

Chapter 5

Integrative Goals for Instructional Design⁷

Robert M. Gagné and M. David Merrill

In 1987 Utah State University hosted a dialogue between Robert Gagné and David Merrill. The notion of enterprise schema and integrated goals emerged from these discussions. The idea was subsequently expanded and published in 1990. It responds in part to those in the field who have criticized the vestiges of behaviorism in much design practice, specifically the continued tendency in some quarters to emphasize instruction directed toward fragmented factual information. This article not only shows the relationships between the work of Gagné and Merrill, but it provides the last major addition to Gagné's explanation of his taxonomy of learning outcomes. Moreover, it reinforces Gagné's lifelong concern with transfer of training that has been evident in each of the five articles presented here.



One of the signal accomplishments of contemporary doctrine on the design of instruction, whether considered as model or theory (Reigeluth, 1983), is the idea that design begins with the identification of the goals of learning. Goals are sometimes conceived as objectives reflecting human performance, and sometimes as learning outcomes implying the acquired capabilities for those performances. In either sense, the goals which are projected to result from learning are presumed to be the starting point of the process of instructional design. Having distinguished these goals, the designer proceeds by iteratively posing and answering the question, "What is it that must be learned for the learner to reach these goals?" In this article, we deal with the requirements for design when the instructional goal must be a combination of several individual objectives that are to be integrated into a comprehensive purposeful activity (such as baking a cake, writing a letter).

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Regardless of differences in terminology and style, there are many common features to models of instructional design. The procedure of working backwards from goals to the requirements of instructional events is one of the most effective and widely employed techniques. This approach requires the initial identification of a category of instructional objectives, such as *verbal information, intellectual skill, cognitive strategies* (Gagné, 1985) or alternatively the remembering, using, or finding of *facts, concepts, procedures, or principles* (Merrill, 1987). From each of the single categories of learning outcome, the designer is able to analyze and prescribe the instructional conditions necessary for effective learning.

In using this procedure, the designer is working with single objectives and must therefore plan instruction for content that is circumscribed in coverage at the level of an individual topic, or at most a single lesson. For example, the topic of legislative powers vested in Congress (Article 1, Section 1) may be identified as *verbal information* in a lesson on the U. S. Constitution and its instruction planned accordingly. The algebraic addition of polynomial expressions might be the subject of a lesson consisting of the learning of one or more rules. The derivation of instructional design procedures from such objectives as these is usually straightforward and clear.

When instruction is considered in the more comprehensive sense of a module, section, or course, it becomes apparent that *multiple objectives* commonly occur. A student seldom learns about the legislative powers vested in Congress in isolation. Usually the module or section of the course is concerned with the way Congress operates to make laws. Not only are new facts introduced, but new concepts must be acquired, and new principles of government understood. Polynomial expressions must be seen to be subject not only to the procedure of addition, but also to those of decomposition, and in the context of real world problems for which these mathematical operations provide a solution tool (Brown, Collins, & Duguid, 1989). A lesson on as familiar a subject as plant growth may readily involve verbal information concerning plant names and varieties, the concept of plant parts, and some rules about plant growth. When the comprehensiveness of topics reaches a level such as often occurs in practice, instructional design is forced to deal with multiple objectives and the relationship among these objectives.

Planning instruction for more than one objective may sometimes be simply a matter of designing instructional procedures for one after another in sequence. This is particularly evident in topics composed primarily of intellectual skills, in which a lesson such as addition of simple fractions may be followed by a lesson on improper fractions, and followed again by one on simplification of fractions. Such a linear sequence of single objective lessons may not be so evidently satisfactory for multiple objectives, however,

since it fails to assist the learner in the acquisition of interrelationships among the various component objectives. This is the case, for example, when one is dealing with content like the legislative powers of Congress, which contains many facts, new concepts, and novel rules.

Article 1, Section 1 states: "All legislative powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives." For some learners, this statement might be dealt with simply as a piece of verbal information. But such a single objective cannot be adequately employed to describe what needs to be learned by the typical high-school student in a course on American government. Such a student, in order to acquire the understanding that is desired, must at the very least either retrieve or newly learn the concepts named by the words of the sentence: *legislative, powers, vested, Congress*, and so forth. These several objectives could conceivably be reflected in instruction in a serial, one-at-a-time fashion. Yet there is room for doubt that this approach would be the best that could be devised. Instead, it seems possible that some integration of these objectives might be conceived as a way of expressing a combined goal. Such an integration would not replace the multiple objectives that make up a module or course goal, but instead would actually incorporate the several different objectives.

Integrating Multiple Objectives

In seeking a way of dealing with multiple objectives other than serially, we perceive a need for treating human performance at a somewhat higher level of abstraction than is usual in most instructional design models. People may learn facts, but what for? They may learn new concepts, but how are these to function in the context of the larger task that they as human individuals do? Learners can acquire procedures, but in the context of what larger scale activity? Performances may be described, not simply as steps in a sequence but also in terms of their function and purpose in meeting the goal of an activity as a whole.

We propose that the integration of multiple objectives may usefully be conceived in terms of the more comprehensive activity in which the human performer is engaged, which we call an *enterprise*. An *enterprise* is a purposive activity that may depend for its execution on some combination of verbal information, intellectual skills, and cognitive strategies, all related by their involvement in the common goal. A task for the instructional designer is to identify the goal of a targeted enterprise along with its component skills and knowledges, and then to design instruction that enables the student to acquire the capability of achieving this integrated outcome. Thus, learners may acquire a fact or a concept that enables them to distinguish a given object or set of

objects. Or this fact or concept may be part of a goal that enables them to communicate the stages of some process. Or this fact or concept may be part of a goal that enables them to predict the next stage in a process, to invent a new device, or discover a new process. Each of these is a different enterprise, and each is accordingly represented by a different integrated goal. Each such enterprise requires a different kind of integration of the multiple objectives that support it.

The notion of integrated learning objectives as goals for enterprises implies that this conceptual focus should be given full consideration in instructional design. In addition to the individual capabilities, which result from learning a multiple-objective lesson, provision should also be made for a cognitive representation of the enterprise to which these objectives are related. We propose that different *integrated goals* of various enterprises are represented in memory as different kinds of cognitive structures. Some would call these structures frames (Minsky, 1986) while others would call them *mental models* (Gentner & Stevens, 1983). The notion of *schema* (Rumelhart & Norman, 1978) refers to a cognitive structure that contains blanks or slots to be filled in, as in an application form. Brewer (1987) describes schemas as knowledge structures that are composed of previously acquired generic information. In so far as the enterprise schema embodies the idea of learning transfer, the notion of *work model* (Bunderson, Gibbons, Olsen, & Kearsley, 1981) seems appropriate. In our view, each kind of enterprise is represented in memory by a schema that reflects the purpose or goal of the enterprise category, the various knowledges and skills required to engage in the enterprise, and a scenario which indicates when and how each piece of knowledge or skill is required by the enterprise. There are different kinds of enterprise schemas, just as there are different kinds of application forms. Each such schema contains slots to be filled by the details of any specific enterprise.

Integrative goals, then, are the aims of human enterprises that embody and integrate multiple objectives. The general form of schemas representing such goals is diagrammed in Figure 5.1.

As the figure shows, the *enterprise schema* is expected to contain a number of knowledge and skill constituents which become associated in the service of the integrated goal. These include verbal labels, connected-discourse forms of verbal information, intellectual skills, and cognitive strategies. Depending upon the enterprise, motor skills, and attitudes may also be involved. The integrative goal itself is incorporated in the schema as verbal knowledge. An important feature associated with the goal is the enterprise scenario that relates component activities (identifying concepts, carrying out procedures, etc.) to the goal. It is the scenario that provides a basis for the application of the constituent knowledge and skill in the enterprise performance. This

entire complex is what is meant by the enterprise schema.

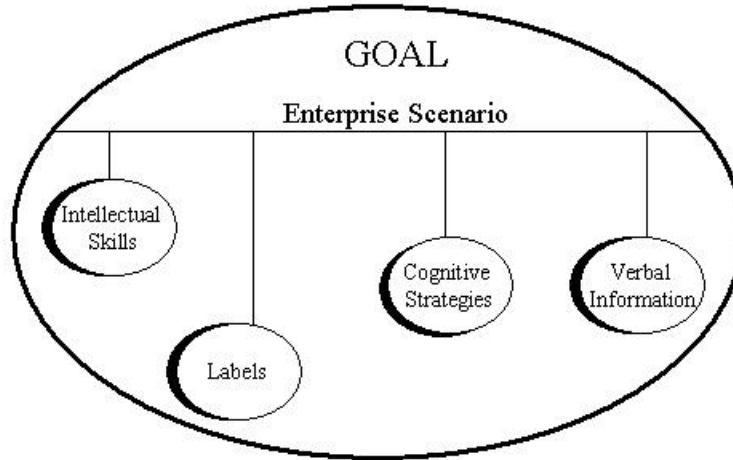


Figure 5.1 The General Form of an Enterprise Schema

Some related ideas in the writings of other investigators are worthy of note. In a recent paper, Mayer (1989) reviews evidence showing that, in a variety of process activities, students who were presented a mental model (similar to an enterprise schema) performed significantly better than students who were merely taught constituent knowledge and skill about the process. In still another formulation, Elaboration Theory (Reigeluth, 1987), the technique of presenting an epitome resembles that of communicating an enterprise schema to the student. However, an *epitome* is defined as an “overview containing the simplest and most fundamental ideas” (p. 248), and is ambiguous regarding the notion of integrating different kinds of knowledge and skill into a single unified schema.

The instructional designer makes provision for the enterprise goal in instruction by communicating the schema as verbal information. This includes, on the one hand, identification of the intellectual skills and verbal knowledge that relate to the goal, and on the other, the scenario that must be played out in conducting the enterprise. For example, instruction for the enterprise of troubleshooting a piece of complex electrical equipment would normally require conveying information about the current flow in the system as a whole, the identification of functioning (or malfunctioning) parts, and the

procedure for checking each of those parts. Problem-solving strategies relevant to troubleshooting represent another type of objective to be included. These individual knowledges and skills would become a part of the scenario that expresses the sequence and purpose of troubleshooting as checking the fault symptom, finding a malfunctioning part, and re-placing it.

Categories of Integrative Goals

There appear to be several categories of integrative goals that are useful to distinguish as different kinds of enterprise schemas. Three of these will be identified here in terms of their goals. A following section will give an account of the several singular objectives that compose each of these schemas.

Denoting

An entity (thing, place, event) or class of entities may be denoted by giving its name, the class to which it belongs, and the function it serves. The denoting communication may also include identification of the parts of the entity, their locations, and functions. As an example, a hawser is denoted as a large rope (its class) for towing or moving a ship (its function). Denoting may also proceed to indicate parts, such as the hawser bend (used for connecting two hawsers) and a hawser clamp (a device for gripping a hawser). Entities other than objects may be denoted, such as persons, places, or events. Examples might be the U. S. Attorney General, the city of St. Louis, the 1988 baseball World Series. An enterprise of this sort is a part of many human occupations such as teaching, explaining, orienting, counseling, and giving directions.

Manifesting

Actions involving entities as actors or objects may be arranged in a series of steps leading to a particular result. Such a series is called a *process*, and it is this that is the object of a *manifesting* enterprise. Learners must gain knowledge of the steps in the process. A manifesting enterprise consists of making a process evident to other people (e.g., students, co-workers) by indicating its stages and their sequence. Manifesting a process implies going beyond employing a simple verbal communication; it may require the use of pictures or props, as is commonly done in a demonstration. An example of manifesting a process occurs when a student can indicate the stages in the life cycle of an insect and can show how these stages vary under different environmental conditions.

Discovering

The enterprise of discovering reveals (to observers) a previously unknown novel entity or process. Often, entities and the procedures for manipulating them are inventions. One of the most creative types of enterprise involves the capability to design or *discover* a novel

entity or procedure. For example, to remove tight covers from jars, a learner might discover the design of an object that grips the cover tightly, making possible its unscrewing from the jar. Alternatively, a learner might discover a procedure that would cause the cover to loosen its grip on the jar by metal expansion. As another example, having knowledge of control mechanisms in mechanical systems, a learner may discover a hypothesis about biological control mechanisms which trigger phases of the life cycle of insects.

Integrative Goals and Single Objective Categories

Integrative goals are represented in enterprise schemas that incorporate multiple objectives. The several different singular objectives described by Gagne (1985) or by Merrill (1987) become integrated in one or another enterprise schema. Integrative goals are conceived as incorporating, not as supplanting, the various single types of instructional outcomes (facts, concepts, rules, strategies). Enterprise schemas may be seen as building upon one or more of these learning out-comes, in the sense that the latter are constituent parts of the more complex activity. The various kinds of single objectives embodied in enterprise schemas are shown in Figure 5.1.

Denoting

As an integrative goal, denoting includes the intellectual skills of *concept identification* (for both concrete and defined concepts) and also the verbal information of *labeling*. A concrete concept is said to have been learned when the learner can point to an instance of the concept and can distinguish an instance from non-instance. The operation of "pointing," however, may be accomplished by stating a name or label, when it can be assumed that this is firmly associated with the concept. Since the integrative goal of denoting includes communicating to others, both the label and the concept itself must be known and exhibited in the learner's performance. When defined concepts are involved in denoting an entity, the learner gives evidence of attainment by demonstrating the component concepts of the definition and their relationships. This may mean showing the use of a procedure described by the definition: for example, a circle is "the locus of points equidistant from a given point." In communicating such a concept to others, the learner must first know and communicate the definition in verbal form. Thus, denoting a defined concept means demonstrating the relationships of the component concepts in the definition while naming them.

Notice, however, that denoting does not mean simply stating the definition; the latter would be the case if the goal were the single objective of stating verbal information. We realize that the denoting of a defined concept is sometimes tested in practice by requiring the learner to "state the definition." Although such a procedure is often impelled

by considerations of convenience and expense, it is one that puts validity at risk. The intention of testing should be to assess the enterprise of denoting, whereas mere verbal knowledge of a definition should be avoided.

Manifesting

Making a sequence of events or a process evident to other people by “showing” constitutes the enterprise called manifesting. A procedure known to the individual may be shown to others, using verbal labels to identify key points in the performance. Or, the learner may describe a procedure that exists externally, as opposed to one that is executed personally. The sequence of stages engaged in by a leaf as it changes color in autumn has the form of a procedure. Since it is what a person observes, rather than does, it is called a process. Showing the process typically involves more than a verbal description. Often it requires picturing, diagramming, and demonstrating. The several single objectives comprising this enterprise include the intellectual skill of following a procedure and the constituent skills of identifying the concepts of leaf structure.

Discovering

The integrative goal of discovering requires problem solving in which the learner finds, in a cognitive sense, a novel process. A botanist, for example, may discover a new way of explaining the changing color of leaves. This problem-solving activity requires that the learner have available some constituent learnings (Gagne, 1985), including particularly those concepts and rules involved in the process of color change. In addition, one or more cognitive strategies of problem solving applicable to botanical structure might be included in the schema.

Discovering often implies relating familiar entities to the goal of an enterprise in new ways. For example, when confronted with Maier’s (1931) two-string problem, some subjects were able to use a pair of pliers as a weight, thus enabling a string to be swung as a pendulum so that it could be caught by a person standing in a particular position. Solving such a problem evidently requires an enterprise schema that includes knowledge of strings, of pliers and their weight, of the characteristics of pendulums, and of some rules of pendulum motion. Stated in general terms, the discovering schema includes a number of intellectual skills (concepts, rules), as well as verbal scenarios relating familiar entities to the goal of the enterprise.

The Enterprise Scenario in Learning Transfer

Verbal information in the form of an enterprise scenario is typically a prominent part of an enterprise schema (Figure 5.1). It is this declarative knowledge that relates particular singular objectives that compose the expected behavior to the purposive activity that is

the enterprise. The enterprise scenario “tells” the learners that the concept they are identifying, or the procedure they are following, is actually an essential part of a purposeful enterprise. For example, an enterprise scenario may remind students of arithmetic that they are going to encounter future situations requiring them to perform mental subtraction in order to verify the change from a purchase made with a paper-money bill of fixed value. Or, an enterprise scenario may help a student of physics to bring to mind the relation between the practice of electric heating and the cost of electric power. The enterprise schema is likely to be a factor of considerable prominence in the mediation of transfer of learning from one task to another, or from a learning task to a later performance. A number of recent articles on transfer have made a similar suggestion (Brooks & Dansereau, 1987; Gick & Holyoak, 1987; Gray & Orasanu, 1987). As contrasted with factors pertaining to the quality of learning content such as amount and variety of practice, the enterprise frame is a metacognitive feature. The implication it carries for instructional design, therefore, is this: To ensure transfer from training to the job, provision must be made for learner acquisition of an enterprise schema in addition to the specific knowledges and skills that the performance requires. The enterprise scenario of this schema is one that relates each component of knowledge and skill to the goal, and thus to the enterprise that embodies this goal.

Discussion

We perceive a requirement for instructional design to provide for the integration of multiple objectives as they occur in lessons and courses. In addition to the various single objectives described by Gagné (1985) and by Merrill (1987), design theory should encompass instruction in *integrative goals*. Such goals do not supplant single objectives such as labels, facts, concepts, and rules; rather, they incorporate them.

We propose that integrative goals are represented in cognitive space by enterprise schemas whose focal integrating concept is the integrative goal. Associated with the integrative goal is an enterprise scenario and the various items of verbal knowledge, intellectual skills, and cognitive strategies that must be learned in order to support the required performances. These performances are brought together in a purposeful activity known as enterprise. Examples of enterprises are: operating X equipment, teaching a science topic, counseling someone about applying for a job, giving directions about how to use a weedcutter. The schema representing the goal of the enterprise and including the goal-related knowledges and skills is an enterprise schema.

Instructional design must specify the conditions for acquisition of an enterprise schema. Besides constituent knowledges and skills, this schema includes a scenario of declarative knowledge relating these skills to the goal. This scenario serves to remind

the learner of the purpose for learning the various facts and skills—the relations they have with the enterprise to be accomplished. In view of these characteristics, the enterprise schema is seen as a factor of substantial positive influence in transfer of training.

We anticipate that a learning requirements analysis which focuses on enterprises will also lead to significant changes in the design of instructional strategies. Whereas current instructional design methodology focuses on components such as generalities and examples, which are geared for promoting acquisition of single objectives such as concepts or procedures, a consideration of enterprises as integrated wholes may lead to a future focus on more holistic student interactions or “transactions” (see Merrill, Li, & Jones, 1990a, 1990b). The development of instructional strategy implications of integrated goal enterprises is not further pursued within the present paper.

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