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# Foreword

As someone who has been teaching a Trends and Issues in Instructional Design course for over 20 years, I look for readings each year that will provide students with a good introduction to the field and/or the trends and issues that are affecting it. So when I came across the first edition of this monograph back in the early 1980s, I was delighted. Not only did it present an excellent definition of the field of instructional design, it also discussed differing perspectives on the instructional development (ID) process and provided a brief history of ID models. Moreover it laid out a taxonomy for classifying different types of ID models and provided detailed discussions of several models within each category. In light of all of the valuable information and ideas it contained, I decided to add portions of the monograph as a required reading in my course. And, as new editions have been published, I have continued to require my students to read the monograph.

Since 1997, when the previous edition of the monograph was published, the field of instructional design has been affected by many factors. New approaches to the design process, such as rapid prototyping and concurrent engineering, have been proposed and employed. New methods for presenting information to learners, such as electronic performance support systems and knowledge management systems, have gained increasing popularity. New advances in technology have enabled us to design instruction that is more interactive. New ID models have been proposed, new ID procedures have been employed, and the role and scope of professionals in the ID field have greatly expanded. In addition, new (and not so new!) ideas and theories such as constructivism, situated cognition, and social learning theory have had an ever-increasing influence on the practices of many instructional designers.

As a result of these factors, the ID field has greatly changed in the past few years. This new edition of *Survey of Instructional Development Models* does an excellent job of providing a brief overview of the recent trends that have affected, and will continue to affect, our field. But it does much more than that. Similar to the three preceding editions, it provides a brief history of ID models, an excellent definition of the field (revised to reflect today's realities), and the authors' taxonomy of ID models, updated to include models that have been developed in other countries, among others. In light of the extent of ID activities taking place in the international arena, this is a welcomed addition.

This monograph provides an excellent introduction to and overview of the field of instructional development. Whether you are someone who is first entering the field, or you have been in it for as long as I have, I am sure that you will find the information and ideas contained in this volume to be very enlightening.

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# Preface

## Purpose

The purpose of this ERIC publication is to update and expand upon earlier ERIC publications by Twelker and others (1972), Gustafson (1981, 1991), and Gustafson and Branch (1997) on the topic of instructional development (ID) models. Since the first appearance of ID models in the 1960s, there has been an ever-increasing number published in the instructional technology literature and other educational curricular literature. This publication presents a very brief history of ID models, presents a taxonomy for classifying those models, provides examples from each of the categories in the taxonomy, and discusses the latest trends in instructional development affecting the use of ID models.

In preparing this survey, it was necessary to select only a few models to describe in detail. This was a difficult task because there are literally hundreds in the literature about curriculum development. Selection criteria included: the historical significance of the model, its unique structure or perspective, or its frequent citation in the literature. Due to the increasing presence of ID models in the literature from around the world, a deliberate decision was made to make this review more international than previous editions. Obviously it was also necessary to select models to match each of the categories in the classification taxonomy. The decision was also made to exclude models that represent only part of the overall ID process and to focus on ID models that include elements of analysis, design, development, implementation, and evaluation. As a result, many excellent models are not included in this survey. However, the ID models that were selected are believed to be generally representative of the literature and among them contain all of the main concepts found in other models.

## Instructional Development Defined

The term *instructional development* is used in this edition to include both instructional development and instructional design. This is necessary because one of the major problems plaguing the field of educational technology is inconsistent use of terminology. The terms *instructional development* and *instructional design* are no exception. Although several attempts have been made to define the field and derive a standard set of meanings for various terms (Ely, 1973; AECT, 1977; Ely, 1983; Seels & Richey, 1994), the results have not been widely adopted or consistently used in the literature.

For our purposes, we could use either the definitions created by Seels and Richey that are currently circulating or the Association for Educational Communications and Technology (AECT) definitions used in earlier editions of this publication. Seels and Richey use the term *instructional systems design* (ISD) instead of *instructional development* and define it as "an organized procedure that includes the steps of analyzing, designing, developing, implementing, and evaluating instruction" (p. 31). The Seels and Richey definition is not unlike how an AECT (1977) committee, chaired by Kenneth Silber, defined instructional development almost two decades earlier: "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 only one phase of instructional development" (p. 172).

Both definitions encompass a wide array of activities, from the initial concern that "something" ought to be done to the implementation and evaluation of the instruction that was developed. Consistent to both definitions is that the overall process is far more inclusive than those activities associated with preparing lesson specifications and determining moment-to-moment instructional strategies, sequencing, motivational elements, and learner actions. These latter decisions are often labeled *instructional design*, but also have been called *instructional development* by some authors who use the term *instructional development* to describe the production component of the overall process. This discussion may be adding to the confusion, however, it seems prudent to alert readers to the fact we are dealing with the comprehensive process, not one or only a few of its components. For simplicity and consistency, we will use the term *instructional development* or the acronym ID when referring to the overall process in any general narrative, but use the actual terms employed by the authors when describing their specific models.

Another term that has experienced inconsistent use and which therefore further adds to the confusion of communication is *system*. The term *system* is used in at least three different ways, one of which is equivalent with how we have chosen to define instructional development. However, some authors also use the term *system* to describe the outcomes or products of the development effort. From this second perspective the actual learner environment and its related management and support components together comprise an instructional system. Still a third, but less common use of the term *system*, is in the context of general systems theory (GST). Within this third perspective, numerous general systems theory concepts (for example, opened and closed systems, entropy, and interdependence) are applied when thinking about the instructional development process. Reiser (2001) indicates that "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.* Although the specific combination of procedures often varies from one instructional design model to the next, most of the models include design, development, implementation and evaluation of instructional procedures and materials intended to solve those problems" (p. 58).

In some respects, professionals find themselves in an Alice in Wonderland setting where any term means whatever the author wants it to mean. This situation is one of the reasons we have found it desirable to create a taxonomy for classifying models. By carefully examining ID models, one can determine what activities their creators are describing and the goals and settings in which the activities are to occur. One is then in a position to understand what the creators are talking about even though the terminology is inconsistent across models.

In summary, there are many different and inconsistent uses of terminology to describe the comprehensive process we call *instructional development.* By our definition, instructional development consists of at least five major activities: (1) analysis of the setting and learner needs, (2) design of a set of specifications for an effective, efficient, and relevant learner environment, (3) development of all learner and management materials, (4) implementation of the resulting instruction, and (5) both formative and summative evaluations of the results of the development.

The above activities have often been referred to as ADDIE and labeled as a generic ID model. ADDIE also provides a useful set of criteria for determining whether a model is inclusive of the entire ID process or only one or more of its elements. A sixth activity may be added involving distribution or dissemination and monitoring of that learning environment across varied settings, perhaps over an extended period of time.

**Assumptions**

Because we place great emphasis on identifying the assumptions made by the creators of the ID models reviewed, it seems appropriate that we make visible our own assumptions about the ID process and ID model building and application. First and foremost, we are attempting to promote a better understanding about and appropriate utilization of ID models. Both long-time practitioners and those new to the field will benefit from a greater awareness of the diversity of models used to portray the process. Second, we believe there is enough room within the fundamental concept of ID to incorporate many emerging theories and philosophies of learning as well as advances in the technology available for design, development, and delivery of instruction. Further, our definition of the process, vision of the role of models, and the taxonomy presented for classifying them, are based on the following five explicit assumptions.

1. ID models serve as conceptual, management, and communication tools for analyzing, designing, creating, and evaluating guided learning, ranging from broad educational environments to narrow training applications.

2. No single ID model is well matched to the many and varied design and development environments in which ID personnel work. Hence ID professionals should be competent in applying (and possibly adapting) a variety of models to meet the requirements of specific situations.

3. The greater the compatibility between an ID model and its contextual, theoretical, philosophical, and phenomenological origins, the greater the potential is for success in constructing effective learning environments.

4. ID models help one to take into account the multiple backgrounds of learners, the multiple interactions that may occur during learning, and the variety of contexts in which learning is situated.

5. Interest in ID models will continue, however the level of application will vary depending on the context or situation.

## Early Instructional Development Models

Of necessity, one must pick an arbitrary date from which to begin to trace the origins of the ID model building process. Otherwise one can make the case that the creators of the earliest recorded cave drawings and the scribes that produced papyrus scrolls represent the pioneers of systematic instruction. Similarly, many ideas and procedures commonly found in ID models (e.g., job analysis, measurable objectives, and performance testing) predate the period generally accepted as representing the beginnings of ID model building.

The specific term *instructional development,* defined as a systematic process for improving instruction, appears to have its origins in a project conducted at Michigan State University from 1961 to 1965 (Barson, 1967). The setting for this ID model and related project is higher education, and its purpose is to improve college courses. The Barson model is notable in that it is one of the few models ever subjected to evaluation in a variety of projects at a variety of institutions. The Barson project also produced a set of heuristics (e.g., take faculty members out of their own disciplines when showing them examples of instructional strategies) for instructional developers. These heuristics provided the basis for much of the early research on the ID process and also served as a general guide for developers in higher education.

Other early work by a number of authors also produced ID models, although they did not use the specific term *instructional development.* For example, the developers of programmed instruction (cf., Markle, 1964, 1978) often applied a systematic process, but generally did not recognize the major contribution of the tryout and revision process to the successes they recorded. In the 1950s and 1960s, one of the most influential model builders was L. C. Silvern (1965). His work with the military and aerospace industry resulted in an extremely complex and detailed model (with multiple variations) that drew heavily on general systems theory. The model is not widely circulated today, but remains an excellent original source. Students of the ID process will readily see his influence on the content of contemporary models.

A model developed by Hamreus (1968), while at the Teaching Research Division of the Oregon State System of Higher Education, is another classic. One of his significant contributions was to present maxi and mini versions of his model. This two-size approach was based on the belief that there is a need for a simple model to communicate with clients and a more detailed operational version for those working on the project. Hamreus' model provided the basic structure for the Instructional Development Institute (IDI) model (National Special Media Institute, 1971). The latter model received extremely wide distribution and was among the best known in the United States in the 1970s and 1980s. A five-day workshop was created for teachers and administrators, which had been offered to over 20,000 public school personnel by the late seventies. The materials from that workshop were extensively used by graduate programs of that era to introduce the basic concepts of the ID process. The IDI model was reproduced and described by Seels and Glasgow (1998) in their book on the ID process. The reader is referred to Twelker (1972), who extensively reviewed Hamreus' model.

### Other Reviews of Instructional Development Models

In addition to the Twelker (1972) review, at least four other major reviews of ID models have been done that are worthy of mention. In 1972, Stamas reviewed 23 models to determine whether or not each included a list of components he felt were part of the ID process. Originally part of a doctoral dissertation at Michigan State University (Stamas, 1972), this study was reproduced as an occasional paper by AECT's Division of Instructional Development. Andrews and Goodson (1980) reviewed 40 models in the *Journal of Instructional Deve- ment*. Like Stamas, they developed a matrix of ID elements and a lyzed the models for their inclusion of those elements. They a attempted to trace a logical progression or evolution of later mod from earlier ones, but were unable to detect any pattern.

More recently, Sailsbury (1990) reviewed a number of ID mod from major textbooks in the field to determine the degree to which th contained specific references to a range of general systems theory co cepts. He concluded that most models contained few specific referen to those general systems concepts contained in his matrix. Edmon Branch and Mukherjee (1994) reviewed a large number of ID models a way to address their proliferation over the previous decade. They co cluded that an ID model is understood better when it is classified by context and by the level of application for a specific context.

Taken together, these reviews provide an excellent sampling of th array of existing ID models and present alternate perspectives on h they might be examined. It is interesting to note that up through abo the time of the Edmonds, Branch and Mukherjee review (and includi the third edition of this publication), reviewers of ID models conclud that the overall ID process as originally conceived had not changed si nificantly, even though additional theories and design and delivery to and procedures had emerged.

However, the last few years have seen a rather dramatic shift thinking about how ID can be practiced. The shift represents an *exte sion* of our thinking about ID, rather than a replacement of past mode and practice. Despite the rather exaggerated claims of some recent a thors that classic ID is dead, or at least seriously ill (e.g., Gordan Zemke, 2000), there remains considerable interest in and enthusias for its application (e.g., Beckschi & Doty, 2000). More will be sa about these emerging ideas and trends in chapter 1.

chapter one

# Introduction

*The Role of Models in Instructional Development*

Why models? Models help us conceptualize representations of reality. A model is a simple representation of more complex forms, processes and functions of physical phenomena or ideas. Models, of necessity, simplify reality because often reality is too complex to portray. Since much of that complexity is unique to specific situations, models help by identifying what is generic and applicable across multiple contexts. For example, Norbert Seel (1997) identifies three different types of ID models (theoretical/conceptual, organization, and planning-and-prognosis), and he would label those we review here as organization models that can be used as general prescriptions for instructional planning.

We believe that the models discussed here provide conceptual and communication tools that can be used to visualize, direct and manage processes for creating high quality instruction. Models also assist us in selecting or developing appropriate operational tools and techniques as we apply the models. Finally, models inspire research questions as we seek to develop a comprehensive theory of instructional development.

Rarely are these models tested in the sense of rigorous assessment of their application and the resulting instruction against either predetermined criteria or competitive means of developing instruction using some other defined process. Rather, those ID models with wide distribution and acceptance gain their credibility by being found useful by practitioners, who frequently adapt and modify them to match specific conditions.

### Conceptual and Communication Tools

Instructional development is a complex process that, when appropriately applied, promotes creativity during development and results in instruction that is both effective and appealing to learners. Instructional development models convey the guiding principles for analyzing, producing and revising learning environments. Both established and newer ID models accommodate emerging theories about planned learning and the broad array of contexts in which ID is being applied. Philosophical orientation and theoretical perspective frame the concepts upon which ID models are constructed. The more compatible the theory and philosophy are to the context in which a model is to be applied the greater the potential that the original intent of the model will be achieved.

Instructional development models visually communicate their associated processes to stakeholders by illustrating the procedures that make it possible to produce instruction. Instructional development models provide communication tools for determining appropriate outcomes, collecting data, analyzing data, generating learning strategies, selecting or constructing media, conducting assessment, and implementing and revising the results. Figure 1 shows a conceptual relationship among the core elements of the ID process. The five core elements—*analyze, design, develop, implement,* and *evaluate* (ADDIE)—each inform the other as development takes place and revision continues throughout the process, at least up until the instruction is implemented.

While the conceptual display of the core elements of the ID process in Figure 1 is helpful, there remains a need to indicate *how to practice* particular elements of the ID process in specific contexts. It is the addition of this detail that has led to the creation of the many different mod-

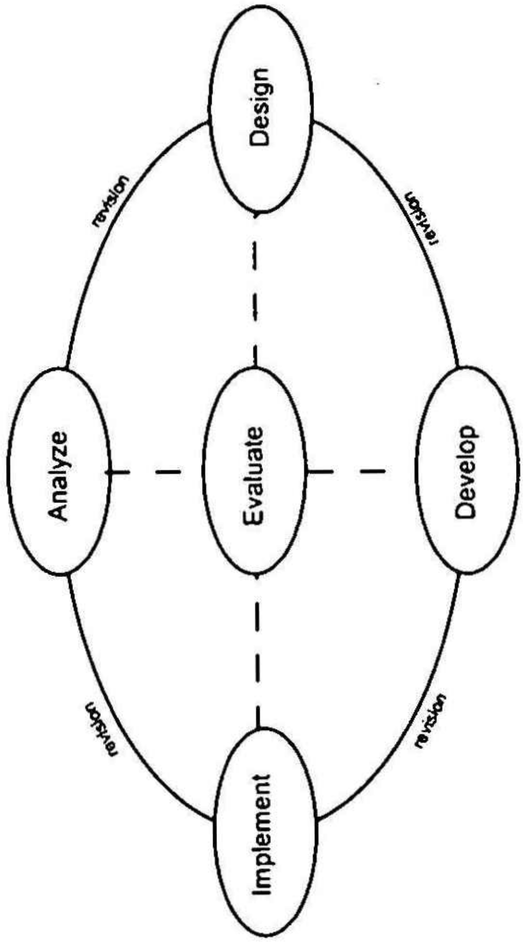



Figure 1. Core elements of instructional development.

els that appear in the literature. Conceptual and operational tools assist in identifying the contexts within which an ID model might be utilized. In fact, the quantity and quality of tools accompanying a model become significant criteria for selecting one for a specific setting. However, specific procedures for planning, conducting, and managing the ID process can be implemented with operational tools that may or may not be identified as part of the ID model.

### Operational Tools

An ID model should contain enough detail about the process to establish guidelines for managing the people, places and things that will interact with each other and to estimate the resources required to complete a project. Instructional development models can directly or indirectly specify products, such as time lines, samples of work, deliverables, and periodic endorsements by appropriate supervisory personnel.

While models provide the conceptual reference, they also provide the framework for selecting or constructing the operational tools needed to apply the model. Operational tools—such as Program Evaluation and Review Technology (PERT) charts, nominal group techniques, task analysis diagrams, lesson plan templates, worksheets for generating objectives, and production schedule templates—contextualize the ID process. Some ID models include highly prescriptive information about how to develop the companion tools or provide most of the tools necessary to apply the process. Other models only provide a conceptual diagram without any operational tools or directions for constructing companion tools necessary for their application. The Interservice Procedures for Instructional Systems Development model (Branson, 1975) is an example of a highly prescriptive ID model with a comprehensive set of companion operational tools. The Dick, Carey and Carey model (2001) is moderately prescriptive and contains an array of companion operational tools. For those models having few or no accompanying tools, Zemke & Kramlinger (1984) and Gentry (1994) describe tools that can be used with a variety of models. Generic operational tools are also available for managing ID (e.g., Greer, 1992).

**Linear and Concurrent Aspects of Instructional Design**

The instructional development process can be approached as a single linear process or as a set of concurrent or recursive procedures. Instructional development should be portrayed in ways that communicate the true richness and reality associated with planning instruction. Critics of ID models sometimes interpret them as stifling, passive, lockstep, and simple because of the visual elements used to compose the models (Branch, 1997). This is, in part, because ID models have traditionally been portrayed as rectilinear rows of boxes connected by straight lines with one-way arrows and one or more feedback (revision) lines that are parallel to other straight lines (see fig. 2). Rectilinear portrayals of ID models often do not acknowledge the actual complexities associated with the instructional development process. Curvilinear compositions of ovals connected by curved lines with two-way arrows better acknowledge the complex reality upon which the ID process is modeled (see fig. 3). However, even here, there remains an implied sequence, at least among the core elements.

Another approach is to model the ID process as sets of concurrent procedures. Portraying ID as sets of procedures occurring simultaneously, or as overlapping procedures during the process, tends to communicate more of the simultaneous iterations that characterize the way instructional development is commonly practiced (Rowland, 1992; Visscher-Voerman, 1999). The selection of an appropriate model for an instructional development context may, in part, depend on the need to reflect the degree of linearity or concurrency planned for the project.

As various forms of prototyping are used more often in ID, two different forms of rapid prototyping emerge. Some recent models have

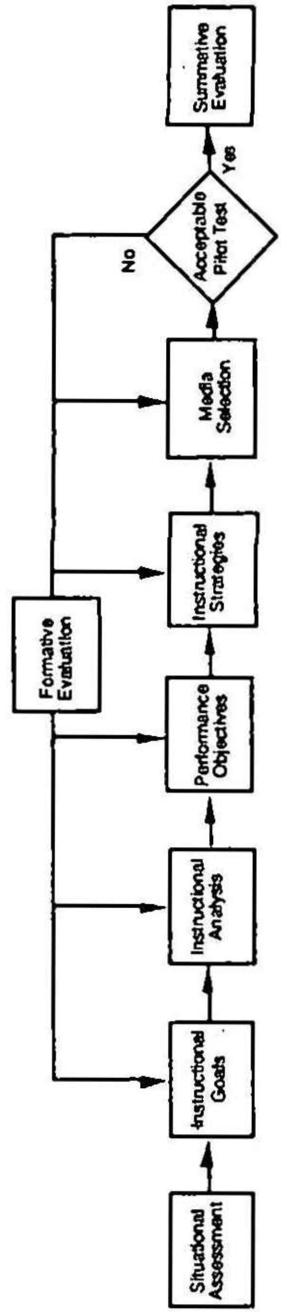



Figure 2. Rectilinear portrayal of the instructional development process.

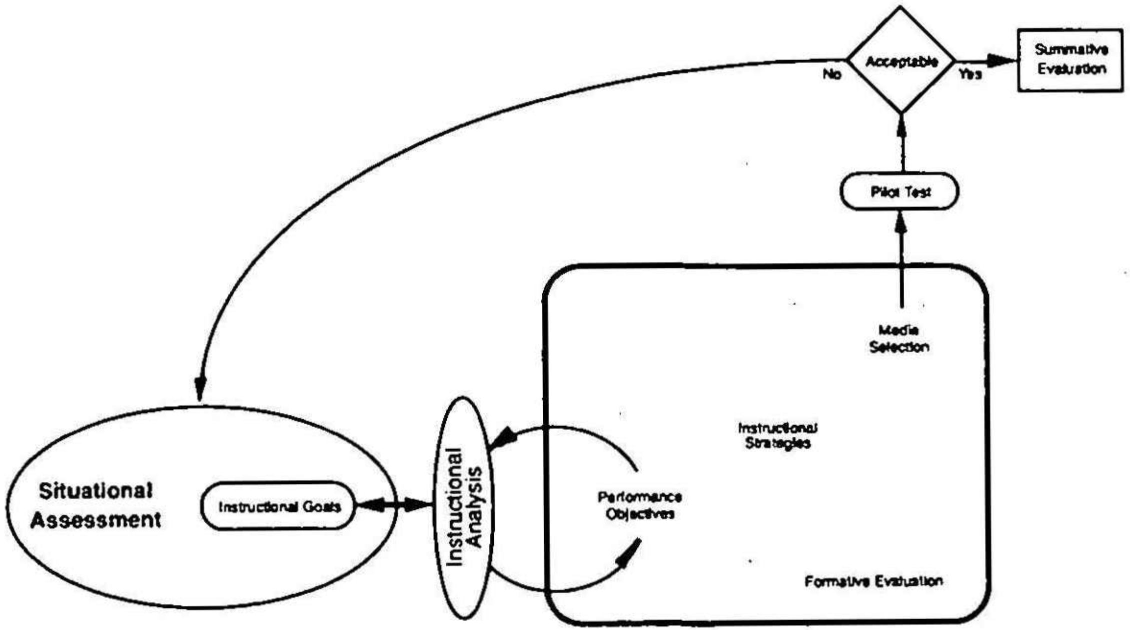



Figure 3. Curvilinear portrayal of the instructional development process.

adopted a spiral design to indicate the highly iterative nature of the process, perhaps with multiple initial design ideas being placed in competition with each other and the best ideas from each being included in subsequent designs that are also extensively tested and revised. Much of this work draws on an original model (see fig. 4) from computer software development that was created by Boehm (1988) (cf., Goodyear, 1997; de Hoog, de Jong, & de Vries, 1994; Willis & Wright, 2000). One example of a highly iterative model (Dorsey, Goodrum & Schwen, 1997) is presented and reviewed in chapter 5. A second form of rapid prototyping model emphasizes early development of a simple and incomplete prototype that then evolves into a complete design as the client and developers become clearer on what the problem is and the type of solution desired (Tripp & Bichelmeyer 1990, Stokes & Richey, 2000). Both forms of prototyping are reported to be particularly useful when there is uncertainty as to what the client wants or when a highly creative solution is desired.

Another important contribution to the ID models literature is the work of Tessmer and Wedman, which continues to communicate the importance of the development context. In 1991, Tessmer and Wedman created the Layers of Necessity model, which has since been refined and expanded as the Contextual Layered ID model (1995; see fig. 5).

Tessmer and Wedman (1995) seek to convey the central and critical importance of context when selecting the processes and procedures for an ID project. We strongly agree with this perspective, which forms the basis for our belief that a taxonomy of models is desirable. We believe an ID model should be selected (and probably modified) based on the specific context of the project. Further, as will be seen in chapter 2 where we describe our taxonomy, the characteristics that are used to form a matrix to accompany the model classification schema aid in clarifying the general context typically associated with each class of model.

Instructional development models vary widely in purpose, amount

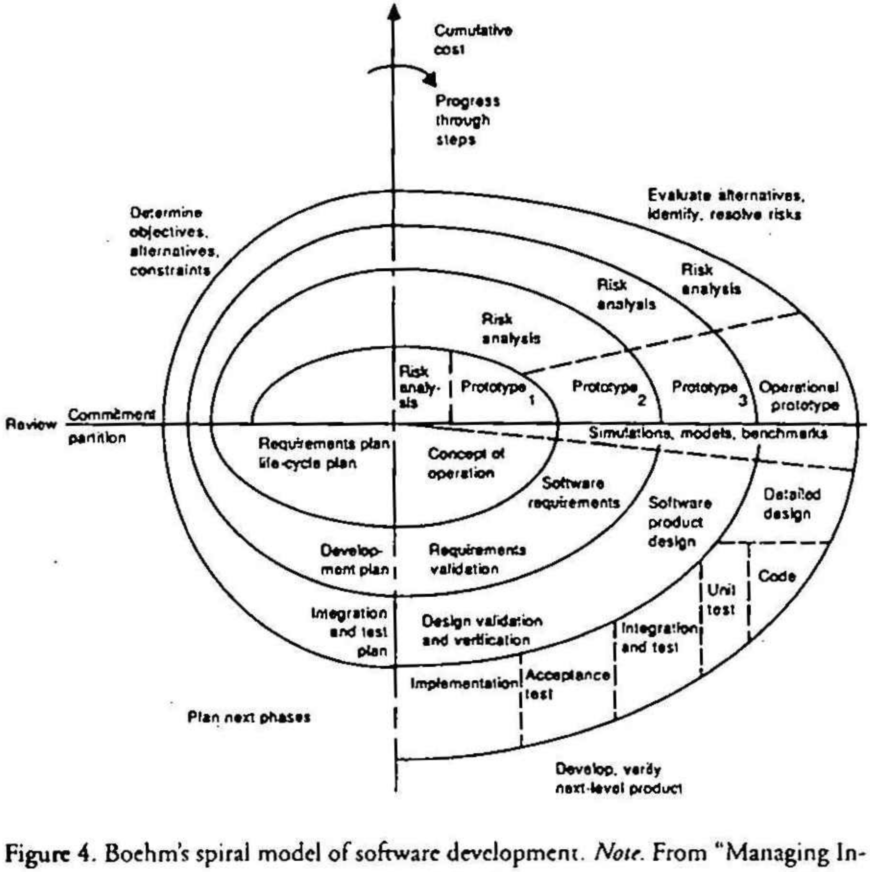



Figure 4. Boehm's spiral model of software development. *Note.* From "Managing Interactive Video/Multimedia Projects," by B. Boehm, 1988, *IEEE Computer, 21* (2), p. 61–72. Copyright 1988 by IEEE Computer. Reprinted with permission.

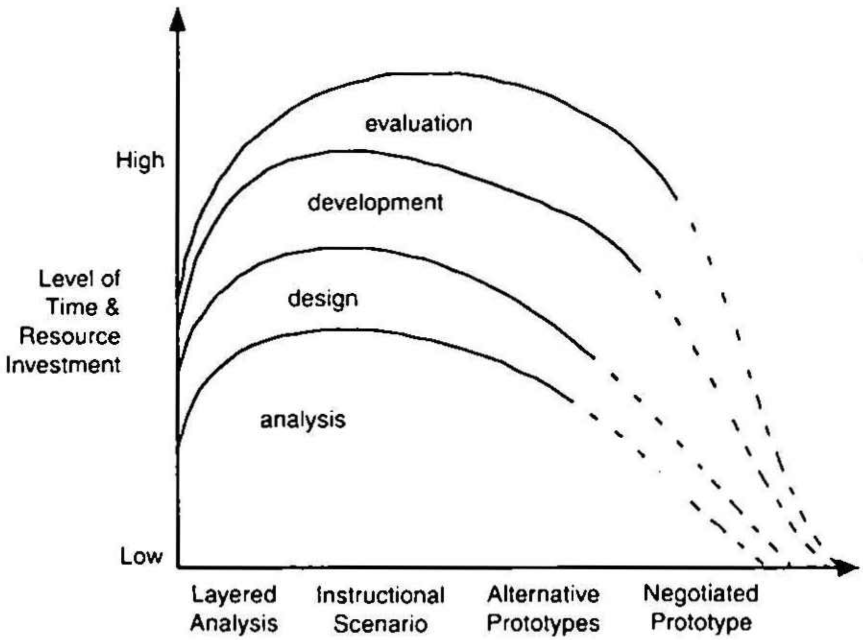



Figure 5. The Tessmer and Wedman Contextual Layered ID model. *Note.* From "Context-Sensitive Instructional Design Models: A Response to Design Research Studies and Criticism," by M. Tessmer and J. Wedman, 1995, *Performance Improvement Quarterly, 8* (3), 38–54. Copyright 1995 by the International Society for Performance Improvement. Reprinted with permission.

of detail, and degree of linearity, as well as in quantity, quality, and utility of accompanying operational tools. While no single model is useful for all settings and all purposes, it is important to identify the intended focus of an ID model and the context for which it is intended. The following taxonomy of ID models can help guide the way in which we adopt or adapt instructional development models.

chapter two

# A Taxonomy of Instructional Development Models

Instructional development is practiced in a variety of settings, leading to the creation of many different models. A taxonomy of ID models can help clarify each model's underlying assumptions and identify the conditions under which each might be most appropriately applied.

Although the number of models published far exceeds the number of unique environments in which they are applied, there are several substantive differences among ID models. Thus, there is some value in creating a taxonomy for classifying them. A taxonomy also helps to organize the extensive literature on this topic and perhaps to assist instructional developers in selecting one that is best matched to a given set of circumstances.

Gustafson (1981) created one such taxonomy. Gustafson's schema contains three categories into which models can be placed: classroom, product, and system. Placement of any model in one of the categories is based on the set of assumptions that its creator has made, often implicitly, about the conditions under which both the development and delivery of instruction will occur. For example, the models by Gerlach and Ely (1980) and by Heinich, Molenda, Russell, and Smaldino (1999) are clearly intended for use by classroom teachers, who most often work alone as both the designers and deliverers of instruction. In contrast, Bergman and Moore (1990) describe how a team consisting of a project manager, instructional developers, production staff, and computer programmers can use their model to develop multimedia-based instructional products for what is usually wide distribution. Bergman and Moore's model implicitly assumes that no members of the development team will have a role in the product's implementation or use. Likewise, the model by de Hoog, de Jong and de Vries (1994) describes the process they used to develop simulations and expert systems products.

The models by Dick, Carey and Carey (2001) and Smith and Ragan (1999) represent still a third category of ID models that are intended for use in a variety of organizational settings. Each of the models in this category will most likely be used by a skilled development team to develop instructional systems—such as one or more courses or an entire curriculum. The Branson (1975) model, designed specifically for military training, also assumes there will be a large-scale, team-oriented development effort and wide distribution of the resulting system.

The taxonomy presented in Figure 6 can be used to categorize ID models based on a number of assumptions its creator or creators have made about the setting in which it might be applied and about how the process might take place. The taxonomy has three categories, indicating whether a given model is best applied for developing (1) individual classroom instruction, (2) products for implementation by users other than the developers, or (3) larger and more complex instructional systems directed at an organization's problems or goals.

A matrix, relating the three classes of models (classroom, product, and system) to the nine characteristics above, is presented in Figure 6. The comments in each cell of the matrix indicate how those using that class of model typically view each characteristic. Examples of how the characteristics relate to each class of model are described below.

In order to categorize the models, we examined the following nine characteristics of each: (1) typical output in terms of amount of instruction prepared; (2) resources committed to the development effort; (3) whether it is a team or individual effort; (4) expected ID skill and experience of the individual or team; (5) whether most instructional

| Selected Characteristics | Classroom Orientation | Product Orientation | System Orientation |
|---|---|---|---|
| Typical Output | One or a Few Hours of Instruction | Self-Instructional or Instructor-Delivered Package | Course or Entire Curriculum |
| Resources Committed to Development | Very Low | High | High |
| Team or Individual Effort | Individual | Usually a Team | Team |
| ID Skill/ Experience | Low | High | High/Very High |
| Emphasis on Development or Selection | Selection | Development | Development |
| Amount of Front-End Analysis/ Needs Assessment | Low | Low to Medium | Very High |
| Technological Complexity of Delivery Media | Low | Medium to High | Medium to High |
| Amount of Tryout and Revision | Low to Medium | Very High | Medium to High |
| Amount of Distribution/ Dissemination | None | High | Medium to High |

Figure 6. A taxonomy of instructional development models based on selected characteristics.

materials will be selected from existing sources or represent original design and production; (6) amount of preliminary (front-end) analysis conducted; (7) anticipated technological complexity of the development and delivery environments; (8) amount of tryout and revision conducted; and (9) amount of dissemination and follow-up occurring after development.

As noted earlier, most authors of ID models do not explicitly discuss any of the above characteristics or assumptions. Rather, they simply describe their model's major elements and how they are to be implemented. Thus the characteristics used for classifying each model discussed in subsequent chapters were derived solely by us and were based upon our review of the descriptive material accompanying each model.

Heinich, Molenda, Russell and Smaldino (1999) and Newby, Stepich, Lehman and Russell (2000) offer a perspective about how to practice instructional development in the classroom. Each set of authors makes the assumptions that: the size of the planned instructional event will be small; the amount of resources available will be low; it will be an individual rather than a team effort; the teacher is not a trained instructional developer (although hopefully he or she will have gained some of those skills by studying the text); and the teacher will generally be limited to selecting and adapting existing materials rather than creating new ones. In addition, the classroom perspective typically assumes that: little time will be devoted to front-end analysis; the development and learning environments will likely be relatively low-tech; the amount of tryout and revision will be limited, and the amount of dissemination beyond that classroom will be very low, if existing at all. This is not to say that classroom teachers never work on development efforts that are large-scale and that involve a team, the use of extensive resources, a high-tech environment, and periods of extensive analysis, tryout, revision, and dissemination. However, when they are involved in such a project, these classroom-oriented models would no longer be their best choice since the characteristics or assumptions would be entirely different.

Creators of product development models, such as de Hoog, de Jong and de Vries (1994) and Bergman and Moore (1990), make different assumptions including that there will be a specific product produced. Usually the product will be of only a few hours or days in duration. Product development models also assume substantial resources are available to a team of highly trained individuals, often including a professional manager. Typically the team will produce sophisticated (often technology-based) original materials, perhaps to be commercially marketed. The amount of front-end analysis varies widely, and a technically sophisticated product often results. Tryout and revision is usually extensive, and wide dissemination of the product is common.

Systems-oriented models, such as those created by Branson (1975), Dick, Carey and Carey (2001), and Smith and Ragan (1998), typically assume a substantial amount of instruction will be created, such as an entire course or entire curriculum. Substantial resources are typically provided to a team of skilled instructional developers and subject matter experts. Whether or not original production or selection of materials will occur varies, but in many corporate settings original development may be required. Assumptions about the technological sophistication of the development and delivery systems also vary, with the decision often being based on the infrastructure available for course delivery. The amount of front-end analysis is usually high, as is the amount of tryout and revision. Dissemination and utilization may be quite wide, but probably does not involve the team that did the development.

In summary, we placed each ID model in one of three categories in the taxonomy, based on the assumptions we believe were made by its creator or creators. Of course many ID models can be, and no doubt are, used successfully under different sets of assumptions. Our placement of a model in a particular class should not be interpreted as believing it can only be used in that context. Particularly if users adapt a model and employ tools not originally associated with it, many of the models become applicable in at least one of the adjacent classes in the taxonomy. Nonetheless, classifying models does have the advantage of exposing their characteristics to analysis and of assisting in selecting one that is most appropriate to a given situation.

In closing this discussion, we would be remiss if we did not acknowledge that other authors have created different classification schemas for ID models and processes. Of particular note is the work of Visscher-Voerman (1999) who, based on extensive data collection related to how instructional designers conducted projects, created a four-category classification framework. Her four categories are *instrumental, communicative, pragmatic,* and *artistic.* Visscher-Voerman's intent was to characterize the underlying philosophy and values of each approach rather than the context of the development and use of the instruction as we have done.

Thus, we make no claim that our taxonomy is the only one or even the best of those created. Our sole hope is that it will be useful to practitioners, researchers, and those in training to become instructional designers as they read and think about the many models in the literature.

chapter three

# Classroom-Oriented Models

## Assumptions

Classroom ID models are primarily of interest to professional teachers who accept as a given that their role is to teach and that students require some form of instruction. Users include elementary and secondary schoolteachers, community college and vocational school instructors, and university faculty. Some training programs in business and industry also assume this classroom orientation. Thus, there are a wide variety of classroom settings to consider when selecting an appropriate ID model for use.

Most teachers assume (with real justification) that students will be assigned to or will enroll in their classes and that there will be a specified number of class meetings, each of a pre-determined length. The teacher's role is to decide on appropriate content, plan instructional strategies, identify appropriate media, deliver the instruction, and evaluate learners. Due to the ongoing nature of classroom instruction, often accompanied by a heavy teaching load, there is little time for the comprehensive development of instructional materials. Resources for development are usually limited. Furthermore, many elementary and secondary teachers teach most topics only once a year; thus, they have less concern for the rigorous formative evaluation and revision associated with courses and workshops that are offered on a repetitive basis.

Hence teachers usually need to identify and adapt existing resources rather than engage in original development.

Classroom teachers usually view any ID model as a general road map to follow. Typically only a few functions are outlined in this class of model, and they simply provide a guide for teachers. It should be noted that although there are a number of classroom-oriented ID models, they are not widely known to or adopted by teachers. The developer who works with teachers within the given conditions and assumptions described above would do well to employ any ID model with caution because teachers are unlikely to be familiar with the concepts or processes of systematic instructional development. Teachers may also view the process depicted in many ID models as mechanistic and resulting in dehumanized instruction.

However, the models discussed below have been found to be acceptable to and readily understandable by at least some teachers and represent a class of models with which all developers should be familiar. Four models have been selected to represent the variety of ID models most applicable in the classroom environment: Gerlach and Ely (1980); Heinich, Molenda, Russell and Smaldino (1999); Newby, Stepich, Lehman and Russell (2000); and Morrison, Ross and Kemp (2001).

### The Gerlach and Ely Model

The Gerlach and Ely model (1980) is a mix of linear and concurrent development activities (see fig. 7). Several steps are seen as simultaneous, but the model is generally linear in its orientation. The entry point of the model calls for identifying content and specifying objectives as simultaneous, interactive activities. While Gerlach and Ely clearly prefer the approach of specifying objectives as a "first task," they recognize that many teachers first think about content. Their model is one of only a few that recognizes this content orientation of many teachers. Learning

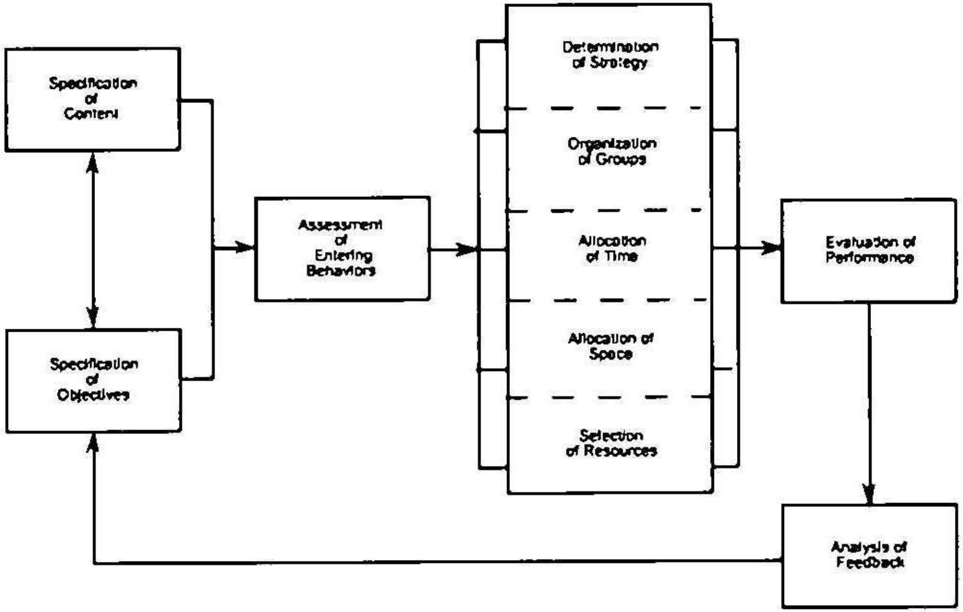



Figure 7. The Gerlach and Ely model. *Note.* From *Teaching and Media: A Systematic Approach*, Second Edition, by V. S. Gerlach & D. P. Ely, 1980, Boston, MA: Allyn and Bacon. Copyright 1980 by Pearson Education. Reprinted by permission of the publisher.

objectives are to be written and classified before making several decisions about design. Their classification scheme is based on Gerlach's other scholarly work and presents a five-part cognitive taxonomy with single categories for affective and motor skill objectives.

The next step in Gerlach and Ely's model is assessing the entry behavior of learners, a step that is common to many classroom-oriented models. The step that follows is really five activities to be performed simultaneously. These activities are viewed as interactive, with any decision in one area influencing the range of decisions available in the others. The five activities are: (1) determine strategy, (2) organize groups, (3) allocate time, (4) allocate space, and (5) select resources.

The five characteristics represent a continuum of strategic cues for determining necessary resources. The continuum has exposition (all cues) on one end and discovery (no cues) on the other end. The teacher/designer's role is to select one or more strategies along this continuum. Students can be organized into configurations ranging from self-study to whole-class activities based on strategies, space, time, and resources. Time is viewed as a constant to be divided up among various strategies. Space is not a constant because teachers can and should extend learning experiences beyond the classroom, which itself can be rearranged for different grouping patterns.

*Selection of resources* focuses on the teacher's need to locate, obtain, and adapt or supplement existing instructional materials. Emphasis is placed on where and how to find such resources and the importance of previewing and planning for their use as a part of the overall instructional strategy. This emphasis on selecting rather than developing instructional materials is a common feature of classroom-oriented ID models.

Following these five simultaneous decisions is *evaluation of performance*. This step directs the teacher/designer's attention to measuring student achievement and the students' attitudes toward the content and instruction. Evaluation is closely linked to the learner objectives with particular attention directed to evaluating the overall effectiveness and efficiency of the instruction. The last step in their model is feedback to the teacher regarding the effectiveness of the instruction so that improvements can be made the next time the topic is taught. *Analysis of feedback* focuses on reviewing all earlier steps in the model, particularly the objectives and strategies selected.

### The Heinich, Molenda, Russell and Smaldino Model

Heinich, Molenda, Russell and Smaldino (1999) present their classroom-oriented instructional development model, ASSURE, in what is currently the most widely adopted college text on instructional media and technology for current and future teachers. While some might argue it is not a complete or formal instructional development model, teachers can readily identify with the systematic planning process it describes and its match to the realities of K-12 classrooms. Unlike most ID models, ASSURE is not portrayed in graphic or pictorial form (see fig. 8).

The *A* for *analyze learners* acknowledges the importance of determining the entry characteristics of learners. Heinich, Molenda, Russell and Smaldino caution teachers about the feasibility of analyzing all learner attributes. They suggest that only selected "general characteristics" (e.g., grade level, job or position, and cultural and economic factors) and selected specific entry competencies (e.g., knowledge, technical vocabulary, attitudes, and misconceptions) be examined. They also suggest that "learning style" (anxiety, aptitude, visual and auditory preference, and so on) be considered, but acknowledge problems of defining and measuring these characteristics.

Their second step, *S*, for *state objectives*, emphasizes the need to state the desired outcomes of instruction in specific and measurable terms. A rationale for stating measurable objectives is presented, including their role in strategy and media selection, assessment of learning, and com-

ASSURE is an acronym for
- Analyze learners
- State objectives
- Select media and materials
- Utilize media and materials
- Require learner participation
- Evaluate and revise

Figure 8. The Heinich, Molenda, Russell and Smaldino ASSURE model. *Note.* From *Instructional Media and Technologies for Learning*, Sixth Edition, by R. Heinich, M. Molenda, J. Russell, and S. Smaldino, 1999. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

municating the intent of the instruction to learners. (The ABCD format—representing *audience, behaviors, conditions,* and *degree*—they suggest for writing complete objectives is easy to remember and apply.) The second *S* in their model, *select media and materials,* recognizes that most teachers have little time for designing and developing their own materials. However, the authors do discuss the option of modifying existing materials and indicate that original development may sometimes be possible. The procedures and criteria they present for selecting media and materials provide useful guidelines to teachers and to those assisting teachers in that task.

The *U,* or *utilize media and materials* step, in their model describes how teachers need to plan for utilizing the selected media and materials in the classroom. The practical advice they offer recognizes the realities of most American classrooms and the fact that teachers play a central role in delivering most instruction. The *R, require learner participation,* step in the ASSURE model emphasizes the importance of keeping learners actively involved. The role of feedback and practice are also described. While one might question why learner participation is singled out over and above other design considerations and elevated to a step in the ASSURE model, Heinich, Molenda, Russell and Smaldino consider it to be of primary importance. The last step in their model, *E* for *evaluate and revise*, is in reality two steps: evaluate *and* revise. They discuss the importance of evaluating the "total picture" to assure both learner achievement of the objectives and the feasibility of the instructional process itself. Revision is then planned based on discrepancies between intended and actual outcomes and any noted deficiencies of the media, methods or materials.

Although Heinich, Molenda, Russell and Smaldino's model focuses on media and materials selection and utilization, in contrast to a wider view of the ID process, it has much to offer classroom teachers. The relationship of its steps to an authentic environment and its practical guidance and structure make it easy to understand and apply. Further, the well-written text and accompanying CD-ROM and Web site are excellent resources for teaching teachers the rudiments of the ID process.

### The Newby, Stepich, Lehman and Russell Model

Newby, Stepich, Lehman and Russell (2000) present the PIE model (see fig. 9) in a book written primarily for pre-service teachers, although they do mention in-service teachers in their preface. *Planning, implementing* and *evaluating* are the three phases of the PIE model. Clearly the focus is on classroom instruction created and delivered by the same individual or small group with an emphasis on using media and technology to assist them. The authors describe PIE as supporting a shift from a teacher-centered to a learner-centered classroom environment. To highlight this point, they devote significant time to defining roles for the students for each of the three PIE phases. Their view is that media,

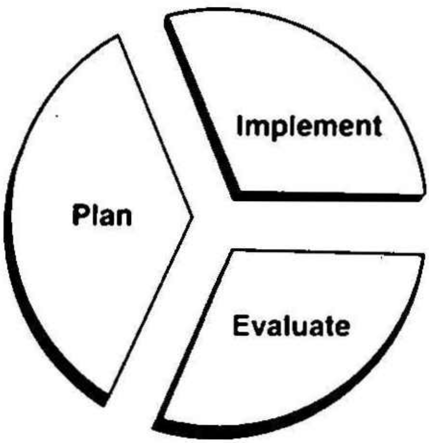



Figure 9. The Newby, Stepich, Lehman and Russell PIE model. *Note.* From *Instructional Technology for Teaching and Learning: Designing Instruction, Integrating Computers and Using Media,* Second Edition, by T. Newby, D. Stepich, J. Lehman and J. Russell, 2000. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

particularly computers, can play a central role provided their use is carefully planed for, implemented and evaluated.

Planning includes gathering information about the learner, content and setting. How technology can assist in creating effective and motivational instruction also is part of this phase. Implementation addresses various forms of media and methods with a particular focus on how the computer can be incorporated into lessons. Evaluation includes both learner performance and how the data can be used to continuously improve their own and student performance.

Newby, Stepich, Lehman and Russell frame the PIE model with a set of questions related to the categories of learners, the teacher and instructional technology. These three categories are placed on the horizontal axis of a matrix with planning, implementing and evaluating being on the vertical axis. The questions are then placed in the resulting nine cells thereby providing the overall structure for a systematic design model. For example, questions in the *planning* row relate to the role that learners are expected to play during instruction, what learners already know, the goal of the instruction, the materials that exist, and how technology can be used to increase the efficiency of planning. In the *implementing* row of the matrix, some of the questions relate to how students know they are learning, how the classroom will be managed, how student attention and motivation will be maintained, and how technology can increase the impact of the instruction. Typical questions in the *evaluation* row of the matrix relate to whether the quality and quantity of the learning was at the level needed, what type of enrichment or remediation activities might be necessary, how the materials and activities might be improved for repeated or adapted use, and how technology can be used to measure the effectiveness, efficiency and appeal of the instruction.

## The Morrison, Ross and Kemp Model

The current version of this popular ID model (see fig. 10) was initially created by Kemp and adapted by Kemp, Morrison and Ross in 1994. In

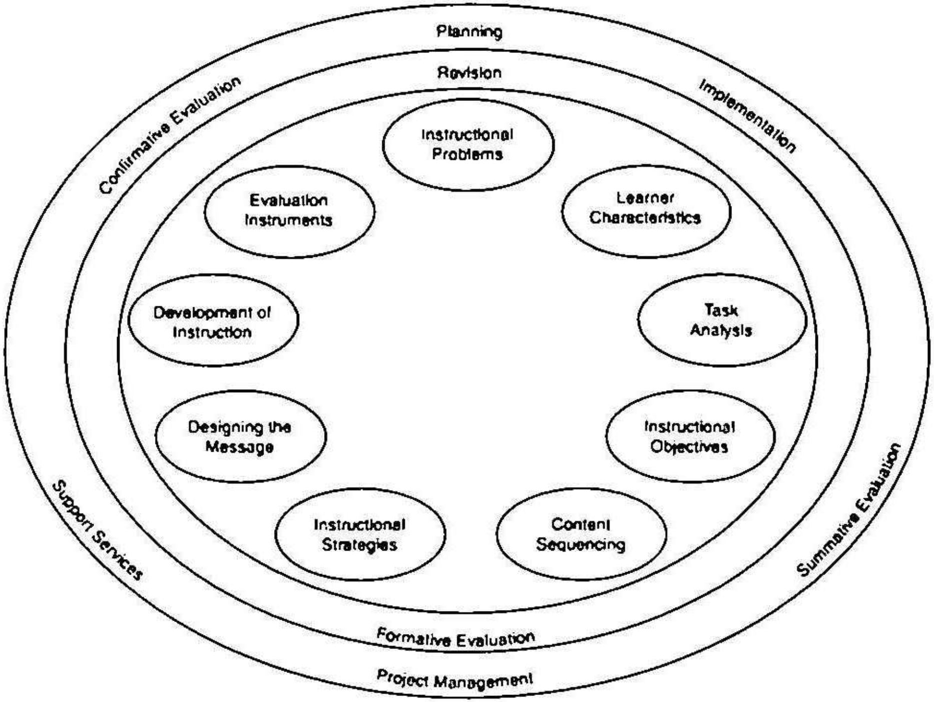



**Figure 10.** The Morrison, Ross and Kemp model. *Note.* From *Designing Effective Instruction*, Third Edition, by G. Morrison, S. Ross and J. Kemp, 2001, New York: John Wiley & Sons. Copyright 2001 by John Wiley & Sons. Reprinted by permission of the publisher.

the third edition of the book, *Designing Effective Instruction*, Morrison has become the lead author, but the important continuing influence of Kemp remains obvious. The 1994 version of this ID model has been modified to include project management and support services as components of the process.

Morrison, Ross and Kemp (2001) present an instructional development model with a focus on curriculum planning. They approach instruction from the perspective of the learner rather than from the content and contrast ID with traditional design practice by asking the following six questions: (1) What level of readiness do individual students need for accomplishing the objectives? (2) What instructional strategies are most appropriate in terms of objectives and student characteristics? (3) What media or other resources are most suitable? (4) What support is needed for successful learning? (5) How is achievement of objectives determined? (6) What revisions are necessary if a tryout of the program does not match expectations? (p. 4).

Based on the identified key factors, Morrison, Ross and Kemp (2001) identify the following nine elements that should receive attention in a comprehensive instructional development plan: (1) identify instructional problems and specify goals for designing an instructional program; (2) examine learner characteristics that will influence your instructional decisions; (3) identify subject content and analyze task components related to stated goals and purposes; (4) specify the instructional objectives; (5) sequence content within each instructional unit for logical learning; (6) design instructional strategies so that each learner can master the objectives; (7) plan the instructional message and develop the instruction; (8) develop evaluation instruments to assess objectives; and (9) select resources to support instruction and learning activities (p. 6).

Morrison, Ross and Kemp's model communicates their belief that ID is a continuous cycle with revision as an on-going activity associated with all the other elements. They feel that the teacher/designer can start anywhere and proceed in any order. This is essentially a general systems view of development wherein all elements are interdependent and may be performed independently or simultaneously as appropriate. Although the Morrison, Ross and Kemp model indicates that the developer can start anywhere, the narrative presents a conventional framework that suggests that the developer begin with *task analysis*. The classroom orientation of the model is apparent through their choice of the words *topics* and *subject content* for determining what will be taught. Both K-12 and business and industry instructors can readily identify with these words. From a teacher's perspective, the strength of this model is the concept of starting "where you are." Also, the emphasis on subject matter content, goals and purposes, and selection of resources makes it attractive to teachers. The current version places greater emphasis on both formative and summative evaluation as being continuous and places all activities within the context of goals, priorities and constraints. Greater emphasis on the need to manage the ID process is made clear both in the narrative and with the fact that a trial version of Microsoft Project is included with the text. This model is one of the few that continues to be modified over time.

chapter four

# Product-Oriented Models

## Assumptions

Product development models typically assume the amount of product to be developed will be several hours, or perhaps a few days, in duration. The amount of front-end analysis for product-oriented models may vary widely, but often it is assumed that a technically sophisticated product will be produced. Users may have no contact with the developers except during prototype tryout. However, in some rapid prototyping models, early and continuous interaction with users and/or clients is a central feature of the process.

Product development models are characterized by four key assumptions: (1) the instructional product is needed, (2) something needs to be produced rather than selected or modified from existing materials, (3) there will be considerable emphasis on tryout and revision, and (4) the product must be usable by learners with only "managers" or facilitators, but not teachers, available. The assumption of need should not necessarily be considered a limitation of these models. In some settings, a front-end analysis has already been conducted and needs have already been determined for a variety of products. The task then becomes developing several related products efficiently and effectively. Also, in a number of situations, the need is so obvious that it is unnecessary to ask whether there is a need, but rather only what needs to be done. An example would be the need to develop an operator-training package for a new machine that is about to be marketed.

Extensive tryout and revision often accompany product development, because the end-user cannot, or will not, tolerate low performance. Also, the performance level may be externally established, as in the case of the user being able to utilize all the capabilities of word processing software. This is in contrast to classroom settings where the performance level is often subject to considerable up or down adjustment based on the effectiveness of the instruction. Cosmetic appearance of the product may also be important to clients, thus making subjective evaluation an important part of the tryout process. Use of the product by learners as opposed to teachers often means the product is required to stand on its own without a content expert available. An example would be computer-based training for telephone company line engineers on how to install a specialized piece of equipment that is distributed to them for self-study on a CD-ROM. The demand for freestanding products is another reason tryout and revision stages are emphasized in product development.

As computer-based instruction has become more popular, the demand for effective instructional products has increased and is likely to expand even more rapidly in the future. The rapid growth in distance learning also has increased interest in product-oriented ID models. Hence the demand for highly prescriptive ID models which are applicable to a variety of settings and instructional products will continue and likely increase. This was a factor in our decision to review five product models, four of them new, in this review.

Product models often contain elements that might qualify them as systems models, such as those reviewed in the next section. However, they seem best classed as product models based on our belief they are *primarily* focused on creating instructional products rather than more comprehensive instruction systems. The five models reviewed are:

Bergman and Moore (1990), de Hoog, de Jong and de Vries (1994), Bates (1995), Nieveen (1997), and Seels and Glasgow (1998).

### The Bergman and Moore Model

Bergman and Moore (1990) published a model (see fig. 11) specifically intended to guide and manage the production of interactive multimedia products. This focus on managing the process, which receives little attention in many ID models, is the basis for its selection for this review. Although their model includes specific reference to interactive video (IVD) and multi-media (MM) products, it is generally applicable for a variety of more recent high-tech, interactive instructional products.

Bergman and Moore's model contains six major activities: *analysis, design, develop, produce, author,* and *validate*. Each activity specifies input, deliverables (output), and evaluation strategies. The output of each activity provides the input for the subsequent activity. They refer to each horizontal row of their model as a phase and remind the reader that, although not shown, it may be necessary to review a phase and re-examine selected activities. They also emphasize the importance of evaluating the output (deliverables) from each activity before proceeding. The checklists they provide for performing these evaluations are extensive and would be valuable even if one were using a different product development model for interactive multimedia development.

Bergman and Moore report that a request for proposal (RFP) initiates the development process. They suggest that even if an external RFP does not exist, preparing an internal RFP is desirable. The RFP drives analysis activities, including identification of the audience, tasks, user environments, and content. Design activities include sequencing the major segments and defining their treatment, labeled by Bergman and Moore as *high-level design*. Detailed design then follows and includes specification of motivational elements, media, interaction strategies, and assessment methodology. Development includes preparing all the

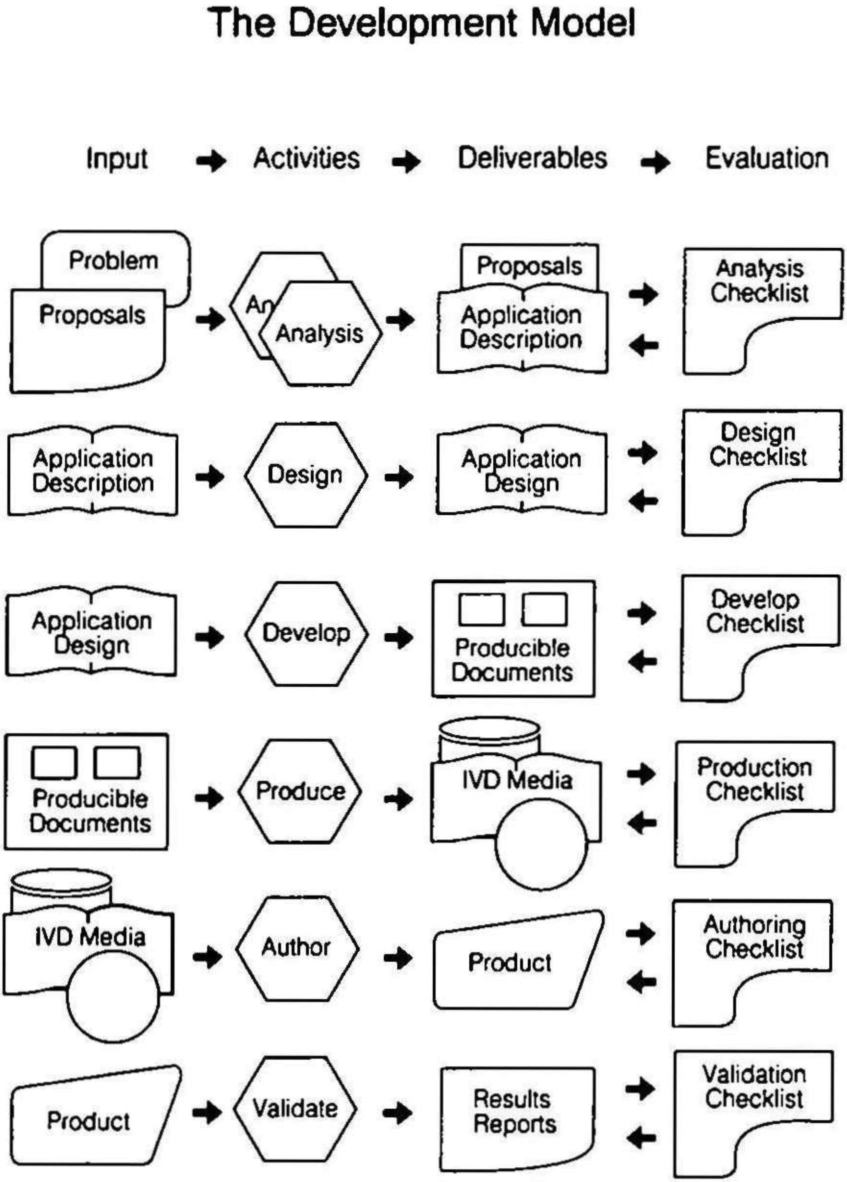



Figure 11. The Bergman and Moore model. *Note.* From *Managing Interactive Video/Multimedia Projects,* by R. Bergman and T. Moore, 1990, Englewood Cliffs, NJ: Educational Technology Publications. Copyright 1990 by Educational Technology Publications. Reprinted by permission of the publisher.

documents necessary for later production. Examples of what Bergman and Moore call *producible documents* are storybooks, audio scripts, shot lists, art and graphics renditions and a database for managing production. Production "transforms the producible documentation into its corresponding medium: video sequence, audio, graphic, or text" (Bergman & Moore, 1990, p. 17).

*Authoring* activities integrate the individual media into the completed product. Its three sub-activities are coding, testing, and tuning. *Validation* consists of comparing the finished product with its original objectives. Revision, to reflect changing conditions or to increase effectiveness, and assessment of whether the sponsor's goals have been achieved may both occur at this time.

Developing sophisticated interactive multimedia products almost always requires a team, a point made repeatedly by Bergman and Moore. Interactive video and multimedia also require a sound management system, the structure for which this model provides. This model was selected for review partially because of its focus on new technology and partially due to the excellent and extensive checklists and other guides contained in the text. Even without the model these support materials are well worth examining.

### The de Hoog, de Jong and de Vries Model

De Hoog, de Jong and de Vries (1994) created a model (see fig. 12) for developing simulations and expert systems. The products produced are for distribution and use by individuals other than the developers. The authors describe the model as "product-driven," hence its placement in our taxonomy as a product model. They report that their model was heavily influenced by Boehm's spiral model of computer software development mentioned earlier and included as Figure 4.

The underlying bases of the de Hoog, de Jong and de Vries model lie in rapid prototyping, availability of computer tools to facilitate proto-

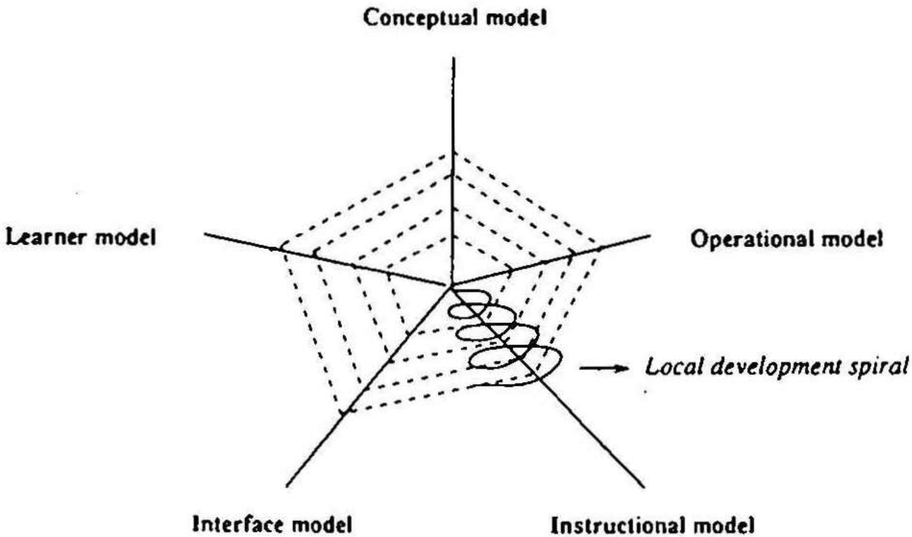



Figure 12. The de Hoog, de Jong and de Vries model. *Note.* From "Constraint-driven Software Design: An Escape from the Waterfall Model," by R. de Hoog, T. de Jong and F. de Vries, 1994, *Performance Improvement Quarterly, 7* (3), p. 56. Copyright 1994 by the International Society for Performance Improvement. Reprinted with permission.

type development and testing, and a "web structure" for elements needing to be considered when creating simulations. The creators of the model stress that "intertwining of methodology, product, and tools requires a comprehensive approach," that if not followed "will probably do more harm than good" (de Hoog, de Jong and de Vries, 1994, p. 60).

As an example of a product developed using the model, they describe a web structure that includes five partial products: conceptual model, operational model, instructional model, interface model and learner model. These partial products are considered part of global development and represent important underlying features of the simulation or expert system that can be developed by different team members. Although not specifically stated by the authors, we interpret their description to mean that these partial products may vary somewhat depending on the overall product being developed.

Emanating from the web that represents the entire product are axes for each of the partial products around which there is spiral development of four components: compliance, quality, integration, and specificity. These axes are referred to as *local development*. Thus, to understand the model, it is necessary to think in three dimensions, with spiraling taking place concurrently around the axis and with the complete product gradually emerging as the partial products become more complete.

The dotted lines on their model represent the interdependent nature of the conceptual, operational, instructional, interface and learner models and the need to consider how decisions in one area will likely affect the others. These lines also indicate the emerging nature of the final product. The spirals around each axis (only one is shown in Figure 12) represent the prototyping that takes place related to compliance, quality, integration, and specificity. Electronic communication with T. de Jong (personal communication, August, 2001) indicates the authors have continued to refine and apply their model and that another article with additional details will be forthcoming in the near future.

### The Bates Model

Bates (1995) presents a model (see fig. 13) for developing open and distance learning based on his experience in Canada. While acknowledging the limitations of the model and the resulting instruction, he notes that extensive pre-planning and design are necessary for students at a distance, who often are working largely on their own schedules and perhaps independently. In particular, Bates raises a concern for the lack of interaction and flexibility in much distance learning and stresses the need to specifically focus on these issues during design of such courses.

Bates' model of what he calls *front-end system design* has four phases: *course outline development, selection of media, development/production of materials,* and *course delivery.* Within each phase, he identifies the team roles that are required and the actions and/or issues that need to be addressed. Although, according to Bates, this model is based on a systems approach, it implies, rather than specifically addresses, some of the ADDIE elements.

Bates characterizes the model as relying heavily on theories of instructional design, including those for building in student activities, providing clear and timely feedback and carefully structuring content. He also notes that different kinds of learning can be carefully assigned to specific technologies or learning modes and need not all be technology based. However, since technology is a major component of most open and distance learning course delivery systems, great emphasis is placed on making the best match of learning requirements to appropriate technologies and then carefully testing the resulting instruction.

Additional comments by Bates caution about the typical lack of adaptation of materials to individual needs and that the design of a course can take as much as two years. However, Bates also criticizes much of what he calls *remote* instruction, wherein a live instructor offers a course to students at a distance via satellite or other technology. This often is nothing more than a replication of face-to-face classes with lit-

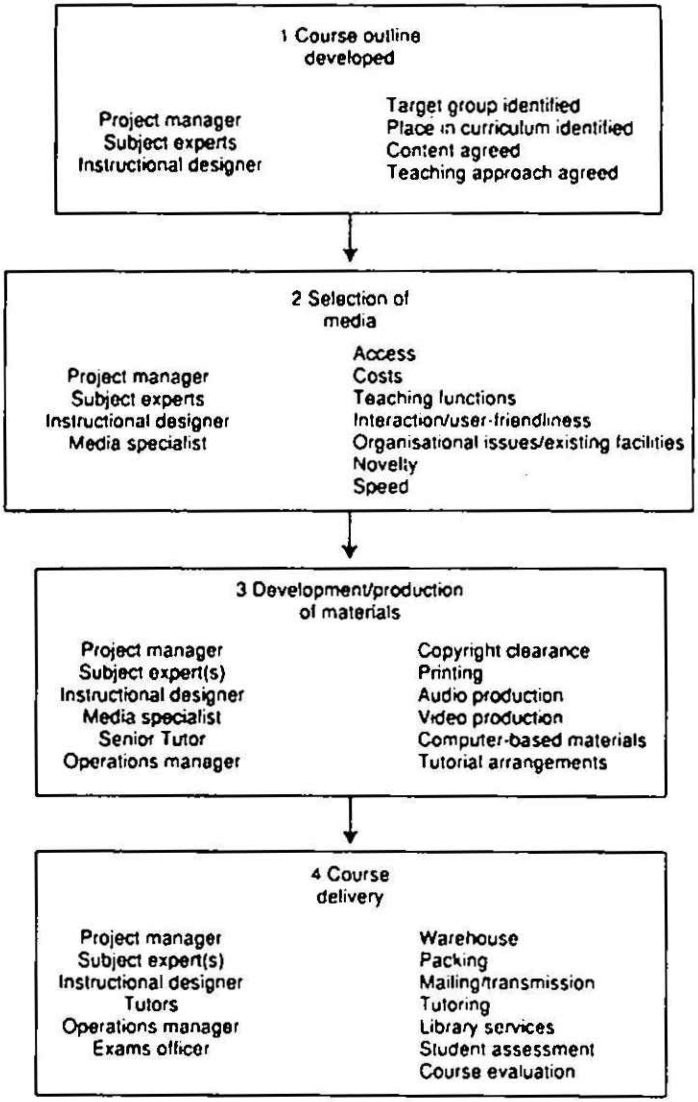



Figure 13. The Bates model. *Note.* From *Technology, Open Learning and Distance Education,* by A. Bates, 1995, London: Routledge. Reprinted by permission of the publisher.

tle thought given to learner interaction, and it often fails to take advantage of the unique benefits of the available technology while incurring many of its limitations. Somewhat unique elements of Bates' model relate to creating open and distance learning products and account for access, cost, copyright clearance and tutoring arrangements. Bates reminds readers that, at the time of course delivery, the issues of warehousing, packaging and mailing of print materials, library services, and tutoring become critical to success. These are make-or-break issues too often neglected by novice designers of open and distance learning courses.

### The Nieveen Model

Nieveen (1997) published an ID model (see fig. 14) in Holland that was the outgrowth of several years of work by herself and with colleagues at the University of Twente. The long-term goal of this effort is to produce multiple versions of a computer-based electronic performance support system (EPSS) for enhancing the quality and efficiency of curriculum materials development. To date, several versions of these EPSSs have been developed and tested in Holland, Botswana, South Africa, and the Peoples Republic of China. Although Nieveen uses the term *curriculum development* rather than *instructional development*, the underlying perspective is consistent with ADDIE. Her model has been applied to educational materials for schools rather than for training programs in business and industry. Nieveen's model has been used for creating lesson materials and courses for distribution to schools across Holland. These materials would typically include both learner materials, with which they might directly interact, and support materials to assure successful implementation by teachers.

Nieveen's model is driven by extensive use of formative evaluation of successive versions of the design documents and then of the actual curriculum materials until a satisfactory level of quality has been achieved.

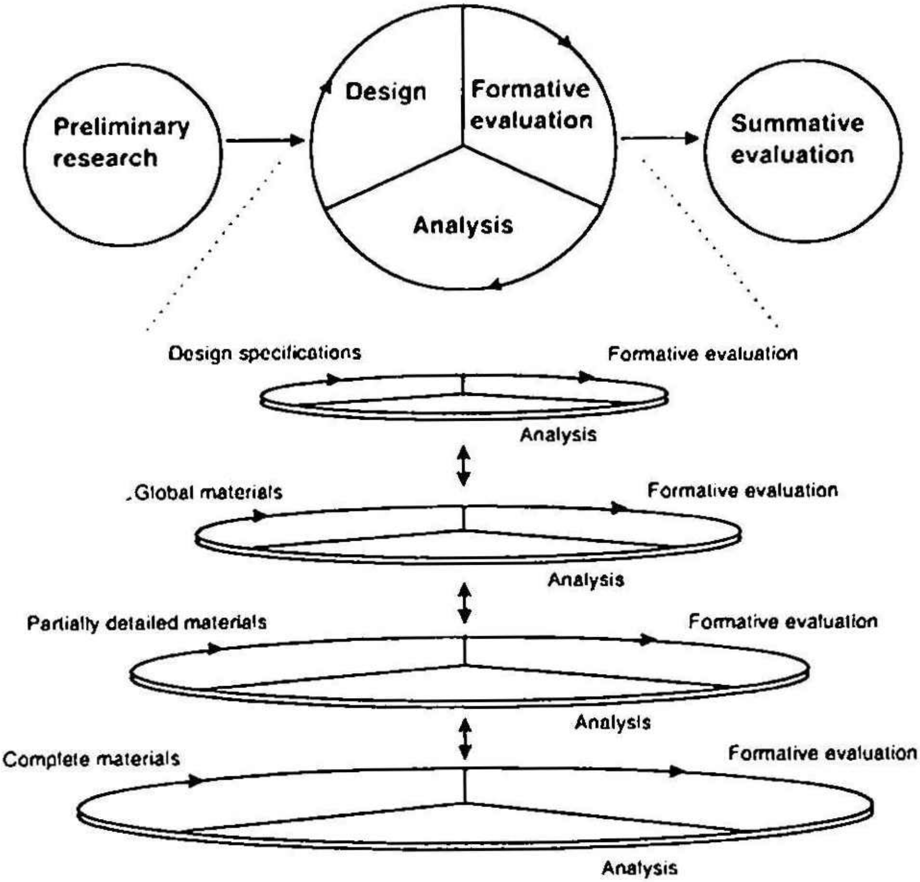



Figure 14. The Nieveen CASCADE model. *Note.* From *Computer Support for Curriculum Developers: A Study on the Potential of Computer Support in the Domain of Formative Evaluation,* by N. Nieveen, 1997, doctoral dissertation, University of Twente, Enschede, The Netherlands. Reprinted by permission of the author.

Quality is defined in terms of *validity* (materials are based on state-of-the-art knowledge and are internally consistent), *practicality* (users can and do use the materials as designed), and *effectiveness* (learners experience the materials as intended and achieve the intended objectives). These definitions of quality adhere to the distinctions made in the literature about different perspectives on what constitutes the curriculum.

The process begins with preliminary research as to what is needed and concludes with summative evaluation. However, in-between these anchoring activities, the development process goes through several iterative cycles, each consisting of analysis, design and formative evaluation activities. The model depicts this iterative process as having four levels, but in reality each cycle may have multiple iterations to achieve the necessary level of quality. Preliminary research may not be a part of every project since it may have been done earlier on a larger scale, with the results being applied to a series of smaller development efforts. Assuming the preliminary research indicates development should take place and funding is available, the first development cycle includes creating and formatively evaluating design specifications. This is done primarily by the design team. During the second cycle, global materials are created, with evaluation being largely done by expert appraisal. During the third cycle, partially designed materials are prepared and both expert appraisal and small-scale tryout are employed. During the last cycle, complete materials are prepared and subjected to expert appraisal, small group testing, and large group tryout. Summative evaluation occurs after the materials have been released for general use in a variety of settings.

### The Seels and Glasgow Model

In the second edition of their book, Seels and Glasgow (1998) present the ISD Model 2: For Practitioners (see fig. 15). Seels and Glasgow compare their model to several others, including some reviewed by us,

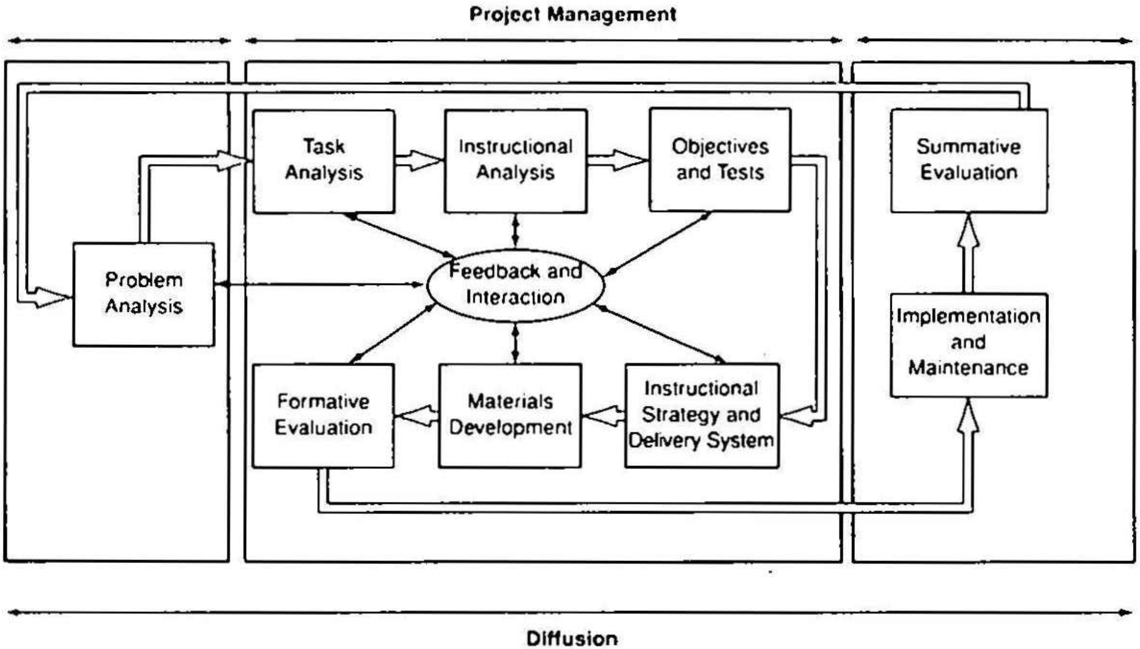



Figure 15. The Seels and Glasgow ISD Model 2: For Practitioners. *Note.* From *Making Instructional Design Decisions,* Second Edition (p. 178), by B. Seels and R. Richey, 1998. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

and to the generic ADDIE framework. Seels and Glasgow conclude that their model is quite similar to many others, but is based on the assumption that design and development take place in the context of project management. Thus, their model is organized into three management phases: *needs analysis management, instructional design management,* and *implementation and evaluation management.* Utilizing all three phases promotes the diffusion of the *products* that are created and their adoption by clients and users. Utilizing all three phases addresses the need often encountered by developers who seek ways to promote the adoption and diffusion of instructional *products.* The effective application of all three phases increases the potential for adoption. Individual chapters in their book provide specifics on how each phase and each step are to be conducted and include related exercises. Seels and Glasgow emphasize that the steps within each phase may be conducted in a linear fashion, but often are not, although the three phases are generally considered to be self-contained and linear. In particular, they note that the steps in the instructional design phase are interdependent and concurrent and may involve iterative cycling.

Their first phase, *needs analysis,* includes all of the decisions associated with conducting needs analysis and formulating a management plan. These include *needs assessment* (goals), *performance analysis* (instructional requirements), and *context analysis* (constraints, resources, and learner characteristics). The interactive and dynamic nature of their second phase, *instructional design,* is indicated by the double-ended arrows connecting each of the six steps with a central oval labeled, *feedback and interaction.* Completion of phase two occurs after satisfactory results are obtained from formative evaluation. Phase three, *implementation and evaluation,* includes preparing training materials and offering training for users, creating support structures, doing a summative evaluation the instruction, and disseminating information about the project.

The Seels and Glasgow model appears to be intended for developers of products and lessons with the expectation that the results will be disseminated for others to use. Somewhat unique features of the model are its emphasis on management and on its early and continuing attention to diffusion of the results.

# Systems-Oriented Models

## Assumptions

Systems-oriented models typically assume that a large amount of instruction, such as an entire course or entire curriculum, will be developed with substantial resources being made available to a team of highly trained developers. Assumptions vary as to whether original production or selection of materials will occur, but in many cases original development is specified. Assumptions about the technological sophistication of the delivery system vary, with trainers often opting for much more technology than teachers are able to consider. The amount of front-end analysis is usually high as is the amount of tryout and revision. Dissemination is usually extensive, and delivery does not typically involve the team that did the development.

Systems-oriented ID models usually begin with a data collection phase to determine the feasibility and desirability of developing an instructional solution to a "problem." Many systems-oriented models require that a problem be specified in a given format before proceeding. Thomas Gilbert's (1978) and Mager and Pipe's (1984) work in front-end analysis is particularly relevant to the models discussed herein. They take the position that, although a problem may have an instructional solution, one should first consider lack of motivation and environmental factors as alternative domains for action. Systems models, as a class, differ from product development models in the amount of emphasis placed on analyzing the goals of the organization before committing to development. Systems models also typically assume a larger scope of effort than product development models. However, in the design, development, and evaluation phases, the primary difference between systems models and product models is one of magnitude rather than type of specific tasks to be performed. Six models have been selected to represent the variety of ID models most applicable in the systems context: Interservice Procedures for Instructional Systems Development (Branson, 1975); Gentry (1994); Dorsey, Goodrum and Schwen (1997); Diamond (1989); Smith and Ragan (1999); and Dick, Carey and Carey (2001).

## The Interservice Procedures for Instructional Systems Development (IPISD) Model

The Interservice Procedures for Instructional Systems Development (IPISD) model is, as the name suggests, a joint effort of the United States military services. The Army, Navy, Marines, and Air Force created this model (see fig. 16) in the interest of utilizing a common approach to instructional development. The underlying concern of each service was to have a rigorous procedure for developing effective instruction. An additional motivation was to facilitate shared development efforts and improve communication with contractors doing instructional development across different branches of the military. A large number of personnel contributed to creating the IPISD model; however, the name most commonly associated with it is Robert Branson (1975).

The IPISD model has several levels of detail. The simplest level has five phases: *analyze, design, develop, implement,* and *control.* These phases sub-divide into twenty steps, which can be further divided into hundreds of sub-steps. In fact, the IPISD model is one of the most highly detailed models of the ID process generally available. The IPISD

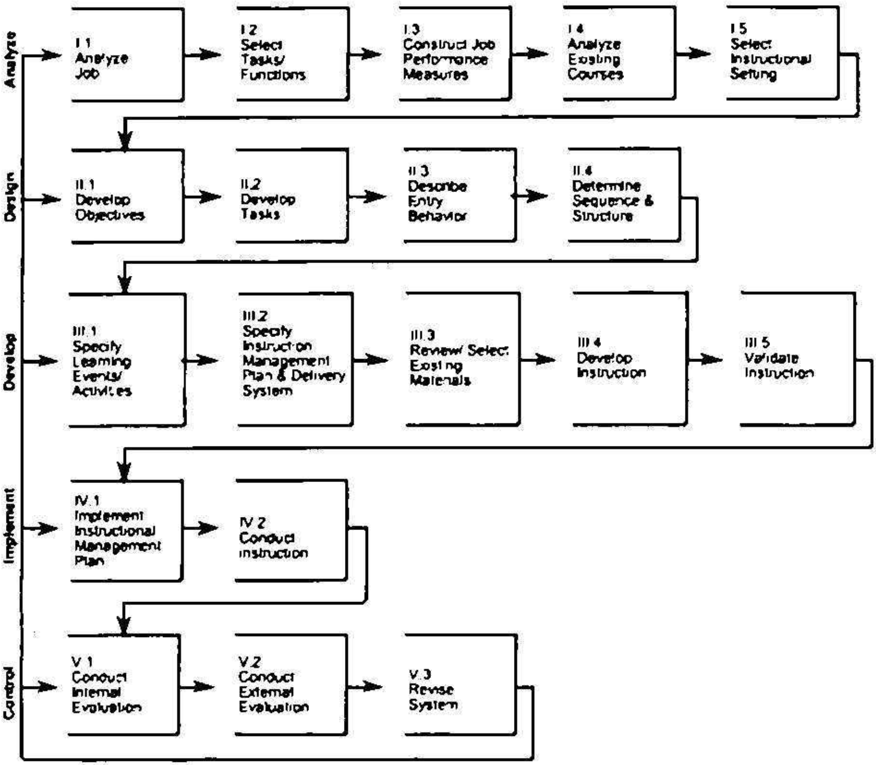



Figure 16. The Interservice Procedures for Instructional Systems Development (IPISD) model. *Note.* From *Interservice Procedures for Instructional Systems Development: Executive Summary and Model,* by R. K. Branson, 1975, Tallahassee, FL: Center for Educational Technology, Florida State University.

model is published as a four volume set (Branson, 1975) and can be ordered from the National Technical Information Service (NTIS) or from the Educational Resources Information Center (ERIC).

Since a detailed review of all the steps in this model is beyond the scope of this survey, it will be reviewed only at the phase level. The reader should keep in mind that the IPISD approach is designed specifically for military training. Most other models have a much broader range of intended applications. The narrower focus of IPISD is both a blessing and a bane. Its virtue is the extremely detailed level of specification it contains. However, it is too specific to be useful in other contexts.

Phase one of IPISD, *analyze,* requires specification of the tasks military personnel perform on the job. Tasks that are already known or easy to acquire are subtracted, and a list of tasks requiring instruction is generated. Performance levels and evaluation procedures are specified for the tasks, and existing courses are examined to determine if any of the identified tasks are included. A decision is then made either to modify the existing course to fulfill task requirements or to plan a new course. The final step in phase one is to determine the most appropriate site for instruction, i.e., school or non-resident instruction.

Phase two, *design,* begins with the arrangement of job tasks into instructional outcomes classified by the learning elements involved. Tests are generated and validated on a sample of the population, and instructional objectives are written in behavioral form. Next, the entry behavior expected of typical students is determined, followed by the design of the sequence and structure for the course.

The development of prototype materials occurs in phase three of the model. Phase three, *develop,* begins with specifying a list of events and activities for inclusion in instruction. Media are then selected and a course management plan developed. Existing instructional materials are reviewed for their relevance and, if appropriate, adopted or adapted for the course. Necessary new materials are then produced, and the entire package is field-tested and revised until satisfactory learner and systems performance is achieved.

Phase four, *implement,* includes training for course managers in the utilization of the package, training of subject matter personnel who will manage or deliver the training, and distribution of all materials to the selected sites. Instruction is then conducted and evaluation data collected on both learner and systems performance.

During phase five, entitled *control,* internal evaluation is performed by "online" staff. This staff is expected to make small-scale changes to improve the system after each offering. In addition, they forward evaluation results to a central location. External evaluation is a team effort directed toward identifying major deficiencies requiring immediate correction. External evaluation also follows course graduates to the job site to assess real-world performance. Changes in practice in the field are also monitored to determine necessary revisions to the course. Thus the emphasis in phase five is on quality control and continued relevance of the training over an extended period of time.

The major strength of the IPISD model is the extensive specification of procedures to follow during the ID process. Its major limitations are its narrow instructional focus and linear approach to ID.

### The Gentry Model

Gentry (1994) created an Instructional Project Development and Management (IPDM) model intended to introduce both the concepts and procedures of the ID process *and* the supporting processes (see fig. 17). His model attends to *what* needs to be done and *how* something is done during an instructional development project. Gentry's model is accompanied by numerous techniques and job aids for completing the tasks associated with instructional development. According to Gentry, the IPDM model is intended for graduate students, practicing instructional

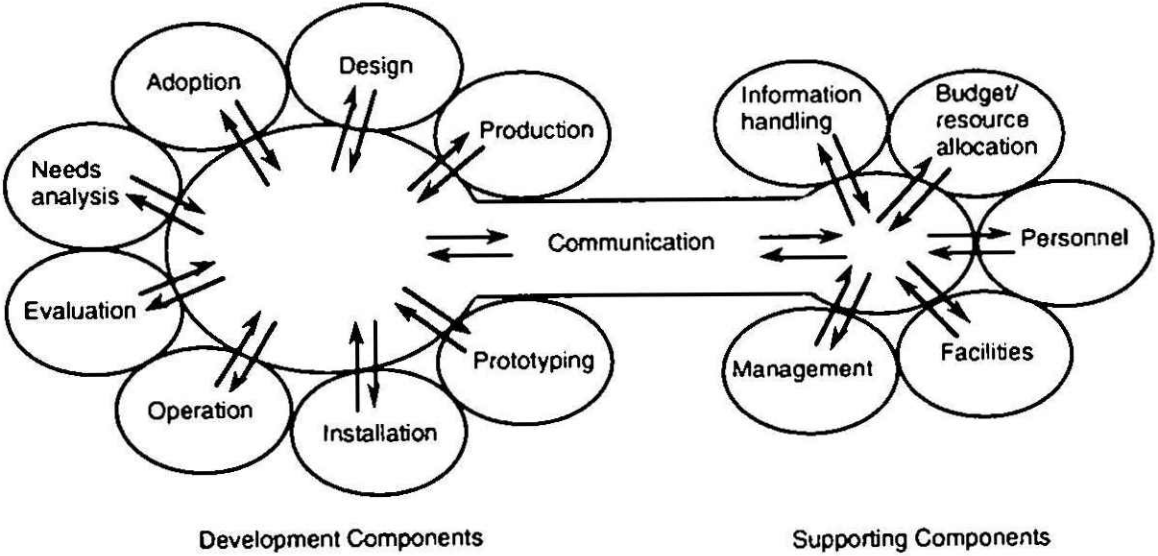



**Figure 17.** The Gentry Instructional Product Development and Management (IPDM) model. *Note.* From *Introduction to Instructional Development Process and Technique*, First Edition (p. 4), by C. G. Gentry 1994. Reprinted with permission of Wadsworth, an imprint of the Wadsworth Group, a division of Thomson Learning. Fax 800–730–2215.

developers, and teachers. However, the comprehensive description of the entire process and the accompanying tools for managing large projects make it suitable for developing large-scale systems.

Gentry's model is divided into two groups of components: *development components* and *supporting components* with a *communication* component connecting the two clusters. There are eight development components: (1) *needs analysis* (establish needs and prioritize goals for existing or proposed instruction); (2) *adoption* (establish acceptance by decision makers, and obtain commitment of resources); (3) *design* (specify objectives, strategies, techniques, and media); (4) *production* (construct project elements specified by the design and revision data); (5) *prototyping* (assemble, pilot test, validate, and finalize an instructional unit); (6) *installation* (establish the necessary conditions for effective operation of a new instructional product); (7) *operation* (maintain the instructional product after its installation); and (8) *evaluation* (collect, analyze, and summarize data to enable revision decisions).

There are five supporting components: (1) *management* (process by which resources are controlled, coordinated, integrated, and allocated to accomplish project goals); (2) *information handling* (process of selecting, collecting, generating, organizing, storing, retrieving, distributing, and assessing information required by an ID project); (3) *budget/resource allocation* (processes for determining resource needs, formalizing budgets, and acquiring and distributing resources); (4) *personnel* (processes for determining staffing needs, hiring, training, assessing, motivating, counseling, censuring, and dismissing ID project members); and (5) *facilities* (process for organizing and renovating spaces for design, implementation, and testing of elements of instruction).

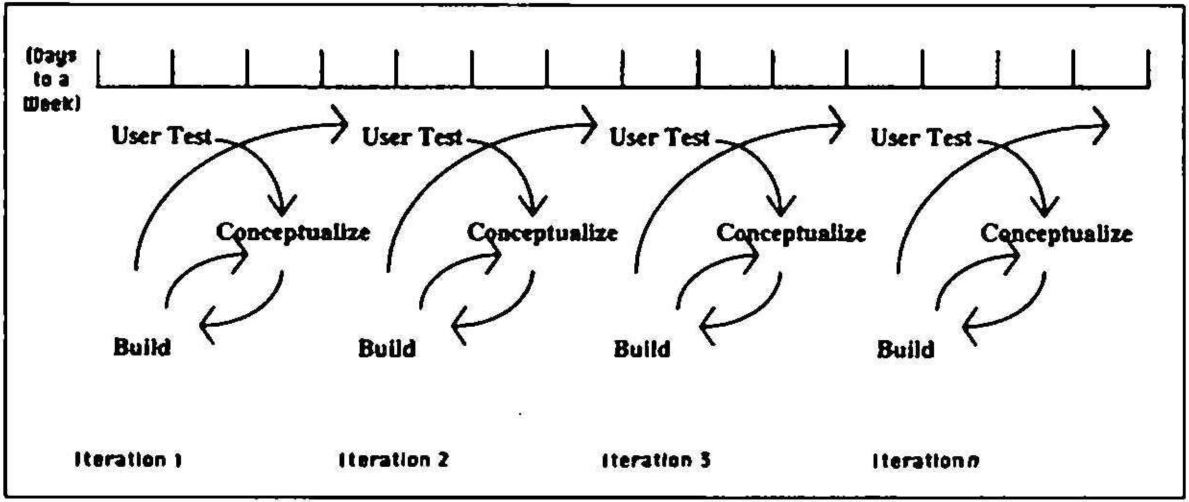
The IPDM model emphasizes the importance of sharing information between the two clusters of components during the life of the instructional development project. The communication component is the "process by which essential information is distributed and circulated among those responsible for, or involved in, the activities of a project" (Gentry, 1994, p. 5).

A unique quality of Gentry's IPDM model is the way that the instructional development process is related to specific techniques for its implementation. Some may view the IPDM model as a somewhat mechanistic approach to instructional development because of its reliance on jargon and its behavioristic orientation. However, Gentry warns against being overly dogmatic and linear in applying his model. The model depicts procedures that contain enough descriptive and prescriptive information, and at varying levels of detail, to make it a comprehensive introduction to the processes and techniques of instructional development.

### The Dorsey, Goodrum and Schwen Model

Dorsey, Goodrum and Schwen (1997) label the process they describe *rapid collaborative prototyping* so as to emphasize the central role users play in the development process. They conceive of designers not as external experts who oversee development, but rather as collaborators on teams on which users play key design roles. They believe that this collaboration, with users playing a central role in all phases of the process, results in better products that are more likely to be used.

Based on the examples included in their description of the model (see fig. 18), rapid collaborative prototyping seems most appropriately applied at the course development level, although it might also be used to produce products for use within courses. Their model features a series of tightly spaced iterative testing cycles of prototypes. The initial prototypes are usually of low fidelity to the desired product, whereas later prototypes that are actually pilot tested have a high fidelity to the desired product. The five cycles are: *create a vision, explore conceptual prototypes, experiment with hands-on mock-ups, pilot test working prototypes*, and *fully implement the evolving vision.*




**TERMINOLOGY**

| | |
|---|---|
| • **User Test** | The experience of the user operating the application in the conducting of real tasks |
| • **Conceptualize** | The addition and refinement of problem definitions and of solution requirements |
| • **Build** | Realizing the additions and refinements in the application prototype |

Figure 18. The Dorsey, Goodrum and Schwen model. *Note.* From "Rapid Collaborative Prototyping as an Instructional Development Paradigm," by L. Dorsey, D. Goodrum, and T. Schwen, in C. Dills and A. Romiszowski (Eds.), *Instructional Development Paradigms* (p. 449), 1997, Englewood Cliffs, NJ: Educational Technology Publications. Reprinted by permission of the publisher.

Dorsey, Goodrum and Schwen do not provide detailed prescriptive information on how development and testing should take place, but do offer a number of rapid prototyping principles under four categories: *process*, *interaction*, *fidelity*, and *feedback*. The three *process* principles are: iteratively modify the prototype several times in each level of design; modify and return the prototype quickly (speed is critical); and seek alternatives, not just modifications. Their three *interaction* principles are: regard the user as designer, avoid the use of technical language, and maintain consistent communication. Under *fidelity*, the three principles are: employ low fidelity prototypes to gain feedback during early levels of design and employ high fidelity prototypes to gain quality feedback during final levels of design; consider the prototype to be effective if it allows the user to give pertinent and productive feedback; and exploit the available technology. The three *feedback* principles are: capture what the user likes and, more importantly, what he or she does not like; if the user doesn't want it fixed, don't fix it; and gather data on three levels (micro, mini, and macro).

This highly iterative model, which stresses rapid prototyping across all five ADDIE elements, makes it somewhat unique in the ID literature and is the basis of its selection for review. Unfortunately, it is more conceptual than operational, so details as to how to implement it are lacking. However, we anticipate seeing more such models in the future, hopefully with more operational detail, as developers seek to apply rapid prototyping to all phases of the ID process.

### The Diamond Model

Over a number of years, Diamond (1989) developed and refined a development model that is specific to higher education institutions (see fig. 19). Although Diamond's model might be considered classroom-oriented, we have placed it in the systems category due to his belief that development is a team effort and is often directed at comprehensive

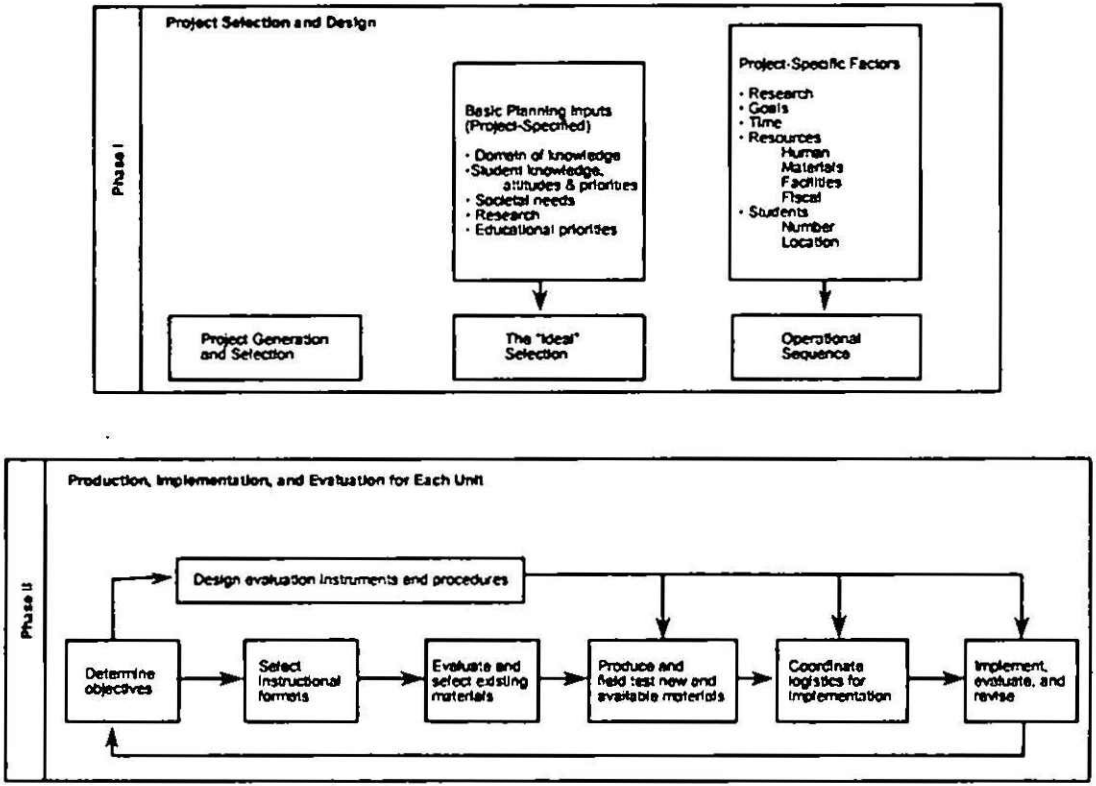



Figure 19. The Diamond model. *Note.* From *Designing and Improving Courses and Curricula in Higher Education*, by R. M. Diamond, 1989, San Francisco, CA: Jossey-Bass. Copyright 1990 by R. M. Diamond. Reprinted by permission of the author.

curricula offerings in addition to individual courses. Diamond also emphasizes the need to be sensitive to political and social issues existing on the campus and within academic departments. Assuring that the proposed development effort is consistent with organizational priorities and missions is another critical concern somewhat unique to this model. Diamond believes ID is a team process with significant input from university personnel who are specifically assigned to assist faculty. For all these reasons, his model seems most appropriate for classification as a systems model.

Diamond's model is divided into two phases: *project selection and design* and *production, implementation and evaluation.* During phase one, the feasibility and desirability of launching the project are examined. Instructional issues such as enrollment projections, level of effectiveness of existing courses, institutional priorities, and faculty enthusiasm are all considered prior to beginning development. Diamond recommends commencing the ID process by thinking in terms of an ideal solution, without regard to existing constraints. His argument is that by thinking in ideal terms, a team will be more creative and innovative in outlining powerful solutions. Once a decision is made to begin a project, an operational plan is developed that accounts for the goals, timeline, human and other resources, and student needs.

During phase two of the activities specified in Diamond's model, each unit of the course or curriculum proceeds through a seven-step process. The first step is to determine the unit's objectives. This is followed by design of evaluation instruments and procedures, a step that proceeds concurrently with selecting the instructional format and examining existing materials for their possible inclusion in the system. Once these steps have been taken, new materials are produced and existing materials are modified. Interestingly Diamond includes field-testing as part of the same step as materials production, although most model developers make them separate steps. Also implicit to this step is revision of the instruction based on field test data, but Diamond includes revision later in the process. The next to the last step is coordinating logistics for implementation, followed by full-scale implementation, including evaluation and revision.

Diamond emphasizes matching the decision on whether to engage in development to institutional missions and strategic plans, as well as to instructional issues. He also stresses the need to assure faculty ownership of the results of the development effort and the need for a formal organization to support faculty development efforts.

### The Smith and Ragan Model

Smith and Ragan (1999) have created an instructional design process model (see fig. 20) that is becoming increasingly popular with students and professionals in the field of instructional technology who are particularly interested in the cognitive psychology base of the ID process. Almost half of the procedures in their model address the design of instructional strategies.

Smith and Ragan's model has three phases: *analysis, strategy* and *evaluation.* These three phases provide the conceptual framework for the eight steps that comprise their ID process. Their eight-step approach includes: *analyze learning environment, analyze learners, analyze learning task, write test items, determine instructional strategies, produce instruction, conduct formative evaluation,* and *revise instruction.*

*Analyze learning environment* involves a two-part procedure: (1) substantiation of a need for instruction in a certain content area, and (2) preparing a description of the learning environment in which the instructional product will be used. *Analyze learners* includes procedures for describing the stable and changing characteristics of the intended learner audience. *Analyze learning task* describes procedures for recognizing and writing appropriate instructional goals. *Write test items* describes procedures for identifying which of several possible assessment items are valid assessments of objectives for various types of learning.

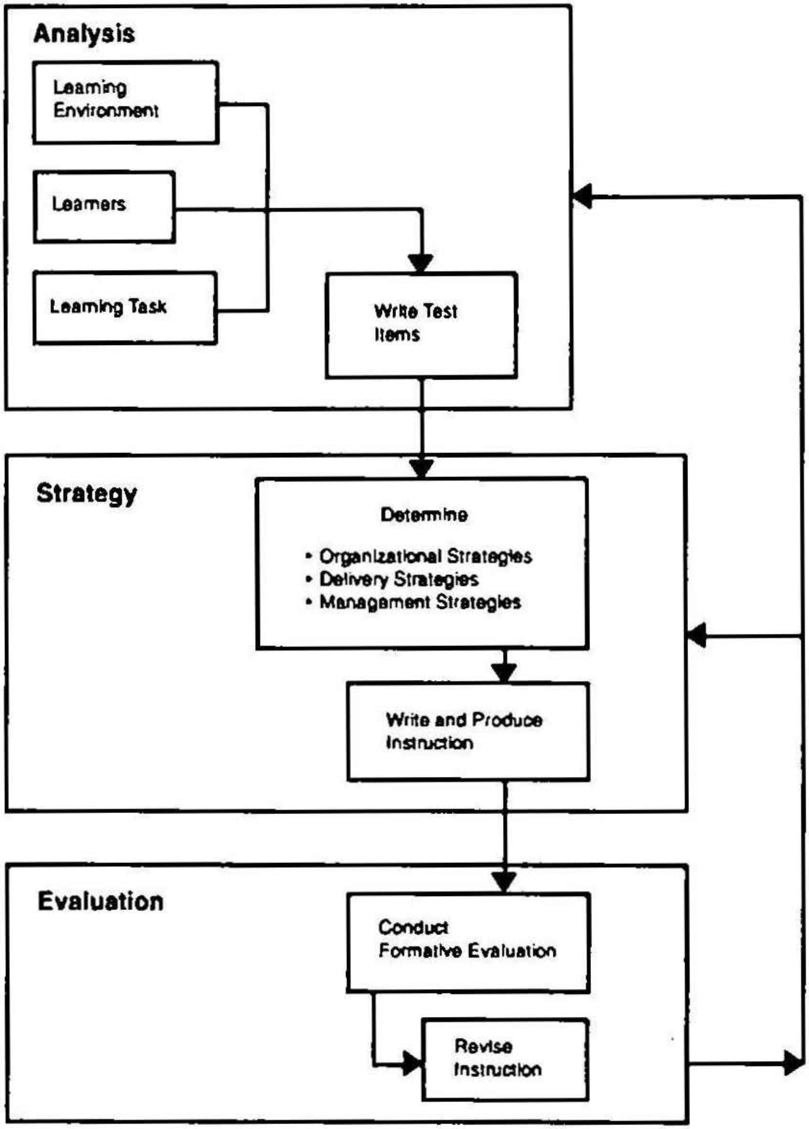



Figure 20. The Smith and Ragan model. *Note.* From *Instructional Design*, by P. Smith and T. Ragan, 1999, New York: John Wiley & Sons. Copyright 1999 by John Wiley & Sons. Reprinted by permission of the publisher.

*Determine instructional strategies* is the step that presents strategies for organizing and managing instruction. *Produce instruction* is the step that provides strategies for translating the decisions and specifications made in previous steps into instructional materials and trainer guides. Production is followed by *conduct formative evaluation*. Smith and Ragan offer procedures for evaluating the effectiveness of the instructional materials, both during development and after implementation. And lastly, *revise instruction* offers procedures for modifying the proposed instruction. Although this description suggests that the process is highly linear, Smith and Ragan caution that often circumstances require concurrent attention to several steps in their model.

The Smith and Ragan model reflects their philosophic belief that applying a systematic, problem-solving process can result in effective, learner-centered instruction. Their model is particularly strong in the area of developing specific instructional strategies, a common weakness of many other ID models.

**The Dick, Carey and Carey Model**

Without a doubt, the most widely cited ID model is the one originally published by Walter Dick and Lou Carey to which they have now added James Carey. Both the advocates of ID and its most vocal critics almost invariably cite this model when expressing their opinions about the desirability of systematically designing instruction. The Dick, Carey and Carey model (2001) has become the standard to which all other ID models (and alternative approaches to design and development of instruction) are compared. Hence we are including it in this publication once again.

In this widely used text, now in its fifth edition (Dick, Carey and Carey, 2001), the model (see fig. 21) is unchanged from earlier editions. This model might be considered product-oriented rather than systems-oriented depending on the size and scope of step-one activities

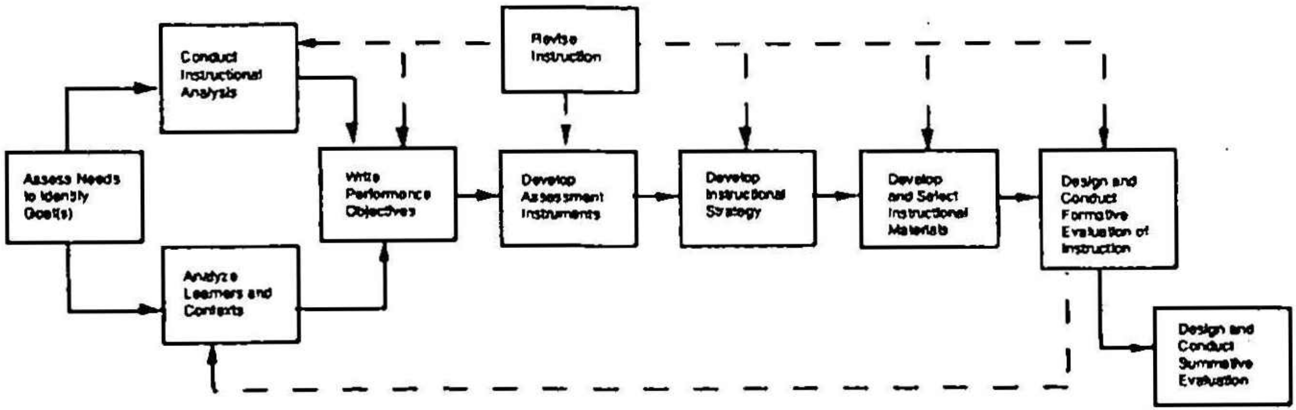



Figure 21. The Dick, Carey and Carey model. *Note.* From *The Systematic Design of Instruction*, Fifth Edition, by W. Dick, L. Carey & J. Carey, 2001, Boston, MA: Allyn and Bacon. Copyright 2001 by Pearson Education. Reprinted by permission of the publisher.

*(assess needs to identify instructional goals).* Many of the examples and worksheets seem to be directed at developing specific instructional products, but parts of the narrative suggest a more encompassing perspective. For our purpose, we consider it to be a course or systems level model that is also applicable to projects having a more limited focus. It should be noted that they use the term *instructional design* for the overall process that we define as *instructional development*

Dick, Carey and Carey's model begins with *assess needs to identify goal(s).* The first component of their model immediately distinguishes it from many other instructional development models in the way in which it promotes using needs assessment procedures and clear and measurable goals. The authors recommend criteria for establishing instructional goals as a way to decide what one is trying to achieve before beginning the ID process. Two steps are then done in parallel: *conduct instructional analysis* and *analyze learners and contexts.* The former is vintage hierarchical analysis as conceived by Gagné, with added procedures for constructing cluster analysis diagrams for verbal information. The latter step specifies collecting information about prospective learners' knowledge, skills, attitudes, and the environment.

The next step is to *write performance objectives* in measurable terms, followed by *develop assessment instruments.* Criterion-referenced test items are then generated for each objective. In the step labeled *develop instructional strategy,* they recommend ways to develop strategies for assisting a particular group of learners to achieve the stated objectives. The next step is to *develop and select instructional materials.* Dick, Cary and Carey acknowledge the desirability of selecting as well as developing materials, but the degree of emphasis devoted to development suggests they are far more interested in original development. The next step is to *design and conduct formative evaluation of instruction,* a process for which they give excellent guidance. *Revise instruction* is the step that describes various methods for collecting, summarizing, and analyzing data collected during the tryout process to facilitate decisions concerning revision. *Design and conduct summative evaluation* determines the degree to which the original instructional goals have been achieved.

The Dick, Carey and Carey model reflects the fundamental design process used in many business, industry, government, and military training settings, as well as the influence of performance technology and the application of computers to instruction. It is particularly detailed and useful during the analysis and evaluation phases of a project.

# Conclusion

This review of representative instructional development models may leave you unsure of how to react to such a wide variety of models. The literature is replete with models, many claiming to be unique and deserving of attention. However, while there are hundreds of models, until recently, there have been only a few major distinctions among them. Many of the models are simply restatements of earlier models by other authors, often using somewhat different terminology. The typical journal article simply describes the major steps in the ID model and perhaps how they are to be performed. Books on the topic (e.g., Dick, Carey & Carey, 2001; Smith & Ragan, 1999) do provide extensive guidance on how to apply the models, and some computer-based tools are beginning to appear. However in almost all instances, the authors assume their models are worthwhile, but they present no evidence to substantiate their positions. There is a disturbingly small volume of literature describing any testing of the models. While no one can be certain, it appears many have never actually been applied, never mind rigorously evaluated. In some instances, a case study of a development project is presented along with the model, but even this low level of validation is less common than we would prefer. (There is a useful compilation of short cases studies by Ertmer and Quinn [1999], but the cases are not systematically linked to specific ID models.)

We hope that in the future at least some ID models will be subjected to more rigorous validation. Such validation would require precise description of the elements of the model, followed by systematic data collection concerning their application and the impact of the resulting instruction. The investigator also would need to be alert to possible discrepant or negative data. Repeated trials under such conditions would, if the model had validity, result in a set of specifications regarding the conditions under which the model was valid. It is safe to say none of the models currently available in the literature has been subjected to such rigorous scrutiny. In fact, most authors completely ignore the issue of what conditions should be present if one plans to use their models. We refer the reader to an excellent chapter by Rubinstein (1975) for a more complete discussion of procedures for validating a model.

What, then, should be the response of the responsible ID professional to the plethora of ID models? First, we would suggest that developers acquire a working knowledge of several models, being certain that all three of the categories in our taxonomy are represented. Then, as new and different models are encountered, they can be compared to those with which one is familiar. Also, if a client brings a model to a development project, it is probably better to use it (and modify it, if necessary) rather than to force the client to adopt your favorite model. Another suggestion is to have available in your repertoire examples of models that can be presented with varying levels of detail. This will provide an easy introduction that can later be expanded to provide more detail for uninformed clients as they become more experienced. Also, when facing a range of situations, developers should be in the position of selecting an appropriate model rather than forcing the situation to fit the model. Bass and Romiszowski (1997) probably state this position best: "instructional design is, *and always will be* [emphasis added], a practice based on multiple paradigms" (p. xii). Like Bass and Romiszowski, we believe all competent professional developers should have a number of models in their tool bag and be able to use the right one, perhaps with modification, for the right job.

Looking back over the last few years, we have seen significant trends developing after many years of little change in the underlying structure of the ID process and its accompanying models. Although some would say that the newfound interest in constructivism (an old idea rediscovered) forms the basis for this trend, we believe new trends in instructional development lie more in advances in technology and the emergence of better design and delivery tools. For example, as was noted earlier, rapid prototyping models are now becoming more common. Their emergence closely parallels creation of tools that facilitate quick and inexpensive creation and modification of prototypes that simply were not possible previously. Instructional developers have always appreciated the power of prototypes to generate creative thinking and to test the feasibility of design ideas. However, until tools became available, most developers were forced to use the "design by analysis" approach common to most classic ID models.

This is not to suggest that constructivism (as well as social learning and other theories) have not contributed to the increased interest in learner-centered instruction. However, one of the fundamental early contributions of ID was to move from teacher-centered to learner-centered instruction. Recent developments continue to promote this view, which we believe should be encouraged; but its origins should not be ignored. Advances in technology also increase our ability to create more interactive and engaging learning environments, a goal of developers designing from virtually all theoretical perspectives.

Other forces that are influencing how we are now beginning to think about the ID process include performance support systems, knowledge management and concurrent engineering. To date, most of the interest in performance support has been in occupational job support, but this idea can be extended to formal learning environments as well. There are at least two issues here. One issue is, how can ID contribute to the design of performance support systems? The second issue is, how does one design training to complement performance support, since many will require at least some prior or concurrent knowledge and skill development? There are similar issues related to knowledge management. Effective knowledge management systems will require much more than simply organizing and making available large quantities of data to users. Data is not information. Although, to date, interest in knowledge management has been limited to the commercial sector, we believe it also has implications for how we design classroom and independent learning environments. Similarly, as concurrent engineering becomes more common, instructional developers will need to find ways to become contributing members of development teams if they hope to be central to the primary business of corporations and large social services agencies. Being an initial member of a cross-disciplinary team creating a new product or process will require ID models and practices beyond what we now use.

Tool creation is increasingly becoming a major enterprise for some ID professionals, a trend we expect to continue. These tools range from the very simple to the very complex. Instructional development professionals are creating many tools for use by themselves and other developers as well as tools to support teachers or subject matter experts in doing their own development. Goodyear (1997) and van den Akker et al. (1999) provide excellent descriptions of some such tools and how they are being used. Tools to support automation of the ID process are also increasing in number, but progress has been slower than their proponents had hoped. However, they too will play an expanded role over the next decade.

In closing, it is fair to predict that the future will be both exciting and a little unsettling for ID professionals. After a relatively lengthy period of slow evolution of ID practice, we are on the threshold of major shifts. As is the case in all such shifts, the key is determining how to incorporate what is valid and useful from past theory and practice into a new framework, while testing and revising the new ideas rather than accepting them without any prior critical analysis. These are exciting times for ID professionals, with many opportunities (some brilliantly disguised as headaches) for making significant contributions. We are eager to see which of these trends will most affect the next edition of this book.

# References

Akker, J. van den, Branch, R., Gustafson, K. Nieveen, N., & Plomp. T. (1999). *Design approaches and tools in education and training.* Dordrecht: Kluwer Academic Publishers.

Andrews, D. H., & Goodson, L. A. (1980). A comparative analysis of models of instructional design. *Journal of Instructional Development, 3* (4), 2–16. (ERIC Document Reproduction Service No. EJ 228 351)

Association for Educational Communications and Technology. (1977). *Educational technology definition and glossary of terms.* Washington, DC: Association for Educational Communications and Technology.

Barson, J. (1967). *Instructional systems development: A demonstration and evaluation project: Final report.* East Lansing, MI: Michigan State University. (ERIC Document Reproduction Service No. ED 020 673)

Bass, C., & Romiszowski, A. (Eds.). (1997). *Instructional development paradigms.* Englewood Cliffs, NJ: Educational Technology Publications.

Bates, A. (1995). *Technology, open learning and distance education.* London: Routledge. (ERIC Document Reproduction Service No. ED 407 597)

Beckschi, P., & Doty, M. (2000). Instructional systems design: A little bit of ADDIEtude, please. In G. Piskurich, P. Beckschi, & B. Hall (Eds.), *The ASTD handbook of training design and delivery.* New York: McGraw-Hill.

Bergman, R., & Moore, T. (1990). *Managing interactive video/multimedia projects.* Englewood Cliffs, NJ: Educational Technology Publications.

Boehm, B. (1988). A spiral model of software development and enhancement. *IEEE Computer, 21* (2), 61–72.

Branch, R. (1997). Perceptions of instructional design process models. In R.

E. Griffin, D. G. Beauchamp, J. M. Hunter, & C. B. Schiffman (Eds.), *VisionQuest: Journeys toward visual literacy.* Selected readings from the 28th Annual Conference of the International Visual Literacy Association, Cheyenne, WY. (ERIC Document Reproduction Service No. ED 408 940)

Branson, R. K. (1975). Interservice procedures for instructional systems development: Executive summary and model. Tallahassee, FL: Center for Educational Technology, Florida State University. (ERIC Document Reproduction Service No. ED 122 022)

Diamond, R. M. (1989). *Designing and improving courses and curricula in higher education.* San Francisco, CA: Jossey-Bass. (ERIC Document Reproduction Service No. ED 304 056)

Dick, W., Carey, L., & Carey, J. (2001). *The systematic design of instruction* (5th ed.). New York: Longman.

Dorsey, L., Goodrum, D., & Schwen, T. (1997). Rapid collaborative prototyping as an instructional development paradigm. In C. Dills & A. Romiszowski (Eds.), *Instructional development paradigms* (pp. 445–465). Englewood Cliffs, NJ: Educational Technology Publications. (ERIC Document Reproduction Service No. ED 407 932)

Edmonds, G., Branch, R., & Mukherjee, P. (1994). A conceptual framework for comparing instructional design models. *Educational Technology Research and Development, 42* (4), 55–72. (ERIC Document Reproduction Service No. EJ 496 612)

Ely, D. (1973). Defining the field of educational technology. *Audiovisual Instruction, 8* (3), 52–53. (ERIC Document Reproduction Service No. EJ 074 342)

Ely, D. (1983). The definition of educational technology: An emerging stability. *Educational Considerations, 10* (2), 2–4.

Ertmer, P., & Quinn, J. (1999). *The ID casebook: Case studies in instructional design.* Upper Saddle River, NJ: Merrill.

Gentry, C. G. (1994). *Introduction to instructional development: Process and technique.* Belmont, CA: Wadsworth Publishing Company.

Gerlach, V. S., & Ely, D. P. (1980). *Teaching and media: A systematic approach* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall Incorporated.

Gilbert, T. (1978). *Human competence: Engineering worthy performance.* New York: McGraw-Hill.

Goodyear, P. (1997). Instructional design environments: Methods and tools for the design of complex instructional systems. In S. Dijkstra, N. Seel, F. Schott, & R. Tennyson (Eds.), *Instructional design: International perspectives,* Vol. 2. Mahwah, NJ: Lawrence Erlbaum Associates.

Gordon, J., & Zemke, R. (2000). The attack on ISD. *Training, 37*(4), 42–45. (ERIC Document Reproduction Service No. EJ 602 912)

Greer, M. (1992). *ID project management: Tools and techniques for instructional designers and developers.* Englewood Cliffs, NJ: Educational Technology Publications.

Gustafson, K. L. (1981). *Survey of instructional development models.* Syracuse, NY: ERIC Clearinghouse on Information & Technology, Syracuse University. (ERIC Document Reproduction Service No. ED 211 097)

Gustafson, K. L. (1991). *Survey of instructional development models* (2nd ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology, Syracuse University. (ERIC Document Reproduction Service No. ED 335 027)

Gustafson, K. L., & Branch, R. (1997). *Survey of instructional development models* (3rd ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology, Syracuse University. (ERIC Document Reproduction Service No. ED 411 780)

Hamreus, D. (1968). The systems approach to instructional development. In *The contribution of behavioral science to instructional technology.* Monmouth, Oregon: Oregon State System of Higher Education, Teaching Research Division. (ERIC Document Reproduction Service No. ED 041 448)

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1999). *Instructional media and technologies for learning* (6th ed.). Upper Saddle River, NJ: Merrill, Prentice-Hall.

Hoog, R. de, Jong, T. de, & Vries, F. de. (1994). Constraint-driven software design: An escape from the waterfall model. *Performance Improvement Quarterly, 7*(3), 48–63. (ERIC Document Reproduction Services No. EJ 488 348)

Mager, R., & Pipe, P. (1984). *Analyzing performance problems: Or you really oughta wanna* (2nd ed.). Belmont, CA: Lake Publishing.

Markle, S. (1964). *Good frames and bad—a grammar of frame writing.* New York: Wiley. (ERIC Document Reproduction Service No. ED 019 867)

Markle, S. (1978). *Designs for instructional designers.* Champaign, IL: Stipes Publishing Co.

Morrison, G., Ross, S., & Kemp, J. (2001). *Designing effective instruction* (3rd ed.). New York: John Wiley & Sons.

National Special Media Institute. (1971). *What is an IDI?* East Lansing, MI: Michigan State University.

Newby, T., Stepich, D., Lehman, J., & Russell, J. (2000). *Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media* (2nd ed.). Upper Saddle River, NJ: Prentice-Hall.

Nieveen, N. (1997). *Computer support for curriculum developers: A study on the potential of computer support in the domain of formative evaluation.* Doctoral dissertation, University of Twente, Enschede, The Netherlands.

Reiser, R. A. (2001). A history of instructional design and technology, part II: A history of instructional design. *Educational Technology Research and Development, 49* (2), 57–67. (ERIC Document Reproduction Service No. EJ 629 874)

Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. *Performance Improvement Quarterly, 5* (2), 65–86. (ERIC Document Reproduction Service No. EJ 446 270)

Rubinstein, M. (1975). *Patterns of problem solving.* Englewood Cliffs, NJ: Prentice-Hall.

Salisbury, D. (1990). General systems theory and instructional systems design. *Performance and Instruction, 29* (2), 1–11. (ERIC Document Reproduction Service No. EJ 408 935)

Seel, N. (1997). Models of instructional design: Introduction and overview. In R. Tennyson, F. Schott, N. Seel, & S. Dijkstra, *Instructional design: International perspectives* (Vol. 1). Mahwah, NJ: Lawrence Erlbaum Associates.

Seels, B., & Glasgow, Z. (1998). *Making instructional design decisions* (2nd ed.). Upper Saddle River, NJ: Merrill, Prentice-Hall.

Seels, B., & Richey, R. (1994). *Instructional technology: The definitions and do-*

*mains of the field.* Washington, DC: Association for Educational Communications and Technology.

Silvern, L. C. (1965). *Basic analysis.* Los Angeles, CA: Education and Training Consultants Company.

Smith, P., & Ragan, T. (1999). *Instructional design.* New York: John Wiley & Sons.

Stamas, S. (1972). A descriptive study of a synthesized model, reporting its effectiveness, efficiency, and cognitive and affective influence of the development process on a client. *Dissertation Abstracts International, 34.* (University Microfilms No. 74–6139).

Stokes, T., & Richey, R. (2000). Rapid prototyping methodology in action: A developmental study. *Educational Technology Research and Development, 48* (2), 63–80. (ERIC Document Reproduction Service No. EJ 610 138)

Tessmer, M., & Wedman, J. (1995). Context-sensitive instructional design models: A response to design research studies and criticism. *Performance Improvement Quarterly, 8* (3), 38–54.

Tripp, S., & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research and Development, 38* (1), 31–44. (ERIC Document Reproduction Service No. EJ 412 118)

Twelker, P. A., et al. (1972). *The systematic development of instruction: An overview and basic guide to the literature.* Stanford, CA: ERIC Clearinghouse on Educational Media and Technology, Stanford University. (ERIC Document Reproduction Service No. ED 059 629)

Visscher-Voerman, I. (1999). *Design approaches: A reconstructive study in training and education.* Doctoral dissertation, University of Twente, Enschede, The Netherlands.

Wedman, J., & Tessmer, M. (1991). Adapting instructional design to project circumstance: The layers of necessity model. *Educational Technology, 21,* 48–52.

Willis, J., & Wright, K. (2000). A general set of procedures for constructivist design: The new R2D2 model. *Educational Technology, 40* (3), 5–20. (ERIC Document Reproduction Service No. EJ 605 319)

Zemke, R., & Kramlinger, T. (1984). *Figuring things out: A trainer's guide to needs and task analysis.* Reading, MA: Addison-Wesley.