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menting policies. The Office of Institutional Research defines common data sets used by the college or university to establish policies for administrative procedures. It is the responsibility of this office to define a part-time student or a part-time faculty member, as well as the concepts of doctoral degree, bachelor's degree, master's degree, a commuter, credit hour, contact hour, credit, or grade point average. The common data set is essential to the smooth administration of the institution because it helps the institution to develop rules, regulations, and policies to guide staff, student, and faculty conduct in the service of the institution.

See also: COLLEGES AND UNIVERSITIES, ORGANIZATIONAL STRUCTURE OF; PRESIDENCY, COLLEGE AND UNIVERSITY.

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KWABENA DEI OFORI-ATTAH

INSTRUCTIONAL DESIGN

OVERVIEW

Instructional-design theory provides guidance on how to help people learn (or develop) in different situations and under different conditions. This guidance includes what to teach and how to teach it. To do this, instructional-design theory must take into account both methods and situations. Just as a carpenter uses different tools for different situations, so do instructional design theories offer instructional designers and teachers different tools for facilitating learning in different situations.

Elements of Instructional-Design Theory

Elements of instructional-design theory include instructional outcomes, conditions, methods, and values. Instructional values are an individual's or group's philosophy or beliefs about instruction. Instructional design theories ought to inform possible users (teachers and instructional designers) of the values about learning and instruction with which the theory was constructed, for they are the values that users and students must hold in order for the theory to work well.

Instructional outcomes include both results that are intentional and those that are incidental. Outcomes include the instruction's effectiveness, efficiency, and appeal. Instructional outcomes should not be confused with learning outcomes. Instructional outcomes focus on the degree of success in attaining the desired learning outcomes (the effectiveness of instruction) but also include the efficiency and appeal of the instruction.

Instructional conditions are factors beyond the influence of the instructional designer that impact upon the effects of the methods of instruction. Conditions may include the nature of what is being learned (the content), the learner, the learning environment, and the instructional development constraints (e.g., time and money). Instructional-design theory, in attempting to provide guidance for people to help others learn, ought to state explicitly the conditions under which different methods should and should not be used.

Instructional methods are the "how to" for facilitating human learning. They are the elements of guidelines that inform designers and teachers what to do to help students learn. They can be very general, such as "provide opportunities for practice," or they can be broken down into much more detailed specifications, such as (for learning concept classification) presenting previously unencountered examples and nonexamples of the concept in random order and asking the learner to identify those that are examples of the concept.

Instructional methods are situational rather than universal. This means that there are values, desired instructional outcomes, and instructional conditions (collectively referred to as instructional situations) in any context that influence whether or not a given instructional method should be used. Hence, instructional-design theory should specify the values, outcomes, and conditions for which each method should be used. Also, instructional methods are probabilistic rather than deterministic. That is, their use can only increase the probability that the desired outcomes will be attained.

Differences

Instructional design theories differ most importantly by the methods they offer. But the methods differ because of differences in the outcomes, values, and conditions for which they are intended.

For example, regarding instructional outcomes, some theories may focus more on effectiveness of the instruction, while others may focus more on appeal or efficiency. Also, regarding learning outcomes, different instructional theories can promote very different kinds of learning: from memorization to deep understandings or higher-order thinking and self-regulatory skills; from cognitive goals to such affective goals as emotional and social development.

Instructional values may differ, and they lead one to select different goals and different methods to attain those goals. Traditional instruction systems design (ISD), "a systematic approach to the planning and development of a means to meet instructional needs and goals" (Briggs, p. xxi), specifies that goals should be selected based on an assessment of learners' needs. However, in 1999 Charles Reigeluth proposed that users also consider teachers' and learners' values about goals. Furthermore, designers have tried to rely on experimental research to determine which methods are best for any given situation. Reigeluth countered that users also consider teachers' and learners' values about methods. If a teacher does not value learner-centered methods, then forcing the teacher to use them is not likely to ensure success.

Instructional conditions may also differ across instructional design theories. First, the nature of

what is to be learned (the content) may differ. For example, some theories, such as those of David Perkins and Chris Unger, focus on deep understandings, which are taught differently than skills. Second, the nature of the learner may differ, including prior knowledge, skills, understandings, motivation to learn, and learning strategies. Third, the nature of the learning environment may differ. And finally, different instructional design theories may be intended for different constraints on instructional development (time and money). In essence, different instructional theories use different methods to attain different outcomes under different conditions and based on different values.

Major Trends

Two major trends in the field of instructional-design theory are apparent: the increasing predominance of an information-age paradigm of theories and the broadening of the kinds of learning and human development addressed by instructional theorists.

Information-age paradigm. Scholars, such as Bernie Trilling and Paul Hood, are increasingly drawing attention to the need for an attainment-based, "learning-focused paradigm" of instruction to meet learners' new educational needs in the information age, compared to the time-based, "sorting-focused paradigm" of the industrial age. Reigeluth (1999) distinguishes between the industrial and information ages with certain "key markers" (see Table 1).

In the early twenty-first century there is a growing recognition that the current system of education is beginning to fail society, not in its ability to attain traditional goals, but in its ability to provide what is increasingly needed in the emerging information society. There has begun a societal transition in which the complexity of human activity systems is growing dramatically, and learning has become the "indispensable investment" according to the National Commission on Excellence in Education 1983 report, *A Nation at Risk*. This has important implications for both what should be taught and how it should be taught.

Broadening the scope of instructional theory. Much of the work that has been done in relation to and with instructional-design theory has been focused on teaching and learning procedural tasks, which are performed by following sets of defined mental or physical steps that were predominant in the industrial age. However, educational and corporate settings increasingly require people to solve problems in ill-structured and complex domains—problems for which there is not a clear solution or just one way of doing things. These "heuristic" tasks entail the use of causal models and "rules of thumb," along with other kinds of typically tacit knowledge that require different methods of instruction. This heuristic knowledge because of its nature often takes years for experts to develop through trial and error, if at all. Therefore, it would be valuable for schools and corporations to be able to teach it well.

Several new methods and tools are designed to assist learners with real-world problem solving, including just-in-time instruction and electronic performance support systems (EPSSs). However, they do not provide the appropriate amount or types of support for learning this usually tacit heuristic knowledge. Only toward the close of the twentieth century have instructional deign theorists seriously attempted to address this complex type of learning. Promising work has been done in the area of problem-based learning by such theorists as John D. Bransford and colleagues, David Jonassen, Laurie Nelson, and Roger Schank.

Other current areas of promising instructional-design theory include collaborative learning, self-regulated learning, and such affective areas as emotional development and social development.

Peter Senge highlighted the importance of the "learning organization," which he defined as "an organization that is continually expanding its capacity to create its future" (p.14) through the use of five disciplines: systems thinking, personal mastery, mental models, building shared vision, and team learning. A challenge for instructional design theorists is to develop comprehensive theories that foster such organizational learning.

The preceding offers only a sampling of areas in which instructional-design theory is currently being developed. Due to the nature of human learning, there exist many more domains of instructional guidance that require greater study.

Controversial Issues

Three controversial or problematic issues are discussed below: (1) Should instructional design theories be "theoretically pure" or eclectic? (2) Are traditional research methods appropriate for advancing instructional design theories, or is a different paradigm of research needed? (3) Should

instructional-design theories be strictly "local" in scope, or should they generalize across settings?

Eclecticism versus purism. Some scholars, such as Anne K. Bednar and colleagues, argue that an instructional-design theory should be "theoretically pure" in that it should follow a set of assumptions from a single theoretical perspective, such as constructivism or behaviorism. Others, such as Peggy Ertmer and Timothy Newby, believe that such is true for descriptive theories, but that design theories, with their goal orientation, should draw on all useful methods for accomplishing the stated goals. For example, a behaviorist perspective would offer the method of drill and practice to help learners remember important information, whereas a cognitive perspective would offer the use of mnemonics to relate the new information to meaningful information. Perhaps there are some situations where good mnemonics cannot be developed, in which case drill and practice would be suggested by a design theory. Is it unwise for a teacher to draw on both kinds of methods because they hail from different theoretical perspectives? This issue is particularly important because it greatly influences the nature of an instructional theory.

Traditional versus new research methods. Many scholars advocate experimental and/or descriptive case studies or other kinds of descriptive research to advance our knowledge about design theories. Other theorists, such as James Greeno and colleagues, advocate new forms of research, such as "design experiments" and "formative research" (Reigeluth and Frick). "Design experiments" is the term Greeno, Allan Collins, and Lauren Resnick have come to use to refer to educators collaborating to analyze and design changes in institutional practice. "Formative research" is a form of research developed by Charles Reigeluth and Theodore Frick that is meant to help improve instructional-design theory. In an analysis of this issue, Glenn Snelbecker argued in 1974 that descriptive theories in the field are evaluated by how truthfully they describe why learning occurs, whereas instructional theories are evaluated by how useful their methods are for attaining their stated goals. Given this very different orientation toward usefulness rather than truthfulness, Reigeluth (1999) has proposed that the major concern in research on design theory should be "preferability" (whether or not a given method is more useful than the alternatives), rather than "validity" (whether or not the description is truthful). He has also suggested that the focus for research on a design theory should be to improve it rather than to prove it, because most of our methods of instruction are not nearly as successful as we need them to be. There is also clearly a role for descriptive research on instructional design theories, however. It is occasionally helpful to compare one method with another for a given situation, and descriptions of what a highly effective teacher or computer program does can be helpful for improving an instructional theory.

TABLE 1

Key markers of the industrial and information ages that affect education

Industrial age	Information age
Standardization	Customization
Bureaucratic organization	Team-based organization
Centralized organization	Autonomy with accountability
Adversarial relationships	Cooperative relationships
Autocratic decision-making	Shared decision-making
Compliance	Initiative
Conformity	Diversity
One-way communications	Networking
Compartmentalization	Holism
Parts-oriented	Process-oriented
Planned obsolescence	Total quality
CEO or boss as "king"	Customer as "king"

SOURCE: Reigeluth, Charles M. 1999. "What Is Instructional-Design Theory and How Is It Changing?" In *Instructional-Design Theories and Models, Vol. II: A New Paradigm of Instructional Theory,* ed. Charles M. Reigeluth. Mahwah, NJ: Erlbaum. Page 17. Reprinted with permission.

Although most researchers recognize that different research methods are useful for different purposes, perhaps there has not been enough emphasis on research to improve the preferability of instructional-design theories.

Generalizable versus local knowledge. Some scholars argue that instructional design theories should be "local" in scope because every situation is unique and methods that work well in one situation may not work well in another. Others believe that the purpose of an instructional-design theory is to generalize across situations—that if it loses this quality, it has little usefulness. Given that the standard for a design theory is usefulness rather than truthfulness, the issue may boil down to whether a highly local theory is more useful than a highly generalizable theory, or even whether a design theory that is intermediate between local and general may be the most useful.

There is another consideration that may enlighten this issue. Design theories are made up of not only methods, but also situations (values, desired outcomes, and conditions) that serve as a basis for deciding when to use each method. If a design theory offers different methods for different situations, the theory is at once both local and generalizable. It recognizes the unique needs of each situation but also offers methods for a wide range of situations. In this manner perhaps the profession can transcend "either–or" thinking and be both local and global.

Further Directions

Instructional-design theory bridges the gap between descriptive theory and practice and offers powerful guidance for practitioners. It has the potential to spur tremendous improvements in practice, but it currently constitutes a minor percentage of scholarly efforts devoted to education. Partnering of researchers and practictioners to develop and improve more powerful instructional-design theories can provide valuable insights and improvements for more useful design theory to facilitate human learning and development.

See also: COOPERATIVE AND COLLABORATIVE LEARNING; INSTRUCTIONAL DESIGN, ***subentries on*** ANCHORED INSTRUCTION, DIRECT INSTRUCTION, LEARNING THROUGH DESIGN, PROBLEM-BASED LEARNING.

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ANCHORED INSTRUCTION

Anchored instruction (AI) is an example of an approach to curriculum and instruction that provides opportunities for students to learn important content while attempting to understand and solve authentic problems that arise within particular disciplines. Other related approaches are case-based learning, which is used in law and business education, and problem-based learning, sometimes used in medical education. Another way of organizing instruction around problem solving is through project-based learning.

The Problem of Inert Knowledge

In 1929 the English philosopher Alfred Whitehead identified a major problem in schools, namely the problem of *inert knowledge.* Inert knowledge is knowledge than can be recalled when people are explicitly prompted to remember it, but is not spontaneously used to solve problems even though it is relevant. A major goal of AI is to create learning environments that overcome the inert knowledge problem.

Research suggests that the degree to which knowledge remains inert is strongly affected by the way the information was learned initially. One factor contributing to the problem of inert knowledge is that traditional instruction too often consists of learning isolated facts and procedures. As a consequence, students do not learn when or how to use what they have learned. The knowledge is not organized in memory with information on the conditions under which to apply it. In AI students are provided with opportunities to solve realistic problems—called anchors—that help them learn when and how to apply knowledge.

The Role of Prior Knowledge in Learning

Research indicates that learning is affected by the knowledge that people bring to the learning situation. Sometimes people's prior knowledge of a situation enables them to understand with little effort the meaning and significance of new information. More typically, especially in the case of young learners, prior knowledge of the situation is limited and the learner is unable to make sense of new information and has difficulty discriminating important from less important aspects of the information. When learners lack sufficient prior knowledge, information is treated as facts to be memorized. Anchored instruction was developed to compensate for learners' lack of experience and knowledge. Anchors consist of multimedia (e.g., video or audio with pictures) scenarios that are designed to improve learners' understanding of the problems to be solved.

Experience Being an Expert

Another major goal of AI is to help people learn the kinds of problems that experts in various areas encounter and to experience how experts identify, represent, and solve problems. The problems that experts encounter are more complex and open ended than the problems that students are asked to solve in school. Experts also assume greater autonomy than students in solving problems, including learning new skills and knowledge on an as-needed basis to solve problems. Anchors are designed to afford these kinds of experiences.

An Example of AI: *The Adventures of Jasper Woodbury*

Some of the original work on AI was conducted in the domain of middle school mathematics by the Cognition and Technology Group at Vanderbilt. These efforts culminated in a series called *The Adventures of Jasper Woodbury. Jasper* consists of twelve anchors (on videodisc or CD-ROM) that are designed for students in grades five and up. To promote transfer of learning, multiple related anchors are available to provide extra practice on core concepts and problem schemas. Three anchors relate to each of the following topics: statistics and business planning, trip planning, geometry, and algebra. Each anchor contains a short (about fifteen minutes) story on video, which ends in a complex challenge. The adventures are like good detective novels, where all the data necessary to solve the adventure (plus additional solution-irrelevant data) are embedded in the story.