

# **Instructional-Design Theories and Models**

## **Volume III**

**Building a Common Knowledge Base**

Edited by

**Charles M. Reigeluth**

**Alison A. Carr-Chellman**

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## Understanding Instruction

**CHARLES M. REIGELUTH**

*Indiana University*

**JOHN B. KELLER**

*Indiana Department of Education*



For Educational Communications and Technology (AECT). He also received AECT's Distinguished Service Award and Brigham Young University's Distinguished Alumnus Award.

**John B. Keller** is currently serving the Indiana Department of Education in the Center for Information Systems where he collaborates on the development of teacher productivity software and contributes to the creation of longitudinal data systems. John has also worked in the nonprofit sector on grants for designing, developing, and implementing a teacher productivity portal. Teaching endeavors have included six years of elementary school and a variety of courses as an adjunct professor for several Indiana teacher preparation institutions. John completed his doctoral work at Indiana University in the Instructional Systems Technology Department in the School of Education.



**Charles M. Reigeluth** received a B.A. in economics from Harvard University. He was a high school teacher for three years before earning his doctorate in instructional psychology at Brigham Young University. He has been a professor in the Instructional Systems Technology Department at Indiana University's School of Education in Bloomington since 1988, and served as chairman of the department from 1990 to 1992. His major area for service, teaching, and research is the process for facilitating district-wide paradigm change in public school systems. His major research goal is to advance knowledge to help school districts successfully navigate transformation to the learner-centered paradigm of education. He has published nine books and over 120 journal articles and chapters. Two of his books received an "outstanding book of the year" award from Association



## 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*

—CMR & ACC

## 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., Gagné's Nine Events) but few efforts to develop a descriptive schema to accommodate the numerous constructs of instruction. Prescriptive arrangements such as Gagné'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 Constructs 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

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

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 automatize 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 2.2** Categories of Constructs about Instructional Methods

| Instructional Methods   | Examples   |
|-------------------------|--|
| Instructional approach  | Discovery-based learning; Direct Instruction; Problem-based Learning |
| Instructional component | Advance Organizer; Coaching; Guided Practice                         |
| Content sequence        | Concrete-Abstract Sequencing   |

## **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 environment likely to influence the selection of instructional methods?
- How are instructional development constraints or limitations likely to influence the selection of instructional methods?

### *Questions about Instructional Methods*

- What instructional approach should be used?
- What variable instructional components are most appropriate within that approach?
- How should instruction be sequenced?



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.

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**Appendix** Sample List of Instructional Methods

| Term                                | Instructional Approaches  |
|-------------------------------------|---|
| Anchored instruction                | 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]   |
| Authentic learning environments     | 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) |
| Case-based learning                 | A broad method which organizes instruction around consideration of and interaction with a real-world scenario.  |
| Cognitive apprenticeship            | A method in which instruction is organized around the interactions of novice and expert, much as with an expert artisan and an apprentice. In this case, the work to be mastered is thought processes. (Syn: Apprenticeship learning)   |
| Direct instruction                  | An instructional method that draws on carefully scripted instruction intended to promote efficient learning. The method was developed by Sigfried Engelmann.  |
| Discovery-based learning            | A broad method in which instruction is organized around a process of helping learners to discover a pre determined model, concept, or proposition.  |
| Drill and practice                  | A method focused on rote learning and automatization through the repeated presentation of prompts and corrective feedback.  |
| Expository teaching                 | Instruction depending primarily on teacher lecture. (Syn: Didactic, teacher-centered)   |
| Hands-on learning                   | 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.   |
| Individualized instruction          | A method that is responsive to the needs of individual students.  |
| Inquiry-based instruction           | 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.  |
| Instructional game                  | 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.  |
| Instructional simulation            | 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.  |
| Learner-centered instruction        | 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).  |
| Problem-based learning/ instruction | Instruction that is organized around helping students to achieve or arrive at the solution to a problem.  |
| Project-based Learning/ instruction | Instruction organized around making a product, task, or service.  |

| Term                         | Instructional Approaches  |
|------------------------------|---|
| Role play                    | 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.   |
| Teacher-centered instruction | 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)   |
| Tutorial                     | A broad method that involves a high level of adaptation or instructional events to cater to the individual needs of the student.  |
| Instructional Components     |   |
| Advance organizer            | A component method, by all accounts attributed to David Ausubel, that is used at beginning of an instructional sequence to help "bridge" the gap between what the learner knows and what she will be learning or doing.   |
| Analogies                    | A component method that draws comparisons between something familiar and something unfamiliar for the purpose of learning or understanding the latter.  |
| Authentic tasks              | A component method that is used for its similarity to the real-world and for its motivational appeal to the learner.  |
| Coaching                     | 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)   |
| Collaborative work           | 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)  |
| Cooperative work             | 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)                           |
| Demonstration                | 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]  |
| Elaboration                  | 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.  |
| Examples/Nonexamples         | 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. |
| Feedback                     | 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.  |
| Guided practice              | A method involving the learner's practice of a skill, with supervision and assistance from the teacher as needed.   |

(continued)

**Appendix** Sample List of Instructional Methods (Continued)

| Term                                | Instructional Approaches   |
|-------------------------------------|--|
| Independent practice                | A method involving the learner's practice of a skill without supervision or assistance from the teacher.   |
| Peer tutoring                       | A technique in which a peer of the learner helps him or her to grasp ideas and concepts through close monitoring and feedback.   |
| Personalization                     | 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)   |
| Practice                            | A component method involving repetitive interaction of learner with content.   |
| Preview                             | 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.   |
| Reciprocal teaching                 | 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.  |
| Reflection                          | 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. |
| Review                              | A summarizing method that draws together the main points of a learning experience to reinforce the grasp of key concepts.  |
| Self-assessment                     | A component that guides students to reflect upon and compare their work to a standard.   |
| Team work                           | A collaborative method that promotes learning through the accomplishment of an activity, project, or task as a group of learners.  |
| <b>Content Sequencing</b>           |  |
| Concrete-abstract sequencing        | A microlevel sequencing method that organizes content from concrete, physical, being there experiences to abstract, symbolic experiences. (Syn: Inductive sequencing)  |
| Deductive sequencing                | A microlevel sequencing method that organizes content from general to specific.  |
| Easy-to-difficult sequence          | A microlevel sequencing method that organizes content from the easiest examples to the most difficult examples.  |
| Elaboration sequencing: Conceptual  | A sequencing method that proceeds from general concepts to detailed concepts. (Syn: Progressive differentiation sequence)  |
| Elaboration sequencing: Procedural  | A sequencing method that proceeds from simpler versions of a complex procedure to more complex versions. (Syn: Shortest path sequence)   |
| Elaboration sequencing: Theoretical | A sequencing method that proceeds from broader, more inclusive principles to narrower, more restricted principles. (Syn: Spiral curriculum)  |

| Term                    | Instructional Approaches   |
|-------------------------|--|
| Hierarchical sequencing | A sequencing method that teaches simpler component skills before the more complex skills of which they are a part. (Syn: Learning prerequisite sequence)   |
| Procedural sequencing   | A sequencing method that teaches the steps of a simple procedure in the order in which they are performed. (Syn: Forward chaining sequence)  |
| Scaffolding             | A variety of methods that include a sequence that gradually reduces and removes supports of various kinds (fading) and a sequence that gradually increases the acceptable standards of performance (shaping). (Syn: Fading, shaping) |