A History of Instructional Design and Technology: Part II: A History of Instructional Design

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This is the second of a two-part article that discusses the history of the field of instructional design and technology in the United States. The first part, which focused on the history of instructional media, appeared in the previous issue of this journal (volume 49, number 1). This part of the article focuses on the history of instructional design. Starting with a description of the efforts to develop training programs during World War II, and continuing on through the publication of some of the first instructional design models in the 1960s and 1970s, major events in the development of the instructional design process are described. Factors that have affected the field of instructional design over the last two decades, including increasing interest in cognitive psychology, microcomputers, performance technology, and constructivism, are also described.

☐ In Part I of this article, I presented the following definition of the field of instructional design and technology:

> The field of instructional design and technology encompasses the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and noninstructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace. Professionals in the field of instructional design and technology often use systematic instructional design procedures and employ a variety of instructional media to accomplish their goals. Moreover, in recent years, they have paid increasing attention to noninstructional solutions to some performance problems. Research and theory related to each of the aforementioned areas is also an important part of the field. (Reiser, in press)

As was pointed out in Part I, the major features of this definition include (a) its listing of six categories of activities or practices (analysis, design, development, implementation, evaluation, and management) often associated with the field; (b) its identification of research and theory, as well as practice, as important aspects of the profession; and (c) its recognition of the influence the performance technology movement has had on professional practices. Moreover, the definition highlights two practices that have, over the years, formed the core of the field. These two practices are (a) *the use of media for instructional purposes* and (b) *the use of systematic instructional design procedures* (often simply called *instructional design*). As was mentioned in Part I, although many have argued about the value of employing these practices, they remain as the key defining elements of the field of

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instructional design and technology. Individuals involved in the field are those who spend a significant portion of their time working with media, or with tasks associated with systematic instructional design procedures, or with both.

In Part I, I discussed the history of instructional media. In Part II, I will focus on the history of instructional design. This is a natural separation because, from a historical perspective, most of the practices related to instructional media have occurred independent of developments associated with instructional design. It should also be noted that although many important events in the history of the field have taken place in other countries, the emphasis in both parts of this article is on events that have taken place in the United States.

HISTORY OF INSTRUCTIONAL DESIGN

Over the past four decades, a variety of sets of systematic instructional design procedures (or models) have been developed, and have been referred to by such terms as *the systems approach, instructional systems design (ISD), instructional development,* and *instructional design* (which is the term I will usually employ in this article). Although the specific combination of procedures often varies from one instructional design model to the next, most of the models include the analysis of instructional problems, and the design, development, implementation and evaluation of instructional procedures and materials intended to solve those problems. How did this instructional design process come into being? This article will focus on answering that question.

The Origins of Instructional Design: World War II

The origins of instructional design procedures have been traced to World War II (Dick, 1987). During the war, a large number of psychologists and educators who had training and experience in conducting experimental research were called on to conduct research and develop training materials for the military services. These individuals, including Robert Gagné, Leslie Briggs, John Flanagan, and many others, exerted considerable influence on the characteristics of the training materials that were developed, basing much of their work on instructional principles derived from research and theory on instruction, learning, and human behavior (Baker, 1973; Dick, 1987; Saettler, 1990).

Moreover, psychologists used their knowledge of evaluation and testing to help assess the skills of trainees and select the individuals who were most likely to benefit from particular training programs. For example, at one point in the war, the failure rate in a particular flight training program was unacceptably high. In order to overcome this problem, psychologists examined the general intellectual, psychomotor and perceptual skills of individuals who were able to successfully perform the skills taught in the program, and then developed tests that measured those traits. These tests were used to screen candidates for the program, with those individuals who scored poorly being directed into other programs. As a result of using this examination of entry skills as a screening device, the military was able to significantly increase the percentage of personnel who successfully completed the program (Gagné, personal communication, 1985).

Immediately after World War II, many of the psychologists responsible for the success of the military training programs continued to work on solving instructional problems. Organizations such as the American Institutes for Research were established for this purpose. During the late 1940s and throughout the 1950s, psychologists working for such organizations started viewing training as a system, and developed a number of innovative analysis, design, and evaluation procedures (Dick, 1987). For example, during this period, a detailed task analysis methodology was developed by Robert B. Miller while he worked on projects for the military (Miller,1953, 1962). His work and that of other early pioneers in the instructional design field is summarized in *Psychological Principles in System Development*, edited by Gagné (1962b).

More Early Developments: The Programmed Instruction Movement

The programmed instruction movement, which ran from the mid-1950s through the mid-1960s, proved to be another major factor in the development of the systems approach. In 1954, B.F. Skinner's article entitled *The Science of Learning and the Art of Teaching* began what might be called a minor revolution in the field of education. In this article and later ones (e.g., Skinner,1958), Skinner described his ideas regarding the requirements for increasing human learning and the desired characteristics of effective instructional materials. Skinner stated that such materials, called programmed instructional materials, should present instruction in small steps, require overt responses to frequent questions, provide immediate feedback, and allow for learner self-pacing. Moreover, because each step was small, it was thought that learners would answer all questions correctly and thus be positively reinforced by the feedback they received.

The process Skinner and others (cf. Lumsdaine & Glaser, 1960) described for developing programmed instruction exemplified an empirical approach to solving educational problems: Data regarding the effectiveness of the materials were collected, instructional weaknesses were identified, and the materials were revised accordingly. In addition to this trial and revision procedure, which today would be called formative evaluation, the process for developing programmed materials involved many of the steps found in current instructional design models. As Heinich (1970) indicated:

> Programmed instruction has been credited by some with introducing the systems approach to education. By analyzing and breaking down content into specific behavioral objectives, devising the necessary steps to achieve the objectives, setting up procedures to try out and revise the steps, and validating the program against attainment of the objectives, programmed instruction succeeded in creating a small but effective self-instructional system—a technology of instruction. (p. 123)

The Popularization of Behavioral Objectives

As indicated above, those involved in designing programmed instructional materials often began by identifying the specific objectives learners who used the materials would be expected to attain. In the early 1960s, Robert Mager, recognizing the need to teach educators how to write objectives, wrote *Preparing Objectives for Programmed Instruction* (1962). This book, now in its third edition (Mager,1997), has proved to be very popular, and has sold more than 1.5 million copies. The book describes how to write objectives that include a description of desired learner behaviors, the conditions under which the behaviors are to be performed, and the standards (criteria) by which the behaviors are to be judged. Many current-day adherents of the instructional design process advocate the preparation of objectives that contain these three elements.

Although Mager popularized the use of objectives, the concept was discussed and used by educators at least as far back as the early 1900s. Among those early advocates of the use of clearly stated objectives were Bobbitt, Charters, and Burk (Gagné, 1965a). However, Ralph Tyler has often been considered the father of the behavioral objectives movement. In 1934, he wrote, "Each objective must be defined in terms which clarify the kind of behavior which the course should help to develop" (cited in Walbesser & Eisenberg, 1972). During the famous Eight-Year Study that Tyler directed, it was found that in those instances in which schools did specify objectives, those objectives were usually quite vague. By the end of the project, however, it was demonstrated that objectives could be clarified by stating them in behavioral terms, and those objectives could serve as the basis for evaluating the effectiveness of instruction (Borich, 1980; Tyler, 1975).

In the 1950s, behavioral objectives were given another boost when Benjamin Bloom and his colleagues published the *Taxonomy of Educational Objectives* (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The authors of this work indicated that within the cognitive domain there were various types of learning outcomes, that objectives could be classified according to the type of learner behavior described therein, and that there was a hierarchical relationship among the various types of outcomes. Moreover, they indicated that tests should be designed to measure each of these types of outcomes. As we shall see in the next two sections of this article, similar notions described by other educators had significant implications for the systematic design of instruction.

The Criterion-Referenced Testing Movement

In the early 1960s, another important factor in the development of the instructional design process was the emergence of criterion-referenced testing. Until that time, most tests, called norm-referenced tests, were designed to spread out the performance of learners, resulting in some students doing well on a test and others doing poorly. In contrast, a criterion-referenced test is intended to measure how well an individual can perform a particular behavior or set of behaviors, irrespective of how well others perform. As early as 1932, Tyler had indicated that tests could be used for such purposes (Dale, 1967). Later, Flanagan (1951) and Ebel (1962) discussed the differences between such tests and the more familiar norm-referenced measures. However, Robert Glaser (1963; Glaser & Klaus, 1962) was the first to use the term *criterion-referenced measures*. In discussing such measures, Glaser (1963) indicated that they could be used to assess student entry-level behavior and to determine the extent to which students had acquired the behaviors an instructional program was designed to teach. The use of criterion-referenced tests for these two purposes is a central feature of instructional design procedures.

Robert M. Gagné: Domains of Learning, Events of Instruction, and Hierarchical Analysis

Another important event in the history of instructional design occurred in 1965, with the publication of the first edition of *The Conditions of Learning*, written by Robert Gagné (1965b). In this book, Gagné described five domains, or types, of learning outcomes—verbal information, intellectual skills, psychomotor skills, attitudes, and cognitive strategies—each of which required a different set of conditions to promote learning. Gagné also provided detailed descriptions of these conditions for each type of learning outcome.

In the same volume, Gagné also described nine *events of instruction*, or teaching activities, that he considered essential for promoting the attainment of any type of learning outcome. Gagné also described which instructional events were particularly crucial for which type of outcome, and discussed the circumstances under which particular events could be excluded. Now in its fourth edition (Gagné, 1985), Gagné's description of the various types of learning outcomes and the events of instruction remain cornerstones of instructional design practices.

Gagné's work in the area of learning hierarchies and hierarchical analysis also has had a significant impact on the instructional design field. In the early 1960s and later in his career (e.g., Gagné, 1962a, 1985; Gagné, Briggs, and Wager, 1992; Gagné & Medsker, 1996), Gagné indicated that skills within the intellectual skills domain have a hierarchical relationship to each other, so that in order to readily learn to perform a superordinate skill, one would first have to master the skills subordinate to it. This concept leads to the important notion that instruction should be designed so as to ensure that learners acquire subordinate skills before they attempt to acquire superordinate ones. Gagné went on to describe a hierarchical analysis process (also called learning task analysis or instructional task analysis) for identifying subordinate skills. This process remains a key feature in many instructional design models.

Sputnik: The Indirect Launching of Formative Evaluation

In 1957, when the Soviet Union launched Sputnik, the first orbiting space satellite, there began a series of events that would eventually have a major impact on the instructional design process. In response to the launching of Sputnik, the

United States government, shocked by the success of the Soviet effort, poured millions of dollars into improving math and science education in the United States. The instructional materials developed with these funds were usually written by subject matter experts and produced without tryouts with learners. Years later, in the mid-1960s, when it was discovered that many of these materials were not particularly effective, Michael Scriven (1967) pointed to the need to try out drafts of instructional materials with learners prior to the time the materials were in their final form. Scriven indicated that this process would enable educators to evaluate the effectiveness of materials while they were still in their formative stages and, if necessary, revise them before they were produced in their final form. Scriven named this tryout and revision process *formative evaluation*, and contrasted it with what he labeled *summative evaluation*, the testing of instructional materials after they are in their final form.

Although the terms formative and summative evaluation were coined by Scriven, the distinction between these two approaches was previously made by Lee Cronbach (1963). Moreover, during the 1940s and the 1950s, a number of educators, such as Arthur Lumsdaine, Mark May, and C.R. Carpenter, described procedures for evaluating instructional materials that were still in their formative stages (Cambre, 1981).

In spite of the writings of some educators, very few of the instructional products developed in the 1940s and 1950s went through any sort of formative evaluation process. This situation changed somewhat in the late 1950s and through the 1960s, as many of the programmed instructional materials developed during that period were tested while they were being developed. However, authors such as Susan Markle (1967) decried a lack of rigor in testing processes. In light of this problem, Markle prescribed detailed procedures for evaluating materials both during and after the design process. These procedures are much like the formative and summative evaluation techniques generally prescribed today.

Early Instructional Design Models

In the early and mid-1960s, the concepts that were being developed in such areas as task analysis, objective specification, and criterion-referenced testing were linked together to form processes, or models, for systematically designing instructional materials. Among the first individuals to describe such models were Gagné (1962b), Glaser (1962, 1965), and Silvern (1964). These individuals used terms such as *instructional design, system development, systematic instruction,* and *instructional system* to describe the models they created. Other instructional design models created and employed during this decade included those described by Banathy (1968), Barson (1967), and Hamerus (1968).

The 1970s: Burgeoning of Interest in the Systems Approach

During the 1970s, the number of instructional design models greatly increased. Building upon the works of those who preceded them, many individuals created new models for systematically designing instruction (e.g., Dick & Carey, 1978; Gagné & Briggs, 1974; Gerlach & Ely, 1971; Kemp, 1971). Indeed, by the end of the decade, more than 40 such models were identified (Andrews and Goodson, 1980). A detailed discussion of a few of these models, as well as a number of those developed in the 1980s and 1990s, is contained in Gustafson and Branch (1997b).

During the 1970s, interest in the instructional design process flourished in a variety of different sectors. In the mid 1970s, several branches of the United States military adopted an instructional design model (Branson et al., 1975) intended to guide the development of training materials within those branches. In academia during the first half of the decade, many instructional improvement centers were created with the intent of helping faculty use media and instructional design procedures to improve the quality of their instruction (Gaff, 1975; Gustafson & Bratton, 1984). Moreover, many graduate programs in instructional design were created (Partridge & Tennyson, 1979; Redfield & Dick, 1984; Silber, 1982). In business and industry, many organizations, seeing the value of using instructional design to improve the quality of training, began adopting the approach (cf. Mager, 1977; Miles, 1983). Internationally, many nations, such as South Korea, Liberia, and Indonesia, saw the benefits of using instructional design to solve instructional problems in those countries (Chadwick, 1986; Morgan, 1989). These nations supported the design of new instructional programs, created organizations to support the use of instructional design, and provided support to individuals desiring training in this field. Many of these developments were chronicled in the *Journal of Instructional Development*, a journal that was first published during the 1970s and which was the forerunner to the development section of *Educational Technology Research and Development.*

The 1980s: Growth and Redirection

In many sectors, the interest in instructional design that burgeoned during the previous decade continued to grow during the 1980s. Interest in the instructional design process remained strong in business and industry (Bowsher, 1989; Galagan, 1989) the military (Chevalier, 1990; Finch, 1987; McCombs, 1986;) and in the international arena (Ely & Plomp, 1986: Morgan, 1989).

In contrast to its influence in the aforementioned sectors, during the 1980s instructional design had minimal impact in other areas. In the public school arena, some curriculum development efforts involved the use of basic instructional design processes (e.g., Spady, 1988), and some instructional design textbooks for teachers were produced (e.g., Dick & Reiser, 1989; Gerlach & Ely, 1980; Sullivan & Higgins, 1983). However, in spite of these efforts, evidence indicated that instructional design was having little impact on instruction in the public schools (Branson & Grow, 1987; Burkman, 1987b; Rossett & Garbosky, 1987). In a similar vein, with a few exceptions (e.g., Diamond, 1989), instructional design practices had a minimal impact in higher education. Whereas instructional improvement centers in higher education were growing in number through the mid-1970s, by 1983 more than one fourth of these organizations were disbanded and there was a general downward trend in the budgets of the remaining centers (Gustafson & Bratton, 1984). Burkman (1987a, 1987b) provides an analysis of the reasons why instructional design efforts in schools and universities have not been successful, and contrasts these conditions with the more favorable conditions that exist in business and the military.

During the 1980s, there was a growing interest in how the principles of cognitive psychology could be applied in the instructional design process, and a number of publications outlining potential applications were described (e.g., Bonner, 1988; Divesta & Rieber, 1987; "Interview with R.M. Gagné," 1982; Low, 1980). However, several leading figures in the field have indicated that the actual effects of cognitive psychology on instructional design practices during this decade were rather small (Dick, 1987; Gustafson, 1993).

A factor that did have a major effect on instructional design practices in the 1980s was the increasing interest in the use of microcomputers for instructional purposes. With the advent of these devices, many professionals in the instructional design field turned their attention to producing computer-based instruction (Dick, 1987; Shrock, 1995). Others discussed the need to develop new models of instructional design to accommodate the interactive capabilities of this technology (Merrill, Li, & Jones, 1990a, 1990b). Moreover, computers began to be used as tools to automate some instructional design tasks (Merrill & Li, 1989).

In addition, the relatively new performance technology movement, with its emphasis on front-end analysis, on-the-job performance, business results, and noninstructional solutions to performance problems, was beginning to have an effect on instructional design practices (Rosenberg, 1988,1990; Rossett, 1990). It was during the 1990s, however, that the field was significantly affected by this movement.

The 1990s: Changing Views and Practices

During the 1990s, a variety of developments had a significant impact on instructional design principles and practices. As indicated above, one of the major influences was the performance technology movement, which broadened the scope of the instructional design field. As a result of this movement, many instructional designers began conducting more careful analyses of the causes of performance problems, and oftentimes discovered that poor training, or lack of training, was not the cause. In many such instances, instructional designers prescribed non-instructional solutions, such as changes in incentive systems or in the work environment, to solve such problems (Dean, 1995). Thus the types of activities many instructional designers engaged in greatly expanded.

Another factor that affected the field during the 1990s was the growing interest in constructivism, a collection of similar views (labeled, by some, as a theory) of learning and instruction that gained increasing popularity throughout the decade. The instructional principles associated with constructivism include requiring learners to (a) solve complex and realistic problems; (b) work together to solve those problems; (c) examine the problems from multiple perspectives; (d) take ownership of the learning process (rather than being passive recipients of instruction); and (e) become aware of their own role in the knowledge construction process (Driscoll, 2000). During the past decade, constructivist views of learning and instruction have had an impact on the thoughts and actions of many theorists and practitioners in the instructional design field. For example, the constructivist emphasis on designing "authentic" learning tasks—tasks that reflect the complexity of the real-world environment in which learners will be using the skills they are learning—has had an effect on how instructional design is being practiced and taught (Dick, 1996). Although some have argued that "traditional" instructional design practices and constructivist principles are antithetical, in recent years numerous authors have described how consideration of constructivist principles can enhance instructional design practices (e.g., Coleman, Perry, & Schwen, 1997; Dick, 1996; Lebow, 1993; Lin et al., 1996).

During the 1990s, rapid growth in the use and development of electronic performance support systems also led to changes in the nature of the work performed by many instructional designers. Electronic performance support systems are computer-based systems designed to provide workers with the help they need to perform certain job tasks, at the time they need that help, and in a form that will be most helpful. Such systems often include an information base that contains essential work-related information; a series of work activities (often in the form of tutorials and simulations) that workers can access as desired; intelligent coaching and expert advisement systems that provide guidance in performing various activities; and customized performance support tools that automate and greatly simplify many job tasks (Wager & Mckay, in press). By providing workers with the performance tools and information they need, well-designed electronic performance support systems can reduce the need for training. It is not surprising, then, that during the past decade a number of training organizations and instructional designers turned a portion of their attention away from designing training programs and toward designing electronic performance support systems (Rosenberg, 2001).

Rapid prototyping is another trend that has had an effect on instructional design practices in recent years. The rapid prototyping process involves quickly developing a prototype product in the very early stages of an instructional design project and then going through a series of rapid tryout and revision cycles until an acceptable version of the product is produced (Gustafson & Branch, 1997a). This design technique has been advocated as a means of producing quality instructional materials in less time than is required when more conventional instructional design techniques are employed. During the 1990s, there was an increasing interest in rapid prototyping among practitioners and theorists in the instructional design field (e.g., Gustafson & Branch, 1997a; Jones & Richey, 2000).

Another recent trend that has affected the instructional design profession has been the rapidly increasing interest in using the Internet for distance learning. Since 1995, there has been a great increase in the use of the Internet to deliver instruction at a distance (Bassi & Van Buren, 1999; Lewis, Snow, Farris, Levin, and Greene, 1999). As the demand for distance learning programs has grown, so has the recognition that in order to be effective, such programs cannot simply be on-line replicas of the instruction delivered in classrooms; instead such programs must be carefully designed in light of the instructional features that can, and cannot, be incorporated into Internet-based courses (Institute for Higher Education Policy, 2000). As several authors have pointed out, the need for high quality Internet-based instruction already has created some new job opportunities for instructional designers, and is likely to create many more such opportunities in the near future (Dempsey & Van Eck, in press; Hawkridge, in press).

Knowledge management is one of the most recent trends to have affected the field of instructional design. According to Rossett (1999), knowledge management involves identifying, documenting, and disseminating explicit and tacit knowledge within an organization in order to improve the performance of that organization. Oftentimes, useful knowledge and expertise within an organization reside with a particular individual or group, but is not widely known beyond that group or individual. However, current-day technologies such as database programs, groupware, and intranets allow organizations to "manage" (i.e., collect, filter, and disseminate) such knowledge and expertise in ways that were not previously possible. Rosenberg (2001) describes several examples of organizations that have turned some of their attention away from designing training programs and toward creating knowledge management systems. Rossett and Donello (1999) suggest that as the interest in knowledge management continues to grow, instructional designers and other training professionals not only will be responsible for improving human performance, but also will be responsible for locating and improving access to useful organizational knowledge. Thus, the growing interest in knowledge management is likely to change and perhaps expand the types of tasks instructional designers are expected to undertake.

CONCLUSION

Although this article, appearing in two consecutive issues of this journal, has provided separate accounts of the history of instructional media and the history of instructional design, there is an obvious overlapping between these two areas. Many instructional solutions arrived at through the use of instructional design processes require the employment of the types of instructional media that were the focus of Part I (i.e., media other than a teacher, chalkboard, or textbook). Moreover, many individuals (e.g., Clark, 1994; Kozma, 1994; Morrison, 1994; Reiser, 1994; Shrock, 1994) have argued that the effective use of media for instructional purposes requires careful instructional planning, such as that prescribed by models of instructional design. In the field of instructional design and technology, those whose work is influenced by the lessons learned from the history of media *and* the history of instructional design will be well-positioned to have a positive influence on future developments within the field. □

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