenter, 1960).
All four of these similarities between learning and communication are important to the 1963 definition of educational technology. They are important because they all contributed, to some degree, to the definition itself and to the rationale that supported it. The last two ideas, that learning and communication were fundamentally involved with control and modifying behavior, are of particular interest now.

"Control" was a key word in the 1963 definition: educational technology was the study of messages that controlled the learning process (Ely, 1963).

Associating both learning and communication with control and behavior modification was an intentional decision made by early educational technologists. In doing so, they chose a particular view of communication and learning, one that paired the use of these concepts with those from a view of science in education whose primary interest was prediction, measurement, and a linear view of educational engineering.

Leaders in the field adopted the behavioral framework of communication because it fit with an engineering approach to education. Behavioral learning theories came to prominence in educational technology not only because they were consistent with the prevailing view of science held by early educational technologists, but also because behavioral learning theories fit well with the concept of educational engineering, the basis of the intellectual technique that was being developed by the field.

Control

According to the principles of operant conditioning (Skinner, 1954), learning is a change in behavior. Behavior can be modified most efficiently and effectively if reinforcement is properly scheduled. Learning, then, takes place most efficiently and effectively if the necessary reinforcement is properly controlled. Therefore, control became a necessary and desirable part of the teaching and learning process for many of the early educational technologists. But the term "control" had different meanings in different contexts in the field of educational technology.

Writing about training in agriculture, John Cook argued that "the modification of behavior is so central to the process of communication [that] we can approach communication as a problem in learning" (Cook, 1959, p. 257). The purpose of communication and the result of learning were the same thing: they both sought to modify behavior (Cook, 1959).

Communication and learning both required control. But the word "control" had a slightly different meaning in the behavioral framework of communication than it did for behavioral learning theory.

Educational technologists, such as Hoban (1956), and Finn (1960a, 1961), discussed control as "communication control mechanisms." This was a conception based in cybernetics (Weiner, 1948). Control in communication was equated with formal feedback (Weiner, 1948; Jorgenson, 1981). Control mechanisms were formal feedback mechanisms. A feedback mechanism was an established communication channel that was intended to inform a communicant that a message had been received or received and evaluated or both. The difference between control as feedback in communication and control as reinforcement in operant conditioning was that reinforcement was the intentional act of providing rewards for desired activities or outcomes. Control as feedback was the response to a communication event. This feedback can be either positive or negative. Both positive and negative feedback could modify behavior.

To the writers of the 1963 definition, learning and communication were processes that resulted in behavior modification by using control mechanisms for learners and the learning process, as well as for the instructional delivery process. The dominant control that was exerted over the learner and the learning process was positive reinforcement. The control that was exerted over the instructional process was evaluative feedback. This feedback could be either positive or negative. Feedback was presumed to ensure that the intended communication occurred and that, if it had not occurred, adjustments to the message and the channel could be made in order to ensure that it would occur in the future.

Another aspect of the term "control" in educational technology involved the ability to replicate instruction results. This included the idea that there were controlled studies or laboratory-based studies that were used by researchers in the field to generate and validate prescriptions for action. These controlled studies sought to guarantee or control the desired results in actual practice.

The term "control" in the definition of educational technology resulted from the influence of a particular view of science in education and the engineering approach in education. It brought together ideas from the "science" of operant conditioning (control as reinforcement) and ideas inherent in research and development models that were central to the concept of engineering (control as feedback). The science of standardized measurements and the concept of educational engineering based on standardized procedures became important factors in the early conceptions of educational technology.

The Man-Machine System

The concept of "systems" had many uses and applications in the AV field during the 1950s and 1960s (Heinich, 1968). Bela Banathy (1972) observed that "a great deal of semantic confusion surrounds the term 'system' and its derivatives in educational technology" (p. 73). In its broadest sense, there were two distinct, yet interrelated, uses or purposes of the concept of "systems." These purposes were descriptive and prescriptive. These uses were interrelated because the ability to prescribe systems depends greatly on descriptions of existing or desired systems. As one might surmise, system descriptions tend to precede prescriptive uses of the systems concept. The history of the use and development of the systems concept in the AV field bears this out.

The concept of systems was formalized by the United States Armed Forces at the end of the 1940s (Finn, 1956; Saettler, 1990). The systems concept was used as a way to describe the organization of agencies, people, machines, and procedures to accomplish specific tasks and desired outcomes. Using the systems concept soon spread into "many industrial, scientific, business, and governmental sectors" (Saettler, 1990, p. 351). The development of the systems concept was felt in the educational field by the mid-1950s (Jorgenson, 1980). It reached the AV field at about the same time (Finn, 1956; Saettler, 1990).

Finn (1956) formally introduced the systems concept to the audiovisual field. He described and related the systems concept to operational analysis—a management research and development technique—that was used to study organizations. Finn said that

Essentially, the *systems* concept is an idea of organization. It is an idea of organization that includes what might be called the gestalt or whole function of a unit or organization. Thus, in advanced management research circles today, "men machine systems" and "machine systems" are carefully set up and studied (Finn, 1956, p. 190).

Finn's purpose for introducing the systems concept was to modernize school administration and management, specifically as it related to the AV field. To do this, Finn described the school AV program as a system. He argued that "an audiovisual program...is a clear-cut *system*.... It is a man machine system" (p.191). The system, Finn continued, was composed of "people teachers, administrators, students, clerical, and technical help; materials, machines, and other systems (delivery, for example); and outside institutions dealers, producers, and distributors, to name some of the larger units" (p. 191).

Finn claimed that the systems concept could be used to improve the efficiency of AV programs by eliminating waste in two ways: (1) it would clarify the roles of personnel involved in the AV program, and (2) it would be an essential consideration for physical plant development.

At this point, Finn used the concept of systems to *describe* the organization, roles, and functions of the personnel, machines, instructional materials, and other resources, which together were intended to support the delivery of instruction. Finn was describing an administrative system. The concept of system that Finn introduced was organizational systems analysis. The purpose of organizational systems analysis was to describe and analyze *existing* entities, systems, to clarify organizational goals and increase organizational efficiency.

Finn later (1957) discussed the systems concept as it related to "automation" and "technology." Finn argued that systems were necessary characteristics of automation (1957) and technology (1960a; 1961). In 1960, he moved the focus of systems in the AV field away from administration to instructional planning and delivery (McBeath, 1972). Finn used the concept of system or systems analysis as a way to describe and understand existing instructional systems.

In 1961, Finn began to shift his use of the systems concept from description to prescription. Finn stated that "when W.W.Charters...spoke of educational engineering he was at least partly referring to the planned use of the media of communication in instruction.... We have not only invented many small but useful gadgets, but we have also developed the first man-machine systems of instruction" (Finn, 1961, p. 14).

The "development of man-machine systems" inferred that the systems idea could be used to generate new systems in addition to studying existing systems. Just before Finn's (1961) discussion of the "development of the first man-machine systems of instruction," C.Ray Carpenter (1960), an educational psychologist at Pennsylvania State University, provided a rationale for the prescriptive design for the "man-machine systems approach":

A systems design for an educational enterprise would provide: A conceptual framework for planning, orderly consideration of functions and resources including personnel and technical facilities such as television, the kinds and amount of resources needed, and a phased and ordered sequence of events leading to the accomplishment of specified and operationally defined achievements. A *systems approach* should provide a way of checking performances of all components to factors of economy and should reveal any inadequacies of the several components, including the faults of timing and consequently of the entire system (p. 75).

The central thought behind the man-machine systems concept was that it made little sense to design machines without considering the human operators or to design human jobs without considering whether some tasks could more appropriately be delegated to machines. "It was the system as a whole which needed to be optimized" (Eraut, 1985, p. 16).

Carpenter provided a prescriptive use for the systems concept. He may have been the first to use the term "systems approach" for prescriptive purposes. This use of the term was pivotal to the development of the systems concept in educational technology and to the field of educational technology itself. No longer was the systems approach a mere description of what was occurring inside an existing system. The systems approach was now a way to plan and operate a system; it was a prescription.

But Carpenter did not originate the term "systems approach" in the AV field. In his keynote address to the DAVI leadership conference at Lake Okoboji, Iowa, in 1956, Charles F.Hoban Jr. used the term to describe a way to study the communication process to assure the efficiency and effectiveness of AV programs. Hoban had used the term "systems approach" to study existing systems; it was a descriptive use of the term. Carpenter, like the early Finn, saw the systems concept as a way to study organizations. Unlike the early Finn who used the systems concept to analyze existing organizational structures, Carpenter used the term "systems approach" primarily to design new organizational structures for teaching and learning.

The term "systems approach" is used by many present-day instructional designers and developers to mean a systematic way of designing and developing instructional sequences and packages (Banathy, 1968; Dick and Carey, 1990). Theirs is a prescriptive use of the systems concept. Their intent is to provide a system or complete methodology for producing instruction (Gerlach and Ely, 1981).

The connection between Carpenter’s systems approach and modern-day instructional designers’ systems approach was the concept of programming. Programming was the methodology used to produce programmed instruction and the instructional sequences built into teaching machines (Skinner, 1954).
The 1963 Commission on Definition and Terminology recognized that “the task of the audiovisual specialist may be described as assistance in the appropriate design of a presentation which utilizes the elements of messages, media-instrumentation (man-machine systems), men, methods and environment. The appropriate combination of these elements implies a systems approach” (Ely, 1963). Here is a larger view of the systems approach: In addition to prescribing organizational structures, this view plays a direct role in prescribing and devising the materials and methods of instruction. It is the beginning of the systems approach in instructional design. This view will be discussed in detail in the next chapter, where the act of programming will be related to prescriptive systems.
This total systems package—multiple steps and stages of study at different levels of a system—is an example of “Finn’s law of negative entropy” or just “Finn’s law,” which states: “The thrust and energy of technology will force greater organization upon us at every point *at which it is applied to instruction*” (Finn, 1960a, p. 154). Finn anticipated that using the systems concept for descriptive purposes (to describe organizational systems) would soon (and did) result in using the systems concept to prescribe and design organizational systems. The prescription of organizational systems would soon (and did) result in using the systems approach to prescribe materials and methods to be used by the prescribed organizational system. This is not to say that the introduction of technology in education was socially deterministic. Once introduced, the growth and spread of technology need not occur. But the resultant “technological momentum” served as a rationale to further increase the application of technology in a given situation (Taylor and Johnsen, 1986). It was a logical progression. Thus, the application of technology easily becomes a self-generating, perhaps even a self-fulfilling prophecy. As Finn himself said, “Because of the tendency for technology to have no limits and constantly extend into new areas, it is inevitable that in an advanced technical society, technology should begin to extend into the instructional process itself” (Finn, 1960a, p. 8).
Many early educational technologists, like Finn, were attracted to the systems concept because it addressed an important professional problem, separating the respective roles of the classroom teacher, the audiovisual professional, and the mediated instruction (Eraut, 1985). The systems concept became an integral part of the intellectual technique of the audiovisual professional (Gerlach and Ely, 1970). It would help to set the audiovisual professional apart from teachers and curriculum specialists.
The 1963 definition seemed to be successful in characterizing educational technology as a process. The process was the analysis, development, implementation, and evaluation of man-machine systems to deliver instruction. It incorporated certain aspects of learning theories and communications models. This process generated systems for analysis and then followed systematic or linear steps to create an “ideal” system.

The successful implementation of the ideal system would result in "the efficient utilization of every method and medium of communication which can contribute to the learners' full potential" (Ely, 1963, p. 19). The desire to develop the learners' full potential was certainly consistent with Charters's characterization of the goal of wealth in his concept of educational engineering.

The concept of "efficiency" or "efficient utilization" was a consistent theme in this analysis of educational technology. It was directly traceable to Charters's (1945) concept of educational engineering, the Hoover and Fish definition of engineering cited by Charters (1945), and Noble's (1977) analysis of technology itself. Efficiency or efficient utilization was characteristic of the process of industrial technology and industrial engineering. In contrast, in Charters's idea of educational engineering, and in the 1963 definition, efficient utilization was the goal (Ely, 1963). The systems concept played a large part in making efficiency a goal of the field of educational technology. Initially, the systems concept as used in the AV field was a planning aid in the early stages of an engineering approach to education. In later years, the systems concept became the "systems approach," or a specific process for planning organizations and designing instruction. By the time the 1972 definition was published, advocates of the systems approach were divided as to whether the systems approach was a "science" or an engineering procedure. No matter how it was conceived, the systems approach had become an integral part of educational technology.

Conclusion

In 1963, both Finn and Ely realized that the newly developed definition would eventually have to be changed. They knew that the field would evolve and new considerations would be emphasized. It would only be a matter of time before sufficient pressure to change the definition would develop and the process of reconceptualization of the field would have to begin again.

The 1963 definition lasted for nine years before a critical mass of the membership of the field felt that there was reason to change it. When the decision was made to change the definition, there were five primary reasons: (1) the professional organization changed its name from the Department of Audiovisual Instruction to the Association for Educational Communications and Technology; (2) many members of the profession were uncomfortable with the use of the word "control" in the 1963 definition (Ely, 1972, 1982); (3) the rationale offered for the 1963 definition did not fully support the definition (Knowlton, 1964); (4) there were conceptual and practical changes in the roles and procedures performed by educational technology professionals (Heinich, 1970; Silber, 1972a); and (5) the definition of educational technology provided in the report of the Commission on Instructional Technology (1970) was not satisfactory to educational technology professionals. These reasons all contributed to the desire to change the 1963 definition. The resulting new definition of educational technology, published in 1972, will be examined in the next chapter.

Notes

1. The phrase "man-machine system," despite current discomfort with gender insensitivity, has been retained for the following reasons: (1) it is the phrase that was used by the writers such as Finn and Hoban in the field at the time; (2) reasonable substitutions, like "person-machine" connote a degree of humanity that was not intended or was implied by the use of "man-machine," a more sterile phrase; and (3) the "man" in the man-machine was intended to refer to the species rather than a specific gender.
2. I chose to use the terms "social" and "behavioral" to classify the communication frameworks rather than "interpersonal communications" and "mass communications," which is a common classification in this field. My reasoning is that some theories or communication models, like Gerbner's, could be classified as either an interpersonal or a mass communication model.
3. This, in spite of the fact that B.F. Skinner is generally credited with having coined the phrase "teaching machines."

Chapter 3

1972—The Struggle for Identity

In 1972, the AECT defined the term "educational technology" rather than the term "audiovisual communications" as follows: "Educational technology is a field involved in the facilitation of human learning through the systematic identification, development, organization and utilization of a full range of learning resources and through the management of these processes" (Ely, 1972, p. 36).1

The growth and development of the AV field in the early 1960s prompted the Executive Committee of DAVI to commission a group to investigate the need to change its name (Ely, 1965). Four possible courses were identified: (1) retain the audiovisual label, (2) change the name to educational communications, (3) change the name to learning resources, and (4) change the name to instructional technology or educational technology. In 1965, at the DAVI convention held in Milwaukee, Wisconsin, formal discussions were held about the name change, and in 1970, the organization officially changed its name to the Association for Educational Communications and Technology (AECT). However, the field came to be known by the shortened term "educational technology." This identity change occurred despite the fact that the organization's title also included the term "educational communications" (Eraut, 1985). Although the writers of the 1963 definition allowed for a simple change in the label if necessary, other developments in the field also contributed to the need for a new definition.

In producing the first official definition of the field in 1963, the commission's intention was "to define the broader field of instructional technology which incorporates certain aspects of the established audio visual field" (Ely, 1963). Prominent individuals involved with audiovisual education such as Finn (1957; 1960a) and Hoban (1962) had previously used the term "technology" when referring to the activities of the audiovisual field. Considering the 1963 commission's intention "to define the broader field of instructional technology" (p. 3), the acknowledgment in footnote five to the 1963 definition, "that should another label for audiovisual communications evolve that it be substituted" (p. 18), and since prominent individuals in the field had introduced and frequently used the term "technology," it was not surprising that the AV field soon changed its name to include instructional or educational technology.

Donald Ely (1973, 1982) observed that the word "control" in the 1963 definition was problematic for many individuals involved with educational technology. Ely explained that "the strong behavioral emphasis at the time seemed to call for the word 'control'" (Ely, 1982, p. 3). He noted that the word "facilitate" was substituted by many professionals "to make the definition more palatable" (1973, p. 52). Ely described a desire to change the definition of educational technology based on a reaction to certain word choices in the 1963 definition. Ely identified a "metaphysical pathos"2 on the part of some of the members of the field to the term "control." Perhaps equally important was the desire by members of the field to move away from a behaviorally based psychology, which used language such as control, to a more humanistically based psychology, which used language such as facilitate (Finn, 1967).

Critics of the 1963 Definition

James Knowlton, a faculty member at Indiana University, was a consultant for the 1963 Commission on Definition and Terminology. In an essay that reviewed the 1963 definition, he stated that the definition itself was "couched in semiotical terms" (1964, p. 4) but that the conceptual structure used in the rationale for the 1963 definition "was couched in learning theory terms [and] this disjunction produced some surprising anomalies" (p. 4). Knowlton's argument was based on a need for conceptual and semantic consistency in the definition. Knowlton argued that failing to pair the language of the definition with the language of the conceptual structure in the rationale resulted in a general lack of clarity about this new concept. This lack of clarity in turn caused confusion in the direction of research and practice in the field.

Robert Heinich (1970) saw a need to redefine the field of educational technology for two reasons. First, he was critical of the "communications" based language used in the 1963 definition. Heinich argued that this language was too complicated for school-based personnel. Second, Heinich argued that the power to make many of the decisions regarding the use of technology in schools should be transferred from the teacher to the curriculum planners. Heinich's argument for changing the definition was based on both linguistic concerns and changes in the functions of practitioners in the field. Heinich promoted a technocratic approach to schooling, an approach where specialists would decide when and where technology would be used. This position was different than that discussed in the rationale for the 1963 definition. In the rationale for that definition, teachers were viewed as partners of educational technologists rather than as their subordinates.

Kenneth Silber (1972a) introduced a "system" that combined ideas from the open classroom movement with some concepts of educational technology. Like Heinich's scheme, Silber's "Learning System" (p. 19) suggested changes in the roles of the teacher and the educational technologist. Unlike Heinich, however, Silber sought to put many decisions about using educational technology into the hands of the learners themselves. Educational technologists would produce a variety of programs and designs that learners would use or adapt to meet their own "long-range learning destination" (p. 21). Silber's position was that the teacher should be more a "facilitator of learning" and less a "teller of information." As a member of the group that wrote several early drafts of the 1972 definition, Silber succeeded in including changes in many of the roles and functions of the practitioners of the field as part of that definition.

The report of the Presidential Commission on Instructional Technology (1970) stated that instructional technology could be defined in two ways:

In its more familiar sense it means the media born of the communications revolution which can be used for instructional purposes alongside the teacher, textbook and blackboard. In general, the Commission's report follows this usage…the commission has had to look at the pieces that make up instructional technology: television, films, overhead projectors, computers and the other items of "hardware and software" (p. 19).

The second and less familiar definition… (Instructional technology)…is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non human resources to bring about more effective instruction (p. 19).

Educational technology professionals responded to this report in a special section of *AV Communications Review* (Snider, 1970). The professional reviews of the government report were at best mixed. Donald P.Ely of Syracuse University thought the commission's overall effort was commendable given its lofty charge. Earl Funderbunk, of the NEA, called the recommendations a balanced program. But

David Engler of McGraw-Hill disapproved of the commission's effort to relegate the process-based definition of instructional technology (educational technology) to some "future" role. And Leslie Briggs of Florida State University accused the commission of providing a "two headed image" (Briggs in Snider, 1970, p. 313) of instructional technology (educational technology) by stressing both a hardware and a process orientation of the concept.

The contributors to this special section were generally dissatisfied with the "two headed" orientation of educational technology provided by the commission's report, primarily because this orientation might cause confusion among the potential client groups. They viewed the hardware orientation favored by the Presidential Commission as a setback for the profession. It meant a return to the "audiovisual aids" and "technology as machine" conceptions of educational technology. This orientation also implied the de-emphasizing of research and theory. To account for all of these developments related to the idea of educational technology, professionals in the field believed that a new definition was needed.

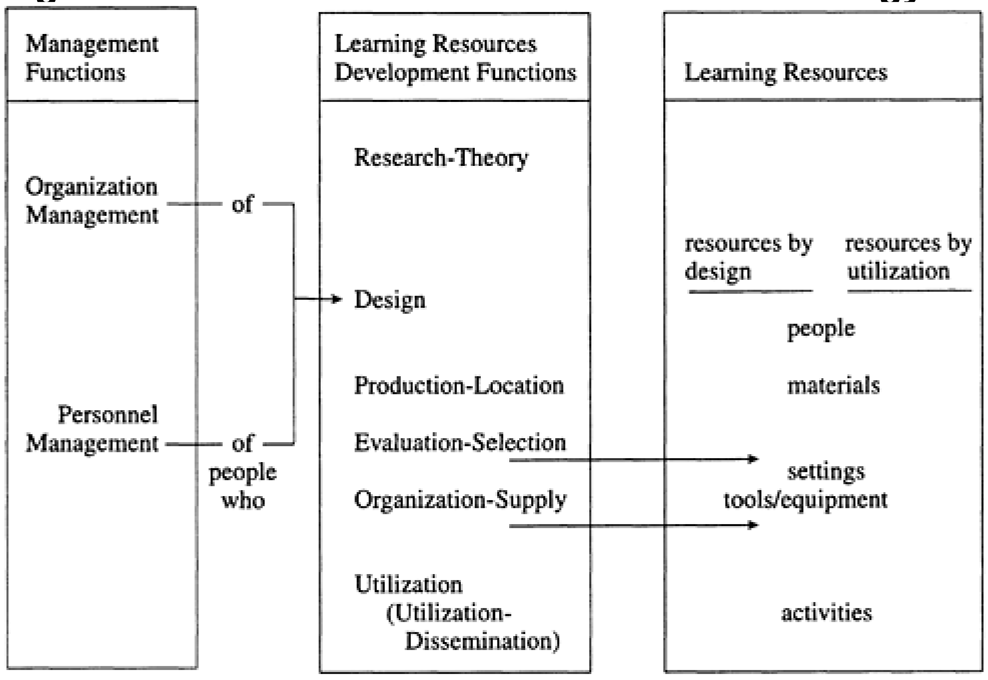
A New Direction

Three concepts are central to the 1972 definition that characterized educational technology as a field: a broad range of learning resources, individualized and personalized learning, and the use of the systems approach (Figure 3.1). "It is these three concepts, when synthesized into a total approach to facilitate learning, that create the uniqueness of, and thus the rationale for, the field of educational technology" (Ely, 1972, p. 37). Examining these three concepts, along with the idea of educational technology as a "field," is crucial to understanding the AECT's 1972 definition.

It is particularly important to recognize that different interpretations of these three concepts would result in differing conceptions of the field of educational technology. Differing interpretations would also have the more visible effect of resulting in substantially different products and processes developed in that field. The different interpretations of these concepts were due in large part to differences in educational philosophy and goals. The writers of the 1972 definition seemed to be aware that the major concepts could be interpreted differently, and they seemed to be interested in including individuals with different philosophical backgrounds in the field.

The writers of the 1963 definition and its supporting rationale were less concerned with accommodating divergent educational philosophies than were the authors of the 1972 definition. Perhaps this was because the 1963 definition was the first formal attempt to define educational technology. Such an undertaking was formidable enough. Perhaps it was because the writers of the 1972 definition paid more attention to the discussions of educational philosophy in the literature from the rest of the field of education than was the case in 1963.3 Perhaps it was because the 1963 definition viewed educational technology as a theory and, potentially, as an educational philosophy itself. There is no doubt, however, that by 1972 the authors chose to consider educational technology a field of study rather than as a specific theory.

Figure 3.1. Functions of Educational Technology



From: Association for Educational Communications and Technology (1972). The field of educational technology: A statement of definition. *Audiovisual Instruction,* 17, 36–43.

The Field

The decision to refer to educational technology as a field of study rather than a theory or a branch of theory did at least four things: (1) it acknowledged that there was more than one theory of educational technology, more than one way to think about the role of educational technology;4 (2) it promoted philosophical discussions by members of the profession;5 (3) using the word "field" encompassed both the "hardware" and "process" orientations of instructional technology reported by the Presidential Commission (1970); and (4) it allowed a definition based on the "tangible elements" (Ely, 1972) that people could observe. This meant defining educational technology by what educational technologists actually did or how they functioned in their profession rather than as an abstract concept, as in the case of the 1963 definition, where educational technology was viewed as a theory.

The concept of "field" has been difficult for educational technologists. Like many areas of study within education, it is very difficult to discuss educational technology without using the word "field" as a descriptor. Certainly AV professionals used the term to describe the "audiovisual field" before either instructional technology or educational technology were ever used. The 1963 definition frequently used "field" (Ely, 1963) to move the discussion along, even though it was argued that educational technology was a theory, or branch of theory. On the surface, the use of "field" seems a rather inescapable semantic problem when speaking of educational technology. But it is significant that the writers of the 1972 definition chose to use "field" rather than "theory" in the definition because using the word "field" established a territory. It also provided a certain legitimacy. The consequences of this were understood by Finn, who proclaimed:

Properly constructed, the concept of instructional or educational technology is totally integrative. It provides a common ground for all professionals, no matter in what aspect of the *field* they are working: it permits the rational development and integration of new devices, materials, and methods as they come along. The concept is so completely viable that *it will not only provide new status for our group, but will, for the first time, threaten the status of others* (my emphasis) (Finn, 1965a, p. 193).

Whether or not educational technology was a threat to other professionals is not an immediate concern here. What is important is that before the 1972 definition was written it was simply understood by educational technology professionals and practitioners that educational technology was a field. Although any causal claim about the impact of the definition may not be independently verified, it appears that after the publication of the 1972 definition, the idea that educational technology was a specific field of study and practice became more popular among individual members involved within educational technology.

Finn argued that an academic field "embraces portions of concepts, skills, and procedures from a number of academic disciplines and also from other applied fields and welds them into new applications" (Finn, 1963, pp. iv–v). An academic field can also be thought of as dynamic because it is based on relationships between ideas. Educational technology fits both of these descriptions. Educational technology had used concepts from different academic disciplines. These concepts were related to each other and were dependent upon each other for their distinct, yet consistent, meaning. This was particularly the case with the 1963 definition. Because educational technology met these considerations, and because it had been so designated by the "common language" of the literature of education, it could reasonably be called a field.

Learning Resources

The first of three major supporting concepts of the 1972 definition was "learning resources." The authors stated that learning resources could be divided into four categories: materials, tools and equipment, people, and settings (Ely, 1972). Some of these "resources become learning resources by *design* and others become learning resources by *utilization*" (Ely, 1972, p. 38). Resources by design were resources intentionally designed for specific learning purposes. Resources by utilization were

sometimes called “real world resources” (p. 38), things that were not specifically designed for instructional purposes but that could be used to aid the learning process. The commission that wrote the 1963 definition was primarily concerned with designed resources, or rather, the process of designing and displaying messages (Ely, 1963).
The idea of resources by utilization acknowledged the ties to the pre-educational technology days of the field when the primary purpose of most individuals involved with the field was to promote the use of machines and equipment in the classroom. The emphasis of the 1963 definition on designed resources was an attempt to show the intellectual technique of the field. But the concept of resources by design was much narrower than the new overall concept of learning resources. By including the notion of resources by utilization as part of the new concept, the 1972 definition widened the scope of the field considerably.
The 1963 commission argued that the machines, or tools and equipment, that were used to display materials, and the materials themselves, were interdependent elements (Ely, 1963). A machine was of no practical use without the materials that were used with it. The 1963 commission used the terms “messages and instruments” instead of “machines and materials” to emphasize the process concept of educational technology. The 1972 definition used the heading of “learning resources” to include all four terms: messages, materials, machines, and instruments under one umbrella. But that concept could be expanded to include other things as well (Ely, 1972).
The concept of learning resources was more than an expansion of the earlier terms referring to audiovisual materials. It also included facilities and people. Facilities referred to places and spaces where learners interact with other resources (Ely, 1972).
These settings could be resources by design, which included school classrooms, resource centers, libraries, and auditoriums. These facilities could also be resources by utilization, which included parks, historic sites, and theaters. “People” was the final category of learning resources. People, too, were discussed in terms of resources by design and resources by utilization. Traditional school personnel, those that are trained and paid to facilitate learning, such as teachers, administrators, and counselors were considered resources by design. People who performed jobs, who were not primarily trained as educators, but could contribute to the learning process by serving as experts, such as bankers, park rangers, and politicians, were considered resources by utilization (Ely, 1972). The idea of people as resources has been disconcerting to some scholars. It implied that all were part of a greater technological system in which individuals served as interchangeable parts within that system (Hlynka and Belland, 1991; Yeaman, 1994).
Gerald Torkelson of the University of Washington (1965) had argued that the Department of Audio Visual Instruction should change its name to incorporate the term “Learning Resources.” Torkelson wanted to place the focus on the learning process rather than on the teaching process. In addition, Torkelson stated that the title of learning resources would unify the “efforts among groups concerned with

similar interests" and that it was "of great importance to the audiovisual field" to have a structure representing all of the interests involved in the technological changes involved in education (p. 200).

Torkelson was not successful in his argument to include learning resources in the name of the professional organization. But he was successful in emphasizing the concept of learning. "Learning resources as opposed to audiovisual as a term, or in opposition to other names which may be suggested focuses upon the learning process and the application of resources to that process" (Torkelson, 1965). The use of learning resources was intended to reduce the emphasis on the teacher or instructional designer as a "transmitter of information" implied by such words as "instructional."

Although ultimately rejected as the designation of the field, learning resources became an important idea in the 1972 definition. Even Finn, the great proponent of technology as process, conceded that machines and materials, which were a significant part of the concept of learning resources, were a major part of instructional technology. In his speech (1965), which was aimed at changing the name of the professional organization and the field to instructional technology, he stated that "machines, materials, methods of use, [and] systems are all part of the pattern of rational mechanisms operating as means to educational ends. And, as Hoban has said, machines are central to this concept even though they alone are not technology" (Finn, 1965).

Under the concept of learning resources, processes were not viewed as resources. The reason for this exclusion is not known. Processes were not always considered as distinct from resources. In a document commissioned for the AECT, Gerald Torkelson, Kenneth Silber, and Geoffrey Squires (1971) included processes in a section devoted to "learning resources." Likely, this was primarily because Torkelson viewed learning resources as the fundamental concept of the field. But the 1972 definition also placed a significant emphasis on the concept of the systems approach. The systems approach was considered to be the primary process of educational technology (Ely, 1972).

Resources became equated with "physical things" in order to maintain some continuity with the old AV education movement. The idea of learning resources, specifically resources by utilization, retained the flavor of the older ideas of AV materials and instruction used by the field when it was seen as the AV education movement. The concept of learning resources encompassed and accurately described the first of the two-part definition of instructional technology prepared by the Presidential Commission on Instructional Technology. This part of the commission's report focused on the "the pieces that made up instructional technology" (1970, p. 19).

Another reason that processes were not included under the idea of learning resources was to maintain a separation of means and ends. Processes were seen as means and products were seen as ends. The leadership of the profession thought it was desirable to see the processes as distinct from the products in order to maintain this separation (Finn, 1960a). For them, developing products resulted from employing a particular process, the systems approach. The decision to use products to assist learning was also made as the result of having used a particular process under the systems approach.

The concept of learning resources was open to interpretation. Implicit here was the idea that learning resources could be studied, developed, and used under several different educational theories and philosophies. These different theories included differing interpretations of the concepts of the systems approach and individualized instruction in combination with the concept of learning resources. Although open to different interpretations, the concept of learning resources had become an important part of the definition of educational technology in 1972 and has remained so to the present day.

Individualized Learning/Instruction

There have been many phrases or terms in the literature of education, which have been associated with, or provided alternatives for, individualized learning. These included: individualized instruction, individually guided education, programmed instruction, personalized learning, personalized instruction, and individually prescribed instruction. The authors of the 1972 definition consciously chose to use the phrases “individualized learning” and “personalized learning.” This was done in response to the “new emphasis” (p. 37) placed on the “learning process and the individual learner” (p. 37). Laudable as the intent may have been, this decision presents the researcher with certain difficulties. One must be aware that there are many terms that are used to discuss individualized learning and personalized learning. Because the term “individualized instruction” is most pervasive in the literature of the field of education, and because the intent here is to analyze some specific plans and the broader background of the concept of “individualized learning,” individualized instruction will be used as the term under which these plans and this background are discussed.

Two basic perspectives on individualized learning or instruction can be taken. One perspective focuses on particular pieces of the subject matter to be taught or the techniques of individualizing the delivery of that subject matter, or both (Deterline, 1962). The other perspective focuses on the growth of each individual learner or the development of the unique potential of each individual learner, or both (Dale, 1972; Silber, 1973; Fox and DeVault, 1978). These two perspectives are not completely independent of one another, but there are basic differences between them that allowed for different interpretations of the concept of individualized instruction—each with its own history—to develop.

Individualized Instruction in Format and Content

Two major factors contributed to the view of individualized instruction that focused on the technique of individualizing the delivery of specific subject matter. The first was the influence of behavioral psychology, specifically as it applied to teaching machines and programmed instruction. Second, and less well known among educational technologists, was the influence of the individualized curriculum movement of the early twentieth century.

The primary influence on programmed instruction was behavioral psychology, specifically operant conditioning. The main force behind operant conditioning was a particular view of science in education based on standardization, measurement, and control. Programmed instruction grew out of the desire to apply the scientific principles of operant conditioning to instruction on a large scale. The development of programmed instruction also required using some of the principles involved in Charters's educational engineering (1945). This included analyzing, dividing, and sequencing the content to be taught into a program, and then repeatedly testing and evaluating the program to verify that it worked.

Although individualized instruction had been in existence for centuries, individualized curricula gained popularity in the late nineteenth century. Mass education was relatively new, and these programs were developed as a response to the lockstep methods of most classrooms of that time (Fox and DeVault, 1978; Saettler, 1990). Educators had a number of reasons, ranging from the "philosophical" to the "practical," for trying to break away from using the large group, lockstep methods of this time (Kliebard, 1987). Philosophical considerations included a more "democratic education," self-reliance and better thinking skills, and the school as a microcosm of society. Practical considerations included eliminating waste, increasing efficiency, increasing effectiveness, easing the burden on teachers, and preparing better workers.6 That some educators chose to develop their forms of individualized instruction based primarily on practical considerations did not mean that they were devoid of philosophy or value orientation or both. To these educators, the practical intent or outcome of the program was the value orientation implicit in the program.

In the late nineteenth and early twentieth centuries, individualized instructional programs that focused on delivering specific subject matter were based on the principles of scientific management. The intent was to solve the practical problems of the classroom by reducing waste and increasing efficiency, effectiveness, and cost containment in education. Scientific management resembled educational engineering much more than it did any particular view of science in education. These early, individualized instructional programs were more a manifestation of educational engineering than was programmed instruction. Programmed instruction was primarily intended to develop a technology of instruction based on science (Skinner, 1968).

Numerous individualized instruction schemes were developed during this time, far too many to examine here. The individualized instruction plans frequently included in the literature of educational technology and individualized instruction are addressed here.

The superintendent of schools in Pueblo, Colorado, Preston Search, instituted the Pueblo Plan in 1884 (Search, 1894). The Pueblo Plan, which was in operation until 1894, was a self-paced program that required each student to complete a sequence of lessons on an individual basis. Presentations covering basic ideas were made to the entire class, but these were limited in number and scope. The Pueblo Plan was intended to "relieve physical strain, train independent, self-reliant workers, result in better work and in more supplementary work, and promote enthusiasm for study with less discouragement among many of the learners" (Fox and DeVault, 1978, p. 274). Approximately 203 schools had tried the Pueblo Plan by 1910 (Fox and DeVault, 1978).

Frederick Burk, of the San Francisco State Normal School, is credited with being among the first to popularize an entire formal system of individualized instruction. The system included instruction in arithmetic, geography, history, language, and grammar for the kindergarten through the eighth-grade levels (Washburne, 1925; Saettler, 1990). Burk and Mary Ward led a team of faculty members from the Normal School in developing a series of self-instructional booklets. This series was widely used and more than 100,000 copies of these booklets were sold in the United States and foreign countries between 1912 and 1915 (Fox and DeVault, 1978; Saettler, 1990). Sales of the booklets were halted by the attorney general of the State of California when he ruled that, although the booklets were not being sold for a profit by the Normal School, any sales and distribution of text materials lay with the State Board of Education (Fox and DeVault, 1978).

The Burk System, like the Pueblo Plan, was started with the hope that students could progress with the materials at their own rates with only a limited amount of teacher presentations. The Burk System not only allowed children to advance at their own pace, it also permitted students to begin the work of the next grade level once the booklet containing the subject matter for the current grade level was completed. This aspect of the plan allowed students to excel in areas in which they were competent. The Burk System also included a provision for careful self checking and allowed for accurate record keeping of the time required by a student to complete the work of each grade level (Fox and DeVault, 1978). This system was a precursor of self-paced mastery learning plans developed in the 1960s.

Individualized instructional programs were frequently criticized for being too expensive and wasteful (Fox and DeVault, 1978). Burk countered these arguments by saying that the intent of his overall program was to eliminate waste in the classroom. He defended his program by saying that:

The current hasty conclusion to the contrary is due to the fact that the largest item in the cost of schooling by the class system unnecessary wastes amounting to considerably more than 50 percent is entirely overlooked. Among the huge wastes inherent in the lockstep of the class system are those due (1) to repetition of grades, (2) to inability to use the gains of accelerated rates of progress, (3) to the regulations that all pupils must learn what only a few have the need of, or the ability to learn, and (4) to certain fractional losses in the teaching of large classes. Individual instruction cuts out these wastes by eliminating their causes (Burk, 1915, p. 1).

Arguing like a scientific manager, Burk made the case for using short-term investments to save the schools money in the long term. Cost consciousness had become an important part of the individualized instruction rationale. The concept of management began to gain popularity in instruction and schooling.

The Batavia System was developed under the leadership of William Bagely, the superintendent of schools in Batavia, New York, in the early 1920s. Bagely (1925) reported that rapidly increasing enrollments required him to use large classrooms in old buildings to accommodate the large number of students, as many as 70 per classroom. The Batavia System called for a second teacher in each large classroom. This second teacher was a specialist in working with individual children. This teacher was not an assistant to the primary teacher, but worked with students to help them keep pace with the whole-class work directed by the first teacher.

The Batavia System was intended to increase the effectiveness of the oversized classroom. Whole-group instruction was the primary basis for operating classrooms in the Batavia System. Individualized instruction was used primarily as a remedial tool to help students who needed it to keep pace with the rest of the class. Unlike the Burk System, the individualized aspects of the Batavia System did not always focus on written work. In fact, Bagely was concerned that his teachers would overemphasize written work because it was the easiest way to provide independent tasks (Bagely, 1925). Bagely's system was not a self-paced program like Burk's or Search's, both of which required that all students perform the same written tasks. Bagely used individualized instruction to complement whole-class teaching.

The Dalton Plan was developed by Helen Parkhurst, an associate of Burk and Mary Ward, in Dalton, Massachusetts, in 1919 (Fox and DeVault, 1978). The plan featured contractual agreements between students and teachers (Dale, 1967; Saettler, 1990). Under the terms of the contract, the students had the freedom to budget their time to complete the terms of the contract. The Dalton Plan was a two-part plan that first used a self-paced program that accounted for the different ability levels of children. Like the Burk plan, self-instructional and self-corrective practice materials were used; and, like the Batavia plan, special assistance was available for individual students having difficulties (Saettler, 1990). The second part was geared toward developing interpersonal skills and social skills in students.

The Dalton Plan has had a major impact on current educational practice. Although it was initially used in a special education context, the contracting aspect of the Dalton Plan has since been used across grade levels in a variety of educational settings. In many school districts, it is still apart of the curriculum (Saettler, 1990).

Carlton Washburne, also an associate of Burk and Ward in San Francisco, developed the Winnetka Plan when he became the superintendent of public schools in Winnetka, Illinois, in 1919 (Cremin, 1961; Fox and DeVault, 1978; Saettler, 1990). The Winnetka Plan was divided into two parts: the "common essentials" and "group and creative activities" (Washburne, 1925).

The common essentials were “those knowledges and skills which will be used by practically everyone” (Washburne, Vogel, and Gray, 1926, p. 15). These skills and knowledge came from the traditional school subjects such as arithmetic, reading, and spelling. They were thought to be the basic skills that a functioning member of society needed to possess (Fox and DeVault, 1978).

The second part of the Winnetka Plan focused on “group and creative activities.”7 These activities, which focused on the social and personal development of the child, did not have set standards and were considered to be ends in themselves (Washburne, 1925; Washburne, Vogel, and Gray, 1926). The two parts of the Winnetka Plan were usually equally divided during the school day. “They occupy about half of each morning and half of each afternoon” (p. 21).

The Winnetka Plan is particularly interesting because it anticipated many of the principles of modern educational technology, such as task analysis and self-paced learning. It also included the application of scientific diagnostic testing to determine entry level as well as post-instructional knowledge. Washburne described his plan as:

A general technique [consisting] of (a) breaking up the common essentials curriculum into very definite units of achievement, (b) using complete diagnostic tests to determine whether a child has mastered each of these units, and, if not, just where his difficulties lie and, (c) the full use of self instructive, self corrective practice materials (Washburne, Vogel, and Gray, 1926)

The definite achievement units that Washburne proposed using were unlike the objectives Franklin Bobbitt (1918) had outlined. Bobbitt’s objectives tended to be vague. Washburne saw the need for more specific objectives in his program. He argued that definite objective statements were required:

To say that every child shall be able to divide four place dividends by two place divisors, involving a naught in the middle of the answer, a naught at the end of the answer, a remainder or a trial divisor, and that he shall be able to divide such examples at the rate of two in three minutes with 100 percent accuracy, is a definite statement (Washburne, 1925, p. 80).

Although he would receive little credit for it, Washburne’s “definite units of achievement” are remarkably similar to what Robert Mager later called instructional objectives (Mager, 1962). Washburne’s unit of achievement included an audience, a desired behavior, a set of conditions under which the behavior would be performed, and a degree of success.

Washburne’s self-paced plan also included language and ideas that predated the popular mastery learning programs of the 1960s and 1970s. Washburne argued that “instead of quality varying, time varies: a child may take as much time as he needs to master a unit of work, but master it he must” (Washburne, 1925, p. 80). The unit of work, or goal, that Washburne described was the units of achievement, the result of extensive subject matter analysis.

Techniques of individualizing pre-established subject matter were devised primarily to increase classroom efficiency. The resulting programs included many of the features that would become popular in individualized instruction during the 1960s and 1970s. Unlike the earlier individualized instruction, which was based on concepts of educational engineering, these later programs were developed to apply the knowledge of a particular view of science on a large scale.

Individualized Instruction in the 1960s and 1970s

The most popular individualized instruction programs of the 1960s and 1970s tended to do three things: (1) they utilized many aspects of the individualized programs of the earlier part of this century; (2) like the early programmed instruction of the 1950s, they were based on the principles of behavioral psychology; and (3) they included some attention to the idea of the individual differences of students (Saettler, 1990).

The developers of these individualized instructional programs recognized that any teaching method that treated all members of a group of learners in the same way would not meet the differing needs of individual students (Glaser, 1966). There were four major strategies for meeting "different needs" of students included in individualized instruction at this time: (1) matching learning styles with the proper instructional strategies (Glaser, 1966); (2) matching learner aptitude with the appropriate subject matter (Glaser, 1966); (3) placing learners at the appropriate point in a fixed sequence of instruction and allowing them to proceed at their own pace (Anderson and Block, 1985); and (4) providing remedial or supplementary instruction to learners needing extra help that have been identified by formative testing (Lindvall and Bolvin, 1967). Any individualized instructional program could, and often did, employ one or more of these strategies.

Four of the more popular individualized instruction programs that were associated with the field of educational technology were: Bloom's Mastery Learning, the Keller Plan, Individually Prescribed Instruction (IPI), and Individually Guided Education (IGE). Mastery Learning was based on a conceptual model of school learning developed by John Carroll (1963) and was put into practical operation by Benjamin Bloom (1968). There were two basic approaches to mastery learning: the group-based approach and the individual-based approach. The large group approach included cooperative learning strategies and teacher-controlled delivery of instruction (Block, 1971). The group program, which had generally evolved within the field of education, has had a significant impact on both elementary and secondary schools (Anderson and Block, 1985).

The individual-based mastery learning program had a great impact on other individualized instructional programs of the 1960s and 1970s. It was predicated on the notion that as many as 95 percent of all students could reach the desired level of success in learning if they were given sufficient time (Bloom, 1968; Block, 1971). The individual-based approach was self paced, and the students learned independently of classmates. Like Washburne's Winnetka Plan, the individual-based approach to mastery learning required students to meet the desired level of success before they could continue with more advanced subject matter.

Bloom (1968) identified five variables that were important to the mastery learning program: the quality of instruction, the ability to understand the instruction, perseverance, time, and aptitude. All five variables were researched by instructional psychologists (Glaser, 1966; Bloom, 1968). It was the effort to account for individual differences in instruction that brought a new wave of scientific investigation into individualized instruction.

Psychometric research was used in both planning and using the mastery learning program and other forms of individualized instruction (Anderson and Block, 1985). The intent was to identify individual differences by testing mental capabilities (Glaser, 1966).

Testing mental capabilities was considered to be scientific research by those who conducted it. The primary goals of this research were exact measurement and standardization. The purpose was to develop a science on which to base instruction and to move students efficiently, no matter what their mental classification, through preselected subject matter in the most efficient way.

The most important part of the individual-based mastery learning program, the one variable on which the other four hinged, was the reorientation of the concept of learner aptitude. Traditionally, the concept of learner aptitude was viewed simply as an ability level. People with high aptitudes would do well with particular subjects and would learn the complex ideas involved with that subject, and those people who had lower aptitudes would learn only the simplest ideas about that subject (Bloom, 1968). John Carroll (1963) explained that if students were distributed on the normal curve with respect to aptitude for a given subject, and all the students received the same quality of instruction over the same duration, achievement measures would be normally distributed.

But Carroll (1963) argued that aptitude was really the amount of time that a learner required to be able to master a task or subject. Traditional conceptions of aptitude were not true measures of an individual's ability to succeed. Most individuals could succeed in mastering the subject matter, but time was the essential variable. The science of instruction sought to develop a reliable method in which students, if given enough time, would succeed.

The Keller Plan (1968), or the Personalized System of Instruction (PSI), was devised by Fred Keller, a psychologist, and colleague of B.F.Skinner. The PSI was initially devised for a university course and became the most popular individualized instruction format on college campuses (Boud, 1985). This individualized instruction plan combined aspects of mastery learning with traditional programmed instruction, but added provisions for motivation. Occasional demonstrations and lectures were intended to supplement or enrich course material rather than act as a source of information essential to gaining mastery of the subject. These lectures and demonstrations were available to the entire class, but attendance was optional.

Keller's system also included the use of proctors. The proctors were chosen because they had mastered a particular course. Their primary duties included administering and scoring tests and tutoring students who required additional assistance. Keller's use of proctors was intended to enhance some social aspects of the educational process (Keller, 1968).

IPI was developed at the University of Pittsburgh in 1964 (Lindvall and Bolvin, 1967; Saettler, 1990), and was first used to teach basic subjects at the elementary school level (Lindvall and Bolvin, 1967). Like the Keller plan, IPI used principles of behavioral psychology and mastery learning. Also, the IPI model was a self-paced, mastery-oriented plan that required extensive written work by the students. Before the students began work on a particular subject, they were pretested to determine their entry knowledge level. Based on the results of the pretest, the students were then assigned the appropriate section or unit of the course. Such entry-level testing was not a part of either the Keller plan or the mastery learning model. Under those plans, all students completed all assignments. Proponents of IPI argued that entrylevel testing would make the classroom more efficient than other mastery learning schemes (Lindvall and Bolvin, 1967).

The IGE program was developed by the Wisconsin Research and Development Center (Saettler, 1990). By 1976, more than 3,000 schools were using some variant of the IGE program. It included the basic features of IPI: pretesting, specific objectives, and planned instructional programs.

The IGE plan also included provisions for teacher training, testing instructional innovations, team teaching, nongraded classrooms, and peer and cross-age tutoring. Not all schools that used IGE required all of these provisions (Klausmeier, 1975). The flexibility of the IGE program and its provisions for staff development, made it one of the more successful models of educational change that focused on individualized instruction (Saettler, 1990).

Individualized instruction was the subject of much research and evaluation during the 1960s and 1970s. The results of these studies suggested that the Keller plan tended to get better results than other forms of individualized instruction that were introduced on a mass scale (Boud, 1985). But most studies that compared individualized instruction with traditional school programs found no significant difference between the programs (Saettler, 1990).

By 1980, the utilization of the individualized instruction programs developed in the 1960s and 1970s had decreased, primarily because of decreased government funding (Boud, 1985; Saettler, 1990). At the same time, new and more promising theoretical developments in instructional design and learning applications began to emerge.

Individual Instruction for Personal Development

An approach to individual instruction that differed from those primarily interested in teaching a particular subject matter through individualized means, was individualized instructional programs that focused on the individual development and growth of the student. The intellectual lineage of these programs can be traced from Socrates to Rousseau (Saettler, 1990). But, because the literature of educational technology identifies the work of William Heard Kilpatrick, specifically his interpretation of John Dewey and his use of projects in education, it is the starting point for this present analysis.

Kilpatrick, who had been a graduate student of Dewey, was on the faculty of Columbia University when he became famous for his "Project Method" in 1918 (Cremin, 1961; Kliebard, 1987). Kilpatrick was, first and foremost, a philosopher rather than a psychologist or administrator, as were most of his contemporaries who had developed other forms of individualized instruction. The Project Method was Kilpatrick's attempt to counter those educators that he felt overemphasized efficiency and the use of measurement science in curriculum making. He wanted to put the philosophical ideas and educational concepts that were articulated by Dewey into a coherent curriculum plan.

Kilpatrick challenged Washburne, Parkhurst, and others that based their individualized curriculum on "common essentials." Kilpatrick asked, "Are honesty and truthfulness not common essentials?" He continued, "Would it not be better then to say, not 'common essentials,' but some common essentials that lend themselves to self teaching assignment?" (1925a, p. 281).

Kilpatrick sought to develop an educational plan that would account for (1) the idea that education was growth, (2) the difference between the logical organization of subject matter by adults and the psychological understanding of phenomena by students, (3) the concept of schooling based on the experience of students, (4) the teaching of reflective thinking and problem solving, (5) the importance of student interest in learning, and (6) the teacher as guide (Cremin, 1961; Kliebard, 1987).

Kilpatrick's plan was based on his belief that education was a moral activity. Education had to use moral means to meet moral ends. Opposing Bobbitt, he argued that "education be considered as life itself and not as mere preparation for later living" (1918). The Project Method used the students' personal experience as a way to encourage and develop thinking and morality. The aim was to teach reflective thinking and problem solving for social as well as scientific purposes.

Kilpatrick's definition of the method changed over the years. In the article titled "The Project Method," he defined it as "wholehearted, purposeful activity proceeding in a social environment" (p. 322). In correspondence to J.A.Stevenson, he wrote that "the term 'project' contemplates a complete act (or experience) which the agent projects, purposes, and within limits sees through to completion" (p. 326). As part of a symposium on the method, he stated that "the term project refers to any unit of purposeful experience, any instance of purposeful activity where the dominating purpose, as inner urge, (1) fixes the aim of the action, (2) guides its process, and (3) furnishes its inner drive and motivation" (Kilpatrick, 1921). And in the book *Foundations of Method,* he argued that "a project is an instance of purposeful activity it is the pursuit of purpose" (Kilpatrick, 1925b, p. 278).

Even though his definition of the Project Method had changed, Kilpatrick consistently described it as consisting of four basic steps: purposing, planning, executing, and judging (1918, 1921, 1925b). These four steps are similar, but not identical, to the five stages in scientific method or reflective thinking identified by Dewey as: "Problem, collection and analysis of *data,* projection and elaboration of suggestions or ideas, experimental application and testing, the resulting conclusion or judgment" (Dewey, 1916). Kilpatrick's project method was intended to enact Dewey's concept of the scientific method and reflective thinking in a generalizable model of education. Kilpatrick, like Dewey, did not draw the separation of means and ends as other educators of the time had done. Kilpatrick believed that the means of education should not be viewed as separate from the ends of education. Distinctions could be drawn between means and ends, but to treat them as different entities would be wrong. The fundamental goal of his method was to use a plan devised through the reflective scientific method to teach a reflective method of thought.

Aware that the choice of the word "project" caused some problems for his contemporaries, Kilpatrick wrote "the term 'project' must not be allowed to distract attention from the reality back of it. It is the reality and not the name that concerns us" (1925a, p. 279).8

One of the reasons the term "project" might have caused confusion for those interested in this method of instruction was that "projects" had been used in education since at least 1908 (Kliebard, 1987). R.W.Stimson (1912) discussed using projects in agriculture courses. David Snedden (1916) wrote about using projects as units of a vocational curriculum. Later, curriculum specialists like Charters (1918) and Stevenson (1921) supported integrating projects into the standard school curriculum.

Kilpatrick's use of the term "project" differs from that of the educators who had previously used the term. These differences can be seen in three areas: intrinsic motivation and project selection, projects vs. problem solving, and project completion. Kilpatrick believed that a project must not only be intrinsically motivating to students, but that the students themselves should conceive the project. Without student purposing there was no project. (Kilpatrick, 1918; 1925b). Other educators saw the project as a teaching strategy, as something to be devised by teachers and specialists as a tool for teaching particular subject matter to students (Stimson, 1914; Snedden, 1916). Other educators did not consider student interest and intrinsic motivation to be necessary criteria for projects (Charters, 1918).

Kilpatrick explained that there were four distinct types of projects: (1) to make something, (2) to experience or appreciate something, (3) to solve a problem, and (4) to acquire some specific knowledge or skill (Kilpatrick, 1925b). Other educators claimed that solving a problem was a critical characteristic of a project, so their conception of project was much more limited than was Kilpatrick's (Snedden, 1916; Charters, 1918).

Kilpatrick also argued that if the student lost interest or purpose in an activity, it was no longer a project. Therefore, the student was no longer required to complete the activity (Kilpatrick, 1918). Because they were interested in projects as a method for teaching subjects, other educators insisted that all projects be carried through to completion (Charters, 1918). Only activities that would be completed, often resulting in some product, would be considered projects.

With its unified philosophical and conceptual base, Kilpatrick's Project Method, and the activity curriculum that evolved from it, became a popular alternative to the scientific curriculum-making plans of the 1920s. By the beginning of World War II, the Project Method faded in popularity as had interest in the early use of teaching machines. The educational critics of the 1960s revived several concepts from the project method, although these more modern interpretations did not emphasize the scientific method and reflective thought as Kilpatrick had advocated.

Individualized Instruction for Personal Development in the 1960s and 1970s

Just as Kilpatrick's Project Method was an alternative to the efficiency experts and scientific curriculum-makers of the post-World War I era, the educational critics of the 1960s offered an array of ideas about individualized instruction for a child's personal development in the post-Sputnik era. The renewal of child-centered education was a response to formalism in schooling promoted by subject matter-focused, efficiency-oriented, and measurement science-based educators (Januszewski, 1995).

These critics emphasized the growth and development of the "whole child." That is, they were interested in the affective and social development of children, as well as their cognitive development, which these critics saw as the primary focus of traditional schools. They also decried the prepackaged, mass-produced education, which most students received, as dehumanizing and irrelevant. They claimed that the major outcome of this mass education was the alienation of the individual student.

The critics included Paul Goodman (1956; 1962), Herbert Kohl (1967; 1969), John Holt (1964), Charles Silberman (1970), James Herndon (1965), Jonathan Kozol (1967), Ivan Illich (1970), and Carl Rogers (1969). Certainly, no single plan of action for curriculum development was supported by all these critics. However, they did have one thing in common—they encouraged teachers to explore and take chances in the classroom. Perhaps the single most important contribution these critics made during the 1960s was their influence on the development of open education models, specifically the open classroom.

Individualized instruction for personal growth and development was an important concept in the field of educational technology only briefly. Most of the favorable discussion in the professional literature concentrated on the relationship of technology, mainly in the materials and hardware sense, to the open classroom (Silber, 1972a).9

The names of two critics, Illich and Rogers, appeared frequently in the literature of educational technology. Illich authored the book *Deschooling Society* in 1970. It was a scathing indictment of the schools, which he believed had become mechanistic social credentialing centers. This position opposed an environment for individual growth and education, which Illich believed was the school's role. Illich became a popular source for those in the field interested in using technology to establish and work with alternative educational and learning systems.

Carl Rogers was an influential psychologist who had conducted a substantial amount of clinical research on counseling. The research that Rogers conducted led him to a position that was opposed to Skinner's behavioral psychology and behavioral learning theory. The first of several debates between Rogers and Skinner was held in 1956 (Kirschenbaum and Henderson, 1989), but educational technologists did not become attracted to Rogers's work until the late 1960s. Rogers believed in individual freedom in the learning process, and he emphasized reaching students at their emotional as well as their cognitive level. His work prompted Finn, an admitted behaviorist, to call upon the field to move away from behaviorism and follow Rogers's lead. In one of his last published papers, Finn (1967) implored the members of the profession to begin working with whole human beings, to shift their emphasis to the affective domain.

Kenneth Silber, a student of Finn, was dedicated to developing an alternative learning system within the field of educational technology. From 1970 to 1975, Silber published a series of articles discussing the possibility of developing an alternative educational system based on the concepts and principles of educational technology. Silber's vision, "the Learning System," (1972a) drew upon the educational ideas of both Illich and Rogers. He wanted to "deschool" the learning process and free learners in the community as had Illich. He also wanted to replace the popular conception of a teacher as an authority figure with Rogers's idea that a teacher should be more of a consultant, someone to help learners to discover what they wish to learn, and then help them to find the means to accomplish it.

Silber's system was a community-centered, resource- and data- (information) based model, which allowed learners to choose and develop their own goals and objectives. In this model, the teacher was a learning consultant whose role was to help learners to clarify their learning goals and then help them locate a variety of resources and information to attain those goals. As a community-centered model, there would be no school building per se; learners would go where they needed to within the community to gain access to the resources they required to attain their goals (Silber, 1972a; 1973; Silber and Saretsky, 1975).

Silber reasoned that learning, because it occurred in the community, would include an important social aspect. Because learning in this system was ungraded, co-operation between learners would likely develop. Personal and peer evaluation would provide opportunities for dialogue between learners and consultants and this, in turn, would give rise to new learning goals (Silber, 1973; 1975).

Silber's sketch of the learning system's philosophy reveals that he had certain beliefs in common with Kilpatrick and the project method (1974). However, his discussion of educational philosophy was just that, a sketch. It was not a systematic attempt to unite concepts and ideas into a rationale. That might be too much to expect in so short a time from someone who did not have a background in educational philosophy. Nor were the editors and publishers of educational technology journals particularly anxious to print such lengthy arguments. In the end, Silber might well be classified as an educational engineer. As Charters wrote: "The educational engineer is interested in philosophy and theories and the situations from which they emerge, but he studies them to get his bearings to attack a problem. To him the program is the thing." (Charters, 1945, p. 35). For Silber, the program was the thing.

Silber was a critical figure at this juncture. In addition to developing the learning system, Silber was also involved in the formulation of the AECT's 1972 definition of educational technology. He provided an early analysis of discussion papers with Gerald Torkelson and then, with Kenneth Norberg, completed several drafts of the definition. Donald Ely, Chairman of the Definition and Terminology Committee of the AECT, acknowledged Silber's continuous effort on the project in an introduction to the definition (Ely, 1972).

Silber's conceptual work on an alternative learning system, although interesting to some, did not inspire a major change in the role for educational technology. However, some of his ideas were included in various distance education plans, albeit in a slightly different form. Some of these distance education programs are still in operation. Perhaps Silber's most important contribution was his conception of the teacher as consultant. Some in the field were interested in redefining the role of the teacher in relation to the technology, and Silber's concepts and model provided viable options.

Systems Approach

The systems approach was the third major concept included in the 1972 definition of educational technology. The systems approach was used in both its descriptive and prescriptive senses in this definition, but momentum was growing to move the systems approach into a more prescriptive usage in the field.

The concept of programming greatly affected the prescriptive view of the systems approach. Programming, the process by which programmed instruction and other instructional products were developed, was based on linear logic (Stolurow, 1961). Many in the field were comfortable with programming as a method of product development. "Programming is not new to the audiovisual tradition." Finn (1961) said, "Any cross media approach to instruction the linking of films, direct experiences, filmstrips, etc. together to achieve an instructional objective must be programmed. The sequencing of a film or television program is a kind of programming."

The process of programming consisted of five basic steps in the early 1960s: (1) generally stating the objective and description of students; (2) determining behaviors related to the subject matter; (3) redefining the objective; (4) writing the criterion frames; and (5) testing the criterion frames. Much of the programming done in educational technology was on the intuitive level. There was no programming theory that guided practice in the field. It was the development of programmed instruction that gave rise to a formal procedure, if not a formal theory, of programming.

The early advocates of programming and programmed instruction were interested in developing a science of instruction based on principles of behavioral learning theory. Like Thorndike before them, some, like Stolurow (1961) and Skinner (1954), saw efficiency in education as part of the rationale for enacting their instructional theory. But efficiency in education was not their primary objective. Their primary objective was to build a science of instruction. The program itself, the product developed by using the engineering method, could be viewed as the application of scientific principles, or scientific knowledge in an educational setting. For Skinner and Stolurow, efficiency in education was a byproduct of science. It came from a program's ability to be replicated once the field testing was successfully completed.

Educational engineering and measurement-based, educational science were closely tied to the concept of programming. Skinner and other behavioral psychologists identified what they believed to be the most important scientific principles of learning. However, knowing what the principles were, and having a tested theory for implementing them in an educational setting, were two different things. Aware that there were gaps in the behavioral scientist's knowledge and abilities to prescribe actions, Finn said that practitioners could not turn to science for answers. This was why, he explained, that an empirical approach to solving educational problems was growing:

The empiricists hold that materials, devices and processes must be validated in advance in terms of well stated objectives of instruction on the students on which they are to be used. In other words, materials, devices, and processes are produced on a best guess basis, are tried out, are refined or changed as necessary, and are tested again. The process is repeated until a system that works is derived. Such a concept can be considered a sheer technological or engineering approach and is so referred to by those that advocate it (Finn, 1966, p. 283).

There are noticeable similarities between these and Charters's analysis of engineering techniques, particularly the emphasis on determining the main objective and then detailing the parts of that objective. The act of programming could be viewed as an engineering process. It was based on linear logic, much like Charters's interpretation of the scientific method in his explanation of educational engineering (1945).

For Finn, programming was an important aspect of the education field. Even though programming was certainly not the scientific theory that he had hoped would make the AV field a profession, Finn certainly considered it to be an important intellectual technique. This technique was an essential tool for educators. "A true professional teacher," he said, "should be able to program, should be able to put parts of a system together, should be able to create systems" (Finn, 1961). As important as the technique of programming was to educational technology, it was not unique to the field. An approach that incorporated the important aspects of programming but added ideas and concepts that were unique to the field of educational technology was desired. The systems concept was certainly a possibility.

When the 1972 definition of educational technology was published, the literature referred to the systems concept as the "systems approach," rather than as the "man-machine system," as it had been up until the 1963 definition statement. Given the discussion of the systems approach and the man-machine system in the previous chapter, one might conclude that the systems approach was now being used solely for prescriptive purposes. But such a conclusion would not be correct.

The systems concept was certainly being used to mean "prescription" more frequently than it had in the past. But there were still some members of the field who used the systems approach to describe entire instructional systems and the relationships of these instructional systems with other systems that were popular about 1970. W.E.Hug and J.E.King (1984) made a distinction between these two interpretations of the systems concept. They referred to the prescription as being primarily interested in linear logic. Those interested in prescription believed in clearly separating the means and ends in their procedures. Their purpose was to use a "systematic set of procedures for generating, implementing, and evaluating educational programs" (Hug and King, 1984). The other interpretation of the systems approach is based on Ludwig von Bertalanffy's General System Theory (1975). Here the emphasis is on "the study of the whole entity by understanding the fundamental relationships existing among the components of all systems" (Hug and King, 1984). It is a descriptive use of the systems concept.

Advocates of the linear interpretation of the systems approach have suggested that their approach included the General System Theory view in the initial stages of the procedure (Hug and King, 1984). They claimed that a clear understanding of the relationships within a system must be understood before actions could be prescribed. Von Bertalanffy himself rejected this interpretation of General System Theory. He stated that "the goal of General System Theory is clearly circumscribed. It aims at a general theory of wholeness, of entire systems…it does not deal with isolated processes, with relations between two or a few variables or with linear causal relationships" (1975, p. 23). Von Bertalanffy argued that the whole of General Systems Theory could not be accounted for in a prescribed process. Although the earliest uses of the systems concept in educational technology were descriptive, and in some ways like General Systems Theory, they were based in operations research (Finn, 1956; Hoban, 1956). Operations research was a method of determining the most efficient way to conduct an operation or a business. Operations research was interested in man-made systems. General Systems Theory was originally conceived as a way to study biology. Determining an operational efficiency goal is not part of the study of natural systems.

C.West Churchman, of the University of California at Berkeley, identified four views of the systems approach: the advocates of efficiency, the advocates of science, the humanists, and the anti-planners (1968). Of these four views, the advocates of efficiency and science were most prevalent in the field of educational technology.

There was some discrepancy among the many educational technologists who viewed the systems approach as a prescriptive procedure as to how that procedure should be characterized. Advocates of the systems approach as a science, like Henry Lehman (1968), argued that the systems approach was the scientific method and that it could be used to generate a body of knowledge. Advocates of the systems approach as a way to increase efficiency, like Leo Silvern (1969), discussed it in relation to engineering. These were the two popular metaphors for the systems approach. Although they included some of the same basic ideas, each required a different emphasis for the prescriptive process.

In the section on the rationale for the 1972 definition, titled *The Systems Approach,* Ely explained the meaning of the term "systems approach":

When scientific and experimental methods are applied in an orderly and comprehensive way to the planning of instructional tasks, or to entire programs, this process is sometimes known as "systems design," or the "systems approach to instructional development." Implicit in the systems approach is the use of clearly stated objectives, experimentally derived data to evaluate the results of the system, and feedback loops that allow the system to improve itself based on evaluation. A systematic approach usually involves: needs assessment; solution selection; development of objectives; analysis of tasks and content needed to meet the objectives; selection of instructional strategies; sequencing of instructional events; selection of media; developing or locating the necessary resources; revision of resources until they are effective; and recycling continuously through the whole process (Ely, 1972, p. 38).

Three points should be considered here. First, the systems approach incorporated the basic components of programming (Sturlorow, 1961). Like programming, the process began with a detailed analysis and included production and evaluation. However, the intention of early programming was to develop tangible products: materials that were to be used in instruction. The systems approach, as discussed by Ely, was not limited to producing products. Certainly products could be produced using the systems approach, but the systems approach could also be used to develop the instructional plans that would include the use of instructional products. Some later versions of the systems approach did not require that products be used in instruction.

Second, the language that Ely used accommodated both those who believed that the systems approach was the scientific method and those who considered the systems approach as an engineering tool. The words "scientific and experimental methods" certainly suggested that the systems approach was a science or the scientific method. And the phrase "experimentally derived data to evaluate the results of the systems" suggested that the systems approach included the idea of research and development, which was a basic concept of engineering. The systems approach

seemed to be an outgrowth of both Charters's educational engineering and the development of a science of education. But the view of science that Ely is referring to when he discusses the systems approach is not clear.
The third point is that Ely did not distinguish the systems approach from a systematic approach. The excerpt from the rationale for the 1972 definition implied that the systems approach and a systematic approach were the same thing.10 This explanation helped answer the question about which kind of science is being suggested in the rationale for the 1972 definition. Among the steps included by Ely in the systematic approach were the "development of instructional objectives" and the "selection of instructional strategies." One purpose of instructional objectives was to standardize instructional outcomes. One purpose of developing different instructional strategies was to provide the optimum strategy for each type of learner. Learner types were frequently determined by psychometric testing of abilities and characteristics. The science implied by Ely was the science of education based on standardized measurement.
When the 1972 definition was published, those in the field who viewed the systems approach as a prescriptive process saw it as either science or engineering. The reason to choose one or the other of these characterizations of the systems approach was frequently determined by the primary purpose for using the systems approach. Those who were interested in developing an instructional plan or product in the most efficient or effective manner tended to view the systems approach as an engineering process; that is, they viewed the process of development as the system. Those who viewed the systems approach as a science were primarily interested in developing a body of knowledge that could be used to prescribe actions to attain predetermined results. They viewed the system as a way to generate and apply the scientific body of knowledge.
It should be noted that the 1972 definition, which was published in the journal *Audiovisual Instruction,* was considered by many in the field to be an interim definition (AECT, 1977). The version that appeared was not as lengthy or as detailed as the 1963 definition was, or as the 1977 definition would be. Records that included many of the details of the discussions included in the supporting rationale of the 1972 definition, and early drafts of that definition, were kept by Ely, then chair of the AECT's Committee on Definition and Terminology. Editing these documents would yield a document similar in length to the 1963 definition.

Critics of the 1972 Definition

The 1972 definition was not the object of numerous criticisms as was the 1963 definition, perhaps because it was considered to be only an interim definition (Ely, 1994). Only one critical article appeared in the literature. This critique (1973) was written by Dennis Myers, then a graduate student at Syracuse University, and Lida Cochran, a faculty member at the University of Iowa.11

The brief analysis offered by Myers and Cochran was critical of the 1972 definition for at least five different reasons. First, they suggest including a statement in the rationale for the definition that said students have a right of access to technological delivery systems as part of their regular instruction. Including such a statement follows from Hoban's (1968) discussion about the appropriateness of technology for instruction in a technological society. Second, Myers and Cochran argued that the 1972 definition statement was weakened by neglecting to include a theoretical rationale for the definition. This criticism, which correctly points out that the definition is lacking a unified theoretical direction, supports Robert Heinich's (1970) assertions in his philosophical view of the field.

In a third point, Myers and Cochran criticize the limited role that the educational technologist is provided in the description of the systems approach that was provided in the definition. In a fourth point, they discuss the shortcomings of the terminology used to discuss the domains and roles in educational technology.

Perhaps the most interesting point made in this analysis deals with the relationship of educational technology to the rest of the education field. In noting the problem of defining the field by the functions performed, Myers and Cochran point out the importance of considering the purpose of education. "What is important is that certain functions get done in education. That generalization is important because it conveys an attitude that transcends narrow professional interests and strikes a note of community and cooperativeness, qualities which are essential to the solution of problems facing education and society" (p. 13). Here Myers and Cochran seem to be chastising the writers of the 1972 definition for being overly concerned with intellectual territory and the roles performed in the field of educational technology. This particular criticism loses only a little of its sharpness when it is viewed in light of earlier comments made about the inappropriateness of the limited role assigned to educational technologists in the definition.

Conclusion

By 1972, the name of the concept had changed from AV communications to educational technology. In the nine years since the first definition, there had been substantial changes. Educational technology was now identified as a field of study. This field of study was open to interpretation by those that practiced within it and these interpretations were reflected in the 1972 definition. But the 1972 definition was only intended to be a temporary measure. Almost as soon as it was published, work began on the next definition.

Notes

1. This is the popular abridged version of the 1972 definition. It is argued in the definition statement that "nothing less than the entire statement constitutes a definition of the field" (1972, p. 37). The entire statement was eight pages long. The credit for authorship of the 1972 definition varies. Different sources cite the authors differently. Some sources cite Ely as the author even though the definition was the product of a committee. Some sources cite Ely as the editor of the definition statement because he was the chair of the AECT's Committee on Definition and Terminology when the definition was published. Still other sources cite the AECT as the author of the definition. In this study, the citation shall read (Ely, 1972).
2. Arthur Lovejoy discussed the concept of a metaphysical pathos in the introductory chapter of his 1940 volume *The Great Chain of Being.* A metaphysical pathos is an attitude, either positive or negative, toward particular words or concepts that represent ideas.
3. It should be noted that the rationale for the 1963 definition argued that educational technology was part of an overall educational system that included other areas of study that might make decisions on subject matter and educational philosophy. The rationale for the 1972 definition includes a discussion on the relationship of educational technology to "alternative educational systems" (p. 43). The acknowledgment of the existence of multiple educational-institutional systems promotes differing philosophical considerations by educational technologists.
4. It must be acknowledged that the 1963 definition reads: "that branch of educational theory." One might infer from this statement that the 1963 definition encompasses more than one theory. The point is that the 1972 definition makes this possibility clearer.
5. Here it is acknowledged that, like the curriculum field, educational technology can encompass different philosophical approaches.
6. Space does not permit a complete analysis of each of the conflicting notions of these concepts in early twentieth-century educational thought. Herbert M. Kliebard's *The Struggle for the American Curriculum 1893–1958* is recommended as a starting point for such an analysis.
7. Proponents and historians of educational technology such as Dale (1967) and others neglect to mention this second part of the plan, leaving the impression that the Winnetka plan was nothing more than a series of individualized instruction booklets.

8. This is not unlike the semantic problems that the educational technology field faces regularly.
9. The literature of educational technology contains much discussion about the open classroom movement and its proponents. Also prevalent are commentaries defending educational technology from charges that it is a dehumanizing way to instruct. The latter argument revolves around statements like "humanism is the use of technique to attain human goals" (Rosove, 1972).
10. During this time, the systems approach was frequently equated with a systematic approach in the literature of the educational technology field. However, there were also articles that distinguished between the systems approach and a systematic approach. Almost all of these studies point out that the systems approach is systematic, but that it has other attributes as well.
11. Lida Cochran was also the spouse of Lee Cochran, a professor of education at the University of Iowa, the organizer of the Lake Okoboji leadership conferences, and an acknowledged leader of the early educational technology movement. I realize that including this particular footnote runs the risk of diminishing or devaluing the contribution that Lida Cochran has made to the field of educational technology. I sincerely hope that such an inference is not made. I have included this note as a way to offer yet another set of intellectual connections in the field. Lida Cochran was also the mother of Dennis Myers, who became a professor of Instructional Technology at the University of Toledo.

Chapter 4

1977—The Systemization of Educational Technology

In 1977, the AECT changed its definition of educational technology from:

Educational technology is a field involved in the facilitation of human learning through the systematic identification, development, organization and utilization of a full range of learning resources and through the management of these processes (Ely, 1972, p. 36), to its third definition of educational technology:

Educational technology is a complex, integrated process, involving people, procedures, ideas, devices and organization, for analyzing problems and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solution to problems takes the form of all the *Learning Resources* that are designed, selected, used, or all three, to bring about learning; these resources are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems, and devising, implementing, and evaluating solutions are identified by the *Educational Development Functions* of Research Theory, Design, Production, Evaluation Selection, Logistics, Utilization, and Utilization Dissemination. The processes of directing or coordinating one or more of these functions are identified by the *Educational Management Functions* of Organizational Management and Personnel Management (AECT, 1977, p. 1).

Conceptual Changes for the 1977 Definition

The *Definition of Educational Technology* (AECT, 1977) was a 169-page book that was intended to do two things: (1) systematically analyze the complex ideas and concepts used in the educational technology field; and (2) show how these concepts and ideas related to one another (Wallington, 1977). This publication included the definition of educational technology (which is 16 pages of the text), a history of the field, a rationale for the definition, a theoretical framework for the definition, a discussion of the practical application of the intellectual technique of the field, the code of ethics of the professional organization, and a glossary of terms related to the definition.

A substantial portion of the analysis in this book was predicated on a conceptual difference between the terms "educational technology" and "instructional technology." Understanding how the authors of the 1977 definition viewed the relationship between instructional technology and educational technology is essential to understanding the 1977 definition and its theoretical framework. The basic premise of this distinction was that instructional technology was to educational technology as instruction was to education. The reasoning was that, because instruction was considered a subset of education, then instructional technology was a subset of educational technology (AECT, 1977). For example, the concept of "educational technology" was involved in the solution to problems in "all aspects of human learning" (p. 1). The concept of "instructional technology" was involved in the solution to problems where "learning is purposive and controlled" (p. 3).

In addition to the distinction between educational technology and instructional technology, at least two other complex conceptual developments were also undertaken by the authors of the 1977 definition. These developments were interrelated. The developments were: (1) the 1977 definition of educational technology was called a "process" (p. 1). The authors intended the term "process" to suggest that educational technology could be viewed as a theory, or a field, or a profession. And (2) the systems concept was infused throughout the entire definition statement and in all the major supporting concepts for the definition in both its descriptive and prescriptive senses. The authors tied these two conceptual developments together by saying that the use of the systems concept was a process (AECT, 1977).

The systems approach was one of the three major supporting concepts for the 1972 definition. In 1977, the systems approach was no longer a major supporting concept for the definition. It had become the basis for the definition itself. In their effort to reinforce the process conception of educational technology, the leadership of the field now assumed that all major supporting concepts of the definition were tied to, or to be viewed in light of, the systems approach.

The three major supporting concepts of the 1977 definition were learning resources, management, and development. Learning resources were any resources utilized in educational systems. The 1977 writers called the descriptive use of the systems concept "resources by utilization." The authors called resources specifically designed for instructional purposes, a prescriptive use of the systems approach, "resources by design" or "instructional system components."

The concept of "management" was often used as a metaphor for the systems approach (Heinich, 1970). Like the concept of learning resources, management could be used in a descriptive fashion to describe administrative systems, or in a prescriptive way to prescribe action. The term "instructional development" was frequently used to mean the "systems approach to instructional development" or "instructional systems development" (Twelker, et al., 1972). The fact that the management view of the systems approach to instruction often included an instructional development process, and the fact that instructional development models frequently included management as a task to be completed in the systems approach, further intertwined the systems concept with the process view of educational technology.

The Process of Educational Technology: Theory, Field, and Profession

The notion that educational technology was a process was not new when the 1977 definition was written. "Process" was one of the three major supporting concepts incorporated into the rationale of the 1963 definition (Ely, 1963). The belief that educational technology was a process was also one of the major reasons why the leadership of the profession tended to reject the report of the Presidential Commission on Instructional Technology (1970), which focused on the hardware of the field in its first definition of instructional technology.

The authors of the 1977 definition sought to use the term “process” to develop a systematic and congruent scheme for the concept of educational technology. They said:

The definition presented here defines the theory, the field, and profession as congruent. This occurs because the definition of the field of educational technology is directly derived from, and includes, the theory of educational technology, and the profession of educational technology is directly derived from, and includes, the field of educational technology (AECT, 1977, p. 135).

Ultimately, the effort to demonstrate the congruence of the major concepts provided as many problems for the field as it solved. But there were at least four immediate advantages in describing educational technology as a process:

1. Using the term “process” reinforced the primacy of the process view of educational technology over the product view. The process view had been outlined in the 1963 definition statement, but the report of the Presidential Commission on Instructional Technology (1970) appeared to reverse this emphasis.
2. Using the term “process” would ground the definition of educational technology in the activities of its practitioners, activities that could be directly observed and verified.
3. Using the term “process” could be used to describe educational technology as a theory, or a field, or a profession.
4. An organized process implies the use of research and theory, which would reinforce the idea that educational technology was a profession.

The authors of the 1977 definition argued that educational technology could be thought of “in three different ways as a theoretical construct, as a field, and as a profession” (p. 17). “None of the foregoing perspectives,” they continued, “is more correct or better than the others. Each is a different way of thinking about the same thing” (p. 18). The writers of the 1977 definition used the term “process” to describe and to connect all three of these perspectives with a single word. They argued that the theoretical construct, the field, and the profession were all process based.

The idea that educational technology was either a theory or a field was also not new in the 1977 definition. Educational technology had been called a theory in 1963 (Ely, 1963) and it had been called a field in 1972 (Ely, 1972). What was new to the 1977 definition was the argument that educational technology was also a profession. Before 1977, “profession” was a term that was used in passing as it related to educational technology. Members of the field had made few attempts to systematically analyze educational technology as a profession (Silber, 1970) since Finn had argued in his 1953 paper that the field had not yet reached professional status.1 Using the criteria set down by Finn, the writers of the 1977 definition argued that educational technology was now a profession.

The success of using the term "process" to describe educational technology as a theory, a field, or a profession was hinged on differing interpretations of the systems approach. Educational technology could be explained as a theory, a field, or a profession depending upon the interpretation and application of the systems concept.

The three major supporting concepts of the 1977 definition—learning resources, management, and development—could also be interpreted differently based on different conceptions of the systems approach. The different interpretations also provided the writers of the 1977 definition with the reasoning behind the distinction between educational technology and instructional technology.

Learning Resources

Of the three major supporting concepts for the 1977 definition, the concept of "learning resources" had the most obvious ties to prior definitions of educational technology provided by the AECT/DAVI. "Learning resources" was one of the three major supporting concepts of the 1972 definition. In the 1972 definition, the concept of learning resources included four categories or classes: (1) materials, (2) tools and equipment, (3) people, and (4) settings (Ely, 1972). In 1972, learning resources was an expansion of the "audiovisual" concept that was discussed in the 1963 definition. By 1972, the term "audiovisual" had become synonymous with equipment and materials. The writers of the 1972 definition added the categories of "people" and "settings" to the audiovisual concept of the 1963 definition in response to changing practices in the field. This addition prompted the change of the name from "audiovisual" in 1963 to "learning resources" in 1972.

In 1977, the concept of learning resources was viewed somewhat differently than it had been in 1963 and 1972. There were four components of the rationale for learning resources in the 1977 definition: (1) classification, (2) a broad range of resources, (3) media, and (4) resources by design and utilization. All four components were part of the 1972 definition statement, but they were organized differently in the 1977 definition. Reorganizing these components was sufficient to change the emphasis and the utility of the concept of learning resources.

In the 1972 definition, classification was the main thrust in the discussion of the learning resources concept. The authors were primarily interested in classifying the types of learning resources. The writers of the 1977 definition still considered the classification of learning resources to be important, but the scheme they used to classify those resources had changed. Learning resources were not classified by "type" as they had been in the 1972 definition. Nor were they classified on the "concrete abstract axis" (p. 70) that was inherent in the different versions of Edgar Dale's "Cone of Experience" (1946, 1954).2

The 1977 definition adopted the classification scheme described in the Jobs in Instructional Media Study (JIMS) (Wallington et al., 1970). The purpose of the JIMS report was to identify and describe the jobs involved in instructional media. The JIMS study classified learning resources based on the purpose of the resource rather than by its type. Using a classification scheme based on the purpose of the resources meant that, to ensure the resources achieved their purpose, the jobs that had to be accomplished would have to be identified and described. This classification scheme was consistent with the attempt in the 1972 definition to describe the field "in terms of what its practitioners do" (Ely, 1972, p. 38). Using purpose as a basis for classifying resources also served to reinforce the distinction between educational and instructional technology. In instructional technology, learning was purposive and controlled.

In their discussion of the JIMS project, the authors of the 1977 definition substituted the phrase "learning resources" for media that had been used in the JIMS report.3 Substituting "learning resources" for "media" was consistent with the effort to increase the range and scope of the field. The logic was based on the idea that learning "resources" was a broader category than "media" and would, therefore, be more inclusive. Citing the JIMS report, the 1977 authors argued that "the major role of the [learning resources] in learning and instruction is to transmit some stimulus or some information to the learner" (p. 71). The classification of learning resources in the 1977 definition would be based on sending stimuli and information to learners (AECT, 1977). This scheme ensured the conceptual connection between the 1977 definition and the 1963 definition. There was a substantial effort to tie concepts from communication to concepts from learning theory in the 1963 definition (Ely, 1963).

The authors of the JIMS report discussed media in six categories or classes: messages, people, materials, devices, techniques, and settings. These six categories were adopted by the writers of the 1977 definition as a classification of learning resources. They believed that this classification scheme demonstrated continuity between their study and previous definitions of educational technology. "There is a strong similarity between the classifications used here and those used in the 1963 definition model," they argued (p. 71).

Some of the changes were limited to the addition or replacement of some labels with terms that were previously considered "explanatory" (p. 71). The categories "messages" and "techniques," which were added to the 1977 discussion of learning resources, were considered to be secondary concepts in the 1963 definition. Messages were thought of as the "content to be taught," and techniques were the "means of delivery" (Ely, 1963). The decision to add these terms to the 1977 definition was based on a desire to "include a broader perspective of learning resources" in the new definition (p. 72).

The remaining three components of the rationale for the learning resources concept in the 1977 definition were: (1) a broad range of resources, (2) media, and (3) resources by design and utilization. These three components of the rationale were very brief statements intended to expand the idea of learning resources beyond the "restricted list of common school materials" (p. 72). "Limiting the range of resources" the authors felt, "consequently limits the tools available to the field of educational technology" (p. 72). Already confronted with an environment where technology was often associated with equipment, limiting the tools available to the field was the same as limiting the growth prospects of the field. The leadership of the field was careful to avoid discussions that implied limiting the growth of the field.

The desire to increase the amount of resources available to the field echoed the argument of Gerald Torkelson (1965). Torkelson had brought the term "learning resources" to prominence as part of the debate on the name change for the professional organization in the 1960s. Kenneth Silber built on Torkelson's argument when he reasoned that broadening the definition of learning resources could broaden the field of educational technology (1970).

In their effort to clarify and expand the concept of learning resources, the authors of the 1977 definition reinforced one of the basic premises of the rationale for the 1972 definition: that there were resources by design and resources by utilization. Resources by design were specifically developed to assist in training people in industry and in the military, or to "specifically teach school children subjects in the curriculum" (AECT, 1977). Resources by utilization were resources that existed in the real world but were not specifically designed to aid in instruction, yet they "could be applied or used for learning purposes" (AECT, 1977).

The authors of the 1977 definition used the distinction between resources by design and resources by utilization as part of the basis to organize an entire conceptual framework for educational technology. A fundamental part of this framework was the distinction between "instructional technology" and "educational technology." This distinction was "based on the concept that instruction is a subset of education" (p. 3). Educational technology was "involved in all aspects of human learning" (p. 1), and instructional technology was concerned with those "situations in which learning was purposive and controlled" (p. 3). Instructional technology was considered to be a subset of educational technology (AECT, 1977).

To underscore the difference between resources by design and resources by utilization, the writers of the 1977 definition adopted Silber's phrase "Instructional System Components" (1970). As part of the definition of *instructional technology,* they explained that "*Instructional System Components* are prestructured in design or selection, *and* in utilization, and are combined into complete instructional systems; these components are identified as Messages, People, Materials, Devices, Techniques, and Settings" (p. 3). Resources by design were instructional system components and were considered a part of instructional technology.

The individuals who developed the instructional system components used the systems approach to design or select them and to integrate the instructional system components into complete instructional systems. In the area of instructional technology, the systems approach referred to at least four kinds of systems: (1) the "instructional system component," (2) the system that was followed to develop the individual "instructional system component," (3) the "complete instructional system," and (4) the system that was followed to generate the "complete instructional system." Systems could be either processes or physical things.

As a part of the definition of *educational technology,* the authors stated that "*Learning Resources* are designed and/or selected and/or utilized to bring about learning; these resources are identified as: Messages, People, Materials, Devices, Techniques, and Settings" (p. 1). Resources by utilization *alone* were called learning resources and were a part of educational technology and not part of instructional technology.

Following the idea that instructional technology was a subset of educational technology, all parts of instructional technology were parts of educational technology. The concept of instructional system components (resources by design), which was a part of instructional technology, was subsumed by learning resources, which was part of educational technology. Learning resources included instructional system components (resources by design) as well as resources by utilization. Instructional technology included only instructional system components or resources by design.

The learning resources that were not instructional system components were resources by utilization. These resources were not specifically designed for instructional purposes, but they became learning resources when used for learning purposes. Learning resources were a part of a systems approach, but they were part of a described system of learning rather than a prescribed system of instruction.

The two types of learning resources, resources by design and resources by utilization, are both easily tied to the older AV education movement and the AV communications concept. The purpose of the AV education movement was to promote the use of AV resources in the schools (Saettler, 1990). These resources were not intended or designed for use with a specific piece of instruction. They were, primarily, resources by utilization.

As the AV education movement matured and developed into AV communications, more and more of the resources used in the schools were specifically designed for that purpose.4 They were resources by design. Resources by design (instructional system components) were generated specifically for instructional purposes. They were intended to help to teach specific objectives.

There was a corollary here with the growing influence of educational engineering and science in education on the early educational technology movement. "Design," in resources by design, often followed the educational engineering process. In other words, it was a systematic and sequential process. Frequently, although not always, considerations in the design process included using scientific findings, scientific principles, and research data from psychology and sociology. The movement toward resources by design, and the use of the systems approach in the instructional design and media selection processes, reflected the growing influence of educational engineering and measurement-oriented science on the field of educational technology.

Management

The second major supporting concept for the 1977 definition of educational technology was "management." The concept of management became popular in education around the beginning of the twentieth century as part of scientific management and the efficiency movement in education: first as they related to school administration and later to classroom instruction (Callahan, 1962).

In 1977, "management" was a new major supporting concept for defining educational technology, although the term management had been used in the rationales for both the 1963 and 1972 definitions. In 1963, management was listed as one of the five undertakings or functions performed by those involved the field. In the early days of the educational technology field, management was considered a task to be accomplished. It was one of the things that an educational technologist might do. Management was viewed as a process, but the processes that were the focus of discussion in the 1963 definition were the "design and use" of educational messages. Conceptually, management was a secondary concern in the 1963 definition and its supporting rationale.

By the time the 1972 definition was written, the concept of management had become more prominent in the field. Finn, Hoban, and Heinich made substantial contributions to the growth of this concept. Finn (1965b) wrote of the relationship of management to technology in general, and of the possibilities for management in education. Charles Hoban Jr. (1968) explained the importance of management to educational technology, specifically the teaching and learning processes. And Heinich (1970) developed the management concept into an entirely new view of the educational technology field.

Finn frequently made the conceptual connection between management and technology (1955, 1956, 1957, 1960a). To Finn, management was, along with process, system, and control, a hallmark of technology. In Finn's opinion, managing the systems, processes, and control mechanisms provided the objectives and gave direction to technology. Without goal-oriented management and control mechanisms for the system in question, there was no technology. Finn's early writing (1955, 1956) explored the concept of management in relation to school administration and AV programs. He suggested using the systems concept from operations research to analyze how organizations worked. Finn believed that schools and AV programs could be made more efficient by viewing them as systems. As an administrative tool, the systems concept could be used to ensure that the organization's objectives were being accomplished with the most efficiency. Once viewed as systems, the schools and AV programs needed to be managed to ensure optimum efficiency and effectiveness.

Finn's later writing (1960b, 1961) showed that management could be important to the delivery of instruction as well as the administration of programs. Finn advocated treating the classroom as a system, with efficiency being the goal. But now the target system was the classroom. The teacher was seen as the manager of the classroom. Teachers were asked to view themselves as a part of an instructional system. Under this view of management, teachers were to develop their own classrooms into more efficient and effective instructional systems.
Finn was not the first to suggest that the teacher could be a manager of the classroom. When Finn published his suggestions in 1960, the concept of the teacher as a technical manager of the classroom was at least 40 years old (Callahan, 1962; Kliebard, 1987). Finn did revitalize this argument in the context of applying technology in the classroom. His work in this area was part of a resurgence in the literature of education that was intended to redirect the role of the teacher in the classroom (e.g. Hunter, 1982).
Like Finn, Charles Hoban Jr. (1965, 1968) believed that management was essential to the concept of technology. "Technology is not just machines and men. It is a complex, integrated organization of men and machines, of ideas, of procedures, and of *management,*" he argued (my italics) (Hoban Jr., 1965). For Hoban, management was synonymous with control. And, in the 1960s, using behavioral learning theory required control of the learning process.
It should not be surprising, then, that Hoban also thought education could be best understood through the management concept. "The central problem of education," he wrote, "is *not* learning but the management of learning…the teaching learning problem is subsumed *under* the management of learning problem" (1965, p. 243). Hoban saw the focus of education not as learning but as management. This problematic view of education touted management, with its emphasis on efficiency and effectiveness, as the answer to the problems of education rather than seeing learning itself as the problem of education. Statements of this kind prompted the growing number of critics of technology-based education to argue that efficiency and effectiveness had become the de facto ends of education rather than well-thought-out goals grounded in a sound educational philosophy (Taylor and Johnsen, 1986; Yeaman, 1994).
For Hoban, management was the concept that connected learning and technology. He used the "management of learning" concept as a way to introduce the newly conceived educational technology into the school classroom. "Acceptance of management of learning as a central problem of organized and institutional education would, at least, permit the admission of a wider range of alternative procedures, techniques, and methods in teaching without threatening or substantially altering the critical functions of education, teaching, or learning" (Hoban Jr., 1965).
At first, Hoban stated that introducing educational technology into the classroom did not threaten or alter the role of the teacher. But he later admitted, "there is some reason to believe that the problem of management of learning becomes more acute when any aspect of new technology is introduced" (p. 243). He later attributed these problems to the reorganization of procedures, the introduction and wider use of management techniques and "role changes and new skills required of 'classroom'

teachers" (1968). Hoban stated that these role changes would have to take place in two areas: "(I) management of technology, and (II) other and/or new non structured, non mediated teaching activities essential to personality development, humanistic growth, and cultivation of values, all of which lie outside the present and foreseeable potential of instructional technology" (p. 177).

Hoban's analysis suggested that technology would replace teachers for at least some of the delivery of instruction. The teachers would manage the technology that delivered the instruction. In addition, the teachers would focus their attention on the personal development and growth of the students. This meant that teachers would have to refocus their efforts to accommodate the new technology in their classrooms. Not only would practicing teachers have to change, but the centers of teacher preparation, the colleges, would have to change as well (Hoban Jr., 1968).

Even if teachers would, to some degree, be replaced by technology, the teachers would still have to know how to deliver instruction. In this way, much of the traditional teacher preparation program would still have to be retained. But teacher preparation programs would have to change in two areas: (1) they would have to emphasize more of the personal growth aspects of education, and (2) they would have to increase their focus on technology operation and management. These two ideas would be difficult to reconcile.

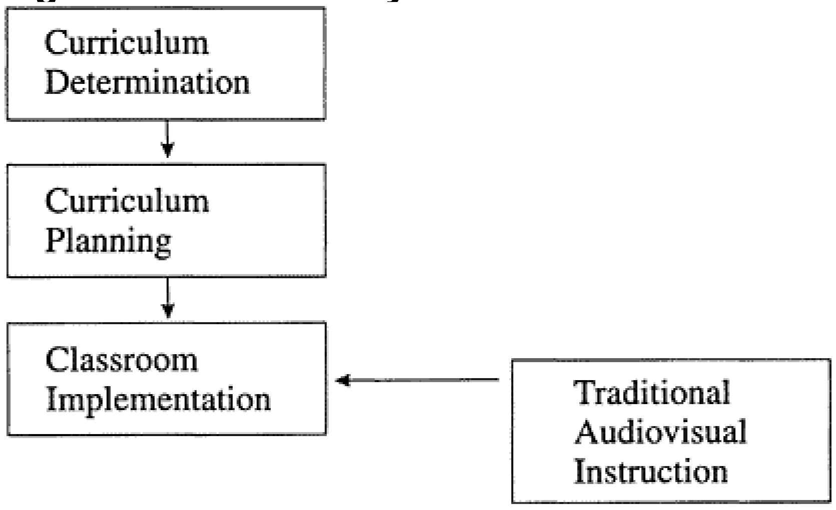
Hoban's discussion of the "management of learning problem" provided an opportunity to reconstruct the concept of management in education to look like more recent conceptions of "educational engineering" and less like an administrative action. At the beginning of the twentieth century, educational engineering was discussed in the context of educational efficiency and scientific management of the schools (Callahan, 1962). At that time, the scientific management movement in the schools, also called educational engineering (Munroe, 1912), was concerned with many aspects of operating the school plant. Later, Charters (1945) focused the idea of educational engineering into a way to develop methods, materials, and other products to be used in the classroom.

Hoban thought that the management of learning problems was more likely to be solved by Charters's concept of educational engineering than it was by the older concept of scientific management in education. Hoban was primarily concerned with developing and using instructional methods and materials effectively. Although he did not discard budget and personnel matters, which were central to the older concept of scientific management, these were on the periphery for Hoban, who was concerned with the control of learning by the teacher.

The concepts of "educational engineering" and "management of learning" shared a common interpretation of the term "problem." Both of these viewed a problem as an object of action. A problem was not something to be merely understood or appreciated; it was to be solved. Understanding was merely a step in the process. Problems of education and learning had to be changed from philosophical problems, which focused on questions of "what" and "why," into technical problems, which focused on questions of "how," so the technical solutions of management and educational engineering could be employed.

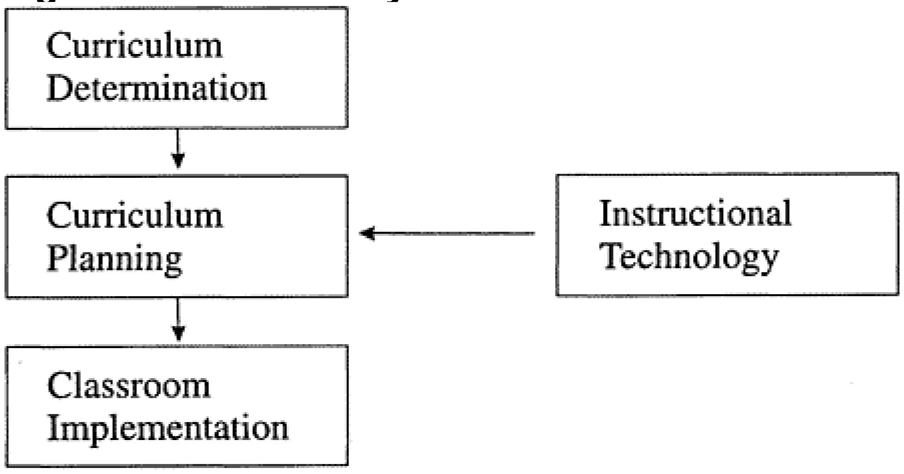
Like many of the individuals who worked on the AECT's definitions of educational technology, Heinich attended USC and had been a graduate student of James Finn. Heinich's classic analysis, *Technology and the Management of Instruction* (1970), was a reworking of his doctoral dissertation. This analysis was built mainly on the interpretations of the management concept developed by Hoban and, to a lesser extent, Finn. Heinich used the phrase "management of instruction" instead of Hoban's "management of learning." However, Heinich said that he made this change only "for purposes of clarity and style" (p. 106). He did not believe that his study was a radical reconceptualization of the concept of management (Heinich, 1970); instead, he sought to reconceptualize the field. Heinich's conception of "management" was "developed in accordance with principles of systems in applied fields, rather than in pure science" (p. 109). For Heinich, like Hoban, the management of instruction was more related to the concept of educational engineering than it was to any particular view of the role of science in education.
Heinich argued that the management of instruction included not only the development and use of materials and techniques but "also logistical, sociological, and economic factors" (p. 106). The proper management of instruction required that a management, production-oriented, or engineering attitude toward education be adopted by educators throughout the entire schooling process. For Heinich, management was not just a role or prerogative of the teacher, as Hoban seemed to imply. He advanced a view of management in education that was to serve as an alternative paradigm for the field of educational technology.
Heinich challenged the traditional view of schooling that saw classroom teachers making the decisions about instructional methods and media utilization. In his view, curriculum specialists, including educational technologists, should make the decisions about the content of the curriculum and the delivery of the instruction (see Figure 4.1). Heinich's so-called paradigm of the management of instruction called for a shift in the view of educational technology as one of AV aids controlled by the classroom teacher to one that placed educational technology in the curriculum development process (see Figure 4.2). Heinich argued that this new conception was appropriate because "the curriculum planning and development level has become the center of instructional strategy where decisions are made regarding the tactics of instruction" (p. 141).
Heinich's contribution to educational technology was a bureaucratic model of the school system in which instructional decisions were developed and passed down to teachers who would implement these decisions in their classroom settings. Teachers not only lost the decision-making role in this model of instruction but, functionally, they were treated as a part of the technology itself. They were viewed as interchangeable parts of the instructional management system (Taylor and Johnsen, 1986). The momentum implicit in Heinich's paradigm was anticipated by Finn who had said "the introduction of technology…increases the need and desire for more technology" (Finn, 1961, p. 117).

Figure 4.1. The Entry of Traditional Audiovisual Aids into the Instructional Process



From: Heinich, R. (1970). *Technology and the management of instruction.* Washington, D.C.: Association for Educational Communications and Technology.

Figure 4.2. The Entry of Instructional Technology into the Instruction Process



From: Heinich, R. (1970). *Technology and the management of instruction.* Washington, D.C.: Association for Educational Communications and Technology.

Apart from Heinich's discussion of a prescribed system for management in educational technology, another interpretation of the management concept became more pervasive in the literature in the early 1970s. This interpretation of the management concept was more in line with what Finn (1956) was describing in his earliest discussions of the systems concept and the administration of the AV education movement in schools. This concept was centered on managing educational resources. It was primarily a descriptive use of the systems concept.

The tasks involved in managing educational resources were most often handled by school library media specialists, media resource managers, and AV coordinators. These professionals operated the schools' AV systems. Throughout the late 1960s and early 1970s, these individuals had become increasingly important to the planning and implementation of educational media and technology in the classroom.

Margaret Chisholm and Donald Ely (1976) supported this administrative system view of the concept of management. They described the competencies and functions involved in management in educational technology. Their view of management reflected the workings of the school library and the AV program or educational resources program in the schools. Here, the overall concept of management was balanced between the organizational and personnel needs of the school media system.

Chisholm and Ely identified six focal points in the organizational management aspects of the media program: establishing goals, program planning, budgeting, planning and managing facilities, organizing access and delivery systems, and conducting program evaluations. They later identified six elements that were emphasized in personnel management: establishing goals; recruiting, hiring, and terminating personnel; conducting staff in-service training; assigning job responsibilities; assessing performance; and implementing creative supervision.

Although the glossary appended to the 1977 definition included two kinds of management—organization and personnel—the 1977 definition of educational technology was much more reflective of the idea of organization management than personnel management. Likely this was because school media managers did not perform personnel management functions as often as they did organizational ones. Relatively few personnel were involved in the resource management system of a single school. Most personnel reported directly to the school principal rather than to a media manager.

Even Chisholm and Ely ultimately realized that organizational management was a more central theme to educational technology than was personnel management. "It [personnel management] is an integral part of organization management and plays a role in the operation of each function performed by the media center staff," they argued (1976, p. 129). Ultimately, personnel management was viewed as a part of organizational management. The management of the organization was the superordinate theme in discussions of management in the field of educational technology.

Heinich's concept of management became widely accepted in the field (Jorgenson, 1981). His interpretation centered primarily on the organization in which instruction would be delivered and focused on the most efficient and effective ways of delivering that instruction. Heinich's later writing (1984; Heinrich, Molenda, and Russell, 1989) associated the concept of management with the concept of engineering. For Heinich, the management of instruction was the same as educational engineering.

A portion of Heinich's discussion of management was included in the rationale of the 1972 definition, but management was not formally recognized as an essential concept of the field until the 1977 definition was published. By the time the 1972 definition was written, management had evolved from a task to be accomplished (as it was considered in the 1963 definition) to one of the important factors to be considered when doing educational technology. By 1977, many practitioners in the field had adopted differing portions of Heinich's conception of management. How the intellectual technique developed in the future would depend greatly on how the concept of management was interpreted.

Development

A number of terms have been used to describe "instructional development," which is the third major supporting concept of the 1977 definition. A partial listing of these terms and designations includes: instructional development, instructional design, instructional technology, designing instructional systems, developing instructional systems, instructional systems design, instructional systems development, planning instructional systems, managing instructional systems, and instructional systems management. Such differences in terminology make a thorough analysis of instructional development difficult because one can never be certain if all of the different ideas involved in instructional development have been considered.

Shrock (1990) pointed out that the term "instructional development" was being used synonymously with both instructional technology and instructional design. The terms "instructional design" and "instructional technology" appear frequently in the literature of the field and mean different things to different groups of practitioners in the field. This lack of clarity about the meaning of instructional development, instructional design, and instructional technology added to the confusion that the members of the field felt about its terminology, and correspondingly, the activities described by its terminology. This is especially about the term "instructional development."

The definition of instructional development that was produced by the writers of the 1977 definition and which guided their work was:

A systematic approach to the design, production, evaluation, and utilization of complete systems of instruction, including all appropriate components and a management pattern for using them; instructional development is larger than instructional product development, which is concerned with only isolated products, and is larger than instructional design, which is one part of instructional development (AECT, 1977, p. 161).

Clearly the authors of the 1977 definition intended instructional development to be a broad, process-based concept that included instructional design, product development, and management. That is how it will be considered here.

In 1977, many components or tasks were associated with the instructional development process. Shortly after the completion of the 1977 definition, Andrews and Goodson (1980) published a comparative analysis of 40 popular instructional development models that were generated in the 1960s and 1970s. They found that 14 tasks were frequently included in many of these models:

1. Formulation of broad goals and detailed subgoals stated in observable terms
2. Development of pretest and posttest matching goals and subgoals
3. Analysis of goals and sub-goals for types of skills/learning required
4. Sequencing of goals to facilitate learning
5. Characterization of learner population "as to age, grade level, past learning history, special aptitudes or disabilities, and, not least, estimated attainment of current and prerequisite goals" (Gropper, 1977, p. 8, as cited in Andrews and Goodson, 1980)
6. Formulation of instructional strategy to match subject matter and learner requirements
7. Selection of media to implement strategies
8. Development of courseware based on strategies
9. Empirical try out of courseware with learner population, diagnosis of learning and courseware failures, and revision of courseware based on diagnosis
10. Development of materials and procedures for installing, maintaining, and periodically repairing the instructional program
11. Assessment of need, problem identification, occupational analysis, competence, or training requirements
12. Consideration of alternative solutions to instruction
13. Formulation of system and environmental descriptions and identification of constraints
14. Costing instructional programs (Andrews and Goodson, 1980, p. 8).

The Andrews and Goodson study brought some order to the instructional development process by identifying the tasks that were a part of early instructional development models. Their study was not intended to be a highly theoretical analysis of the meaning of the concept of instructional development. Rather, it was part of a larger and growing series of studies that contributed to the analysis of concepts related to educational technology that focused on what educational technologists actually did. The trend in doing this kind of analysis began about the time of the writing of the 1972 definition and is still popular in the current literature of the field.

Two factors contribute to the difficulty of performing analyses of instructional development: (1) not all of the 14 tasks identified by Andrews and Goodson were included in all 40 of the instructional development models that were reviewed in their study; and (2) not all of the models that were analyzed in the Andrews and Goodson study followed the same task sequence.

Two historical analyses have supported the Andrews and Goodson discussion of instructional development models. Jorgensen (1981) was able to show that the tasks included in instructional development originated in a variety of academic areas. Jorgensen identified six areas of thought that influenced the growth and direction of instructional development: (1) AV and technological developments, (2) programmed instruction, (3) behavioral objectives, (4) communications and control sciences, (5) differing areas of psychology, and (6) management and production sciences.5

Shrock (1990) provided a time frame for the primary development of many instructional development tasks as they became popular in the field of education: before 1920, there was the beginning of an empirical knowledge base for education; during the 1920s, there was the beginning of prespecified objectives and individualized instruction; in the 1930s, there was the further development of behavioral objectives and the introduction of formative evaluation; in the 1940s, instructional media and research and development from the war became popular; in the 1950s, programmed instruction and task analysis were developed; in the 1960s, instructional systems, psychological research, and criterion referenced testing made their mark; and in the 1970s, instructional models became popular. Many of the ideas that Jorgensen and Shrock identified have been included earlier in this study. Here, the focus is on systems history and instructional development models rather than on a historical account of each of the tasks involved in the instructional development process.

Systems in Instructional Development

Adding to the confusion about the relationship of instructional development to instructional design and to instructional technology, in the AECT's 1977 definition of educational technology, the concept of instructional development was also interrelated with the concept of systems. Robert Wagner, a professor of film and film studies in education at Ohio State University, foresaw the potential for conceptual problems when trying to relate the systems concept to instructional development.6 Wagner (1961) warned that some in the field might challenge the consistency of such a conception. “Design and system are affective words. Design does not refer to pure artistry any more than system is intended to connote the ultimate development of mechanical consciousness” (p. 1).

Wagner was arguing that the words “design” and “system” carried an emotional charge for those involved in the field because “system” implied a business and engineering approach to education, and design implied an artistic concept of education. Wagner did not believe that design and systems were independent theoretical constructs. He thought that they were related. “Design in education,” he stated, “as thoughtful, artful, organic use and creative control of necessary system, is more than a philosophical consideration. It is part of a larger concept of systems development” (p. 2).

Wagner agreed fundamentally with the analyses of “systems” provided by Finn (1956) and Carpenter (1960). Wagner argued that “systems are expressions of a drive toward organization and standardization; a breakdown of ideas, information, and processes into bits and pieces which may be easily reconstructed” (p. 12). He followed his description of systems by noting that

Design implies a less standardized approach. It involves the sketching or outlining of action without confining it. Design is dynamic, less likely to become formalized, more dependent on individual judgment… It involves creativity, and hence is more disorganizing and less reliable in action than the more systematic scientific approach (p. 2).

It is not clear if Wagner intended to describe a system as a product of the design approach. What is clear is that he believed design could contribute to the field of educational technology and that the concept of systems development should allow for certain less formal and more creative individual judgments Certainly Wagner’s thoughts on the role of design were influential on the origins of the concept of instructional development.

The concept of instructional development was affected by a variety of historical factors. Members of the profession with different historical backgrounds interpreted it differently. There was no single procedure for doing instructional development. This point has been made by a number of scholars in the field of educational technology, including Davies and Schwen (1971), Andrews and Goodson (1980), and Gustafson (1981). Bass and Dills (1984) argued that the context in which instructional development was practiced affected the way in which instructional development was done. They stated that “instructional development, as practiced, appears to be different things when viewed within different environments” (p. 3).

Some of the differences that arise instructional development were articulated in a collection of articles edited by Davies and Schwen of Indiana University (1971). The AECT published this collection as part of its Occasional Paper Series. The five papers in this document addressed the issue of defining and conceptualizing instructional development. Robert Heinich, of Indiana University, argued for an eclectic approach to instructional development. Kent Gustafson, then of Michigan State University, considered instructional development to be a systems approach. David Merrill of Brigham Young University believed in a theoretical approach to instructional development. Leslie Briggs of Florida State University advocated an empirical approach. And Dale Hamerus of the U.S. International University thought that instructional development was an organizational approach to improving instruction.

Even though the five contributors to this document did not always agree on a unified concept of instructional development, the two editors were able to identify some activities, principles, and ideas that brought together the five theoretical positions. In the conclusion to the occasional paper they argued that

Instructional Development is concerned with:

1. the recognition of the objectives (or intents) of both a learning task and the participants involved.
2. the feasibility of realizing the objectives (or intents) within the two constraints of: a) necessary limited resources and, b) adequate measures of the effectiveness with which both sets of objectives are achieved.
3. the comparison of alternative strategies and tactics for achieving feasible objectives (or intents).
4. the choice or selection of a best or optimum alternative so as to: a) realize these learning objectives (or intents), b) increase student interest, enthusiasm and motivation to the task in hand, and c) maximize learning efficiency in the context of an appropriate use of available resources.
5. the execution of this decision process into an effective and worthwhile instructional program.
6. the continual ongoing recycling and refining of the above 5 concerns so as to sharpen and enrich the total learning experience.
7. the successful selection of the optimal point to stop development and hand over the program, since further development is unlikely to be worthwhile or meaningful and [may] even be harmful (Davies and Schwen, 1971, p. 87).

In their postscript, whenever Davies and Schwen used the word "objectives," they followed it with the phrase "or intents" in parentheses. This strongly implies that they did not believe behavioral objectives were a necessary part of instructional development. But it seems clear that some sort of instructional intent had to be identified before instructional development programs could be fully enacted and completed.

Other attempts to synthesize the early conceptions and models of instructional development were done by Twelker, Urbach, and Buck (1972) and the National Special Media Institute's Consortium (1972). Both of these syntheses represented the instructional development process in three phases: define, develop, and evaluate.
Twelker and colleagues (1972) believed that there was a strong connection between the systems approach and instructional development. They called this three-phase representation of instructional development a simple definition of a systems approach. They identified three interpretations and/or purposes for instructional development, all of which were closely tied to the systems approach.

1. An instructional system is an empirically developed set of learning experiences which bring about a given learning outcome for a given set of learners with a given degree of reliability (p. 1).
2. Systematic development consists of a series of planning, developmental and evaluation techniques which provide information to revise the instructional system until it works to the developer's satisfaction (p. 1).
3. Systems approaches are management techniques of seeking solutions to educational problems or at least of making maximum use of every resource available to the improvement of instruction (p. 1).

In fact, Twelker and associates used the term "instructional development" interchangeably with "the systems approach to developing instruction."
In ways similar to the Twelker study, Kent Gustafson (1981; Gustafson and Branch, 1997) identified three approaches to perspectives on instructional development: the systems perspective, the systematic perspective, and the prescriptive perspective. For Gustafson, the systems perspective viewed the instructional development process itself as "an integrated system with numerous interacting elements" (p. 3). The systematic perspective suggested that the instructional development process must be carefully described and that a list must be made of "all the necessary development tasks to be performed by the developer" (p. 3). The prescriptive perspective views instructional development as "a series of 'if then' statements. That is, if the learning is of type 'x' and the learner of type 'y', then the learning activity should have given characteristics" (p. 3). Gustafson did draw a distinction between the systems approach and instructional development that Twelker did not. Gustafson did, however, retain something like Twelker's three interpretations of instructional development. Most importantly, both Twelker and Gustafson viewed instructional development as a process rather than as a product system.

Simon Ramo (1973) echoed the process-focused observations made by Twelker when he defined the systems approach as: “a technique for the application of a scientific approach to complex problems. It concentrates on the analysis and design of the whole, as distinct from the components or the parts” (p. 15). Calling the systems approach a technique was important because it reinforced the shift in the early use of the systems concept in the field of educational technology from conceptualizing an organization to applying a set of principles. Sometimes this application of principles resulted in a recipe or an algorithm for developing instruction, depending on which interpretation or model of instructional development was being used.

Instructional Development Models

The word “model” has many different connotations (Black, 1962). In the area of instructional development, the word model tends to mean, but is not limited to, a graphic representation of a concept or a plan. Different models of instructional development have been around as long as different conceptions of instructional development have been, and these older models played an important role in the evolution of the instructional development process.

Gustafson (1981) described three reasons why instructional developers would use these kinds of models: (1) as devices to help them communicate with clients and with each other; (2) as “planning guides” for the management of activities; and (3) as “prescriptive algorithms for decision making” (p. 5). Simple models were used to communicate with clients, and more detailed models were used to manage and make decisions about a project.

Twelker and colleagues (1972) identified five of the most influential models of instructional development of the 1960s and early 1970s. These models, which were representative of the varying contexts and audiences for which instructional development was intended, were the Michigan State University Instructional Systems Development Model, the System Approach for Education, Project MINERVA, the Banathy Instructional Development System, and the Teaching Research Systems Approach.

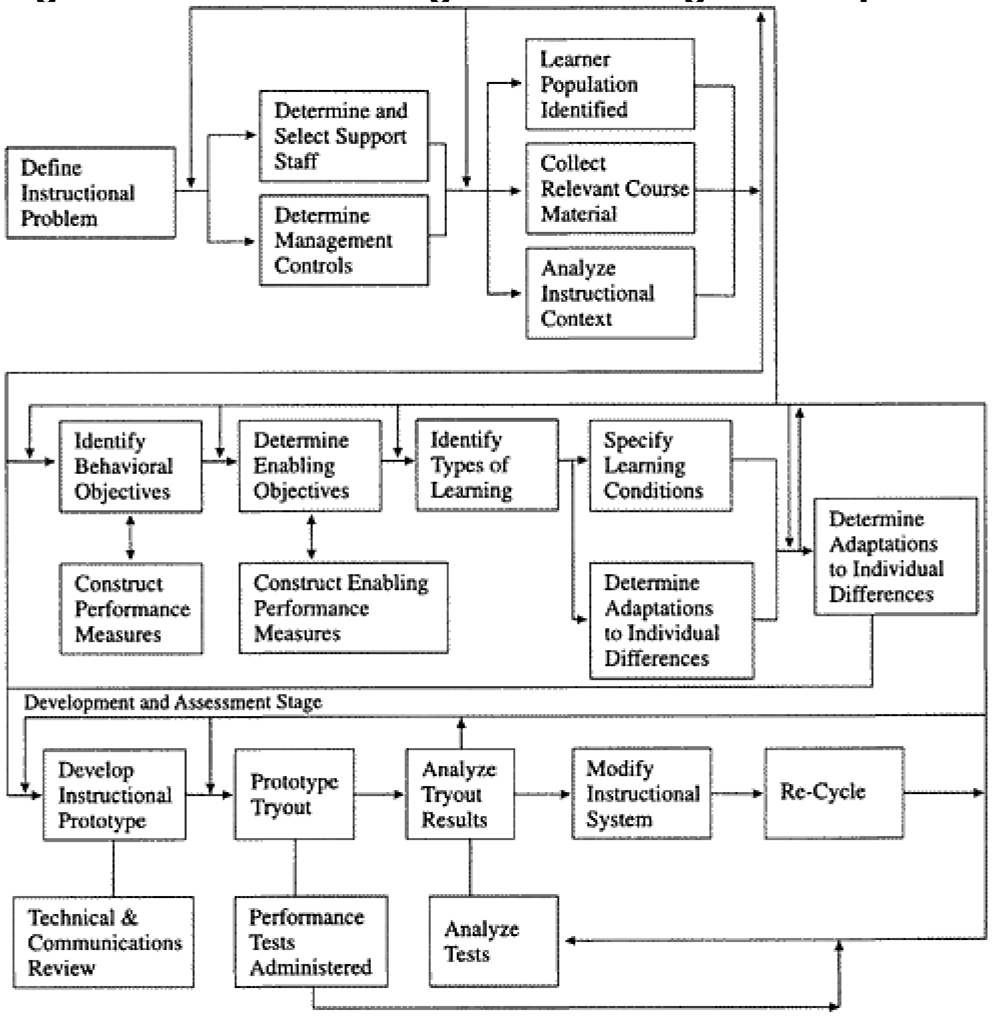
The Michigan State University Model was intended as a way for teaching faculty to systematically develop college courses. It was a generic model of instructional development because it could be used in a number of different contexts, from the research university center to the community college. This model was extensively field tested during a two-year study that included four institutions of higher education representing different settings (Twelker, et al. 1972).

The Systems Approach for Education (SAFE) model was intended as a problem-solving tool for educators of all age and grade levels. The SAFE model, developed by Robert Corrigan (1966), has been used in a variety of settings including public and private schools, colleges and research laboratories (Twelker, et al. 1972).

The model that came out of Project MINERVA was intended as a way to analyze and subsequently improve training in the U.S. Army, specifically the Army Security Agency. The MINERVA model has been tested and validated through developing multiple training programs in varied U.S. Army settings (Twelker, et al. 1972).

Banathy's model was primarily intended for instructional systems developers (Twelker, et al. 1972). Banathy's approach saw the learner as the center of the instructional system with the system being designed around the learner (Banathy, 1968). This model was popular with academics because of its focus on the individual learner, but was not widely adopted for use because of the complexity of trying to develop multiple systems in each setting.
The Teaching Research Systems Approach Model (Figure 4.3) was developed by Dale Hamerus of the Teaching Research Division of the Oregon State System of Higher Education (Gustafson, 1981; Gustafson and Branch, 1997). Hamerus intended this model for educational technologists and professional instructional developers (Twelker, et al. 1972). The Hamerus model was divided into three tiers: (1) definition and management, (2) design analysis, and (3) development and assessment. Included in these three tiers were nine stages that were further divided into 22 steps or tasks. The instructional development process consisted of these tiers, stages, and tasks (Hamerus, 1968). The Hamerus model was the most complete and detailed model of instructional development of its time (Twelker, et al. 1972; Jorgensen, 1981; Gustafson, 1981; Gustafson and Branch, 1997).
The Hamerus model was the most influential model of instructional development in the 1970s (Twelker, et al. 1972; Jorgensen, 1981; Gustafson, 1981). It was the only model included in the rationale for the development section of the 1977 definition. It was also the basis for much of the instructional development work done during the 1970s (Gustafson, 1981).
In 1971, the National Special Media Institute (NSMI) produced an instructional development model based, primarily, on the work of Hamerus (Gustafson, 1981; Gustafson and Branch, 1997). The model produced by NSMI was an integral part of the Instructional Development Institute (IDI), a federally funded effort to improve classroom instruction at the K-12 level. This popular model was referred to as the IDI model.
The IDI was a validated program developed by a consortium of four higher education institutions: Michigan State University, Syracuse University, the United States International University, and the University of Southern California under a grant provided by the United States Department of Education. The purpose of the IDI was "to assist school systems with limited resources, substantial numbers of academically or culturally deprived students, and a real desire to find innovative and effective solutions to consequent learning and instructional problems" (National Special Media Institute, 1971, p. 2).
The IDI model operated under three assumptions: (1) it was a problem-oriented model; (2) it specified a team approach to instructional development; and (3) it intended the results of the instructional development process be distributed and utilized by other groups doing instructional development (Gustafson, 1981; Gustafson and Branch, 1997).

Figure 4.3. A Flow Diagram Showing the Steps in the Teaching Research Model



National Special Media Institute, Instructional Development Institute (IDI).

The IDI model was among the best-known models of instructional development used in the United States. This model was taught as part of numerous professional preparation programs, and was the focus of in-service training for large numbers of public school personnel (Gustafson, 1981). The IDI model enjoyed a particular level of success because it was developed by a consortium of major universities with programs in educational technology and because it was well received by professionals in the public schools. The focus, assumptions, and activities of the IDI model are still maintained in college courses and preparation programs in educational technology.

The concept of instructional development, like the concept of systems, was associated with both science and engineering. There were two groupings of practitioners who believed that instructional development was a science. It is conceivable that some individuals belonged to both groups. The first grouping in the field of educational technology considered instructional development to be a science because the steps in the instructional development process mirrored the scientific method. That is, that the instructional development process was a rigorous method of inquiry into the improvement of instruction.

The second group believed instructional development to be a science because it could use quantitative methods, with some degree of reliability, to measure and test for changes in behavior. They believed that changes in behavior were a necessary condition for learning to have occurred. The goals for these instructional developers were to predict, control, and verify instructional outcomes.

Other professionals in the field saw the instructional development process to be more Like engineering. They believed that instructional development was a problem-solving approach to improving instruction. They used a systematic approach, which included using available scientific findings, for solving these instructional problems. These professionals operated similarly to what Charters characterized as educational engineers. Planning and delivering instruction efficiently and effectively were their goals.

The distinction between the different views of instructional development described here is similar to earlier discussions of the differences in the concept of technology itself. Some educational technology professionals, following Arthur Lumsdaine, saw technology as the immediate application of science to learning. Others, like Finn, and later Heinich, believed that technology required substantial research and development of the scientific findings to be applicable to instruction. Likewise, some saw instructional development to be the immediate application of scientific findings about learning, and others believed that those scientific findings needed to be further investigated, tested, and reworked to be ready for application in instruction.

Some early literature from the field (e.g., Twelker et al., 1972) describes instructional development as both a science and an engineering process. These referents are used interchangeably. Certainly arguments that depict instructional development as a science can be convincing at least at a non-sophisticated level. But instructional development is in practice more of an engineering approach to instruction. Educational goals are conceived in terms of problems, options for intervention are explored in a research and development fashion, and the intervention is tested and refined.

The instructional development model developed as part of the IDI is an excellent example of how instructional development was characterized as an engineering process. The packet of materials that was used to promote this institute included a series of graphics and drawings representing the three tiers and nine stages of the instructional development model as the building or engineering of a bridge.

Instructional development was also important because it was becoming the intellectual technique for the field of educational technology. Although there was certainly more than one model of instructional development, a series of concepts and activities were unified in an overall approach. The approach of instructional development, when combined with the process and ideas of management, gave the field of educational technology the process orientation that it wanted. It also gave the membership of the field the intellectual technique that many believed was required to be considered as a profession.

Conclusion

The 1977 definition had taken educational technology from an approach to integrating AV communications into the classroom as it was in 1963, to an extensive analytical framework that was intended to systematize the entire educational process. The systems concept was not merely a consideration for those working in the field, it was integrated into the entire definition. That is, systems had become crucial to the identity of educational technology. It was the attempt to develop the definition as an extensive analytical framework, coupled with its dependence on the systems concept, which gave rise to the need for a change in this definition.

Notes

1. It is important to remember that when Finn wrote his paper, the field was still called audiovisual education. His paper was titled “Professionalizing the Audiovisual Field,” AVCR Vol. 1 No. 1. Silber’s paper dealt with educational technology.
2. Dale’s cone had been a significant contribution to the field. It helped change the direction of the field from the AV education movement, which emphasized the use of equipment, to the more theoretical and process-based orientation that developed under educational communications and educational technology.
3. Two of the authors of the *Jobs in Instructional Media Study,* C.J.Wallington and Kenneth Silber, were members of the team that wrote the final version of the 1977 book, *The Definition of Educational Technology.*
4. From the very beginning of the AV education movement, some resources had always been specifically designed to teach specific objectives. In this case, as the movement grew older, more and more resources were being used in schools, and more and more of these resources were being designed to teach specific objectives (Saettler, 1990).
5. Jorgenson also included a limited discussion of certain ideas from the philosophy of science, specifically empiricism and logical positivism. But it seems that the influence of the philosophy of science on the field was secondhand. That is, it was filtered through other areas of thought that more directly influenced instructional development.
6. Wagner was talking about the relationship of the systems concept of design to instructional design. As acknowledged earlier, instructional development was sometimes called instructional design. Here Wagner is using “design” much like Twelker and, later, the 1977 definition committee used the word “development.”

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Chapter 5

1994—The Full Circle

By 1994, the definition of educational technology had nearly come full circle. The definition produced in 1994 read: "Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (Seels and Richey, 1994, p. 1).

There are no new concepts included in the 1994 definition. What was new was the identification of many theoretical and conceptual issues in the explanation. The 1994 definition was intended to be much less complicated than the 1977 one. The extent to which the writers were successful can be judged in part by reviewing the criticisms of the 1977 definition.

Criticisms of the 1977 Definition

The attempt by the writers of the 1977 definition to show the congruence of educational and instructional technology revealed a conceptual problem for the field. The definition of educational technology, which was concerned with "all aspects of human learning" (p. 1), had become so broad that some individuals in the field pointed out that there was no difference between educational technology and the curriculum, school administration, or teaching methods (Ely, 1982). Saettler (1990) wryly pointed out that the definition had become everything to everybody, and he dubbed it the "omnibus definition."

There were also serious flaws in the reasoning and the conceptual interpretations used in the theoretical framework and rationale for the 1977 definition. Establishing the difference between education and instruction, the authors argued that "education, then, includes two classes of processes not included in instruction: those processes related to the administration of instruction…and those processes related to situations in which learning occurs when it is not deliberately managed" (p. 56). One of the examples of learning not being deliberately managed, which was provided in the discussion, was "incidental learning" (p. 56). It was reasonable for the authors to argue that learning that was not deliberately managed, or "incidental learning," was part of the concept of education (Januszewski, 1997). However, the definitions of "technology" by Galbraith, Hoban, and Finn, which are used by the authors of the 1977 definition to discuss the term "technology" as it related to the concept of educational technology, all included the ideas of organization, management, and control (AECT, 1977). Organization, management, and control were considered to be critical characteristics of technology by the writers in 1977. But the ideas of management, organization, and control were contrary to the idea of "incidental learning" and "learning that was not deliberately managed." Education, at least as it was distinguished from instruction included in the rationale of the 1977 definition, did not seem compatible with technology. It is difficult to conceive of a technology of the incidental, unmanaged, and unintended. The gains made in organizing the framework of the concept of educational technology by distinguishing between education and instruction were lost when education was paired with technology (Januszewski, Butler, and Yeaman, 1996).

Another problem with the discussion of educational technology presented in the 1977 definition and rationale was the relationship of educational technology to "theory." There are three ways in which the concept of theory is related to educational technology in the 1977 definition statement: (1) there is the thought that educational technology was a "theoretical construct" (p. 18, 20, 24); (2) there is the notion that educational technology itself was "a theory" (p. 2, 135, 138); and (3) there is the thought that the "definition of educational technology was a theory" (p. 4, 20, 134). To some degree, all three of these discussions of theory and educational technology are accurate, but they cannot be used interchangeably as they are in this definition. A theoretical construct is not the same as a theory. Nor is it the case that, because a definition of a concept is a theory, the concept itself is a theory.

The word “theory” has been used in at least four ways in the literature: (1) the law-like theory of the hard sciences; (2) theories that are supported by statistical evidence; (3) theories that identify variables influencing the field of study; and (4) theory as a systematic analysis of a set of related concepts (Kliebard, 1977).

It is the fourth sense of theory that is of interest to this analysis. Systematic analyses of any abstract concept can be said to be theories of that concept. Referring to educational technology as a theoretical construct, or a theory, or calling the definition of educational technology a theory may be accurate if it includes a systematic analysis of the concept of educational technology.

The writers of the 1977 definition provided criteria for theory that was not theory as a systematic analysis of related concepts. They provided criteria for a view of theory that was attempting to establish general principles and predict outcomes (AECT, 1977). This approach was substantially different from the usage of the word theory in the 1977 definition statement. Further confusion arises because of the authors’ claim that educational technology did indeed meet the criteria for being a predictive theory (Januszewski, 1995).

Theory is a word that many people recognize as having several meanings. The writers of the 1977 definition intended a specific meaning of the term “theory” by providing a set of criteria for that meaning. They wanted to make theory a technical term. However, even if the authors demonstrated their case for meeting the criteria that they imposed (and they did not), the criteria they had established did not match the understanding of the usage of the term “theory” that was implied by the authors in the entire definition statement (theory as a systematic analysis of related concepts).

Certainly “educational technology” is a theoretical construct. “Educational technology” may also be considered a theory, depending on what exactly is intended by the word theory. The 1977 definition is a theory, a theory about the abstract concept of “educational technology.” But because the definition of the concept of educational technology may be a theory of educational technology, it does not make the concept of educational technology itself a theory. This is similar to saying that a definition of the concept of democracy may be a theory of democracy but that the concept of democracy itself is not a theory.

Perhaps the biggest problem with this systematic treatment of the concepts provided in the 1977 definition was that few involved in the field adopted it. Many in the field adopted only portions of the definition (e.g., Gustafson, 1981). Scholars cited certain parts of the definition and its supporting statements to make erudite points about the field of educational technology (e.g., Gentry, 1987), but reading the literature reveals that the whole conceptual framework provided in the 1977 definition, specifically the part intended to distinguish educational technology from instructional technology, was not widely adopted by the membership of the field (Seels and Richey, 1994).

A Change in Label

The effort to revise the definition addressed some of the conceptual incongruities in previous definitions. The first was the difference between educational and instructional technology. Unlike the writers of the 1977 definition, who sought to distinguish between educational and instructional technology, the 1994 authors acknowledged that this was a problem with no easy answer. "At present the terms 'Educational Technology' and 'Instructional Technology' are used interchangeably by most professionals in the field" (p. 5) they admitted. But they went on to argue that

Because the term "Instructional Technology" (a) is more commonly used today in the United States, (b) encompasses many practice settings, (c) describes more precisely the function of technology in education, and (d) allows for an emphasis on both instruction and learning in the same definitional sentence, the term "Instructional Technology" is used in the 1994 definition, but the two terms are considered synonymous (Seels and Richey 1994, p. 5).

With that, the official label of the field was changed from educational technology to instructional technology, although it was quite acceptable to continue to use the term "educational technology."1

Assumptions About and Values Implicit in the 1994 Definition of Instructional Technology

One of the things that differentiated the 1994 definition from previous ones was the identification and analysis of some of the assumptions that underlie this new definition. Among the assumptions identified were:

1. Instructional technology has evolved from a movement to a field and profession. Since a profession is concerned with a knowledge base, the 1994 definition must identify and emphasize Instructional Technology as a field of study as well as practice (p. 2).
2. A revised definition of the field should encompass those areas of concern to practitioners and scholars. These areas are the domains of the field (p. 2).

3. Both process and product are of vital importance to the field and need to be reflected in the definition (p. 2).
4. Subtleties not clearly understood or recognized by the typical Instructional Technology professional should be removed from the definition and its more extended explanation (p. 3).
5. It is assumed that both research and practice in the field are carried out in conformity with ethical norms of the profession (p. 3).
6. Effectiveness and efficiency are inherent in instructional technology (p. 87).
7. The concept of systematic is implicit in the 1994 definition because the domains are equivalent to the systematic process for developing instruction (p. 8).

Including these assumptions in the analysis and explanation that accompanied the 1994 definition allowed a definition that was much more “economical” than previous definitions.

The writers of the 1994 definition also made an effort to identify the characteristics and priorities that were involved with the field of educational technology.

Instructional technologists, as a community of professionals, tend to value concepts, such as

- replicability of instruction
- individualization
- efficiency
- generalizability of process across content areas
- detailed planning
- analysis and specification
- the power of visuals
- benefits of mediated instruction (p. 87)

By making the assumptions and characteristics of Instructional Technology explicit, the authors of the 1994 definition believed that they could produce and maintain a clear and concise definition statement that would account for the varied interests of the membership of the field.

The Components of the 1994 Definition

The 1994 authors stated that the definition was made up of four components: (1) theory and practice; (2) design, development, utilization, management, and evaluation; (3) processes and resources; and (4) learning. These components were not necessarily new. But in this definition they were reorganized and simplified. It was the way in which these concepts were tied together that made the 1994 definition unique (see Figures 5.1, 5.2, 5.3, and 5.4).

Theory and Practice

The 1994 definition used the phrasing that was included in the 1963 definition when it called instructional technology "the theory and practice of… A profession," the authors argued, "must have a knowledge base that supports practice" (p. 9). They used a simple but rather clear notion that "theory consists of the concepts, constructs, principles, and propositions that contribute to the body of knowledge" (p. 11) and that "practice is the application of the knowledge" (p. 11). In so doing, the authors cleared up the problem of the meaning of theory that they had inherited from the writers of the 1977 definition, which had left them with a definition of theory that had been too precise.

Design, Development, Utilization, Management, and Evaluation

The concepts of design, development, utilization, management, and evaluation are the knowledge base of the field. When these concepts are taken together and conducted in sequential order, they are the same as the stages of "development" described in the 1977 definition. These concepts are directly traceable to the idea of educational engineering developed by Charters (1945). It is important to realize that the authors of the 1994 definition did not intend that practitioners of educational technology perform all of these tasks in the sequential order. Specializing in or focusing on one of these tasks would include practitioners in the field (Seels and Richey, 1994).

Processes and Resources

"A process is a series of operations or activities directed towards a particular end.… Resources are sources of support for learning, including support systems and instructional materials and environments" (Seels and Richey, p. 12). By using this wording, the authors could: (1) use process to reinforce notions of engineering and science in instruction; (2) maintain the distinction between resources as things and processes;2 and (3) be consistent with the terminology used in all three previous definitions.

Learning

The concept of learning was not new to the 1994 definition. However, the definition of learning that was intended by the authors was new. In previous definitions, the term learning was intended to connote a change in behavior such as that advocated by Tyler (1950). But the authors wanted to move away from a strong behaviorist orientation. They argued that “in this definition learning refers to the ‘relatively permanent change in a person’s knowledge or behavior due to experience’” (Mayer, 1982, p. 1040, as cited in Seels and Richey, 1994, p. 12). Including the phrase “due to experience” also served to move away from causal connections and claims about learning.

This action signaled the acceptance of a different kind of science in education: one that was less predicated on prediction and control and more interested in applying other theoretical and research principles to the instructional process.

Multiple Theoretical and Conceptual Perspectives on Instructional Technology

The three major nontraditional theoretical approaches that the authors wanted to address and include under this 1994 definition were the post modernist, the constructivist, and the situated learning interpretations of educational technology (p. 89–91).

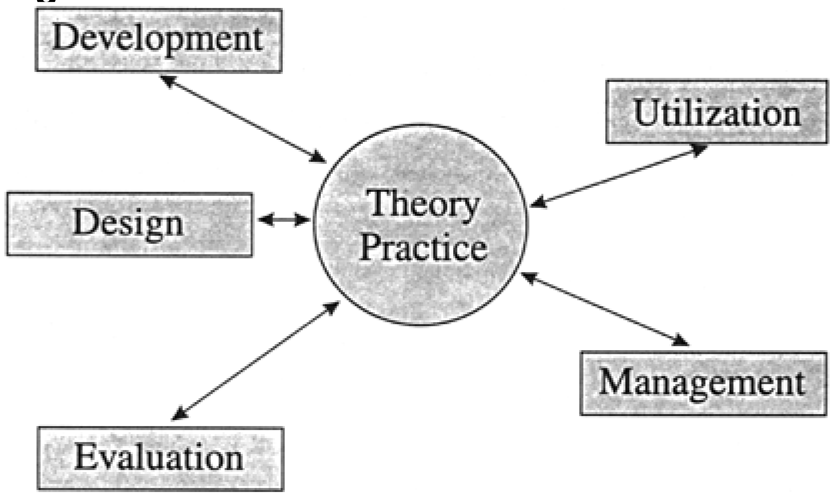
The practice of educational technology that was conducted under these three alternative perspectives obviously differed from the mainstream practice of educational technology. Practitioners did conduct their practice in the domains of design, development, utilization, management, and evaluation. What differed was the overarching theoretical perspective that guided this practice.

These alternative practitioners adopted and adapted different psychologies of learning to their practice. When guided by different psychological and learning principles, it is logical that practices will differ. The outcome of these differences in practice leads to an educational technology that is based much less in the concepts educational engineering and predictive science than is the practice in traditional educational technology.3

Conclusion

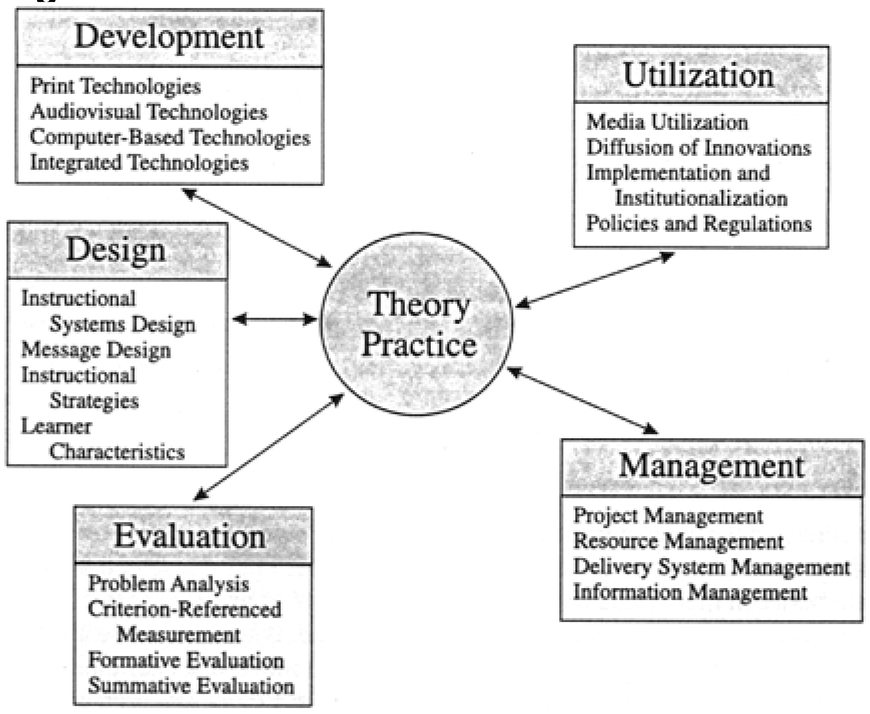
The authors of the 1994 definition emphasized the “study of” instructional technology more than had been done in previous definitions. They presented a strong connection between theory and research and the domains of practice of the field. As the areas of possible research and theory were identified, it became more apparent that practice previously thought of as alternative could fit into the conceptual structure of mainstream educational technology. This appeal to use more research and theory in the field was the key to creating a less complicated, but inclusive, definition of the field.

Figure 5.1. The Definition of Instructional Technology



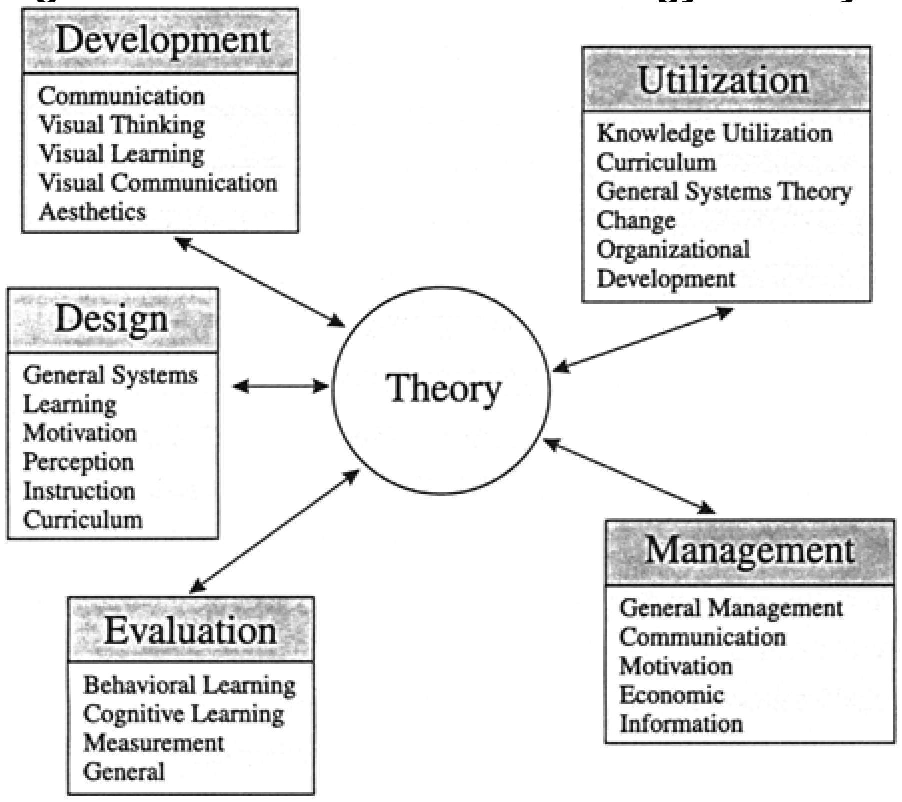
Seels, Barbara B., and Rita C.Richey (1994). *Instructional Technology: The Definition and Domains of the Field.* p. 10. Association for Educational Communications and Technology, Washington D.C.

Figure 5.2. The Domains of Instructional Technology



Seels, Barbara B., and Rita C.Richey (1994). *Instructional Technology: The Definition and Domains of the Field.* p. 26. Association for Educational Communications and Technology, Washington D.C.

Figure 5.3. Instructional Technology: Theory



Seels, Barbara B., and Rita C.Richey (1994). *Instructional Technology: The Definition and Domains of the Field.* p. 70. Association for Educational Communications and Technology, Washington D.C.

Figure 5.4. Instructional Technology: Research

Seels, Barbara B., and Rita C.Richey (1994). *Instructional Technology: The Definition and Domains of the Field.* p. 71. Association for Educational Communications and Technology, Washington D.C.

Notes

1. Having sat through most of the deliberations and debate regarding changes to the definition, I can say that the discussions were indeed sincere. However, the irony of having a professional organization that for more than 20 years had been called the Association for Educational Communications and Technology sponsor a definition of "Instructional Technology" is still not lost on me.
2. I mention this now because it seems perfectly reasonable to consider processes as resources. However, doing so would complicate matters. One of the purposes of this definition was to try to simplify the definition. Another possible reason for maintaining the distinction between resources and processes was to keep the definition as inclusive as possible. This definition could include both the advocates of a "systems approach" interpretation of Educational Technology as well as those who believe in a "tools" conception of Educational Technology. See Eraut (1985) for a further explanation of conceptions of Educational Technology.
3. For a more complete explanation of these differing perspectives of educational technology, I suggest looking at the *Handbook of research on educational communications and technology.* (1996. Edited by David Jonassen. New York: Macmillan. Particularly chapters 5, 6, 7, 8, 9, 10, 38, 40, and 41).

Chapter 6

Problems with Definitions of Educational Technology

The task of defining a field is difficult. No one definition may be considered as *the* final definition. It is a reference point which may serve as a stimulus for further discussion and redefinition. If it is used to promote rigorous discussion among the personnel within the field, it will have served its purpose (Ely, 1963, p. 3).

If, as Ely suggests, the purpose of defining educational technology was to promote discussion among the personnel of the field, then the early definitions served their purpose. In the time since Ely issued his invitation to analyze the field in 1963, many scholars of educational technology have joined in the discussion. They have responded to the official definitions and have contributed their own (Lumsdaine, 1964; Heinich, 1970; Saettler, 1990). Although it may have been necessary to define educational technology either as a practical matter, or as a way to promote discussion within the field, the definitions of educational technology have created some difficulties for the field.

A review of the supporting documentation and position papers that contributed to the thinking behind the early definitions of educational technology suggests that there were four primary considerations for the AECT's creation of a formal definition:

To provide specific language for laws and legal documents; these definitions often helped determine the allocation of the funding for educational programs at federal, state, and local levels.

1. To legitimize the field of educational technology; to carve out a niche or establish a territory to make the field distinct from closely related areas such as Library Studies and Curriculum.
2. To allow individual professionals to consider themselves "in the field"; this also meant that the field could be defined by what members of the professional organization did.
3. To provide specific language for laws and legal documents; these definitions often helped determine the allocation of the funding for educational programs at federal, state, and local levels.
4. To establish guides for curriculum development that would aid in preparing future professionals for the field.

These four reasons contributed to the notion of objectivity, permanence, and exact standards in definitions of educational technology and in its practice.

The reasoning behind the definition produced a dilemma for the field, which may be viewed as a choice between clarity and utility. These turned out to be competing notions for the profession. One of the reasons for defining educational technology was to make the field legitimate and establish a territory for educational technology. This would make the field distinct from related areas such as library science and curriculum. Another reason was to provide specific language for laws and legal documents that could determine funding allocations. It seems that both of these reasons required clear and specific language.

However, the other reasons for defining the field, such as allowing individuals to consider themselves "in the field," defining the field by what practitioners did and generating guidelines and standards for preparing educational technologists, meant that the language used to define educational technology needed to be broad ranging and flexible to accommodate practitioners and allow for the growth and development of the field. The definition had to be clear enough to distinguish educational technology from other areas, yet flexible enough to allow for growth. As the field grew to include different theoretical positions, it became increasingly difficult to strike this balance.

The Myers and Cochran analysis clarifies the paradox facing those who would define educational technology. Attempts to define the field too precisely tend to limit the field and those who are involved in it. Attempts to define the field broadly tend to be vague and possibly without theoretical direction. Both of these outcomes were considered undesirable by the leadership of the field.

Differing interpretations of the concept of profession were not discussed overtly in the literature of the field. The meaning of profession was basically unchallenged in the field after Finn (1953) wrote his analysis of it. Finn's analysis of "profession" had a considerable impact on the thinking of the writers of the three definitions. It affected which concepts needed to be included in a definition and what those concepts had to mean for educational technology to be considered a profession. The momentum that developed because of Finn's analysis of "profession" grew in strength with each of the three definitions published by the AECT. But differing analyses of profession were not included in the rationales supporting those definitions. The desire on the part of the authors to have educational technology be recognized as a profession was apparently more important to them than analyzing and understanding what a profession was.

At least three other aspects of the AECT's definitions are problematic. The first is simply the decision to call these analyses of educational technology "definitions." The second involves the authors' perspectives; and the third is concerned with the definitions' length.

In their report on the definition of instructional development for the AECT, Davies and Schwen of Indiana University point out that "definitions, by their very nature, have an air of finality about them; a proclamation, as it were, of agreed dogma" (1971, p. 86). The decision to define educational technology caused some difficulty for the field because most people tend to believe that definitions imply a high degree of objectivity and permanence. Definitions tend to be static.

The decision to call the analyses of educational technology "definitions," rather than efforts to explore the concept and study its meaning, was strongly influenced by at least three of the same forces that had affected the development of the concept of educational technology: (1) a view of science that was characterized as highly objective and measurement based; (2) an engineering approach to education that required knowing exactly what a problem was before any action could be taken on it; and (3) a desire to gain status for the profession. Objectivity, permanence, and exact standards were characteristics of each of the three influences.

The individuals who prepared the early definitions of educational technology believed that any statement of definition was only tentative (Ely, 1963). This was because their reasons for defining educational technology in the way they did were prompted by a need to keep the definition open to allow growth and development in the field. The 1963 definition was intended to expand the AV education concept (Ely, 1963). The 1972 definition used the term "learning resources to increase the scope of the field beyond media" (Ely, 1972). The 1977 definition used the most inclusive wording of the three definitions published by the AECT. The wording of this definition was so broad that educational technology was difficult to distinguish from curriculum (Ely, 1982). Saettler called it the "omnibus definition" because it could mean everything to everybody (1990).

Choosing to define educational technology so that the concept had flexibility seems at odds with the popular notion of a definition that is something objective and permanent. The authors wanted to legitimize the field and carve out its territory, but they also claimed that they wanted the freedom to allow the field to grow and to change. By choosing to classify their analytical studies of educational technology as definitions, rather than conceptual analyses or simply descriptions, the authors and the professional association they represented seemed to choose territory over flexibility, although the "definitions" were broad. By choosing to call these studies "definitions," the authors, by perhaps more than mere implication, took a big step toward developing objectivity, permanence, and strict standards for the field in the eyes of the public.

The second major difficulty inherent in defining educational technology involves the perspectives and biases of the authors. Are definitions of educational technology merely descriptions of what *is* occurring in practice? Or are they based on individual theories of what *ought* to be involved in educational technology? Whose practice is being analyzed to gain insight to the "is" related questions? Whose theories and ideas are being included in the analyses of any "ought" related questions?

The meanings of abstract concepts are often contested. This means that there are often different interpretations of them. Abstract concepts do not represent physical things that can simply be pointed to and their meanings easily agreed upon. Therefore, it is difficult to isolate and gain specific agreement about the "is" of an abstract concept. It is difficult to gain specific agreement about the "is" in the practice of educational technology. It is even more difficult to establish specific agreement on the "oughts" of the field.

The definition of educational technology can be viewed as a question of politics. In his discussion of definitions, Heinich (1971) noted that, "a definition can be viewed as an attempt to establish a power base" (p. 9). It follows from this statement that the act of establishing a definition is a political act. As individuals tried to influence the content of the definitions of educational technology, they were engaged in political action. Some tried to influence the definitions to include some of the activities that they performed or felt ought to be performed in the field. The writers of the 1963 definition did this when they defined AV communications as "a branch of theory and practice" (p. 19). This statement supported Finn's (1953) call for theory in the field. Some tried to influence the definitions to include theoretical perspectives that they believed could help to guide the field into new areas. The authors of the 1972 definition did this when they included the idea that educational technology could work within a number of different philosophical approaches to education. Here the writers supported Silber's (1972a) concept of a school-free "Learning System."

The beliefs and the biases held by the individual authors of the definitions toward the concepts of science, engineering, and audiovisual education affected the outcome of the writing of the definitions of educational technology.
Different individuals had different understandings of educational technology. This fact explains why there were differences of opinion on what the definition of educational technology should be and why it had changed over time. These definitions were far from being the precise and objective statements that are usually associated with definitions. Rather, they were the products of political activity, most specifically, compromise. The definitions were products of a group process. Each member of the group brought his or her own ideas to the process. But, because at least some of the members of the group disagreed on specific points to be included in the definition, negotiation and the language of compromise were required to maintain agreement among the members on the final definition statement (e.g., Heinich, 1970; Silber, 1972). The resulting statement of definition was a political document by both intent and process.
The third difficulty stemming from the definition process was the desire on the part of some authors to have their entire analysis considered as their definition (Ely, 1972; AECT, 1977). The length of these analyses provided some problems for disseminating the definitions among the membership of the field and the public. People do not commonly think of a definition as being five or more pages long. Rather, they tend to think of definitions as succinct statements that provide the exact meaning of a word or phrase (*Oxford English Dictionary,* 1989).
The *Funk & Wagnalls Dictionary* provides the following description of a definition that also distinguishes it from other terms:
A definition must include all that belongs to the object defined, and exclude all that does not; a description may include only some general features; an explanation may throw light upon some point or special difficulty. An exposition explains a subject in detail. Interpretation may translate from other languages, or give the plain meaning of difficult passages, or render the thought and emotion of worthy literature by adequate written, or oral expression. Definition, explanation, exposition, and interpretation are ordinarily blended in a commentary, which may also include a description (*Funk & Wagnalls Dictionary,* 1963, p. 308).
The criteria for a definition provided in the *Funk & Wagnalls Dictionary* would be difficult to meet; in fact, most definitions provided in most dictionaries do not meet these criteria. But drawing distinctions between the different types of analyses, as demonstrated in the *Funk & Wagnalls Dictionary,* can be a helpful starting point for understanding the scope of different kinds of scholarly analyses. Based on the distinctions of analyses provided in the *Funk & Wagnalls Dictionary,* and considering

the inherent biases of the writers of the AECT's definitions, the lengthy statements that are called definitions would more accurately be called "commentary."

In a way similar to their treatment of the word "definition," the authors and many members of the AECT ignored the popular meaning of the word "technology." Although technology may have been conceived as a process related to science, art, and philosophy, the popular meaning of the word "technology" has changed considerably.

Since the end of World War II, the word "technology" has come to be associated with machines—machines that are the newest or the state of the art. Older machines were not necessarily thought of as technology. At the end of World War II, most of these new machines were powered by electricity. By the late 1970s, the word technology was becoming associated with computers, which were still powered by electricity, but other devices such as calculators and telephones that used other sources of power were also considered technology.

Defining educational technology as a process resulted in a tension or dissonance between the popular notion of technology as state-of-the-art equipment and the older idea of technology as a process. This dissonance surrounding technology resulted in definitions that were neither easily understood nor widely embraced outside of the field of educational technology. For the definition's writers, "technology" had become a technical term—a term that was no longer used in its popular sense.

Educational technology might best be described as a "worldview" of education, which sees education as instruction. Instruction is considered as a set of activities and strategies that can be prescribed to bring about pre-specified and measurable learning objectives. The activities and strategies associated with this view are based on established theories of learning and are developed and tested to ensure reliable and replicable results. As a worldview of education, educational technology emphasizes applying scientific techniques to solving educational problems in efficient and effective ways. This emphasis results in an attitude of action (Charters, 1945; Finn, 1962). This attitude values technique over philosophy. The worldview of educational technology derived from this attitude is a melding of the principles and beliefs about certain approaches to science and engineering in education, and what it would take to make the AV education movement into a profession.

Certainly language can be overly scrutinized. But it seems that discussions of educational technology and its related concepts can shed light on how practitioners and users of these terms view educational technology as a field of study and as a profession. It seems that sometimes the use of terms in the field is conscious and sometimes it is not. It seems that sometimes consideration is given to the implications of using particular language and sometimes it is not. Often the use of language is an attempt to gain prestige for the field. Sometimes decisions about language are made in an attempt to avoid using particular words to which people have an aversion. And sometimes language is simply part of an attempt to communicate an idea with little thought given to the overall implications. The use of language in the field of educational technology has been all of these, and all of these have affected the definitions of educational technology.

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