INSTRUCTIONAL THEORIES IN ACTION

Lessons Illustrating Selected Theories and Models

edited by

Charles M. Reigeluth

1 Introduction

Charles M. Reigeluth
Syracuse University

WHAT IS INSTRUCTIONAL THEORY?

The purpose of the field of instruction is to provide educators and trainers with prescriptions for making their instruction more effective and appealing. Over the past 20 years, methods of instruction (such as expository and discovery) have been analyzed to identify fairly elementary components that comprise them, such as examples, feedback, visual representations, and mnemonics. Many prescriptions for the use of such strategy components have been generated and validated since the mid 1960s. However, those prescriptions are mostly piecemeal—isolated bits and pieces that do not take into consideration the full range of components that a given unit of instruction should have.

Clearly, what teachers, textbook writers, and other instructional developers need are prescriptions that are more integrated and more comprehensive. This is what *prescriptive instructional theories* are meant to offer: They prescribe optimal combinations of strategy components for different situations. The few efforts that have been undertaken to achieve a measure of comprehensiveness have mostly produced independent and relatively incomplete knowledge bases, and most use inconsistent terminology. Hence, this book and its more advanced companion, *Instructional-Design Theories and Models: An Overview of Their Current Status* (Reigeluth, 1983), represent but a small step forward in a sorely needed integrative effort. The companion volume provides a thorough description of each of the theories illustrated in this volume, whereas each chapter in this volume provides a summary of the prescriptions for a theory, followed by a lesson and commentary that illustrate and explain each prescription.

Instructional theory addresses two questions: What methods should be used in

the design of instruction? and when should each be used? These two concerns can be labeled as *methods* and *situations*. Statements that link situations and methods are called "principles" or "theories."

Methods of Instruction. Methods may be individual *strategy components*, the elementary building blocks from which methods are created. Or they may be *models* of instruction: sets of strategy components that have been combined to optimize the quality of the instruction.

Situations of Instruction. How do you know when a certain method of instruction should be used? One way is to examine the instructional *outcomes:* the effects of each method. However, it has been found that the same method can have different effects under different *conditions*. Conditions include such variables as the nature of the content or learning task, the nature of the learners, and the nature of the institutional setting. Together, the desired outcomes and the conditions constitute the situations, or the bases for prescribing when to use each strategy component or each model of instruction.

Principles of Instruction. A *descriptive* principle of instruction describes the effects of a single strategy component. It identifies the likely outcome(s) for a given strategy component under given condition(s). A *prescriptive* principle of instruction, on the other hand, prescribes when the strategy component should be used. It identifies the strategy component that should be used for a given desired outcome and condition(s).

Theories of Instruction. A *descriptive* theory of instruction describes the effects of a whole model of instruction (integrated set of strategy components), instead of just the effects of a single strategy component. A *prescriptive* theory of instruction prescribes when a given model or set of models should be used. It identifies the instructional model that should be used for a given desired outcome and condition(s). The more comprehensive an instructional theory is, the more models it prescribes for different kinds of desired outcomes and conditions.

HISTORICAL TRENDS

The field of instruction, like most disciplines, began with an emphasis on *philosophical* concerns, which entailed the expression of opinions and conjecture (see, e.g., Dewey, 1916). With the advent of Skinner's focus on programmed instruction in the 1950s, this phase finally (considering that education is one of the oldest professions) gave way to a focus on *validated prescriptions,* which require the scientific testing of opinions and conjecture through research. As with other disciplines, initial research on instruction tended to focus on very general,

vague variables, such as discovery versus expository methods and lecture versus discussion formats. However, in that research two different discovery methods often differed more than an expository and a discovery method differed, making it impossible to identify reliable causes of superior outcomes.

Therefore, the discipline soon entered an *analysis* phase, during which phenomena were broken down into manageable components upon which research was conducted (see, e.g., Evans, Homme, & Glaser, 1964). Today much piecemeal knowledge about the effects of different instructional strategy components has been generated and validated. However, it is also common for the analysis phase in a discipline to be followed by a *synthesis* phase, during which that piecemeal knowledge is integrated into progressively more comprehensive models and theories. Although there are signs that such a synthesis phase has begun in the field of instruction, our educational and training problems today are such that we cannot afford to drag our feet in this endeavor. There is a strong need for much more work to integrate our current knowledge into optimal models of instruction, each of which is prescribed for different kinds of instructional situations.

In response to this need, the editor and authors of this book wrote *Instructional Design Theories and Models: An Overview of Their Current Status* (1983). Its primary purpose was to contribute to an integration of instructional prescriptions. That book assembled and described the most comprehensive and thorough of those instructional theories that are still undergoing some further development, to the best knowledge of the editor. (Other notable instructional theories include the various instructional prescriptions of Ausubel, 1968; Bruner, 1960, 1966; and Skinner, 1954, 1965; all of which are no longer under development; and the more recent prescriptions of Bloom, 1976, 1981; Case, 1978a, 1978b; Lawson & Lawson, 1980; Markle, 1978; and Rothkopf, 1981; all of which are, in the editor's opinion, of narrower scope of detailed instructional prescriptions than those included here.) That book went beyond assembling and describing the theories illustrated in this volume; it also attempted to facilitate integration into a common knowledge base through chapter forewords and extensive editor's notes that compared and contrasted individual prescriptions and that assessed overall strengths (unique contributions) and weaknesses (omissions) of each theory.

WHY THIS BOOK?

Understanding. The primary purpose of this book is to help educators and trainers to create more effective and appealing instruction by making it easier to understand the various methods of instruction that are prescribed by these prominent instructional theories. Each of the original theorists (with one exception) has developed a lesson that illustrates most of the methods that his theory prescribes. Therefore, this book provides a more *concrete understanding* of the instructional

theories than does the companion volume. In addition, each author has written numbered comments that identify the specific prescription from his theory that is being implemented at each point in the lesson. These comments have been written in such a way that they are understandable to a reader who has not read the earlier book. Because this book is a more concrete description of the instructional theories, we recommend that someone new to these theories read this book before the earlier book.

Comparison. Another important purpose of this book is to facilitate comparison and contrast of these instructional theories. As one author has put it (Gropper, 1983), most of the theories represented here were developed as "independent knowledge bases" with entirely different terminologies. By having all authors develop their lessons for the *same* set of objectives and test items (see p. 5), it is easier for the reader to cut through the terminology differences and make direct comparisons among the instructional theories. Editor's Notes have been added to further facilitate such comparisons.

Integration. A third important purpose in producing this book is to contribute to the integration of our existing knowledge about instruction. It is our hope that this book will show that, rather than competing with each other, these theories complement each other. There are many commonalities among these theories: that is, many theories prescribe the same methods for the same situations (all in different terminology, though!). Most of the differences in methods prescribed by the theories are due to differences in the situations for which they are prescribed. For example, a discovery approach may be appropriate in some cases but not in others. It would hardly be appropriate for teaching a group of surgeons the latest technique in their field. This book can help draw attention to the need to view instructional theories not as competing with each other but as making *unique contributions* to a truly integrated, comprehensive set of prescriptions for creating effective and appealing instruction. An educator or trainer will benefit by having *all* of these various methods of instruction in his or her repertoire.

Chapter Format

Each chapter has three main sections: an introduction, a lesson, and a set of comments. The *introduction* presents a summary of the theory's major prescriptions. Occasionally, some general information about the overall design of the lesson is also included here. The *lesson* may take a variety of forms. The authors were advised that the lesson "may be in the form of written materials, a sample dialogue between teacher and student(s), a 'map' showing how the topics might be sequenced within a complete course, a description (including drawings, etc.) of any nonprint media that would be used, or any combination of the above." In the lesson, a bracketed number appears in the margin opposite each characteristic

of the lesson for which the author has written a comment. All *comments* appear in the third section of the chapter, and they explain what prescription is being implemented at that particular point in the lesson. Occasional reference is made to pages in the earlier book where more detailed descriptions of the prescriptions can be found.

Each chapter's lesson covers the same set of objectives and test items, both of which are listed in the next section. Although the objectives were selected to provide a broad sample of types of learning, the authors were all encouraged to include additional objectives if such were necessary to adequately illustrate important aspects of their theories. If any of the standard objectives (listed below) were inappropriate for a given theory, the author was instructed to indicate so and to not include it in the lesson.

Objectives and Test Items

Our desire was to choose a set of objectives that are broadly representative of real-world learning tasks. In particular, we wanted to include some objectives that require remembering information and others that require skill application, and within the domain of skill application we wanted to include a variety of types of skills or content. The following are the objectives that were decided upon:

1. Students will be able to classify previously unencountered lenses as to whether or not they are convex lenses.
2. Students will be able to define focal length.
3. Students will be able to explain or predict what effect different convex lenses will have on light rays.
4. Students will be able to explain the way in which the curvature of a lens influences both the magnification and the focal length of different lenses.
5. Students will be able to state from memory the three significant events in the history of the microscope.
6. Students will be able to use a previously unencountered optical microscope properly.

Using *Gagné's* (1977) terminology, these objectives are of two domains: verbal information (Objectives 2, 4, and 5) and intellectual skills (Objectives 1, 3, and 6). Within the intellectual skills domain, the desired behaviors include concept classification (Objective 1) and rule using (Objectives 3 and 6). Using *Merrill's* (Merrill, 1983) terminology, these objectives are of two levels: remember (Objectives 2, 4, and 5) and use (Objectives 1, 3, and 6). Within the use level, the content types include concept (Objective 1), principle (Objective 3), and procedure (Objective 6). Notably absent are any objectives for Gagné's "cognitive strategies" domain, or Merrill's "find" level, largely because the

amount or length of instruction that is required to teach such objectives is prohibitively large for an undertaking such as this book.

Just as examples serve as concrete illustrations of a rule or generality, so test items serve as concrete illustrations of an objective. The following test items were supplied to the authors of the lessons in this book.

Objective 1. Students will be able to classify previously unencountered lenses as to whether or not they are convex lenses.

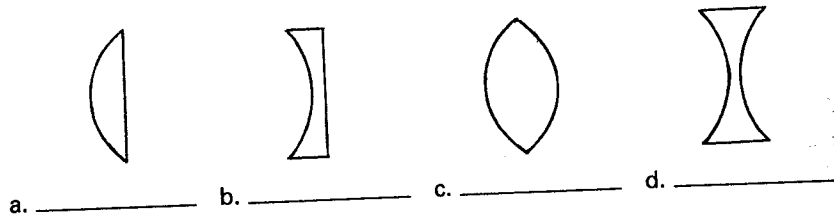5. In the following picture (Fig. 1.1), place a check mark beside the lenses that are convex.

a. _____   b. _____   c. _____   d. _____

FIG. 1.1

12. Examine the lenses on the table and write down the letter of each one that is convex. (Eight samples are given.)

Objective 2. Students will be able to define focal length.

6. What does the term "focal length" mean?

Objective 3. Students will be able to explain or predict what effect different convex lenses will have on light rays.

7. Explain what will happen to the light rays in Fig. 1.2 by drawing their path through and beyond the lens:

FIG. 1.2
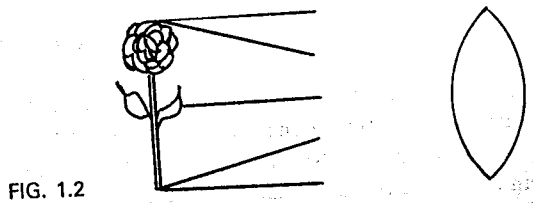
13. (a) Rank the lenses on the table according to the degree to which they bend light rays, that is, the lens that bends light rays the most would be

number 1, and the one that bends light rays the least would be number 6, with the others falling in between. Place the letter of each lens next to its appropriate rank. (Six samples are given.)

(1)   (4)
(2)   (5)
(3)   (6)

(b) Explain why number 1 should bend light rays the most and why number 6 should bend them the least.

Objective 4. Students will be able to explain the way in which the curvature of a lens influences both the magnification and the focal length of different lenses.

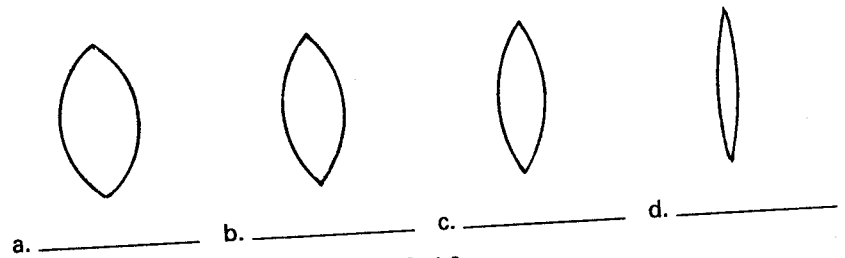8. In the picture in Fig. 1.3, place a check mark by the lens that has the *shortest* focal length.

a. _____   b. _____   c. _____   d. _____

FIG. 1.3

9. In the picture in Fig. 1.4, place a check mark by the lens that has the greatest degree of magnification.

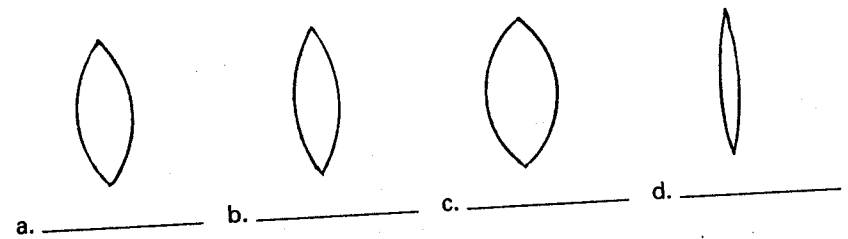a. _____   b. _____   c. _____   d. _____

FIG. 1.4

14. (a) Rank the lenses on the table according to the height they must be held in order to make the rays converge to a point on the table top. Thus, the lens that should be nearest the table top will be number 1, while the

one that should be furthest will be number 4. Place the letter of each lens next to its appropriate rank. (Four samples are given.)

(1)   (3)
(2)   (4)

(b) Explain why number 1 should be nearest the table and why number 4 should be furthest.

Objective 5. Students will be able to state from memory the three significant events in the history of the microscope.

1. What was the first type of magnifying glass used, and when was it first used?
2. When were glass lenses (of the type now used) first introduced?
3. Who developed the first compound microscope?
4. When was the first compound microscope developed?

Objective 6. Students will be able to use a previously unencountered optical microscope properly.

10. Demonstrate the proper way to use a microscope: Using the specimen provided, examine it under the microscope and describe what you see
    (a) using the low-power objective
    (b) using the intermediate-power objective, and
    (c) using the high-power objective.
11. (Same as 10 but use different microscope and specimen.)

SUGGESTIONS FOR READING THIS BOOK

Discovery Approach. To facilitate deeper understanding of and greater ability to use the prescriptions contained in this book, we suggest the following:

1. Read the portion of the lesson that corresponds to the first numbered comment.
2. Try to guess what the comment says, based on the chapter introduction or your own intuition.
3. Look at the numbered comment to see how close you were.
4. Continue this process for each remaining numbered comment.

Expository Approach. If you want to take the easier (but less fruitful) route, we suggest the following:

1. Read the portion of the lesson that corresponds to the first numbered comment. While reading, keep a finger in the comments section so that you can easily flip to the numbered comment as the number is encountered in the lesson.
2. Read the numbered comment, while keeping a finger in the lesson section so that you can easily flip back to it.
3. Return to the lesson to see each aspect of it that the comment identified.
4. Continue this process for each remaining numbered comment.

If you prefer an abstract rather than concrete approach, you could skip step 1.

You ought to keep in mind the objectives and test items in any attempt to evaluate the lessons that follow. However, please also consider that the authors were encouraged to supplement these objectives with any others that they felt were necessary to illustrate important aspects of their respective theories.

Try to concentrate on comparing the theories to find ways that they duplicate each other and ways that they complement each other. Try also to identify how these theories might be integrated into a single comprehensive knowledge base—that is, what prescriptions each theory would contribute to such a knowledge base—and what form might best depict such a comprehensive knowledge base. Then publish your conclusions and share them with us! We would be delighted to see them. Together we can push back the frontiers of instructional design and build a truly useful knowledge base for designers.

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2 A Lesson Based on the Gagné-Briggs Theory of Instruction

Barbara Petry, Harry Mouton,
Charles M. Reigeluth
Syracuse University

FOREWORD

History

The Gagné-Briggs theory of instruction was first developed in the 1960s, although its development has continued to date. It is affectionately known by many as the granddaddy of instructional theories. It was the first major attempt to integrate a wide range of knowledge about learning and instruction (from many theoretical perspectives) into a comprehensive theory of instruction. Its impact on the field has been immense.

Unique Contributions

One of the most outstanding features of the Gagné-Briggs instructional theory is that it is so comprehensive. It prescribes the nature of instruction for all three of Bloom's domains of knowledge: cognitive, affective, and psychomotor; and within the cognitive domain it prescribes methods for teaching verbal information (remember-level knowledge), intellectual skills (application of generalizable knowledge), and cognitive strategies (the higher thought processes).

This instructional theory is also comprehensive in the breadth of instructional strategies that it prescribes. The nine events of instruction include gaining the learners' attention, presenting objectives, and stimulating recall of relevant prior knowledge, all of which have tended to be overlooked by more recent instructional theories. In fairness, however, it should be pointed out that many of the more recent theorists have opted to sacrifice breadth in order to achieve greater