Dedication

This book is dedicated to future generations of learners, to the teachers who will inspire and guide them, to the instructional designers who will provide exciting and effective learning resources for them, and to the instructional theorists who will inspire and guide the teachers and instructional designers.

— CMR & ACC

This book is also dedicated to my mentor, M. David Merrill, whose brilliant thinking, open mind, and intellectual curiosity have inspired me greatly.

— CMR

This book is also dedicated to my mentor, Charles Morgan Reigeluth, who has given me the intellectual capacities to follow him, and mostly to keep up. I am grateful for his continuing to open doors for me and continuing to invite me to work with him. It is among my greatest intellectual joys.

— ACC
How to help people learn better. That is what instructional theory is all about. It describes a variety of methods of instruction (different ways of facilitating human learning and development) and when to use—and not use—each of those methods.

Volume I of Instructional-Design Theories and Models (1983) provides a “snapshot in time” of the status of instructional theory in the early 1980s. Its main purpose was to raise awareness of instructional theories. Volume II (1999) provides a concise summary of a broad sampling of work in the late 1990s on a new paradigm of instructional theories for the Information Age. Its main purpose was to raise awareness of the diversity of theories that provide a customized or learner-centered learning experience in all different domains of human learning and development. It also raised awareness of the importance of values in instructional theory.

However, after the appearance of Volume II, we became increasingly concerned about the extent to which instructional theorists seemed to be working in relative isolation from each other, building their own view of instruction with little regard to building on what knowledge already exists and what terminology has already been used for constructs they also describe. We recognized that every area of knowledge goes through an initial developmental phase in which these differences predominate. We also saw that, as an area of knowledge matures, it enters a second phase of development in which work focuses more on contributing to a common knowledge base with a consistent terminology. While it would be a mistake to push an area of knowledge into phase 2 too soon, we believe that instructional theory is now ready to begin such a transition.

Therefore, the purpose of this Volume III is to take some early steps in building a common knowledge base about instruction with a common use of terms. The primary audience for this volume, like that of the previous two volumes, is instructional theorists, researchers, and graduate students. An additional audience is instructional designers, teachers, and trainers who are interested in guidance about how to design instruction of high quality.

Unit 1 offers some organizational schemes for understanding and developing a common knowledge base about instruction. We strongly urge you to read the four chapters in this unit before reading any of the theories that follow. Unit 2 offers a chapter on each of five major approaches to instruction: the direct-instruction, discussion, experiential, problem-based, and simulation approaches. Each of these chapters synthesizes the current knowledge about that approach as a step toward building a common knowledge base. Unit 3 offers a chapter on
instruction for each of four major outcomes of instruction: skill development, understanding, affective development, and integrated learning outcomes. Each of these chapters also synthesizes the current knowledge about that kind of instruction. Finally, Unit 4 offers ideas that may prove useful for building a common knowledge base about instruction.

Because this volume contains many ideas that may be difficult for all but the most experienced to digest, we have tried to make it easier for the reader by preparing the same kind of unconventional foreword for each chapter as was done for Volume II. Each chapter foreword outlines the major ideas presented in the chapter. This offers something akin to a hypertext capability for you to get a quick overview of a chapter and then flip to parts of it that particularly interest you. It can also serve preview and review functions and make it easier to compare different theories. Furthermore, we have inserted editors’ notes in most chapters to help you relate elements in a chapter to fundamental ideas presented in other chapters. Finally, each unit has a foreword that introduces the chapters in that unit.

It is our sincere hope that this book will help to move instructional theory to the next stage of development—creating a truly common knowledge base with a consistent terminology. We hope it will help instructional theorists and researchers to contribute to the growing knowledge base about instruction in a way that acknowledges and builds on prior work, and that it will help instructional designers and graduate students to understand and utilize the full range of accumulated knowledge about how to help people learn.

—CMR & ACC

Unit 1
Frameworks for Understanding Instructional Theory

Unit Foreword

This unit lays the groundwork for a shared language and a set of common understandings in instructional theory. This unit foreword provides brief descriptions of the primary ideas in each of the chapters in this unit, which offer some organizational schemes for understanding and developing a common knowledge base about instruction. We strongly recommend reading this unit before reading any of the other chapters in this book.

In chapter 1 we (Reigeluth & Carr-Chellman) look at the constructs and terminology used to describe and understand instructional theory. First, we define instruction as anything that is done purposely to facilitate learning. Based on this definition and understanding of the entire field of instructional design, we make the case for the need for a common knowledge base and then relate design theory, instructional design theory, student-assessment design theory, curriculum design theory, learning theory, and the learning sciences to instruction. We identify several aspects of instructional design theory, including event, analysis, planning, building, implementation, and evaluation design theory within instructional design theory. These aspects are then related to the concept of layers of design (Gibbons & Rogers, chapter 14). We identify the need for a significantly new paradigm for future change efforts and describe the need for learner-centeredness in that paradigm. We share the results of a small Delphi study to help build consensus on common terms, which lays a foundation for a common language in our field.

Chapter 2 takes up the issue of what we mean by instruction itself (as opposed to instructional theory, which we deal with in chapter 1). Here Reigeluth and Keller take up the issues associated with major constructs that make up instructional theories. They settle on instructional situations, methods, approaches, components, and content sequencing as the categories of constructs concerned with instruction. Built on an analogy to rules of English grammar, these constructs are linked and designers are advised to carefully consider the relationships among the categories.

In chapter 3 Merrill discusses the principles of good instruction that may be common to all instruction. Calling these “First Principles,” Merrill lays out
the qualifications for inclusion in this list, along with the principles in brief and in more detail. The principles include the demonstration principle, application principle, task-centered principle, activation principle, and integration principle. The chapter takes up the difficult task of elaborating on these principles and relating them to one another to create a defensible set of principles that Merrill asserts will create effective and efficient instruction.

Chapter 4 (Reigeluth & Carr-Chellman) focuses on the situational principles of instruction—ones that vary from one situation to another. This chapter describes what situational principles are and links them to the notion of universal principles through an analogy of the universe and galaxies. In an effort to increase precision in our language and knowledge base, we elaborate on kinds, parts, and criteria as ways to make methods more precise. Principles as heuristics, or rules of thumb, are particularly important for precise descriptions of methods. A review of learning taxonomies leads us to a description of the instructional theories we have included in units 2 and 3.

—CMR & ACC

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The Nature of Instructional Theories: Constructs and Terms

- Results of a Delphi study
- Recommended constructs and terms
  1. Instructional method
     1.1. Scope (micro-meso-macro)
     1.2. Generality (universal-local)
     1.3. Precision (imprecise-precise) based on parts, kinds, or criteria
     1.4. Power (low-high)
     1.5. Consistency (low-high)
  2. Instructional situation
     2.1. Values
        2.1.1. About learning goals
        2.1.2. About priorities (effectiveness, efficiency, appeal)
        2.1.3. About methods
        2.1.4. About power (learner, teacher, institution)
     2.2. Conditions
        2.2.1. Content
        2.2.2. Learner
        2.2.3. Learning environment
        2.2.4. Instructional development constraints

UNDERSTANDING INSTRUCTIONAL THEORY

Instructional theory may sound, at first, like a dense and difficult topic, but it is easier to understand than you might think. Furthermore, this knowledge is central to helping you improve the quality of your teaching and training. Taking the time to understand the nature of instructional theory will help you to understand individual instructional theories and even help you make contributions to this growing knowledge base. Therefore, an understanding of the nature of instructional theory is important to both your growth and the growth of our field.

Vague and inconsistent language is impeding such growth. Different theorists use the same term to refer to different things and different terms to refer to the same things. This is confusing for all of us, from beginning graduate students to expert designers and researchers. When a discipline is young, it is natural for there to be such inconsistent language. We propose that instructional theory has now reached a level of development where a common knowledge base with a consistent terminology would greatly facilitate the future development of knowledge in this important area.

This chapter begins by defining instruction. We then discuss the need for building a common knowledge base about instruction. We describe several different kinds of theories related to instruction and contrast them with other related...
kinds of theories, such as student-assessment theories, curriculum theories, and learning theories. Then we discuss Gibbons and Rogers’s concept of “layers of design” (see chapter 14) and their implications for instructional theory. Next, we turn our attention to the role of instructional theory in educational reform, and specifically discuss the relationship of learner-centered instruction to this book. Finally, we offer particular constructs and terms for a common knowledge base about instruction. These terms may be useful as a foundation upon which instructional theorists and researchers can build, and they should help you, whether a practitioner, a researcher, or a graduate student, to understand the knowledge available to you about fostering learning more effectively.

A Definition of Instruction

A distinction has been made in the literature recently between “instruction” and “construction,” with the implication that instruction is necessarily done to learners (i.e., learners are passive), whereas construction is done by learners (i.e., learners are active). However, a principal tenet of constructivism is that people can only learn by constructing their own knowledge—that learning requires active manipulation of the material to be learned and cannot occur passively. Our concern is with how to help learners learn, which means identifying ways to help learners construct knowledge. Therefore, if instruction is to foster any learning at all, it must foster construction. Instruction is not instruction if it does not foster construction. Furthermore, if construction is what the learner does, then we need a different term for what a teacher (or other agent) does to foster construction, and “instruction” has commonly been used more than any other term to convey that meaning. Therefore, we define instruction as anything that is done purposely to facilitate learning. It includes constructivist methods and self-instruction, as well as more traditional views of instruction, such as lecture and direct instruction.

The Need

Volume 2 of Instructional-Design Theories and Models (Reigeluth, 1999) was a small sample of the wide variety of information-age instructional-design theories that had been created by 1998. That book made it evident that many instructional theories were constructed with little regard for prior theories. Until theorists begin to build upon each other’s contributions, the field will remain in its infancy. The main purpose of this volume, then, is to help instructional theorists and researchers build a common knowledge base about instruction.

The Nature of Theories Related to Instruction

To build (or to understand) a common knowledge base about instruction, it is helpful to understand the nature of such a knowledge base. However, there are many important things to know about instruction, including what an instructional product itself should be like, the process by which it should be designed and built, how it should be implemented, how it should be evaluated, how its effects (e.g., learning) should be assessed, what content should be instructed, how people learn, and the interrelationships among all these kinds of knowledge about instruction. It is also helpful to distinguish between design theory and descriptive theory. Each of these is discussed next.

Design Theory

Design theory is different from descriptive theory in that it is goal oriented and normative—it identifies good methods for accomplishing goals—whereas descriptive theory describes cause-effect relationships, which are usually probabilistic (meaning that the cause does not always result in the effect), especially in the social sciences. Design theory is aimed at facilitating generative outcomes; that is, it assists in the creation of something, while descriptive theory seeks to describe what already exists. We very much agree with Nelson and Stolterman’s (2003) notions of design expertise. They recognize that there are different fields of design expertise, such as instructional design or engineering or architecture. But they also indicate that all designers share some similar field experiences:

It is even more important to emphasize that every informally recognized designer has a similar field of expertise. It goes without saying that every designer needs knowledge and skills concerning materials, tools, methods, languages, traditions, styles, etc., in his or her specific field. (p. 25)

Their book, The Design Way, is not about the particular knowledge and skills, but is indeed about those areas that are relevant for all designers, including instructional designers.

Some people do not like the term theory for such goal-oriented or instrumental knowledge. Some of the terms that they prefer include: method, model, technology, technique, strategy, guidance, and heuristic. However, none of these terms captures the full scope of this kind of knowledge, which includes not only methods (or models, techniques, strategies, and heuristics), but also when and when not to use each method. We have found no other term that fits as well as design theory for capturing methods and when to use them. Second, these two types of knowledge (descriptive and instrumental) are widely recognized as the two major kinds (e.g., the famous distinction by Simon, 1996, between the natural sciences and the sciences of the artificial), and hence are “coordinate” (subordinate to, or kinds of, the same concept—theory). Third, the term theory has been used for decades to characterize the instrumental knowledge base in several fields, and in instruction its use goes back at least to Bruner (1966) and Gagne (1985). For these three reasons, we find it appropriate to refer to each of the two basic kinds of knowledge as theory, and to the
instrumental kind of knowledge as design theory. Consequently, we offer the following definitions.

**Instructional Design Theory**

Instructional design theory is a set of design theories that pertain to various aspects of instruction. One perspective is that those aspects include:

- what the instruction should be like, which could be called instructional-event design theory (DT), or instructional-program DT, or instructional-product DT;
- what the process of gathering information for making decisions about instruction should be like, which could be called instructional-analysis DT;
- what the process of creating the instructional plans should be like, which could be called instructional-planning DT;
- what the process of creating the instructional resources should be like, which could be called instructional-building DT;
- what the process of preparing for implementation of the instruction should be like, which could be called instructional-implementation DT;
- what the process for evaluating the instruction should be like (summative and formative), which could be called instructional-evaluation DT.

While these six terms represent a largely new way of referring to the various design theories that inform our practice, we hope they are sufficiently more intuitive and less ambiguous that they are worth adopting. We welcome dialogue about these six terms and any changes that might make them more intuitive and less ambiguous. Since they are all design theories, we could drop "design" from the labels. A graphic is perhaps a valuable way to represent this new language (see Figure 1.1).

Note that instructional-event theory is the only one that offers guidance about the nature of the instruction itself. The other five all offer guidance about what is commonly called the instructional systems design (or development) process (ISD). Also, please note that there are many interrelationships among these six kinds of instructional-design theory. Obviously, they have input–output relationships with each other. However, analysis and evaluation each play a far more integrated role in the other kinds of theory. For example, analysis should be used to provide useful information in the application of all the other five kinds of instructional-design theory and should be integrated with each. For example, there is a series of decisions that need to be made for planning an instructional event, including decisions about scope and sequence, instructional approach, instructional tactics, media selection, media utilization, and so forth. Each of these kinds of decisions requires a different kind of analysis at a different point in time during the planning process. So instructional-analysis theory must be integrated with instructional-planning theory. Similarly, different kinds of decisions are made during the instructional-building process, and different kinds of information are needed for making those decisions. Therefore, instructional-analysis theory must be integrated with instructional-building theory. The same applies to instructional-implementation theory and instructional-evaluation theory.

In a parallel manner, evaluation should be conducted on each major decision that is made during the instructional-planning process, so instructional-evaluation theory must be integrated with instructional-planning theory. Similarly, it must also be integrated with each of the other four kinds of instructional theory.

So while it is conceptually helpful to understand that all these different kinds of instructional design theory exist, it is essential to understand that useful guidance for practitioners must integrate all of them.

**An Analogy**

We feel that a good analogy here would be that of the building process that results in homes, offices, skyscrapers, hospitals, and other buildings. First, there is a body of theory about architecture. These theories are about the buildings themselves, about the products. They study Gaudi and his use of art in the form of everyday structures, for example. This is most akin to instructional-event theory. Then there is a body of literature that looks at theories of architectural process; that is, what architects do, how they go about the business of creating and producing a blueprint. This is most akin to instructional-planning theory. Now the architect produces a blueprint, which is given to a builder, and the
Learning theory is descriptive theory rather than design (or instrumental) theory, for it describes the learning process. For example, schema theory and information-processing theory describe processes that are believed to occur within learners' heads. If they identified methods for helping those processes to occur, they would be instructional-event design theories. Learning theory may provide an understanding of why a certain method of instruction (in an instructional-event theory) works so well, and hence a rationale for using it, but an instructional-event theory can as easily lead to the development of learning theory (to explain that instructional-event theory) as a learning theory can lead to the development of an instructional-event theory (to apply the learning theory).

Learning Sciences

Learning Sciences is a term that has become popular recently. The term instructional science has also been used, and there is a journal by that name. Based on those labels, one would expect that the learning sciences are dedicated to the development of learning theory, and that instructional science is dedicated to the development of instructional theory. However, in practice most learning scientists are interested in developing knowledge about both learning (descriptive theory) and instructional events (design theory). An operational definition of learning sciences would perhaps be a hybrid discipline that includes learning theory and instructional-event theory. It also seems that most learning scientists are not interested in instructional-planning theory, instructional-building theory, instructional-implementation theory, instructional-evaluation theory, or curriculum theory. There is some interest in student-assessment theory. The field of learning sciences is akin to cognitive science in that it is purposely multidisciplinary and not so interested in goals as in the use of certain kinds of instructional methods to shed light on certain kinds of learning processes.

Interrelationships

The interrelationships among all the kinds of theories related to instruction are powerful and systemic. In many cases, it is most useful for a theory to be a hybrid of several of these kinds of theories, as we have already mentioned. Such hybrids have been common from the early pioneers in instructional theory (e.g., Dewey, Skinner, Gagné, and Ausubel) to recent theorists (e.g., Bransford, Brown, & Cocking, 2000; McCombs & Whisler, 1997).

In spite of the importance of all these kinds of theories and the relationships among them, this book focuses on instructional-event theory, not just because it would be too large an undertaking to do justice to all of the above theories and their interrelationships, but more importantly because instructional-event theory is in dire need of a common knowledge base. Since the term instructional theory is commonly used to refer to what we have called "instructional-event design theory," we often use this simpler term in the remainder of this book.
Instructional Design Theories and Layers of Design

One additional aspect of the nature of theories related to instruction is the notion of "layers of design" discussed by Gibbons and Rogers in chapter 14. Their chapter helps us to understand that designing an instructional system requires considerable attention to the ways in which its parts will interact, wear out, progress, and be utilized at different rates and in different ways. A good example of this, given by Gibbons at a recent conference, was that, while many classrooms did not have overhead fixed video projectors in their ceilings when they were built, the "ceiling layer" of the room was created in such a way as to afford that change in the delivery system by putting in a drop ceiling with tiles that were easily removed. This is an example of one layer wearing out or becoming obsolete sooner than others, and ways that a layer can shift around others without an entire building having to be gutted each time new wires need to be run, for instance.

In chapter 14 Gibbons and Rogers identify seven layers of design that they believe are important in designing instruction: content, strategy, message, control, representation, media logic, and data management layers. Each of these is briefly described next.

Within the content layer, a designer specifies the structure of the subject-matter elements. This layer is most concerned with the many ways content can be structured. For example, instructional theories related to the content layer of designs might identify subject matter elements divided into sets of tasks, sets of propositions, sets of if/then rules, or sets of discrete semantic (meaning) elements.

Within the strategy layer, a designer specifies the organization and properties of learning events, including participant roles and responsibilities, goals and times afforded to goals, and instructional strategies. Theories pertaining to the design at the strategy layer therefore pertain to the setting, the social organization, the "siting" and the strategies of instructional interactions.

Within the message layer, a designer describes the ways that individual messages are used to communicate content and other information to the learner. In essence, if the strategy layer describes a general strategic plan, then the message layer describes the tactical messaging plan for carrying out that strategy. For example, a designer might define in a messaging plan the elements to be used to construct feedback messages in terms of individual message units (right/ wrong judgment, error explanation, remedy explanation, etc.) that will generally comprise feedback messages. There are many classes of messages used during most typical instructional interactions.

Within the control layer, a designer specifies how learners express messages back to the source of learning. Theories related to control layers describe ways that learners can take actions, ask questions, make responses, and generally carry out their side of the instructional conversation. An example might be a theory that specifies ways that the learner can take action during practice in an interactive medium, such as a computer.

Within the representation layer, a designer describes the ways in which messages will be delivered to the learners' senses, including the media channels that will be used, how messages will be assigned to those channels, and how individual messages that use multiple channels are synchronized. Thus, theories used within the design of the representation layer might describe how to visualize certain kinds of messages, how to maximize the coordination of different media channels, and how to synchronize the messages within their different channels for best effect.

Within the media logic layer, a designer specifies how media mechanisms will be made to deliver representations, how to carry out communications (through messaging and control operation), how to implement strategies in a dynamic, unpredictable interaction, how to compute current knowledge model states, and how to gather and analyze data in ways useful during the instruction. This is the part of the design that tells us how media will be used to carry out instructional event plans. For example, a theory related to media logic design might specify ways in which a multimedia computer could be made to deliver a dynamic visual representation simultaneously with an audio description while teaching how to prepare a fine soup.

Within the data management layer, a designer specifies what we do with data in the system in terms of capture, archiving, analysis, interpretation, and reporting. An instructional theory related to the design of the data management layer might specify that the result of each step of the process of adding a fraction be captured and analyzed for correctness or incorrectness so that errors can be debugged, or might specify that certain response patterns should be noted as a student executes a tricky procedure so that later analysis can identify possible sources of errors.

We believe that there is an interaction between Gibbons and Roger's concept of layers (chapter 14) and the application of the six types of instructional theory (event, analysis, planning, building, implementation, and evaluation) that we have defined. For example, to be comprehensive, instructional-event theory should provide guidance for what all seven layers should be like, given the nature of the situation. Similarly, instructional-planning theory should offer guidance for a process in which all seven layers will be designed, and instructional-building theory should offer guidance for a process in which all seven layers will be developed, and so forth.

The Role of Instructional Theory in Educational Reform

The major purpose of most instructional theories is to improve learning in P-12 schools (from preschool through 12th grade), though instructional theories are
also valuable in many other contexts. Chapter 1 in volume 2 proposed that the
industrial-age paradigm (or factory model) of schooling is obsolete—inade-
quate to meet learning needs today—and that a new paradigm of education is
needed.

Why Is a New Paradigm Needed?

We know that students learn at different rates, yet the current industrial-age
paradigm of education requires all students to learn the same thing at the same
time and rate. This means that slow learners are forced on before mastering the
content, and they accumulate learning deficits that make future learning more
difficult, while fast learners are forced to wait and lose both motivation and the
opportunity to learn more. The alternative to holding time "constant" for all stu-
dents and thereby forcing achievement to vary, is to hold achievement constant
(at the level specified by the standards), which requires time to vary—to allow
each student the time needed to attain each standard, and allow each student
to move on as soon as the standard is attained (Reigeluth, 1994). Without this
change in paradigm, we will inevitably continue to leave many children behind
no matter what reforms we implement, and we will continue to waste much of
our top talent in schools.

Is a New Paradigm Possible?

Two developments allow such a customized, attainment-based paradigm of
education to replace the current standardized, time-based paradigm: (1) the de-
velopment of advanced technologies and (2) the advancement of learner-centered
psychological principles and methods of instruction, such as active learning and
collaborative problem-based learning. These developments allow a true paradigm
shift in instruction that has the potential for a quantum improvement in learn-
ing (Banathy, 1991; Branson, 1987; Covington, 1996; Duffy, Rogerson, & Blick,
2000; Ego1, 2003; Jenlink, Reigeluth, Carr, & Nelson, 1996; Reigeluth, 1994), not
just the 5 or 10% improvement found in typical piecemeal educational reform
efforts, including most Comprehensive School Reform programs (American
Institutes for Research, 1999; Franceschini, 2002; Holdzkom, 2002; Ross et al.,
1997; Wong, Nicotera, & Manning, 2003).

What Areas of Knowledge Need to Be Developed to Make It Possible?

Much remains to be learned about the learner-centered paradigm of instruc-
tion (Bransford et al., 2008; McCombs & Whisler, 1997). However, the major
gap in our knowledge for dramatic improvements in learning is how to help
schools transform themselves from the standardized, industrial-age paradigm
to a learner-centered, information-age paradigm of education. The history of
fundamental educational reform has been dominated by classroom-based
and school-based efforts to change to a learner-centered paradigm; but those
changes have been incompatible with the larger school systems, communities,
and social systems within which they existed and consequently were gradually
forced by those encompassing systems to transform back into the industrial-age
model (Sarason, 1990, 1995; Tyack & Cuban, 1995). While fundamental changes
are needed in the ways teachers and students interact to foster learning, those
changes require changes at the classroom level, which in turn require changes
on the school level, which in turn require changes on the district level. In other
words, to be successful, fundamental transformation of education must occur
on the school district level, as well as the school and classroom levels (Duffy et
al., 2000; Squire & Reigeluth, 2000). There is also evidence that related changes
are helpful, if not essential, on the state level (Fullan, 2003).

Therefore, large improvements in learning in public schools require advances
in two kinds of knowledge: knowledge about learner-centered methods of
instruction (e.g., Watson & Reigeluth, 2008, for an overview) and knowledge
about how to help school districts transform themselves to an information-age
paradigm of education (e.g., Duffy & Reigeluth, 2008; Reigeluth & Duffy, 2008).
This book focuses on advancing the former: knowledge about the learner-
centered paradigm of instruction. We see this as pivotal to the advancement of
the larger agenda of school reform as well as reform of all organizations in which
intentional human learning occurs.

Relation to Learner-Centered Instruction

To make the most valuable contribution to knowledge, this book attempts to syn-
thetize the current knowledge about effective instruction to formulate a common
knowledge base about instruction and a common terminology about instruction.
Toward this end, it may be helpful to briefly summarize current knowledge about
learner-centered instruction (see also Watson & Reigeluth, 2008).

Learner-Centered Psychological Principles

The present knowledge about the learner-centered paradigm of instruction is
widely dispersed, but several noted attempts to synthesize or summarize that
knowledge have been published. First, the American Psychological Association
conducted an extensive project to identify research-based, learner-centered,
psychological principles (American Psychological Association Presidential Task
Force on Psychology in Education, 1993). Its report identifies 12 such principles
and presents the research evidence that supports each. McCombs and colleagues
(Lambert & McCombs, 1998; McCombs & Whisler, 1997) summarize that work
and describe specific features and characteristics of learner-centered classrooms
and schools, along with descriptions of their experiences with learner-centered
teachers and schools. They describe the nature of the shift in focus from teaching
to learning, including ways to customize learning to student differences, how to
motivate students to put more effort into learning, how to help students assume increasing responsibility for directing their own learning (to prepare them better to be lifelong learners), how to manage the learning process so that faster students can move on as soon as they reach a standard and slower students are not forced to move on before they have reached a standard, and much more. Technology plays a central role in all of these aspects of the learner-centered paradigm. Methods such as these have been proven to significantly advance the ability of students to reach high standards (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Lambert & McCombs, 1998; McCombs & Whisler, 1997). However, McCombs and Whisler caution that "learner-centered teaching is as much a way of being, a disposition, as it is doing one thing or another" (p. 100), and they discuss the qualities that learner-centered teachers need to have, along with ways to help develop those qualities. These are all important elements of a comprehensive design theory for learner-centered instruction.

The Science of Learning

A second line of work was undertaken by the National Research Council to synthesize present knowledge about how people learn (Bransford et al., 2000). This two-year study resulted in a comprehensive synthesis of research findings that suggest there are new approaches to instruction that "make it possible for the majority of individuals to develop a deep understanding of important subject matter" (p. 6). This growing body of knowledge, which the authors called the science of learning, emphasizes the importance of customizing the instruction to the preexisting knowledge of each individual learner, helping learners take control of their own learning, and developing deep understandings of the subject matter. Both design theory and descriptive theory are offered regarding the design of learning environments that are learner centered, knowledge centered, assessment centered, and learning-community centered. Technology also plays a central role in such learning environments and in design theory to guide creation of such environments. There is much overlap between this line of work and the APA learner-centered psychological principles in terms of the research-based design theory offered by each.

New Paradigm of Instructional Theory

A third line of work was undertaken by Reigeluth in volume 2 to summarize and compare a broad range of instructional design theories that fit the learner-centered paradigm of instruction (Reigeluth, 1999). This included design theories for fostering a wide range of kinds of human learning and development, namely cognitive, physical, affective, and integrated learning of all those types. It also included a wide range of methods, such as problem-based, collaborative, self-directed, individualized, discussion-based, and much more. Again, there is great overlap between this line of work and the first two.

Other Work

We are particularly impressed with Rand Spiro’s cognitive flexibility theory (Spiro et al., 1992) and his observation that information-age (or "post-Gutenberg") technologies both require and facilitate a different worldview (or frame of mind) and a different style of thinking, through prefigurative schemas (schemas for the development of schemas). This has important implications for dramatic changes in the goals of education, as well as the means, as we evolve deeper into the information age. Other lines of work include personalized learning (Clarke, 2003; Keefe, 2007), brain-based learning (Caine, 2005; Caine & Caine, 1997), and differentiated instruction (Tomlinson, 1999, 2001, 2003). Of course, there is much additional work that has been done by researchers that contributes valuable elements of a comprehensive design theory for learner-centered instruction that is frequently made possible only by advanced technologies. This book attempts to identify and synthesize new work as knowledge that educators can utilize to improve learning for all students.

The Nature of Instructional Theories: Constructs and Terms

Instructional theorists often use different terms to refer to the same constructs and the same term to refer to different constructs. This is confusing for researchers, practitioners, and graduate students, and it is the most obvious indicator of the lack of a common knowledge base. Therefore, as a first step to building a common knowledge base for instructional theory, it would be helpful to reach some consensus on constructs about the nature of instructional theory and terms for those constructs.

To initiate this first step, we engaged in several rounds of a Delphi process (Adler & Ziglio, 1996) in which we sent out a list of constructs and terms to a sample of leading instructional theorists to try to build some consensus. A total of 53 e-mail invitations to participate in the Delphi were sent to authors of chapters in all three volumes of Instructional-Design Theories and Models, and to other well-known instructional theorists. The e-mail asked them to read a preliminary version of the terms and definitions that we felt might be best and to click on a link to answer four questions online about the constructs and terms they felt were best for the discipline of instructional theory. The Internet was used to ensure anonymity for their responses, thereby encouraging complete frankness. The response rate on the first round was low (16%), which we believe was, in part, due to our attaching a 3-page preliminary version of terms and definitions to the e-mail. We suspect that participants felt it would take too much time to open and read and review a document prior to taking the survey.

Delphi Results: Round 1

The results of the first round of the Delphi were varied, though most (6 of 9) respondents saw instructional theory as the best term to represent the knowledge
define the terms should be reserved for those who are currently engaged in the field. In addition, some felt that, during the second round, the choices were too narrowly defined or circumscribed. One respondent who did participate sent feedback indicating that he felt the answers were “predetermined and restrained” and suggesting that it was impossible to “define an enterprise as complex and dynamic as ours.”

Despite these few criticisms, we found that a considerable degree of consensus was reached among those who participated, and therefore we believe that the results are an important step in the process of reaching some consensus on constructs and terms for a common knowledge base in instructional theory.

In Round 2 the largest number of respondents (n = 10 or 45%) again felt that instruction is the proper term to refer broadly to all ways of facilitating human learning and development (see Table 1.1). However, the term education also enjoyed some support (n = 5 or 22%). Most of the respondents felt that the term design theory (n = 12 or 54%) was the appropriate term to characterize sets of goal-oriented, normative, artificial-science principles. However, the term instructional theory only enjoyed 18% (n = 4) support, while there was strong support for learning sciences as a more appropriate alternative to instructional theory (n = 7 or 32%). During the initial round of the Delphi there was a suggestion that there was no need for “design theories” to be part of the label for different kinds of instructional theory (e.g., instructional-development design theories), but rather to make things less awkward by simply saying “instructional development theories.” There was mild support for this by the broader round 2 Delphi respondents, with an average of 3.1 (meaning “neutral”) on a Likert scale of 1–7 (with 1 being strongly agree). There was broad support for greater recognition of the ways the word design has been used in related fields (average 2.5 agreement on the Likert scale). Similarly, there was support for explicit recognition of the evolutionary nature of definitions themselves as changes in technology and context accompany definitional refinement (average 2.3) (see Table 1.1).

Thus, while this Delphi study did not enjoy as high a response rate as we might like, there was consensus among respondents around some terms for use in our field. There was also clear support for flexible definitions and giving greater importance to design theories in the field.

**Recommended Constructs and Terms**

Following is the description of constructs and terms that resulted from this process, though we hasten to add that these are offered as a suggestion to theorists, and we encourage those who believe they have a better term or definition to propose it to the community of instructional theorists. Furthermore, we expect that some of these constructs and terms, even if accepted now, will evolve over time. Examples of the following constructs are identified with editors’ notes in the theory chapters that follow (chapters 5–9 and 10–13).

Perhaps the most important construct is defined as “all things that are done base about ways to facilitate human learning and development. However, learning and performance technology and instructional model were also supported. There was a certain amount of criticism of the terms instructional-design theory and instructional-development design theory as being “unwieldy,” though clearly descriptive. An alternative term, instructional design principles, was offered during round 1. Suggesting that we link with other design disciplines was another idea offered by three of the nine participants in round 1. In some cases, participants felt that the definitions needed to remain somewhat fuzzy and not get too specific. In other cases, the participants really wanted to narrow the definitions that were seen as too broad, such as for “instructional situation.” One participant felt uncomfortable about the entire survey, indicating, “I do not believe in instructional theories of any kind…” There was also a sense that stronger contrasts were needed among the definitions that were provided for the terms. Finally, respondents to round 1 generally did not find any additional new terms they thought should be added, but did caution us about being too ambitious in terms of the possibilities of this Delphi leading to consensus. As one respondent wrote,

What you are hoping to achieve is consensus. That won’t happen…. Learning is such a complex phenomenon that shares little common variance with instruction. Micro-macro is overly simplistic (even if we include meso). They are too arbitrary. Learning aggregates in many ways, depending on activity, interests, needs. You can use those terms to describe aggregates, but unfortunately, such categories have a tendency to become self-fulfilling prophecies.

Two respondents were concerned that we were not sufficiently tuned in to the need for, and power of, localized and flexible definitions.

In general, it is useful to have definitions, but I would add some caution with regard to this task. Definitions should be regarded with some degree of fuzziness and not held too rigidly. When definitions prove useful and enlightening, great—when they become burdensome and are used to badger people, then they have outlived their usefulness.

**Delphi Results: Round 2**

The second round Delphi took the responses from the first round and carefully represented them to the same 53 participants, whether or not they had participated in round 1, for further refinement of the terms and definitions of importance in instructional theory. We sent no attachments, and we achieved a higher response rate (39%).

A few reasons were given by some of the people who did not participate in either round of the study. A few challenged the very notion that we, as a field, really need to have further clarification of terms and constructs. Several stated that they were no longer active in the field and felt that the opportunity to help
Table 1.1 Delphi Round 2 Results

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th>Comments/Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>What term should be used to refer broadly to &quot;all ways of facilitating human learning and development? (Selecting more than one option was permissible.)</td>
<td>10 - Instruction 5 - Education 1 - Education engineering or learning design 1 - Training 1 - Facilitating learning and development 3 - Numerous terms 1 - Learning opportunities 1 - Not sure</td>
<td>These terms were provided by round-1 respondents.</td>
</tr>
<tr>
<td>What term should be used for the knowledge base associated with human learning and development?</td>
<td>7 - Learning sciences 5 - Education 4 - Instructional theory 4 - Other 2 - Instructional design principles 2 - Instructional design theory 1 - Learning and performance technology 0 - Instructional model 0 - Learning environments 0 - Instructional science</td>
<td>It is interesting that the group felt that &quot;learning sciences&quot; was a better term than &quot;learning theory&quot; for the descriptive knowledge base.</td>
</tr>
<tr>
<td>Given Simon's distinction between the natural sciences and the sciences of the artificial, if &quot;descriptive theory&quot; is the term used to characterize sets of natural-science principles, what term should be used to characterize goal-oriented, normative, artificial-science principles?</td>
<td>Average of 3.1 on a 7-point Likert scale (n=20)</td>
<td>There was considerable agreement here.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What term should be used to characterize sets of natural-science principles, what term should be used to characterize goal-oriented, normative, artificial-science principles?</td>
<td>Average of 2.5 on a 7-point Likert scale (n=20)</td>
<td>There was considerable agreement here.</td>
</tr>
</tbody>
</table>

1. Instructional method: Anything that is done purposely to facilitate learning or human development.
   Other terms often used for part or all of this construct include strategy, technique, tactic, and approach.

2. Instructional situation: All aspects of an instructional context that are useful for deciding when and when not to use a particular instructional method. Each individual aspect of the context is referred to as a "situationality." Collectively, they are the "situation." Other terms often used include context and condition.

Instructional methods can vary in several ways, each of which is an important construct for instructional theories. They are as follows:

1.1 Scope of a method: The amount of instruction with which a method deals.
   While this is really a continuum, it is often divided into three major levels (van Merriënboer, 1997):
   1.1.1. Micro: Instruction on an individual skill or understanding, such as a sequence of examples and practice.
   1.1.2. Meso: Instruction on a single unit (or cluster of related skills and understandings), such as a sequence of types of cases for a complex cognitive task.
   1.1.3. Macro: Instruction on a course (or even a curriculum), such as a sequence of different types of complex tasks.

1.2. Generality of a method: The breadth of instructional situations in which a method should be used.
   This is a continuum that ranges from high to low or universal to local. Other descriptors include pervasive, common, restricted, rare, narrow, and local.

1.3. Precision of a method: The level of detail of the description of a method. Precision is a reflection of the componental nature of methods. A description of a method typically can be broken down or elaborated into more precise descriptions of the method for facilitating learning. While this characteristic is commonly referred to as a general-versus-
follows.
each of which is an important construct for instructional theories. They are as
understood.
22. Charles M. Reigeluth and Alison A. Carr-Chellman

2.1. Values: More precise descriptions that describe pieces that, when
combined, make up the method.
1.3. Part: More precise descriptions that describe pieces from
which one must choose in using the method.
1.3.3. Criteria: More precise descriptions that provide criteria for making
a decision regarding the method.

1.4. Power of a method: The amount a method contributes toward the attainment
of the learning goal for which it was selected.
Using any particular instructional method does not ensure that the
learning goal will be attained, for there are many factors that influence
whether or not learning occurs. Some methods are more powerful than
others in fostering learning. Every method contributes a certain amount
to the probability that learning will occur. The power contribution of
any given method can vary from very low (or even zero) to very high
(though never reaching a probability of 1.0).

1.5. Consistency of a method: The reliability with which a method contributes its
power toward the attainment of the learning goal for which it was selected
within the situations for which it is appropriate.

Whereas power is similar to the concept of between-group variance in
statistics, consistency is related to the concept of within-group variance.
A method may be highly consistent in contributing a given amount
of power toward the attainment of a learning goal within the situations
for which it is appropriate, or it may be highly inconsistent in the amount
of power (or probability) it contributes. In other words, the probability
that the method contributes toward learning may be very high in some
situations, but only moderately high in other situations for which it is
still appropriate to use. The consistency of a method (or the variability
of its power) within appropriate situations may range from low to high.
Regarding generality and precision, it is helpful to note that the more
precise (or detailed) a method, the less general (or more situational) it
is.

Instructional situations, like instructional methods, can vary in several ways,
each of which is an important construct for instructional theories. They are as
follows.

2.1. Values: The elements of instruction that are deemed important by an
instructional theory but are a matter of opinion rather than a matter that
can be empirically verified.

The complete set of values underlying a theory of instruction represents
a philosophy of instruction. It is helpful to ensure alignment of
values about instruction across all stakeholders. Therefore, values about
instruction should be made explicit for every instructional theory, to
aid in selection of an appropriate instructional theory. The values of
the designer are less important than the values of the "owners" of the
instruction, the teachers, the learners, and the other beneficiaries (e.g.,
employers and communities). We have identified four major kinds of
instructional values.

2.1.1. Values about learning goals: Statements about which learning
outcomes are valued philosophically (opinion). These stand in
contrast to identifying goals empirically through a needs anal-
ysis.

2.1.2. Values about priorities: Statements about which priorities
should be used to judge the success of the instruction. These were for-
ermly called "instructional outcomes" in volumes 1 and 2 (Rei-
geluth, 1983, 1999), but that term led to a misunderstanding of the
construct. Values about priorities address the relative importance
of the effectiveness, efficiency, and appeal of the instruction as
criteria for judging how good the instructional methods and
guidelines are.

2.1.3. Values about methods: Statements about which instructional
methods are valued from a philosophical point of view (opinion).
These stand in contrast to selecting methods empirically based
on research results.

2.1.4. Values about power: Statements about who is given the power to
make decisions about goals, priorities, and methods.
While values about power could be viewed as subcategories of
the three other kinds of instructional values, we believe power
is such an important issue that it deserves a category of its
own. Learner empowerment is an integral part of the whole
concept of an information-age, learner-centered paradigm
of instruction (see Reigeluth, 1999), but different amounts of
empowerment are often appropriate for different situations,
making empowerment a method variable (that spans goals,
priorities, and methods), as well as a value.

2.2. Conditions: All other factors that influence the selection or effects of
methods.
The word context has a similar meaning, but not all aspects of context
influence when a method of instruction should and should not be used.
For example, one could find oneself in a context of low socioeconomic
standing (SES) and find that this situation has a major impact on what
instructional method should be used, or it may not have such an impact,
as many things are taught in similar ways regardless of student SES or
community poverty. On the other hand, there are times when context is very important and should affect our instructional choices. We have identified four major kinds of instructional conditions.

2.2.1. **Content**: The nature of what is to be learned, defined comprehensively to include not only knowledge, skills, and understandings, but also higher-order thinking skills, metacognitive skills, attitudes, values, and so forth.

2.2.2. **Learner**: The nature of the learner, including prior knowledge, learning styles, learning strategies, motivations, interests, and so forth.

2.2.3. **Learning environment**: The nature of the learning environment, which includes human resources, material resources, organizational arrangements, and so forth.

2.2.4. **Instructional development constraints**: The resources available for designing, developing, and implementing the instruction, including money, calendar time, and person hours.

Figure 1.2 shows a summary of these constructs. While each of these constructs can and should be further broken down into additional constructs, if instructional theorists would use these constructs and terms in describing their instructional theories, that would represent an important step in building a foundation, or common knowledge base, to which instructional theorists and researchers could add, and it would help practitioners and graduate students understand the knowledge available to them. Yet, as our Delphi study pointed out, it is important to always keep in mind that an evolving field must have evolving constructs and evolving terminology. These terms and constructs are offered as a beginning point for building an ever-evolving consensus on terms and constructs.

In this chapter we offered a definition of instruction and have started the significant task of creating a common knowledge base and language about instruction. We described six different kinds of theories related to instruction (event, analysis, planning, building, implementing, and evaluation theories) and contrasted them with other related kinds of theories (student-assessment, curriculum, and learning theories, as well as learning science and instructional science). Then we discussed Gibbons and Rogers's concept of "layers of design" (see chapter 14) and their implications for instructional theory. Next, we turned our attention to the role of instructional theory in educational reform, and discussed the relationship of learner-centered instruction to this book. Finally, we presented the results of a Delphi study and offered particular constructs and terms for a common knowledge base about instruction. These terms may be useful as a foundation upon which instructional theorists and researchers can build, and they should help you, whether you are a practitioner, a researcher, or a graduate student, to understand the knowledge available to you about fostering learning more effectively.

### References


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**Table 1.2** Constructs about the Nature of Instructional Theory

<table>
<thead>
<tr>
<th>Instructional Method</th>
<th>Value (continuum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope of a method</td>
<td>(micro to macro)</td>
</tr>
<tr>
<td>Generality of a method</td>
<td>(universal to local)</td>
</tr>
<tr>
<td>Precision of a method</td>
<td>(highly precise to imprecise)</td>
</tr>
<tr>
<td>Parts of a method</td>
<td>(more precise)</td>
</tr>
<tr>
<td>Kind of a method</td>
<td>(more precise)</td>
</tr>
<tr>
<td>Criteria for a method</td>
<td>(more precise)</td>
</tr>
<tr>
<td>Power of a method</td>
<td>(continuum from low to high)</td>
</tr>
<tr>
<td>Consistency of a method</td>
<td>(continuum from low to high)</td>
</tr>
</tbody>
</table>

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**Table 2.2** Values about Learning Goals

<table>
<thead>
<tr>
<th>Value (categories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values about learning goals</td>
</tr>
<tr>
<td>Values about priorities</td>
</tr>
<tr>
<td>Values about methods</td>
</tr>
<tr>
<td>Values about who has power</td>
</tr>
</tbody>
</table>

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**Table 3.2** Conditions (categories)

<table>
<thead>
<tr>
<th>Condition (categories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
</tr>
<tr>
<td>Learner</td>
</tr>
<tr>
<td>Learning environment</td>
</tr>
<tr>
<td>Instructional constraints</td>
</tr>
</tbody>
</table>
Understanding Instruction

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EDITORS’ FOREWORD

Vision
- To help build a common knowledge base by offering a flexible framework for organizing constructs about instruction (in contrast to constructs about instructional theory, discussed in chapter 1).

Instructional Approaches (macrostrategies)
- They are bundles of instructional methods (components).
- Each has some required components and some optional components.
- Each can be broken down into (eventually) elements of instruction.

Instructional Components (meso- and microstrategies)
- They are more "atomic" than "molecular."
- They can be selected individually or in bundles with other component methods.
- Variable components should be chosen after an approach has been chosen.

Content Sequencing
- Sequencing can be done with chunks of content that are very small or very large.
- It can be used with many different approaches to instruction.
- Some sequencing strategies can be large enough to be considered approaches.

Grammar Rules and Rules of Thumb
- Just as a subject and a verb are needed in every sentence, so an approach, components, and sequences are needed in all instruction.
- The careful analysis of situational constructs aids in selecting and combining instructional methods.
- The priority of highly appealing instruction is particularly important for the information-age paradigm of education.

UNDERSTANDING INSTRUCTION

Chapter 1 described the nature and importance of instructional theory and presented the results of a Delphi study to reach consensus among many instructional theorists about terminology for the major constructs that make up all instructional theories. However, in addition to those constructs about theory, there are also constructs about instruction—the particular instructional methods and situations that may be used in any given theory. Examples of constructs about instruction include: practice, demonstration, collaboration, analogy, problem-based instruction, simple-to-complex sequencing, and many more. The major difference between constructs about instructional theory and constructs about instruction is that the former apply to all instructional theories, whereas the latter may or may not be used in any given theory. This chapter focuses on constructs about instruction.

There have been numerous attempts to prescriptively arrange a set of constructs about instruction (e.g., Gagne’s Nine Events) but few efforts to develop a descriptive schema to accommodate the numerous constructs of instruction. Prescriptive arrangements such as Gagne’s (1985) Nine Events of Instruction provided a useful framework for selecting instructional constructs for use in an archetypal instructional sequence. As part of building a common knowledge base about instruction, we believe that a flexible framework is needed to organize the constructs about instruction and to illustrate their relationships. We think of this framework as a “grammar of instruction.” Just as the grammar of the English language is based on eight parts of speech, so it is possible to trace the many constructs of instruction to a discrete number of sufficiently flexible categories and descriptions. It is our hope that this categorization scheme will sharpen communication about instruction and instructional design. The remainder of the chapter will lay out a set of categories for organizing constructs about instruction with example constructs to illustrate each.

Categories of Constructes about Instruction

Chapter 1 proposed that all constructs of importance to instruction fall into two major categories: instructional methods (what the instruction should be like) and instructional situations (when it should be like that). This chapter will focus on methods, but first we will briefly review what chapter 1 said about situations.

Categories of Instructional Situations

Chapter 1 proposed that instructional situations fall into two main categories: values about instruction and conditions of instruction. Values are about learning goals, criteria, methods, or who has power. Conditions are about the nature of the content, the learner, the learning environment, or the instructional development constraints. Table 2.1 provides an overview of these categories.

Categories of Instructional Methods

Methods of instruction are more difficult to organize into a single conceptual scheme, partly due to their rich variety. This is good news and bad news. The major benefit of the variety of instructional methods is that they can be combined in a nearly infinite number of permutations as appropriate for the instructional situation. The major challenge with this variety is in organizing the profusion of methods in a scheme that is powerful and useful for practitioners.
Table 2.1 Categories of Constructs about Instructional Situations

<table>
<thead>
<tr>
<th>Values (about):</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning goals</td>
<td>The topic should be one about which the students are enthusiastic</td>
</tr>
<tr>
<td>Criteria</td>
<td>The instruction should be fun for the learner</td>
</tr>
<tr>
<td>Methods</td>
<td>Project-based learning should be used because it affords the most relevance to students</td>
</tr>
<tr>
<td>Who has power</td>
<td>Student should generate the learning goals</td>
</tr>
<tr>
<td>Conditions:</td>
<td>Examples</td>
</tr>
<tr>
<td>Content</td>
<td>Understanding causes of the Civil War</td>
</tr>
<tr>
<td>Learner</td>
<td>High ability sixth graders with low motivation for the subject</td>
</tr>
<tr>
<td>Learning environment</td>
<td>A multi-media computer lab, the classroom, the school library, and a classroom visit by a Civil War survivor</td>
</tr>
<tr>
<td>Instructional development constraints</td>
<td>Lesson is due tomorrow</td>
</tr>
</tbody>
</table>

Many classifications of instructional methods are possible, such as the classifications explicated in volume 1 (Reigeluth, 1983, chapter 1):

- Organizational strategies (micro to macro)
- Delivery strategies (media selection and utilization)
- Management strategies

Other ways of classifying methods include those presented in volume 2 (Reigeluth & Moore, 1999, chapter 3):

- The type of learning they promote (memorize information, understand relationships, apply skills, apply generic skills, affective development, or so forth; see volume 2, Reigeluth & Moore, 1999, Table 3.2),
- who controls the learning (the learner, teacher, or instructional designer),
- the focus of the learning (a topic or a problem; a single domain or interdisciplinary),
- the grouping for the learning (individuals, pairs, small groups, or large groups),
- the interactions for the learning (with humans: student-teacher, student-student, or student-other; with nonhumans: student-tool, student-information, student-environment/manipulatives, or student-other),
- the support for the learning (cognitive support or emotional support).

Still other potentially useful categorizations for methods include:

- the authenticity of the instructional tasks (a continuum from artificial or fantasy to authentic),
- the instructional approach used (drill-and-practice, tutorial, simulation, experiential learning, direct instruction, problem-based instruction, discussion, and so forth),
- the purpose of the method (to motivate, to provide information, to build linkages, to empower the learner, to generalize skills, to automate performance of skills or recall of information, and so forth),
- the role that technology can play in supporting the method (offering interactivity, showing motion, providing sound, facilitating communications, and so forth).

Each of the categorizations above applies in some contexts and may be useful in helping instructional designers think about the alternatives available to them. However, we would like to propose three categories that could be useful across contexts and help in classifying most instructional methods: instructional approaches, instructional components, and content sequencing. These are discussed next.

**Instructional Approaches**

Instructional methods that fit this category are macrostrategies. Instructional approaches set a general direction or trajectory for the instruction and are comprised of more precise or detailed components. Consider the terms, problem-based learning, experiential learning, direct instruction, and instructional simulation. These terms refer to general instructional approaches in which other instructional methods (components) are bundled. This notion of bundling is related to the precision of a method, which is the level of detail of description of a method (a construct introduced in chapter 1). For example, problem-based learning is comprised of many smaller methods, and describing each of those smaller methods provides a practitioner with more detail (precision) about the larger (less precise) method.

For any given approach, some components are required and some are optional. When optional components are bundled, they comprise a major "flavor" of the approach. For example, there are several flavors of problem-based learning (PBL), each of which is often referred to as a different strategy for PBL, and the component methods that make up each strategy are often called instructional tactics. One can envision bundles within bundles within bundles, and so forth until one reaches what might be considered the "elements" of instruction.

**Instructional Components**

As implied above, instructional components are more atomic than molecular. Such methods can be selected individually, depending on the instructional
situation, but are often selected in concert with other methods as parts of an instructional approach. For example, practice is a method that is included in nearly every instructional approach because of its importance in helping learners grasp the knowledge, skills, or attitudes that are the focus of instruction. These categories, approach and component, are useful to instructional designers in that a designer should choose an approach first, and then choose variable components for the approach, depending on the situation.

**Content Sequencing**

This third category of instructional methods deserves particular attention, because such methods are used with both approaches and components, because the chunks of content that are sequenced can range from very large to fairly small. As an example, a procedural elaboration sequence (the simplifying conditions method; see volume 2, Reigeluth & Moore, 1999, chapter 18) entails starting the instruction with the simplest real-world version of a complex task and progressing to ever more complex versions until all important versions have been learned. The task on which this sequencing method is used could range from very large to quite small. Also, this kind of sequence can be used with many different approaches to instruction, including problem-based instruction, direct instruction, simulation-based instruction, discussion-based instruction, and so forth. At the component level, examples of content sequencing methods include an easy-to-difficult sequence to present examples of a concept and a concrete-to-abstract sequence in mathematics instruction when the instructor utilizes manipulatives to portray an abstract concept in the first steps of learning the symbolic representations of numbers and mathematical operations. To further complicate matters, some sequencing strategies are broad enough to be considered “approaches” to sequencing, while others are components of larger sequencing methods.

To summarize this section about the organization of instructional methods, we have shown that there are many ways to classify methods. We proposed three general categories for classifying most instructional methods (see Table 2.2). While the categories are not mutually exclusive, we believe they are sufficiently broad that most instructional methods fit into at least one of these categories, and we believe they provide a useful organizing scheme for instructional designers.

<table>
<thead>
<tr>
<th>Instructional Methods</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional approach</td>
<td>Discovery-based learning; Direct Instruction; Problem-based Learning</td>
</tr>
<tr>
<td>Instructional component</td>
<td>Advance Organizer; Coaching; Guided Practice</td>
</tr>
<tr>
<td>Content sequence</td>
<td>Concrete-Abstract Sequencing</td>
</tr>
</tbody>
</table>

Grammar Rules and Rules of Thumb

Chapter 1 presented a set of constructs related to instructional situations:

**Values**

- about learning goals
- about priorities
- about methods
- about power

**Conditions**

- the content
- the learner
- the learning environment
- the instructional development constraints

When combined with the constructs about methods just presented (Table 2.2), these constructs might prove useful to practitioners by implying a set of questions for analyzing an instructional situation and selecting appropriate methods.

**Questions about Instructional Situations**

- What are the valued learning goals or outcomes from the instruction?
- What are the priorities in the instruction?
- Which methods are most valued in the instructional context?
- How should power be distributed among those in the instructional interaction?
- How is the nature of the content likely to influence the selection of instructional methods?
- How is the nature of the learner likely to influence the selection of instructional methods?
- How is the instructional environmental likely to influence the selection of instructional methods?
- How are instructional development constraints or limitations likely to influence the selection of instructional methods?
These questions can act as a preliminary guide to analysis and design efforts of the instructional designer. They also serve as issues for instructional theorists to address in their theories.

Returning to the analogy of English grammar presented at the beginning of this chapter, the eight parts of speech are combined according to rules of grammar on which we depend for effective communication. The various categories we have proposed for organizing constructs about instruction are analogous to the parts of speech. Guidelines for combining these constructs to achieve effective instructional design depend largely on a set of heuristics that are learned as expertise develops.

The categories above do suggest a few rules of thumb for thinking through instructional design. Just as a sentence requires a subject and a verb, so instruction requires an approach, components, and sequences. Few English sentences employ all parts of speech. Similarly, designing effective instruction is not as easy as using all the categories described earlier as a checklist of considerations.

There is an understanding about the internal relationships among the categories that is critical to effective instructional design. Specifically, a thorough understanding of the instructional situation helps a theorist (or designer) to select and combine instructional methods to the best effect. These constructs about instruction are not meant to be so many ingredients in whole-grain instruction. Rather, the careful analysis of situational constructs aids in selecting and combining instructional methods. The selection heuristics may be offered by specific instructional theories, but they may also be developed by each instructional designer as insights about the instructional utility of methods in varying instructional situations accrue from experience. While the categorization of instructional methods is descriptively useful, it offers little in the way of prescription, since the selection depends on the grasp that an instructional theorist (or designer) has developed regarding the utility of each instructional method, including its advantages and disadvantages in particular instructional situations.

A final rule of thumb for designing instruction is to pay close attention to the priorities for selecting instructional methods that were described in chapter 1. They strongly influence a method's desirability. One of the most important priorities for the information-age paradigm of education in both K-12 and higher education contexts is how motivating the method is for learners, since learning is a constructive process that requires considerable student effort. As Schlechty (2002) puts it, the challenge for a teacher is to design engaging work for students. Student engagement and the relevance of learning are key factors in designing instruction for information-age learners.

Effectiveness and efficiency are additional priorities for selecting instructional methods. For example, to learn a skill, demonstrations of the performance of the skill and practice in performing the skill (with immediate feedback) have been well proven to make the instruction more effective and efficient. Recent policy at the federal level spotlights the importance of instructional programs that are evidence-based; that is programs shown to be effective through research (Slavin, 2008). Instructional theorists and designers should continually cultivate their knowledge of the effectiveness and efficiency of instructional methods.

Conclusion

To conclude, we have described categories of constructs about instructional situations and instructional methods. We hope that these categories provide designers with useful tools for classifying instructional constructs as well as a framework for analyzing and designing instruction. We believe that the use of this grammar will help to build a common language and knowledge base if these basic notions are applied. To this end, the appendix to this chapter provides a list of common instructional methods organized in these categories.

Utilizing an instructional method from each category will not lead to elegant and effective instructional designs. Insight into the relationships among the categories is still required, along with knowledge of key characteristics of instructional methods, including their motivational potential and situation-dependent effectiveness and efficiency. The value of this organizational scheme is its broad embrace of all constructs of instruction and its small number of generally useful categories that can be used to order the rich array of terms important to the field.

References


### Appendix Sample List of Instructional Methods

<table>
<thead>
<tr>
<th>Term</th>
<th>Instructional Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchored instruction</td>
<td>One kind of authentic learning environment that is organized so that all learning originates from the learner's attempts to solve a real problem. (Synonyms: Situated learning)</td>
</tr>
<tr>
<td>Authentic learning environments</td>
<td>When in the control of the instructional designer, authentic learning environments are approaches that focus on providing some degree of authenticity to the instructional event. In this context, authenticity is synonymous with real world. (Syn: Constructivist learning environments, situated learning)</td>
</tr>
<tr>
<td>Case-based learning</td>
<td>A broad method which organizes instruction around consideration of and interaction with a real-world scenario.</td>
</tr>
<tr>
<td>Cognitive apprenticeship</td>
<td>A method in which instruction is organized around the interactions of novice and expert, much as with an expert artisan and an apprentice. This case, the work to be mastered is thought processes (Syn: Apprenticeship learning)</td>
</tr>
<tr>
<td>Direct instruction</td>
<td>An instructional method that draws on carefully scripted instruction intended to promote efficient learning. The method was developed by Sigfried Engelmann.</td>
</tr>
<tr>
<td>Discovery-based learning</td>
<td>A broad method in which instruction is organized around a process of helping learners to discover a pre determined model, concept, or proposition.</td>
</tr>
<tr>
<td>Drill and practice</td>
<td>A method focused on rote learning and automatization through the repeated presentation of prompts and corrective feedback.</td>
</tr>
<tr>
<td>Expository teaching</td>
<td>Instruction depending primarily on teacher lecture. (Syn: Didactic, teacher-centered)</td>
</tr>
<tr>
<td>Hands-on learning</td>
<td>A method focused on learner involvement in discovery of principles and the mastery of skills or ideas through activity and direct experience—learning by doing.</td>
</tr>
<tr>
<td>Individualized instruction</td>
<td>A method that is responsive to the needs of individual students.</td>
</tr>
<tr>
<td>Inquiry-based instruction</td>
<td>A method in which instruction is organized by the interests of the students. Students are encouraged to ask questions and the learning is centered upon answering those questions.</td>
</tr>
<tr>
<td>Instructional game</td>
<td>A method in which the knowledge, skills, and abilities that are the focus of the instruction are acquired through a game devised for that purpose.</td>
</tr>
<tr>
<td>Instructional simulation</td>
<td>Instruction that simulates the critical elements of a real-life context to approximate the complexity surrounding the skill to be learned or the understanding to be gained.</td>
</tr>
<tr>
<td>Learner-centered instruction</td>
<td>A method that focuses on individual learners (e.g., their backgrounds, interests, capabilities, and needs) and on learning (e.g., knowledge about methods to promote the highest levels of motivation and learning for all kinds of learners).</td>
</tr>
<tr>
<td>Problem-based learning/instruction</td>
<td>Instruction that is organized around helping students to achieve or arrive at the solution to a problem.</td>
</tr>
<tr>
<td>Project-based Learning/instruction</td>
<td>Instruction organized around making a product, task, or service.</td>
</tr>
</tbody>
</table>

### Instructional Approaches

<table>
<thead>
<tr>
<th>Term</th>
<th>Instructional Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role play</td>
<td>A method in which key ideas and skills are illustrated or practiced by learners assuming roles and contexts in which the ideas and skills would typically be applied.</td>
</tr>
<tr>
<td>Teacher-centered instruction</td>
<td>An instructional approach in which the teacher is the primary delivery channel for instructional content—often through presentation and lecture. (Syn: Expository, didactic, transmission-oriented)</td>
</tr>
<tr>
<td>Tutorial</td>
<td>A broad method that involves a high level of adaptation or instructional events to cater to the individual needs of the student.</td>
</tr>
</tbody>
</table>

### Instructional Components

<table>
<thead>
<tr>
<th>Term</th>
<th>Instructional Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance organizer</td>
<td>A component method, by all accounts attributed to David Ausubel, that is used at beginning of an instructional sequence to help &quot;bridge&quot; the gap between what the learner knows and what she will be learning or doing.</td>
</tr>
<tr>
<td>Analogies</td>
<td>A component method that draws comparisons between something familiar and something unfamiliar for the purpose of learning or understanding the latter.</td>
</tr>
<tr>
<td>Authentic tasks</td>
<td>A component method that is used for its similarity to the real-world and for its motivational appeal to the learner.</td>
</tr>
<tr>
<td>Coaching</td>
<td>A method that centers on a more accomplished learner providing guidance and encouragement to a more novice learner in the context of instruction or a learning exercise. (Syn: Facilitating, mentoring)</td>
</tr>
<tr>
<td>Collaborative work</td>
<td>A method that capitalizes on the learning advantages that come from learners working together to solve a problem or accomplish a task. (Syn: Cooperative work)</td>
</tr>
<tr>
<td>Cooperative work</td>
<td>This method provides structures for completing work or products by dividing work among group members. Cooperative work is chosen because bigger projects can be tackled and completed by groups working collectively. (Syn: Collaborative work)</td>
</tr>
<tr>
<td>Demonstration</td>
<td>A basic component method in which an instructor demonstrates to learners how to do or make something. This method is often followed by student trial of the same skill. (Syn: Model)</td>
</tr>
<tr>
<td>Elaboration</td>
<td>Expanding from a simple instance of a concept or skill to a more complex or nuanced instance to aid the learner's full grasp of the content.</td>
</tr>
<tr>
<td>Examples/Nonexamples</td>
<td>The use of instances of a concept that illustrate key attributes of the concept in contrast with instances that do not illustrate the key attributes of the concept, to aid the learner in discrimination regarding salient characteristics or dimensions of the concept.</td>
</tr>
<tr>
<td>Feedback</td>
<td>A component method that provides the student with information about the quality of the performance and specific guidance about the correct and incorrect aspects of the performance.</td>
</tr>
<tr>
<td>Guided practice</td>
<td>A method involving the learner's practice of a skill, with supervision and assistance from the teacher as needed.</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Term</th>
<th>Instructional Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent practice</td>
<td>A method involving the learner's practice of a skill without supervision or assistance from the teacher.</td>
</tr>
<tr>
<td>Peer tutoring</td>
<td>A technique in which a peer of the learner helps him or her to grasp ideas and concepts through close monitoring and feedback.</td>
</tr>
<tr>
<td>Personalization</td>
<td>Instruction that focuses on tailoring methods to target the particular learning needs of each student. Depending on the scope of this method, it could be an approach or a component. (Syn: Customization, individualized instruction)</td>
</tr>
<tr>
<td>Practice</td>
<td>A component method involving repetitive interaction of learner with content.</td>
</tr>
<tr>
<td>Preview</td>
<td>A technique often used at the onset of instruction to establish instructional targets and raise the interest of the learner by some technique that allows the learner to glimpse what the instructional experience will be like.</td>
</tr>
<tr>
<td>Reciprocal teaching</td>
<td>Instruction that utilizes a pair of students or a small group to act as teachers for each other, thus requiring each student to bear some responsibility for helping the others to learn the content.</td>
</tr>
<tr>
<td>Reflection</td>
<td>A metacognitive method that helps a learner to derive deeper and broader understandings of an experience or that promotes self-evaluation through the comparison of one's work to a standard or through an analysis of individual change as a result of the learning experience.</td>
</tr>
<tr>
<td>Review</td>
<td>A summarizing method that draws together the main points of a learning experience to reinforce the grasp of key concepts.</td>
</tr>
<tr>
<td>Self-assessment</td>
<td>A component that guides students to reflect upon and compare their work to a standard.</td>
</tr>
<tr>
<td>Team work</td>
<td>A collaborative method that promotes learning through the accomplishment of an activity, project, or task as a group of learners.</td>
</tr>
<tr>
<td><strong>Content Sequencing</strong></td>
<td></td>
</tr>
<tr>
<td>Concrete-abstract sequencing</td>
<td>A microlevel sequencing method that organizes content from concrete, physical, being there experiences to abstract, symbolic experiences. (Syn: Inductive sequencing)</td>
</tr>
<tr>
<td>Deductive sequencing</td>
<td>A microlevel sequencing method that organizes content from general to specific.</td>
</tr>
<tr>
<td>Easy-to-difficult sequence</td>
<td>A microlevel sequencing method that organizes content from the easiest examples to the most difficult examples.</td>
</tr>
<tr>
<td>Elaboration sequencing: Conceptual</td>
<td>A sequencing method that proceeds from general concepts to detailed concepts. (Syn: Progressive differentiation sequence)</td>
</tr>
<tr>
<td>Elaboration sequencing: Procedural</td>
<td>A sequencing method that proceeds from simpler versions of a complex procedure to more complex versions. (Syn: Shortest path sequence)</td>
</tr>
<tr>
<td>Elaboration sequencing: Theoretical</td>
<td>A sequencing method that proceeds from broader, more inclusive principles to narrower, more restricted principles. (Syn: Spiral curriculum)</td>
</tr>
</tbody>
</table>