# SELECTING INSTRUCTIONAL STRATEGIES

## OR ONCE YOU'VE GOT AN OBJECTIVE, WHAT DO YOU DO WITH IT?

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Perhaps one of the most difficult aspects of instructional development (ID) is getting on with it. A quick review of systems of ID reveals that they often seem to be a series of discrete steps. Certainly, systematic approaches to ID involve, and are advertised as being, a series of interrelated steps. Still, one has the distinct impression when reading the manuals on ID (when they can be found) that within the ID process once one activity is completed, you know what the next activity is to be, but you aren't entirely sure how to get to it and how to use the output of the last step as input to the next. This is no more true than in that vital phase that comes between the development of objectives and the testing of the first draft of the instructional material.

The area between the production of well stated objectives and developed instructional materials is, generally speaking, a wasteland as far as procedures are concerned. The wasteland is broken only by a few general statements of principles such as "teach one objective at a time", "have frequent review", "allow for student practice", "provide feedback", etc. What is needed in this area is a systematic method for identifying classes of objectives that can be differentiated by the instructional strategies which are most appropriate to them. That is, there must be, at some level of generality, a finite number of classes of objectives and there must be a finite number of strategies appropriate to each of these classes.

This paper outlines some relatively simple, practical guidelines that can be used to go from objectives to the selection and specification of instructional strategies. The strategies specified in this system are particular and detailed and allow instructional developers to move directly to the production of instructional displays. The procedures to be described in this paper involve four steps: the classification of objectives, the matching of objective classes with optimal strategies, the specification of the components of strategies to be used, and the development and integration of the specific components. The objectives classification, strategy selection, and specification models described in this paper are extensions, modifications, and, in many cases, simplifications of the work of Merrill and Wood (1975), and are the product of many psychologists and technologists working at Courseware, Inc. The extensions, modifications, and simplifications have been made over a considerable length of time, have resulted from a need to do ID in a broad range of real-world settings, and have produced two books (Coldeway and Faust, 1976; Hughes, Faust, and Coldeway, 1976) which detail and teach many of the procedures to be presented here.

First, let us discuss the concept of an instructional strategy. Instructional strategies can be described at two levels. At one level (a micro level) an instructional strategy is a sequence of instructional events that leads to the accomplishment of a single objective. At another level (a macro level) an instructional strategy can be said to be the sequence of instructional events that teaches a group or set of instructional objectives. The instructional strategies discussed in this paper are micro strategies which are directed at the accomplishment of a single objective. Detailed guidance and specification for macro strategies is also possible, but is not within the scope of this article.

An instructional strategy is composed of a series of displays which are presented to students and from which he is supposed to learn. The displays may take many forms. The word "display" here is meant to be a very general term and to include symbols, words and pictures, objects, and events. For example, the displays discussed here may involve presenting words or pictures on pages, or words spoken in front of a group or presented via computer, or even objects to be manipulated or situations in which a student must act. Taken together, the specific types of displays used in a given situation, their sequence, and the relationship among displays make up instructional strategies. This means that by specifying the type of displays to be used, their sequence, their relationship to one another, and how students get from one display to another we can, in fact, specify an instructional strategy. A prescription like "give the student a definition, two examples, and then two practice items" is, in fact, a prescription for a primitive instructional strategy. Please note that a strategy could be specified without reference to content or delivery system. Decisions about these other facets of instruction can, in fact, be made independently from decisions about instructional strategy. But, how do we know which set of displays is best in a given situation?

The answer in this case, as in most cases when questions are asked in instructional situations, is "it depends." It depends upon the particular learning requirements of the instructional situation. These requirements can be identified by analyzing the instructional objective to be obtained. Objectives can be divided into a finite number of classes. Each class represents a particular set of learning requirements. Several systems have been proposed for classifying objectives (Gagné, 1970; Markle and Tieman, 1970; Merrill and Wood, 1975). This paper presents an admittedly over-simplified adaptation of these systems. In particular, it incorporates several elements from the Merrill and Wood and Markle and Tieman classification systems. The simplifications of these systems was made to accommodate instructional needs most often encountered in a wide variety of ID projects and is the result of considerable tryout and revision. The only distinction between classes of ob-

jectives that are made in this system are those which are needed to identify situations which require specific instructional strategies and for which strategies can be specified. This system has two advantages: it is easy to teach and it results in effective instruction which can be efficiently produced.

It should also be pointed out that not all objectives can be classified by this system. It considers only cognitive objectives and, thus, ignores affective and psychomotor objectives. It also does not treat what Merrill and Wood (1975) call rule-finding objectives. That is, those objectives that would be classed as involving the invention of new rules or very advanced problem-solving. These omissions are by design since objectives of these types are less frequent in most ID situations and since the objective of this system was to be as powerful, yet simple, as possible. The system being discussed can be augmented when other types of objectives are encountered.

It seems that most cognitive objectives can be classified on two dimensions: (1) the type of content they involve and (2) the behavior they require of students. The content dimension can be divided into four basic types (see Figure 1), depending upon the relationship between elements of the content.

Content placed in the FACT category involves one-to-one relationships between objectives, symbols, or events. For example, "π=3.14" is a fact. It is a relationship between the symbol and the number 3.14.

Content falling in the CONCEPT classification involves the relationship between a class name and set of objects, symbols, or events that share common characteristics and, therefore, are identified by that class name. For example, the term "improper fractions" is a class name referring to a set of fractions all of which are expressed as a larger number divided by a smaller number.

A RULE involves a change operation. That is, an operation which changes one set of objects, symbols, or events into another set of objects, symbols, or events. For example, the rule for determining the mean of a set of numbers can be expressed as $\Sigma X/n$. In determining the mean a set of symbols (numbers) are changed by adding them up and dividing the sum by the number of numbers in the original set. This "operation" produces a new symbol which we call "the mean."

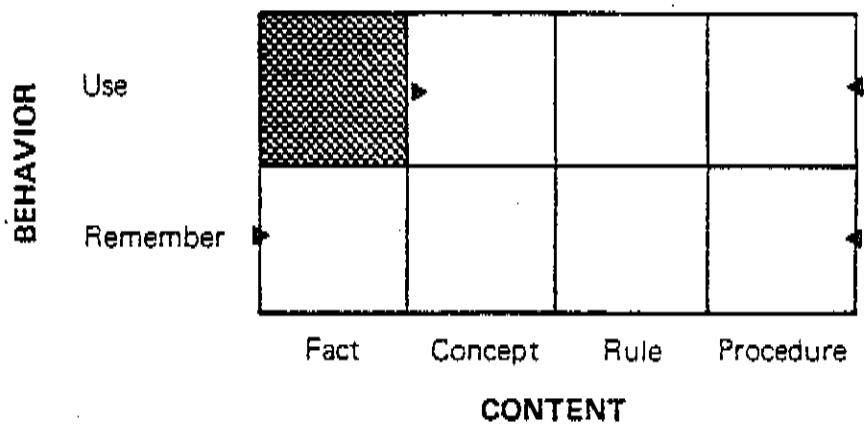


Figure 1. Content/Behavior Matrix

There are actually two types of rules which we have chosen to differentiate between and call RULES and PROCEDURES. Rules meet the requirements of the definition I have just presented, but can be further defined as involving a set of steps which make it possible to solve any of a class of problems and which should be demonstrated using a number of examples. Procedures, on the other hand, are designed to accomplish a specific task and need to be demonstrated in only one way. The recipe for Aunt Abigail's chili and the procedure for initializing a MACROMITE 007 computer are procedures in that they are designed to accomplish specific tasks and they need to be demonstrated in only one way.

Objectives can, using these definitions, be classified by the content they involve. They can also be differentiated by the behavior they require of students. Some objectives only require that students remember what they have learned. For example, when asked for the numerical value of π the student need only remember what he has read or been told: 3.14. Similarly, a student could be asked to state a definition, a rule, or a procedure. In all of these cases he need only repeat what he has read or been told. Objectives with these requirements are classified as remember level objectives.

Objectives which fall in the concept, rule, and procedure category of content can, however, also require students to use their knowledge under new conditions. For example, a student may be given several fractions which he has not seen before and be asked to identify all which are improper fractions. Thus, he is being asked to generalize his knowledge of improper fractions to new instances. A student may be asked to use the rule for finding a mean of a set of numbers. That is, he is given a previously unencountered set of numbers and is asked to find the mean. Similarly, a student can be asked to make some chili using Aunt Abigail's recipe or to actually initialize a MACROMITE 007 computer. All of these levels of behavior would be classified in the USE category.

Using the distinctions of content and behavior we have just described, the instructional designer can place each of the objectives in his program in the appropriate space in the 2x4 objectives matrix. Each cell of this matrix has one or more specific instructional strategies associated with it. The particular strategies that have been developed for this system are the result of the distillation of the research literature, specific research on the effectiveness of various instructional strategies, and years of experience in designing instructional programs. It so happens that all strategies follow a general model. That is, they have the same general types of components which are generally present in the same sequence and generally have the same relationship to one another. This general model is presented in Figure 2.

The model shows the relationship of what we will call lessons and segments of instruction. Segments are chunks of instruction intended to teach a single instructional objective. Lessons are made up of one or more segments that, when taken together, enable the learner to reach a more complicated objective. The model shows components that are used within segments. One of these components, the Introduction, is optional and therefore is indicated by the dotted line. Four components are generally used at the lesson level. Again, one of these, the Summary, is optional. A generally effective sequence is indicated by the arrows which lead from the Expected Learner Outcome for the lesson through the components for each segment to the lesson test.

The following definition refers to components in the model diagrammed in Figure 2.

**Introduction:** An Introduction is always provided for lessons and is seldom, but sometimes, used with segments. It may contain an advanced organizer, a rationale for the topic, or instructions to the learners on how to proceed. The purpose is to prepare the learner for the instruction and provide an overview of the topic being covered.

**Expected Learner Outcome:** The Expected Learner Outcome presents the instructional objective for the segment of instruction. We do not use the term "objective" to describe this component because the Expected Learner Outcome is not necessarily a complete formal objective with precise statements of actions, conditions, and standards. Complete objectives are certainly necessary for instructional developers. However, learners do not always need, nor will they always understand, complete statements of behavioral objectives. What learners do need is a simple, straightforward statement of what they will be expected to do after a lesson or segment. Statements of Expected Learner Outcomes generally use the action component of a behavioral objective. They do not generally include conditions and standards unless they are needed to make the statement clear to the learner.

**Generality:** The Generality (which may take the form of a fact statement, a definition, a rule, or a procedure) describes in a clear and concise way what must be learned in order to achieve the objective.

**Generality Help:** The help following the generality is included as a supplement to the generality. The Generality Help gives special methods for applying the generality or explanations of terms used in the generality which may not be understood by all learners.

**Instances:** The word "instance" is used to describe examples and nonexamples of concepts and rules, or demonstrations of procedures. They are crucial if learners are to learn how to use concepts, rules, or procedures.

**Instance Helps:** The helps associated with instances provide an important link between the generality and the instances. They are included to show the learner why a particular instance fits the generality (e.g., why an example meets the requirements of a concept definition, how a particular problem can be solved by a rule, or how a procedure can be used in a particular situation).

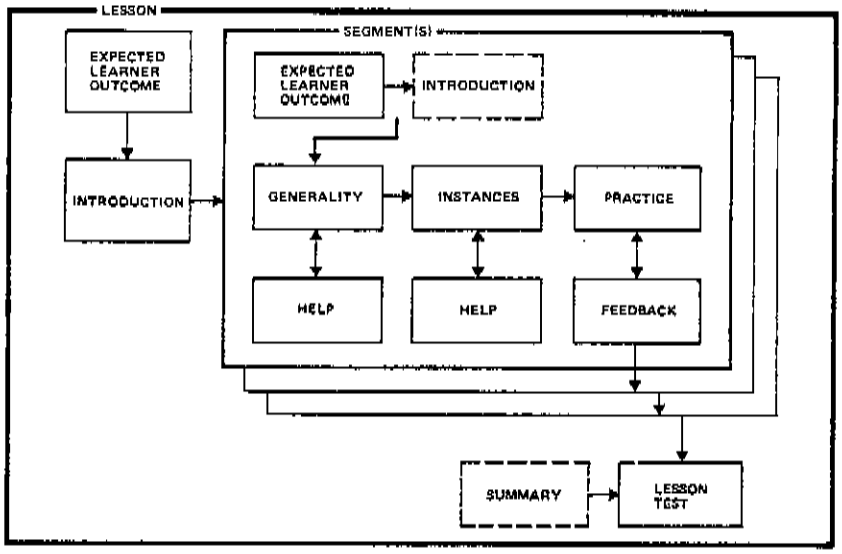


Figure 2. A General Model for Effective Instructional Strategies

**Practice:** Practice is included in every segment of instruction to give learners an opportunity to judge their own ability to meet the objective. Although the practice items require learners to show what they can remember or how well they can use concepts, rules, or procedures, they should not be considered a test. Practice is a diagnostic tool which helps the learner identify areas where her/his learning is not complete. Practice gives learners an opportunity to evaluate their mastery of the objective in a situation which requires the same behavior as that of the objective.

**Feedback:** Feedback provides the learner with the correct answer to a practice item and a description of how that answer should have been determined.

**Summary:** The Summary, typically used only after the last of a series of segments in a lesson, recaps the important points covered in the lesson. Summaries may just be short prose descriptions of the content or they may be longer and include a restatement of the generalities and other information.

**Lesson Test:** The Lesson Test is just that, a test. It provides information to both the learner and the instructor as to how the learner has performed on lesson objectives. It should contain test items which assess the behavior required in the lesson objective. It may also test performance on segment objectives. Feedback for tests is not provided after every item, but rather is provided at a later time after the test has been graded and its results analyzed.

The specific definition used for each component in a given instructional strategy is dependent upon the objectives classification. For example, the generality in a Remember/Fact objective is a statement of the fact itself. For a concept, at either the remember or use level behavior, the generality is a definition. There are no instances in the strategy for Remember/Fact objectives. For Remember/Concept objectives, however, a single, most representative example is used to fill the instance requirement. Whereas, in a Use/Concept strategy the instance set is more extensive and must include a representative sample of examples and nonexamples sufficient to teach students to make the necessary discriminations.

The helps for generalities differ from strategy to strategy in that remember level generality helps focus on providing memory aids (mnemonics, graphic representations, etc.), while use level generality helps focus on helping the student understand and apply the generality. For example, the help for a Use/Concept objective would provide a model for search strategy for identifying critical characteristics in instances, or it could provide explanations of terms used in the definition. Generality helps for Use/Rule objectives may present an algorithm or flow diagram or mistakes to watch for.

For remember level objectives, the feedback is generally directed as presenting the correct answer. But, for use level objectives it will present the correct answer and detail the process the student should have used to arrive at that answer. A discussion and complete definition of all of the seven basic strategies and their

components that follow from the objectives classification system is beyond the scope of the present paper. However, the basic strategy models for each of the objectives classes are presented in Figures 3 through 9.

The specification for each component of each strategy may be given at several levels of detail. Authors can be trained to various levels of skills, depending upon the level of detail they are taught. The level of those details taught can be varied, depending upon the amount of training time available. Authors trained at one level can increase their knowledge and skill through on-the-job training aided by instructional psychologists and/or detailed referenced guides which provide further detail on component instruction.

The critical point to be made here is that an objectives classification system which leads to specific strategy specifications (including the identification of components and their sequence of presentation) and which is accomplished by detailed guidelines for the production of each of the components in each of the strategies makes it possible for authors to move quickly from objectives to production of skeleton instruction. Once components are produced and sequenced they may be turned over to writers, film-makers, artists, or lay-out specialists who can produce the finished instructional material.

The components that have been described are the components which are necessary no matter what instructional media is being used. The only additional work that needs to be done to convert an instructional strategy from one media to another is to apply the skills that are appropriate to that media. For example, to convert a workbook to a tape-slide presentation the skills of the graphic artists and scriptwriter are needed. However, the basic components and their sequence will be the same. This method insures that the critical, instructionally relevant components and relationships will be maintained while the materials are tailored to insure that they are appealing to students.

Making the road between instructional objectives and instructional materials an easy one to follow is the main goal of the system described in this paper. It has been found that the more precision and clarity given to the procedures for following this road the more productive instructional teams can be. Statements of general principal can be of value, but

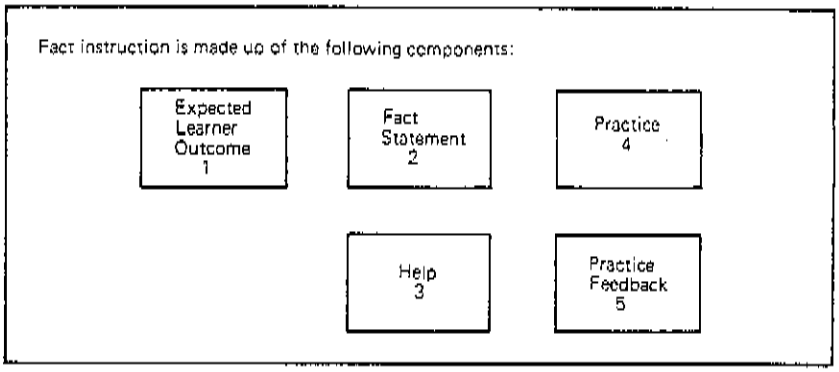


Figure 3. The Instructional Components To Be Used For Teaching Remember/Fact

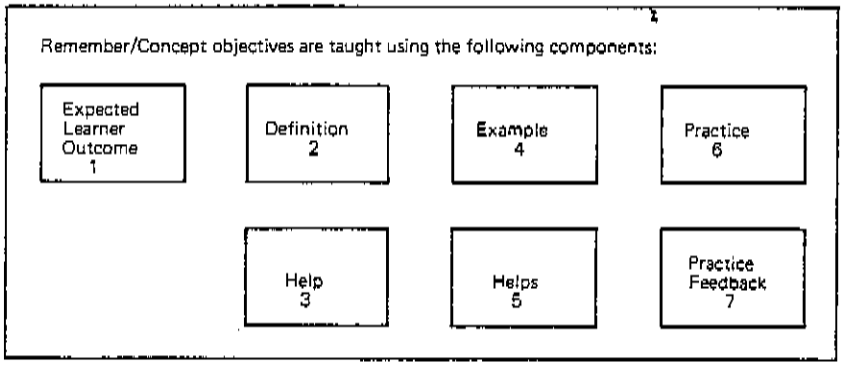


Figure 4. The Instructional Components To Be Used For Teaching Remember/Concept

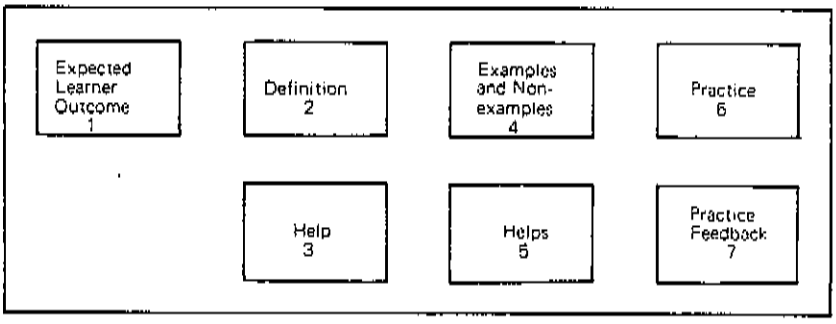


Figure 5. The Instructional Components To Be Used For Teaching Use/Concept

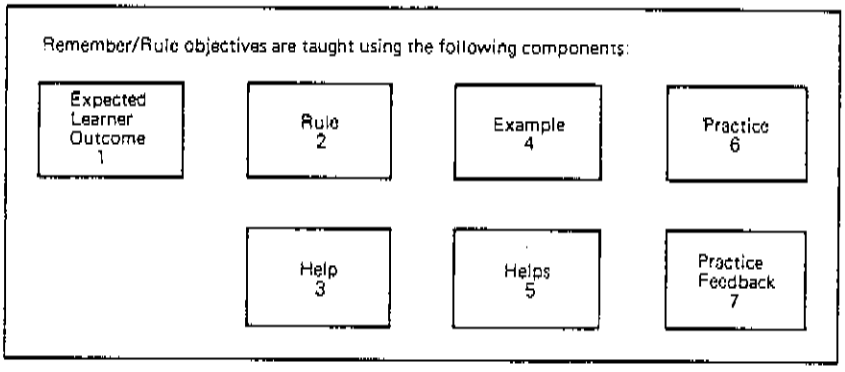


Figure 6. The Instructional Components To Be Used For Teaching Remember/Rule

statements of specific procedures are immensely more valuable. One of the great benefits of this detailed, specific system for selecting from a finite number of instructional strategies is that it makes it very easy for the instructional developer to "get on with the ID process." Each objective and each component of instruction is *not* treated as a completely new challenge requiring the invention of a completely new strategy. The efficiencies generated by this one factor alone have proven to be considerable. Such efficiencies produce several major benefits. One of which is that they make time available which may be used to analyze instructional settings and review instructional materials so that one can identify those cases in which it is appropriate to break the rules set down in the procedure. It also provides the time that is needed to come up with good, sound solutions to those problems which do not fit within the structure of the system being used.

### References


Coldway, D. O. and Faust, G. W., *Instructional Components and Strategies.* San Diego, California, Courseware, Inc., 1976.

Gagné, R. D., *The Conditions of Learning.* New York; Holt, Reinhard and Winston, 1970.

Hughes, J. A., Faust, G. W., and Coldway, D. O. *Classifying Instructional Objectives.* San Diego, California, Courseware, Inc., 1976.

Markle, S. and Tieman, P., "Behavioral Analysis of Cognitive Content". 1970.

Merrill, M. D. and Wood, N. D., *Instructional Strategies: A Preliminary Taxonomy.* Orem, Utah; Brigham Young University and Courseware, Inc., 1975.


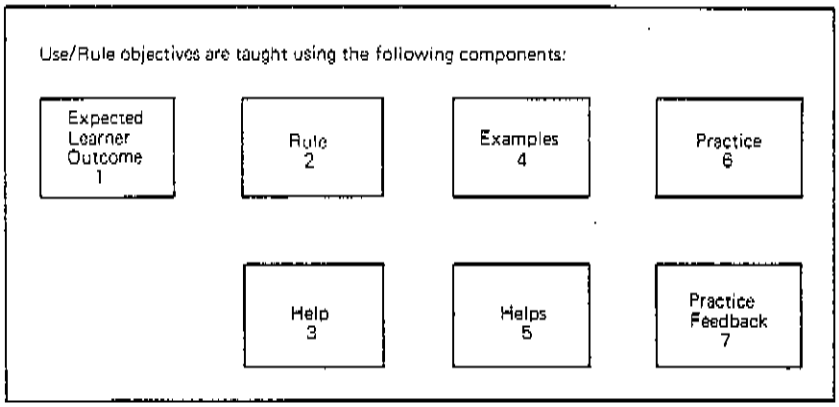


Figure 7. The Instructional Components To Be Used For Teaching Use/Rule

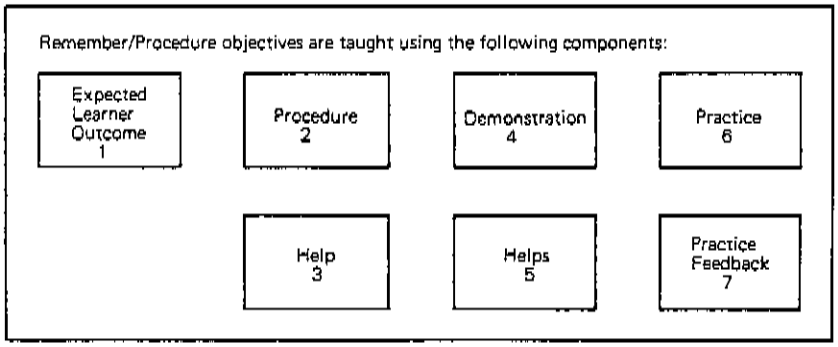


Figure 8. The Instructional Components To Be Used For Teaching Remember/Procedure

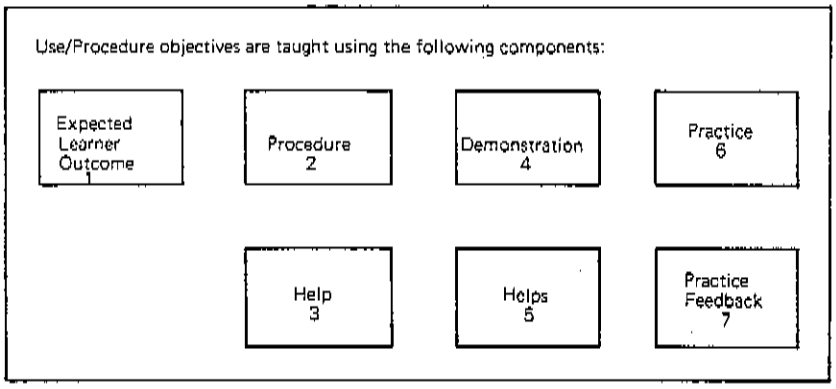


Figure 9. The Instructional Components To Be Used For Teaching Use/Procedure