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## Instructional Design Theories

C. M. Reigeluth

Instructional design (ID) is concerned with discerning the methods of instruction that are most likely to work best for different situations. This entry will begin by exploring the idea of ID. Elaborations of the definition will include a description of the conditions—methods—outcomes nature of ID theories and contrasts between ID and learning theories, between prescriptive and

descriptive theories, between pragmatic (or eclectic) and ideological views of instruction, between validity and superiority as criteria for judging ID theory, between general and detailed theories, and between ID theories and ID process models. The entry will then present a brief history of ID theories and project their future evolution to meet the needs of a post

industrial, information-based society. Finally, there will be a discussion of trends and issues relating to the emergence of a new paradigm of instruction to meet the needs of the information-age society, including the need to develop prescriptions for the use of adaptive strategies, advanced technologies, constructivist strategies, minimalist instruction, affective learning, and systemic change.

Any attempt to understand education is enlightened by the recognition that education is a system; namely, that it is comprised of many interacting elements, and that the effects of each element are dependent to a great extent upon other elements of the system. Banathy (1991) has identified four levels of educational systems: (a) the learning-experience level; (b) the instructional system that implements those learning experiences; (c) the administrative system that supports the instructional system; and (d) the governance system that owns, rules, and funds the entire educational or training enterprise. Separate fields have arisen for each level, including learning theory, instructional and curriculum and counseling theories, administrative studies, and policy studies, respectively. Interdisciplinary linkages are woefully deficient in most cases. This entry will focus on the instructional level of educational systems.

Within the instructional level, there are many theoretical approaches, each oriented around a different type of decision-oriented activity. Curriculum theory and theories of front-end analysis inform decisions about what to teach. Instructional design theory addresses decisions about how to teach it. Instructional mediation (or instructional development) theory is concerned with how to take the designs (or blueprints) for the instruction and make them a reality on the most appropriate media. There are also theories for instructional evaluation, dissemination/implementation/change, and management. This entry only addresses instructional design theory.

### *1. Characteristics of ID Theories*

An ID theory is a set of guidelines that indicate what methods of instruction are most likely to work best for different situations. Just as a carpenter uses different tools for different situations, so a person who creates instruction must use different tools to facilitate learning under different situations. ID theory is accumulated knowledge about which methods work best for which situations.

#### *1.1 Conditions-Methods-Outcomes*

It is helpful to think of two aspects of the teaching "situation" that will influence which methods will work best: desired instructional outcomes and instructional conditions. Desired instructional outcomes include the effectiveness of the instruction (which is based on learning outcomes), the efficiency of the

instruction (as indicated by learning time and/or cost of the instruction), and the appeal of the instruction (the extent to which the learner enjoys it).

Instructional conditions include some aspects of the learner (such as relevant prior knowledge, ability, motivation, and learning styles), some aspects of what is to be learned (such as whether it requires application, understanding, or simple memorization), some aspects of the learning environment (such as instructional resource and time constraints), and even some aspects of the instructional development process (such as development resource and time constraints).

Of course, different aspects of an instructional situation will influence how well different kinds of methods, or "tools," will work. Hence the basic form of instructional theory is "if-then" statements—often called "prescriptions" or "guidelines"—in which a method appears in the "then" part and relevant aspects of a situation appear in the "if" part of the statement. If a prescription is very narrow, prescribing a single method variable, it is usually called a "principle of instruction." A theory is much broader in scope: an integrated set of method variables—a package deal—is prescribed, rather than just a single method variable.

A few additional distinctions will assist in clarifying what ID theory includes and excludes.

#### *1.2 Instruction versus Learning*

ID theory is different from, but related to, learning theory. ID theory focuses on methods of instruction and facilitation—what the teacher or other learning resource does—whereas learning theory focuses on the learning process—what happens inside the learner.

#### *1.3 Prescriptive versus Descriptive*

Simon (1969) has distinguished between the natural sciences, which are descriptive, and the design sciences (or sciences of the artificial), which are prescriptive. The natural and design sciences are usually closely related, as in the case of biology and medicine, physics and engineering, and learning and instruction. Banathy (1991) made the same distinction under the rubrics of conclusion-oriented and decision-oriented disciplines.

ID theory, as a design science, is prescriptive, or decision-oriented, but it is closely related to learning theory. There is a common misconception that descriptive theory must precede prescriptive theory—that learning theory must precede ID theory. In reality, throughout the history of science, from the steam engine to superconductivity, the prescriptive has often preceded the descriptive. Someone has discovered that a certain technique (or tool or method) works; others then set about trying to determine why. Although this has often been true with ID theory, it is also true that instructional tools have been invented and prescriptions have been developed based on a new learning theory.

#### 1.4 Pragmatic (Eclectic) versus Ideological

It seems fair to say that all descriptive theories contribute something useful, no matter how inadequate they may be overall. As Snelbecker (1987) has pointed out, descriptive theorists strive for theoretical purity, adopt a single perspective or view of the world, and put their theories up to compete against other theories. Their primary concern is whether their theory is ideologically pure and conceptually consistent.

But practitioners need to address all aspects of a problem and multiple kinds of problems. Their primary concern is how well a prescriptive theory attains their practical goals. Therefore, they need multiple perspectives, and frequently develop solutions that are based on, or can be explained by, several different descriptive theories. Therefore, prescriptive theorists tend to take a pragmatic view that integrates useful contributions from a variety of theoretical perspectives.

#### 1.5 Validity versus Superiority

For descriptive theories, the major scientific concern is validity—how well they describe reality. But for prescriptive theories, since they are goal-oriented, the major scientific concern is superiority (or optimality)—how well they attain the goal. There are usually many ways to attain a single goal, but some are better than others. The goal of prescriptive theory is not to find out if a given method works; it is not just to identify a method that “satisfices,” but to identify the method that is better than the other known alternatives for each set of conditions. Of course, the efficiency (based on time and/or money) and appeal of a method are important criteria, as well as its effectiveness. The goal of prescriptive theory is also to improve the best available methods continually. This is significant, because it requires a completely different paradigm of research than does descriptive theory—a paradigm that is coming to be called “formative research” (Newman 1990, Reigeluth 1989).

#### 1.6 Level of Detail or Generality

Prescriptive theories, like descriptive theories, can be very detailed, very general, or anywhere between. The more general an ID theory is, the broader it will be (i.e., the more situations in which it will apply), but the guidance it will provide to an instructional designer will be reduced. For example, “To improve learning and motivation, have the learner actively engaged,” applies to almost all instructional situations, but it provides little guidance to a designer or teacher as to exactly what the instruction should be like for their particular situation. More guidance makes the designer’s work easier and quicker, but it also takes more time and effort for the designer to learn initially.

If a designer does not have formal training in instructional theory, he or she will invent their own, but it may differ considerably from the accumu-

lated experience of researchers and practitioners as represented by the current knowledge base of prescriptive theory.

#### 1.7 Product versus Process

Finally, it is helpful to consider the distinction between ends and means, or product and process. ID theory is that knowledge base that deals with the ends or products (using that term loosely)—what the instruction should be like (after it has been designed). Instructional development models, on the other hand, deal with the means or process—what an instructional designer should do to plan and create the “products.” Typical development models specify activities for a developer to perform to analyze (needs, tasks, content, learners, and more), design, produce, evaluate, implement, and manage an instructional system or “product.” ID theories specify instructional methods for a teacher (or other learning resource) to use to help a learner learn. This is a very important, yet often overlooked, distinction.

For a concise description of some modern ID theories see Reigeluth (1983), in which eight theorists describe their respective ID theories. In another volume (Reigeluth (1987) the same theorists illustrate their theories through a sample lesson.

## 2. History of ID Theories

Like most fields, ID theory began by investigating general instructional variables, such as expository vs. discovery, lecture vs. discussion, and media-based vs. traditional methods. It was soon realized that two discovery methods could differ more from each other than do a discovery and an expository method. The field then gradually entered an analysis phase in its development (which began to gain visibility in the late 1950s with B F Skinner’s work). The research objective was to break a method down into elementary components and discover which ones made a difference. Instructional researchers then proceeded to build a considerable knowledge base of validated prescriptions, primarily for the simpler types of learning, for which the behaviorist paradigm was fairly adequate.

Researchers have since found that the effects of each component are often influenced considerably by which other components happen to be present in the instruction. Furthermore, researchers have realized that practitioners need to think holistically; in other words, they need to identify the best *combination* of method components for a given situation. Hence, the field entered into a synthesis phase, which began to gain visibility in the 1980s with the publication of Reigeluth’s (1983) edited volume *Instructional Design Theories and Models*, in which the focus is on building components into optimal models of instruction for different situations. The research objective is to improve a given model or theory.

**Table 1**  
Major differences between the industrial age and the information age that affect education

Industrial age	Information age
Adversarial relationships	Cooperative relationships
Bureaucratic organization	Team organization
Autocratic leadership	Shared leadership
Centralized control	Autonomy with accountability
Autocracy	Democracy
Representative democracy	Participative democracy
Compliance	Initiative
One-way communications	Networking
Compartmentalization (division of labor)	Holism (integration of tasks)

Aside from this developmental process that most fields and disciplines seem to go through, another historical trend has strongly influenced the development of ID theories: the ongoing transformation from the industrial age to the global information age. Certain general characteristics prevailed during the industrial age that are giving way to new characteristics in the information age (Reigeluth 1992a). Some of those changes have particularly important implications for a new paradigm of education (see Table 1).

Perelman (1987) documented many characteristics of the current paradigm systems of education. In the United States and many other industrialized countries, consolidated districts are highly bureaucratic, centrally controlled autocracies in which students receive little preparation for participating in a democratic society. They frequently exhibit adversarial relationships, not only between teachers and administrators but also between teachers and students, and even between teachers and parents. Leadership is vested in individuals according to a hierarchical management structure, and all those lower in the hierarchy are expected to obey those above. Learning is highly compartmentalized into subject areas. Students are often treated as if they are all the same and are all expected to do the same things at the same time. They are also usually forced to be passive learners and passive members of their school community. These characteristics are all incompatible with society's needs in the emerging information age, and changes in this paradigm are beginning to emerge. Those changes will have very important implications for ID theory.

### *3. Emergent Trends and Issues*

Most current ID theories were developed for the industrial-age paradigm of education and training. Just as mass production in business is giving way to customized production (Reich 1991) and mass marketing is giving way to targeted marketing (Toffler 1991), so mass teaching is giving way to personalized teaching. These changes in all of these sectors (and others) are made possible by information technology. Every

year teachers are acquiring more and more powerful tools with which to facilitate learning. Those tools require the use of new instructional methods to take full advantage of their expanded capabilities. Hence, ID theories must offer guidance for the use of such new instructional methods. These information-age ID theories are likely to incorporate prescriptions for the use of adaptive strategies, advanced technologies, constructivist strategies, minimalist instruction, and systemic change, to name but a few of the emerging ideas. Each of these will be briefly described.

#### *3.1 Adaptive Strategies*

Whereas conformity was one of the general characteristics of the industrial age, diversity is emerging as a hallmark of the information age. Different students increasingly have very different learning needs, interests, goals, abilities, prior knowledge, and so forth. It is therefore increasingly important to adapt instruction—both content and methods—to each learner's needs and interests. Advanced technologies are gradually providing more powerful and cost-effective means for such adaptations.

#### *3.2 Advanced Technologies*

There are two important ways in which advanced technologies are influencing the future development of ID theories: through their use as tutors and tools for learners and their use as tools for instructional designers.

As tutors new technologies offer new capabilities that require new instructional strategies to take appropriate advantage of them. Dynamic media require guidelines as to when and how to use motion in instruction. Interactive media require prescriptions as to what kinds of learner activities to elicit when, and when and how to respond to each kind of learner activity. Massive memory storage capabilities require guidelines as to when and how to utilize them best in instruction. Hypertext and hypermedia require guidelines as to when and how their unique capabilities

can best be utilized to facilitate learning. Multimedia, expert systems, artificial intelligence, computer-based simulations, and virtual reality represent but a few of the additional technologies for which guidelines are sorely needed. The increasingly more powerful and cost-effective capabilities of these advanced technologies all require guidelines as to when and how best to use them to facilitate learning.

### *3.3 Constructivist Strategies*

Constructivism offers some practical instructional strategies that have much to contribute to the new paradigm of education for the information age. Some of its strategies are fairly uniformly applicable to most kinds of learning, but others are only applicable to higher-level learning in ill-structured domains.

At the heart of constructivism is the belief that each learner must construct his or her own knowledge and therefore that instruction must create an active role for the learner (see, e.g., Brown et al. 1989, Perkins 1992). It also prescribes that learning should be situated in authentic activities. Slightly less broadly applicable is the prescription that instruction should facilitate the construction of meaning, or sense making. This is accomplished primarily through such strategies as learning in context, modeling, and coaching, but it is not appropriate for all learning situations.

Perhaps the most valuable contributions of constructivism are considerably less broadly applicable: those for facilitating higher-level learning in ill-structured domains. Some useful instructional strategies include: generative tasks, learner exploration, analogical transfer, and the fostering of multiple perspectives.

### *3.4 Minimalist Instruction*

Carroll (1990) has developed the idea of "minimalist instruction" for teaching people "what they need to learn in order to do what they wish to do" (p. 3). It is similar to the notions of just-in-time training and on-line help systems. At its heart is the idea of not teaching people things that they do not yet have to know. This seems most appropriate for training situations, such as training people to use desktop computer systems, where it is relatively easy to determine what one needs to learn at a given point in time. Another important aspect of minimalist instruction is "to design instruction to suit the learning strategies people spontaneously adopt" (p. 3) and the relevant knowledge they have already acquired. Both of these require that the instruction be highly adaptive, and utilize advanced technology and some constructivist strategies.

Specific instructional prescriptions include the following. First, all instruction should occur with real tasks that are meaningful to the learner, so that the learner is motivated. Second, the "training wheels" approach should be used so as to pick a version

of the meaningful task that is simple enough not to overwhelm the beginner. For example, a real word-processing task might be selected that requires the use of only a small subset of the capabilities of the system. This is similar to the Elaboration Theory's "simplifying conditions method" approach to sequencing (Reigeluth 1992b). Some artificial simplifying conditions can also be instituted, such as disabling certain functions of the system, so that the learner cannot yet make certain types of errors. As the learner progresses, the meaningful tasks become gradually more complex until the learner has mastered all that he or she needs to learn.

Third, the learner should be helped to understand meaningfully what he or she is doing. Reasoning is very important for this process, and the learner's prior knowledge must be diagnosed and utilized. Fourth, reading materials and other passive activities should be reduced to a minimum, and largely replaced with discovery activities. The reading materials should be designed for random access and to be read in any order, and they should have strong linkages to different parts of the real, meaningful task. Fifth, emphasis should be placed on helping the learner to recognize and recover from errors so that errors become triggers for positive learning experiences.

### *3.5 Affective Learning*

The affective domain (Krathwohl et al. 1964) has received relatively little attention from instructional theorists, but it is emerging as an important area of human development for the information age. Martin and Briggs (1986) conducted a comprehensive review of ID theories in this domain, and identified three major dimensions that appear to require different models of instruction: attitudes and values, morals and ethics, and self-development. They also identified a variety of other dimensions of the affective domain: emotional development and feelings, interest and motivation, social development and group dynamics, and attributions. The most advanced ID theories are in the dimension of attitudes and values and include the Yale Communication and Attitude Change Program, Dissonance Theory, Cognitive Balancing Theory, Social Judgment Theory, and Social Learning Theory (see Martin and Briggs 1986 for a summary).

One of the most promising new developments in this domain is an ID theory for attitudes being developed by Kamradt and Kamradt (in press). Based on the notion that attitudes have a tripartite composition of feelings, cognitions, and behaviors, they have developed a set of guidelines for systemically influencing all three through a systematic process that moves the learner just outside of his or her comfort zone one step at a time in the direction of the desired attitude. First, role-playing is used to force a new behavior more consistent with the target attitude. This creates a dissonance or discomfort which serves as a trigger event

to influence the cognitive element through discussion and persuasion. Finally, reinforcement techniques are used to change the feelings associated with the new behavior and new thinking. After this small shift in attitude has been consolidated, the learner is ready for another round of this three-part strategy. Ethical issues are particularly important in the affective domain, and the Kamradts advocate that no attempts be made to change a learner's attitude without the knowledge and consent of the learner.

### 3.6 Systemic Change

It seems highly likely, given the different educational needs of the information age, that ID theories will adapt to meet the needs of a new paradigm of education and training, and that those changes will incorporate the use of adaptive strategies, advanced technologies, constructivist strategies, and minimalist instruction. However, this new paradigm of instruction will be of little value if the larger system within which it is embedded remains rooted in the industrial age. Referring back to Banathy's (1991) four levels of educational (and training) systems (learning-experience, instructional, administrative, and governance), this entry has focused on theory for prescribing the instructional system that will support a new paradigm of learning to meet the radically different education and training needs and conditions of the emerging information society. But unless a compatible paradigm shift is also effected at the administrative and governance levels, the new instructional paradigm will be ineffective and short-lived. Instructional designers and ID theorists alike must begin to view themselves as concerned with educational systems design—spanning all four levels of the system—not just with instructional systems design—focusing on just one of those levels. (For further information, see, e.g., Reigeluth and Garfinkle 1992.)

### 4. Conclusion

ID theory is still a relatively young field. Much remains to be learned about how to facilitate learning, especially more complex kinds of learning in ill-defined domains (including thinking skills) and the affective domain (including attitudes and values). In addition, massive changes in society are forcing the development of a new paradigm in ID theory for even the least complex kinds of learning. The need for more adaptive instruction, combined with the development of far more powerful technological tools for learning, have created entirely new horizons for ID theory.

*See also:* Individual Differences, Learning, and Instruction

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