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STRATÉGIES PÉDAGOGIQUES

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A FRAMEWORK FOR INSTRUCTIONAL STRATEGY DESIGN

CHAPTER

7

CHAPTER OBJECTIVES

At the conclusion of this chapter, you should be able to do the following:

- Describe the function of the instructional strategy stage in the instructional design process.
- Recognize and explain examples of the three categories of instructional strategies: organizational, delivery, and management strategies.
- List, describe, and identify examples of the expanded instructional events.
- Describe how a typical lesson proceeds from the standpoint of instructional events.
- Explain the differences between supplantive and generative organizational strategies and the advantages and disadvantages of each.
- Given a description of a strategy, identify it as more supplantive or more generative.
- Given a description of context, task, and learners, specify whether you would choose a more supplantive or more generative strategy, and justify your answer.

AN OVERVIEW OF INSTRUCTIONAL STRATEGY CONCERNS IN INSTRUCTIONAL DESIGN

Try to imagine this lesson: It is in the form of a printed booklet, and it begins with a graphic of a cartoon character puzzling over a sentence with nonparallel sentence construction:

To grow to the correct size, swallow the contents of the bottle marked "Smell Me," dancing in a circle, and write your name in the air three times.

The next paragraph tells students that the lesson is on the parallel construction of sentences and paragraphs and that nonparallel structure is one of the most common problems for adult writers. This paragraph also states that nonparallel structure greatly confuses readers. Next, the lesson reviews the concepts of "verb," "participle," "verb tense," "infinitive," "noun," and "adverb." The following page displays the principle that parallel construction requires that each element of information presented in a series should be in a parallel form of a clause or phrase. Subsequent pages contain examples of the correct application of the principle with textual information explaining why the principle is correctly applied. In addition, violations of the principle are shown with textual and graphic information explaining why the writing sample is incorrect and showing how to correct it. Then learners are presented with sentences and paragraphs and asked to tell whether they are parallel or nonparallel. When learners correctly identify nonparallel structure, they are asked to edit the sentence so that it is parallel. Feedback follows, which tells learners several correct methods of editing.

This description outlines the instructional strategy of a lesson with a relational rule (a principle) objective. Notice that the lesson is carefully organized to provide a high level of support for learners' cognitive processes of attention, encoding, and retrieval of information. Other lessons might be designed to provide much less instructional support, requiring learners to engage their own cognitive strategies in structuring information so that they can learn from it. Both lessons are the products of carefully designed instruction based upon context, task, and learner analysis. Both lessons could be effective. Both lessons could be designed within the constructivist philosophy. Instructional support may legitimately be (1) supplied by the instruction, (2) supplied by the learner, or (3) shared between the learner and the instruction. In this chapter we will present information and practice on designing the organizational elements of an instructional strategy. Then, we will present a model and principles for making decisions regarding optimal instructional support in a learning situation.

According to Reigeluth (1983) instructional strategies are composed of three different aspects: organizational strategy characteristics, delivery strategy characteristics, and management strategy characteristics. **Organizational strategy characteristics** refer to how instruction will be sequenced, what particular content will be presented, and how this content will be presented. **Delivery strategy characteristics** deal with what instructional medium will be used and how learners will be grouped. **Management strategy** characteristics include the scheduling and allocation of resources to implement the instruction that is organized and delivered as planned within the previous two strategy aspects. These strategies can be planned at the course or unit (macro) level or at the lesson (micro) level. By *lesson* we generally mean the amount of instruction that can typically be completed in one meeting (although *lessons* may also extend across two or three days, if little time is spent each day).

In this chapter we will concentrate on *organizational strategy* concerns that apply at the lesson level. Chapters 8 to 15 will focus on how to design an organizational strategy for each of the major types of learning outcomes: declarative knowledge, concepts, procedures, principles, problem solving, cognitive strategies, psychomotor skills, and attitudes. Although we have sequenced the chapters that present these strategies beginning with less complex tasks moving to more complex ones, a good approach to reading can be to begin with problem solving (Chapter 12) as it is the "highest" order or most complex form of learning, since that is the ultimate goal to which much instruction leads. Chapter 16 discusses macro-level design—design issues at larger levels, such as entire courses. Media and learner groupings, what Reigeluth called "delivery strategies" are treated in an online chapter in the Web-based Learning Resources for this text. Chapter 18 discusses management strategies as well as other management-related concerns of interest to instructional designers.

EXERCISES A

Following are descriptions of designers' activities. Identify the activity that the designer is preparing: organizational strategy (O), delivery strategy (D), or management strategy (M).

_____ **1.** Designer determines that practice questions will be completed in groups of five students.

_____ **2.** Designer plans the clustering and sequence of the objectives for the lesson.

_____ **3.** Designer writes an instructor's guide that suggests the scheduling of the unit across six weeks.

_____ **4.** Designer determines that a lesson will be mediated with an instructor and print-based materials.

_____ **5.** Designer lists in the teacher's manual the materials, supplies, and equipment that will be required for the course.

_____ **6.** Designer decides that the lesson will follow an inquiry strategy.

_____ **7.** Designer determines what will occur during each of the events of instruction.

LESSON-LEVEL ORGANIZATIONAL STRATEGIES

The predominant decisions that must be made at the lesson level are organizational strategy decisions: What content should be presented? How should this content be presented? What sequence should the instruction follow?

To introduce these aspects of instructional strategy, we would like to outline in very general and simple terms what psychologists believe to happen cognitively when students learn. These mental activities may occur at either conscious or unconscious levels. (You may remember this sequence of learning as it was portrayed in Chapter 2.)

First, students are immersed in a plethora of sensory inputs—sounds, sights, tactile stimuli, odors, and tastes. For learning to occur, students must choose to attend to those stimuli in the learning environment that are related to the learning task and instruction and to ignore competing stimuli, such as the band practicing outside nearby. This process is called *selective perception*. Following perception, information is momentarily stored in working memory. Next, students "take in" the information in the instruction, using things they already know to help them understand the new information. They interpret this new information based on the related content knowledge, values, beliefs, and strategies that they already have available in long-term memory. During this process of relating what they already know to what is new, much of the new information is stored (encoded) into long-term memory, adding to or modifying what students already know. Either immediately or later, students may retrieve from memory their new learning to answer questions, solve problems, or understand yet more new information.

The organizational strategy the designer selects should facilitate these mental operations. Instructional and cognitive psychologists have researched extensively what the characteristics of organizational instructional strategies should be. As mentioned previously, these characteristics may vary according to the type of goal (e.g., declarative knowledge, concepts, and so on). However, there are some general characteristics of an organizational strategy that seem to facilitate learning, whatever the objective. One of these characteristics is that the organization of a lesson should generally follow this pattern:

- Introduction.
- Body.
- Conclusion.
- Assessment.

Sometimes assessment is not included in an individual lesson but is delayed until a number of goals across several lessons can be assessed at one time. However, the other three sections of a lesson are commonly included in most instructional theorists' lists of the episodes that comprise a lesson organization. What should be included in the introduction, body, assessment, and conclusion? R. Gagné (1972) has suggested that lessons include nine **events of instruction:**

1. Gaining attention.
2. Informing the learner of the objective.
3. Stimulating recall of prerequisite learning.
4. Presenting stimulus materials.
5. Providing learning guidance.
6. Eliciting performance.
7. Providing feedback.
8. Assessing performance.
9. Enhancing retention and transfer.

Traditionally, instruction in training environments, such as military training, has included the following events:

1. Gain attention.
2. Promote motivation.
3. Give overview of lesson.
4. Explain and demonstrate knowledge.
5. Learner practice with supervision.
6. Evaluation.
7. Summary.
8. Remotivation.
9. Closure.

A limitation of these statements is that they make it appear that instruction is something that is *done* to the learner. There is an alternative way to view these events. The events may be viewed in terms of cognitive processes, and those processes can be performed by learners as well as by external provisions. Consideration of this alternative is at the heart of good strategy design: determination of the *locus of cognitive processing*. But before we look at different possible loci of cognitive processing, let's look first at these processes themselves.

What are the key cognitive processing activities associated with learning? These activities fundamentally take place within the learner and are either *necessary* for learning, for example attending and processing information, or the activity is *substantially helpful* to learning, for example becoming oriented and using learning strategies. Definitions provided for these functions are informal in the interest of clarity:

Attending—being focused and aware of what you are working on

Goal—having an idea of what you would like to do

Motivation—having some good reason to do something, wanting to do it

Orientation—knowing where you are, physically, conceptually

Prior learning—being aware of and using what you already know that is related

Processing information—experiencing new stuff

Focusing attention—homing in on particular parts that are critical

Learning strategies—using things you know about how to learn

Practice—trying to do it yourself, with help as needed, to help you learn it

Feedback—knowing what you did right and wrong, how close you got to good

Consolidation—pulling it all together

Transfer—applying it somewhere else

Remotivation—realizing how having learned this will help you

Assessment—trying to do it yourself now that you've supposedly learned it

Feedback—finding out how well your know it, really

When we think of designing a learning environment, it helps to think carefully about the ways in which these cognitive functions will be accomplished. A particular learning environment may provide support or "scaffolding" for some processing and not others. Other instruction may provide more or less of this cognitive scaffolding.

Two general types of instructional strategy can be described based on the locus of cognitive processing can be *primarily generated* by learners (low scaffolding), *primarily supplied* by instruction (high scaffolding), or any place along the continuum between high and low scaffolding. **Scaffolding** is the cognitive processing support that the instruction provides the learners, allowing them to learn complex ideas that would be beyond their grasp if they depended solely on their own cognitive resources, selectively aiding the learners where needed (Greenfield, 1984). What we call the "expanded events of instruction" (see Figure 7.1) reflects these fundamental alternatives as well as a fully elaborated set of events.

Expanded Events of Instruction	
Generative . . . student generates	Supplantive . . . instruction supplies
Introduction	
Activate attention to activity	Gain attention to learning activity
Establish purpose	Inform learner of purpose
Arouse interest and motivation	Stimulate learner's attention/motivation
Preview learning activity	Provide overview
Body	
Recall relevant prior knowledge	Stimulate recall of prior knowledge
Process information and examples	Present information and examples
Focus attention	Gain and direct attention
Employ learning strategies	Guide or prompt use of learning strategies
Practice	Provide for and guide practice
Evaluate feedback	Provide feedback
Conclusion	
Summarize and review	Provide summary and review
Transfer learning	Enhance transfer
Remotivate and cease	Provide remotivation and closure
Assessment	
Assess learning	Conduct assessment
Evaluate feedback	Provide feedback and remediation

Figure 7.1 The Expanded Events of Instruction

Let us look more closely at the expanded events of instruction. The first statement of each event, such as "Summarize and Review," is couched in a **student-generated** form that is described as the learner carrying the primary load for arranging the condition for learning. Although it may be more customary to think of supplied summaries ("Let's look at what we worked on today. . ."), it is often preferable for students to generate their own summaries ("I want each of you to write a short summary of what we worked with today."). Each event, not just summarizing, can be performed by the student, in which the student performs the primary information-processing called for by the event. The second statement of each event, those in parentheses, such as "Provide Summary and Review," is couched in terms of the instruction-supplied equivalent of the event. It is easy to imagine providing a summary—perhaps a teacher summarizing a lesson, a text chapter providing a summary at the end. For most events, it is easier for novice designers to imagine an instruction-supplied version, but as we will see later in this chapter and throughout this text, the student-generated form has many strengths. We have described the events in this fashion to ensure a balanced treatment of two fundamental approaches to instruction. We will have more to say about these two options, but for now, notice how each event is listed in both "generative" and "supplantive" forms.

We have stated the events in such a way that they can accommodate strategies in which the predominant source of control of processing may be the learner, as well as those situations in which guidance of processing is supplied by the instruction. It is very important for designers to consider that these events may actually be provided by the learner; some instruction may either stimulate learners to generate instructional events themselves or assume that learners will generate the instructional events within themselves. On the other hand, the events may be provided entirely by the instruction, or they may be treated as a shared responsibility between learner and instruction. The events describe instruction that is either more expository or more exploratory. Instruction at both ends of the generative–supplantive continuum can be learner-centered, active, and meaningful.

Lessons and Learning Environments

The overall structure of the events as we present them, with Introduction, Body, Conclusion, and Assessment, smack of a presentation or, at the least, a supplantive lesson of some sort rather than an open or exploratory learning environment. Because we are dealing with fifteen separate instructional events, some form of subdivision seems necessary, and all facilitation of learning, regardless of form has a beginning, middle, and end. Each of the fifteen events is applicable to learning environments, as well as to more supplantive forms of learning facilitation. Although we will generally use the term "lesson," we hope you realize that lessons are of all sorts and that the term "learning environment" may be always added or substituted. The heart and soul of strategy design lies in devising the best approach for given learners, contexts, and learning tasks. Fortunately, we have a wide variety of approaches to choose from—many ways to engage and support the cognitive processes that will facilitate learning. As you read the remainder of this text, you will see examples selected from this wide variety of approaches, with what we hope is more or less equal representation of supplantive and generative instruction or learning environments, and we will use the label "lesson" most of the time to denote them.

Although these instructional events have been synthesized from a review of research, if you observe master teachers, you often see them including these events whether or not they have heard of them. Teachers probably follow this pattern because they have discovered that students who experience these events tend to learn better than students who do not. The following sections review the expanded instructional events.

Introduction*

The introduction prepares learners for the lesson or learning experience, promoting their selective attention and bringing relevant memories to working memory, where the existing knowledge may aid in making new information understandable. In addition, the introduction establishes an expectancy for a particular learning goal, which aids the learners in employing strategies that will facilitate their learning. Although we typically imagine a presentation of some sort to be associated with the idea of an introduction, we want to ensure that you don't restrict your thinking to presentations or expository instruction. Regardless of the form of instruction, there will be a beginning for any given unit or lesson. Even when instruction is largely self-directed, the introduction and the events described within it are equally appropriate and needed, although they may be learner-generated.

Activate Attention (Gain Attention)

The purpose of this event is for learners to focus their attention on the learning task. As mentioned earlier, there are many stimuli in the learners' environment,

*If the term "Introduction" is too freighted with supplantive connotations for your taste, you may wish to add to it or replace it with "Initial Experiences."

so it is important that they attend to the part of the environment that is crucial to the learning task. We have all experienced this event when our teachers said, "Please open your textbooks to page 43 and look at question number 1." Older learners may be able to supply this event for themselves, but even they may benefit from direction to the portion of the learning task that should be attended to at any one time. This is one event that can be similar across all learning outcomes. For example, learners' activation of attention for a principle learning task is much the same as their activation of attention for verbal information learning. Many older learners are able to supply this event for themselves, without much prompting by the instruction. This event is often combined with the other events in the introduction.

Technology-based lessons may gain learners' attention in a number of ways: sounds, graphics (either static or animated), a change in the text on the screen, or verbal information that has high relevance to the learner or appears "attractive" because of its games, fantasy, or human interest aspects. For instance, a program might begin with a short segment of animated graphics to introduce a topic such as the relationship between wavelength and frequency. A major concern of designers is that they include enough stimulation in this event to draw students' attention to the learning task, but not so much stimulation that students' attention is directed only toward the attention-directing device and distracted from the learning task. In addition, designers should weigh the costs in production time and hardware requirements for highly complex presentations such as animated graphics. Just because technology can do some attractive things does not mean that it is always worthwhile to do so. Sometimes an alternative method that is less costly or time-consuming may be just as effective. (Chapter W-3 in the Learning Resources Web site contains more information on gaining and maintaining attention.)

Establish Purpose (Inform Learner of Instructional Purpose)

In some situations, learners can establish their own purposes for learning. These purposes may or may not be attainable within available instructional materials. Materials that can support multiple purposes, such as data resources on the World Wide Web, library resources, and other reference materials, may provide the best instruction in cases in which the specific goals of learners cannot be anticipated.

For instruction in which goals for learning have been determined, telling students what they are about to learn often facilitates learning. Knowing the learning goal can establish an expectancy in learners, arousing their interest and giving them a goal toward which to direct their cognitive energies. This event can be easily combined with the event of activating attention by stating the purpose of instruction in a way that attracts students' attention. Only rarely will designers express the learning goals to the learners in the same forms that were used when designing instruction. Goals that are stated in such formal terms may be too detailed, and they may actually interfere with students' learning. The designer may choose to state the goal in terms of a question or to demonstrate what the learner will be able to do after instruction, or the goal may be stated as informally as, "Today you will learn to. . . ."

In general, informing the learners of the purpose of the lesson allows them to "sit in the driver's seat" in the lesson. In informal, voluntary-attendance classes, this information allows the learner to choose whether to attend a particular meeting. In addition, having a clear idea of the purpose of the instruction allows learners to summon from long-term memory prior content and general world knowledge that may be appropriate to the task. It also allows them to recall learning strategies that they have found useful in learning similar kinds of goals. Furthermore, knowing the purpose and goal of the lesson allows learners to monitor their own learning and to actively seek help or clarification when they sense that they are not achieving the goal. There may be occasions when you decide not to inform the learner of the goal because of the strategy you are planning. For example, if you plan to use a discovery or inquiry approach in which the learners induce a principle or concept, you may choose not to reveal the concept or principle in advance. Omitting a statement of the learning goal is acceptable in such circumstances, so long as you ensure at the conclusion of instruction that learners are indeed aware of what they have learned.

The specification of the goal may vary somewhat from learning type to learning type. For example, for declarative knowledge goals, the instruction can specify exactly what the learner must be able to list, summarize, or recall. For intellectual skills goals, the instruction may simply describe kinds of problems learners will be able to solve, or it may demonstrate what learners will be able to do. A demonstration of the desired behavior may also be appropriate for a description of the goal of motor skills or attitude instruction.

It is not uncommon to design materials that are appropriate for multiple purposes. For example, many instructional databases may satisfy a variety of learner purposes. In such cases, the learner takes much of the responsibility in defining the instructional goals and selecting content and sequence that are appropriate to meet these purposes.

Arouse Interest and Motivation (Stimulate Learners' Attention/Motivation)

The critical aspect of this part of the introduction is that learners are cognizant of the importance and relevance of the lesson and/or encouraged to explore the personal relevance of the lesson. The information gained in the learner analysis at this point will be very beneficial in helping you determine why learning may be important to the learner. In courses for which attendance is voluntary, learners may have already made their own determinations as to why the course may be personally relevant, in which case the designer may only need to indicate how this particular lesson relates to the goal of the course. In cases in which learners' attendance is mandatory or a course is required, establishing the importance of the goal may be more of a challenge. In training environments for adults, indicating how attaining the lesson goals may relate to job responsibilities may be sufficient. In other adult learning situations and in many public school environments, the actual application of learning to everyday life may lie in the distant future or may even be unclear. In such cases, the designer may wish to stimulate curiosity in the goal through unusual anecdotes or graphics, or the designer may choose to present a challenging situation in which learning to achieve the goal will allow the learner to resolve the dilemma. (See Chapter W-3 in the Learning Resources Web site for a discussion of creating a motivating lesson.)

Preview Learning Activity (Provide Overview)

In this phase, the instruction itself may summarize the procedure or process that will be followed in the lesson, or the learners may choose or be encouraged to preview the lesson using whatever strategies they already possess. In some cases, learners might be planning the experiences that they believe will allow them to reach the goals of instruction, whether they selected them or "bought into" them.

A very supportive (highly supplantive) lesson might provide an overview that includes a brief content outline as well as an overview of the instructional approach to be used. For example, an instructor might say the following:

> In this lesson, we will first review the portions of the Constitution that allocate powers to the federal government and the state government. Then we will discuss how the contradictions in these two sections of the Constitution lead to an ambiguity that creates two camps of interpretation—loose versus strict constructivism. Finally, you will learn how to recognize positions that represent these two camps. You'll get to practice recognizing these two positions. Next week on our unit test, you'll be tested on your ability to recognize examples of these two diverse interpretations of the Constitution.

Learners engaged in experiential (highly generative) learning experiences will also benefit from knowing something about what they will be doing before they begin. The preview function might be supplied by an explanation (even in an otherwise generative environment) or learners might be guided into exploration that serves a preview function. In problem-based learning, setting the problem, assuring learners that their learning activities will be anchored to it, and supporting the learner in developing ownership of the problem are preview functions in that context. An exploratory, student-centered learning environment (Land & Hannafin, 2000) might look like this:

> *On the computer's display monitor, the image of a camera is provided with all of its operating controls in view, along with buttons which are labeled "exposure simulator," "depth of field simulator," "image sharpness simulator," and a button with the caricature of a rumple-shirted fellow loaded down with cameras. A heading at the top of the screen says "Mastering Photography." Although looking at the images on the screen and reflecting upon their function provides a preview (as would tentatively and experimentally clicking on the buttons to see what happens before deciding to actually begin working with the simulator), the designers provided a bit more support for the preview event: the learner does nothing to begin, after a reasonable wait, an additional button appears, labeled "Preview," and when clicked provides a brief explanation that you can learn to make better pictures with your digital camera by taking pictures on this simulated camera, manipulating settings, and comparing results, and that an artificial "expert," Mr. Gomer Lenscap is available to assist when needed.*

As we stated earlier, being aware of the instructional purpose helps the learners feel expectant and begin to summon knowledge and strategies that will help them achieve the objective. In addition, previewing the process or procedure that will be followed in the lesson or learning environment will also put the learners "in the driver's seat" by allowing them to anticipate the order and character of the instruction.

Body

RECALL RELEVANT PRIOR KNOWLEDGE (STIMULATE RECALL OF PRIOR KNOWLEDGE). During this phase of instruction, learners are stimulated to retrieve knowledge from long-term memory that is necessary or helpful in learning the new objective. In the case of principle-learning goals, this event may be a review of concepts that comprise the principle to be learned. For declarative knowledge goals, this event may be an advance organizer that relates previously acquired, organized declarative knowledge to new information that will be acquired in the lesson. In the case of motor skills, learners may be reminded of component motor skills they may have acquired that are similar to the skills to be learned. Learners may also be encouraged to recall cognitive strategies that can be employed to learn the new information.

This event may be in the form of a totally learner-controlled review of relevant knowledge in which the learner, being aware of the instructional purpose, searches memory for relevant knowledge and abilities. An experienced student who is beginning to read a text chapter accomplishes this event when, after reading enough of the chapter to get an idea of what it is about, looks up from the text and thinks, "Now let's see, what do I already know about this?" Or the instruction may directly encourage the learner to review particular prior knowledge through use of a comparative advance organizer, an analogy, an expository review, or a questioning of the learners.

A comparative advance organizer (Ausubel, Novak, & Hanesian, 1968) provides a framework, or schema, for new learning by comparing a similar known entity to it. For example, Ausubel mentioned that for a lesson in which Westerners are to learn about Buddhism, a possible organizer might be a review of the features of Christianity and a feature-by-feature comparison to those of Buddhism.

An analogy might compare a known concept (sometimes called the *vehicle*) to the concept to be learned (sometimes called the *topic*). For example, a lesson on the aperture of a camera often compares it to the iris of the human eye (relevant prior knowledge). The similarities (sometimes called the *grounds*) of the aperture and the eye might be discussed. It is also important that the ways in which the eye and the aperture are not similar (sometimes called the *limitations*) be carefully presented.

An expository review might be a simple summary or restatement of relevant prior knowledge that learners have learned in previous lessons. Learners might be guided through questions to recall this information. An entry-level assessment followed by feedback is a rather structured method of reviewing this critical prior knowledge.

The recall of prior knowledge may also be intermixed with the next event, processing information and examples. For example, in lessons in which the learners are encouraged to carry much of the instructional burden, they might be asked to invent appropriate analogies or other comparisons as they are presented with new information. These comparisons are made between concepts that the learners already possess and new information. This mental activity is sometimes called *elaboration*, as the learner is required to elaborate on new information by searching for relevant personal experiences or memories that extend the new information by making it personally meaningful.

In addition to considering helpful and prerequisite prior knowledge, it is often useful to point out to the learners or encourage learners to consider for themselves prior knowledge that is not useful, is incompatible, or may interfere with learning of new information. The application of prior knowledge to situations in which it is not applicable is termed *negative transfer*. The application of English word order rules (particularly for nouns and their adjectives) when learning Spanish is an example of negative transfer.

PROCESS INFORMATION AND EXAMPLES (PRESENT INFORMATION AND EXAMPLES). During this event of instruction, learners encounter the material they will be learning. This information may be presented in an expository (didactic) form in which generalities such as concept definitions or statements of generalizations are presented prior to their examples. The sequence may instead involve more discovery (inquiry), in which the learners are presented with examples of the concepts or the applications of principles and are encouraged to induce the generality. For example, if students are learning a new defined concept, such as "transparent," they are often presented with the definition of the concept and examples and nonexamples of the concept. This is an **expository sequence.** Learners might, however, be presented with examples and be prompted to induce the concept. This is a **discovery sequence.** Within a discovery sequence learners often take on more of the processing responsibilities, engaging cognitive strategies as well as domain knowledge. However, intermediate levels of instructional support can be provided if learners founder to frustration in an extreme discovery approach. In fact, a strategy that is somewhere between the extremes of "pure generative" and "pure supplantive" may be best. A discovery approach is fundamentally generative, as giving learners the primary responsibility for information processing is the critical attribute of generative strategies. Although inquiry instruction is somewhat less efficient than expository instruction, many educators feel that learners recall and are able to transfer learning more easily when it is acquired from a discovery-type approach.

Although there are many choices to be made in how this event is approached, some general patterns exist for certain types of learning. For example, psychomotor skill instruction may comprise a statement of the procedure, either as a whole or in parts, and a demonstration of the execution of the psychomotor skill. Psychomotor skill instruction seldom follows a discovery sequence. For problem-solving learning, this event may be delivered by simply stating a problem to be solved. Declarative knowledge is simply stated or available to read at this point (either in the form of facts, lists, or organized information) in an expository form.

FOCUS ATTENTION (GAIN AND DIRECT ATTENTION). Although the learner's attention was invoked at the beginning of instruction, it must be refocused continuously throughout the lesson. This event may be generated by the learners as they highlight or underline critical parts of a textual passage, as they take selective notes, or as they mentally rehearse sections of the instruction. This event may also be scaffolded by the instruction. For example, the instruction might ask leading questions to help students attend to the most critical features of the lesson. Pointing out distinctive attributes of a concept is also an example of focusing attention. (For example, "Notice that in a trapezoid only two sides are parallel.") During psychomotor skills instruction, this event might be supported by an instructor who reminds the learner of the procedure that controls the muscular actions. Textual information either in a print- or computer-based format may direct attention by using boxes, boldfacing, underlining, bulleting, or other attention-directing devices. Video segments may focus attention through such techniques as zooming in on critical portions of a scene. Graphic overlays (such as arrows, boxes, and circles) and cues in the narration are also used to direct the learner's attention.

EMPLOY LEARNING STRATEGIES (GUIDE OR PROMPT USE OF LEARNING STRATEGIES). Throughout the expanded events of instruction, we have pointed out many ways in which the learners might "take charge" of the learning process. When learners do this, they are employing learning strategies they already possess. (Chapter 13 will discuss how to teach these learning strategies.) The purpose of this event is to assist learners to use effective strategies, and that purpose is essentially accomplished by prompting learners to use appropriate learning strategies. Generally during the body of the lesson, this means suggesting to learners how they might encode information so that it can be accurately retrieved. This might involve suggesting to learners that they create mental images of the content, that they take a particular kind of notes, or that they employ a certain kind of mnemonic strategy. Just as the optimal type of content treatment varies from learning outcome type to learning outcome type, so does the appropriate learning strategy. (The following chapters contain information on appropriate strategies for particular learning outcomes.)

Although most media can prompt learners to use learning strategies, few learners can judge the appropriateness of their use. Print and video can suggest that learners employ a strategy, but they cannot assess whether a strategy has been used. Computer-based instruction, including interactive multimedia, can determine if the learner is doing something (entering information); however, it is generally unable to judge the efficacy of the learners' actions as they may or may not contribute to subsequent learning. Although a human can make this judgment, it is improbable that the instructor can assess all learners' use of strategies across all events with large classes of learners. This difficulty leads many designers to design more scaffolded or supplantive instruction than they might otherwise prefer. Designers sometimes do this to ensure that learners are getting all the assistance they need during instruction.

PRACTICE (PROVIDE FOR AND GUIDE PRACTICE). At this point in the lesson, the learners can be given the opportunity or they may take the opportunity to interact with the material being learned and see if they are ready to proceed to the next part of the lesson. Some learners can and will spontaneously generate problems and questions that "test" their understanding of the content of the lesson and whether they are achieving the identified or their generated learning goals.

It is not the purpose of this event to evaluate the students for grading, but rather to provide for learners' active participation in the learning process and to see how learning is progressing so that remediation may be provided if they are not learning. Remember that some constructivists recommend that for "authentic assessment" this practice activity should be the grounds for assessments. If this approach is taken, learning should be assessed at later points in the learning process as well. Inclusion of the practice event—more than all others—allows the learners to be active participants, rather than passive observers, in learning. Because of its fundamental importance, the opportunity for actual practice should not be left out of any instructional sequence.

It is important that the learner have the opportunity to practice across the range of variability of the learning goal. The designer has defined this range in the assessment specifications (see Chapter 6), so he or she can use these specs to help determine what practice should be made available to the learners. This means that they should have the opportunity to practice across the range of the content with which they should be skilled and that they should be able to practice across the range of difficulty of the goal. Although practice may be sequenced from simpler to more complex items, the need for practicing the complete range of complexity remains. It is not uncommon for designers to feel that since learners are just encountering the content, they should not be required to practice at the level of complexity that will be tested later. However, this decision is predicated on the assumption that learners will experience spontaneous learning over time. Although this is feasible, the active practicing of new learning (especially at more complex levels than those to which learners have been exposed) should not be left to chance. Novices in a content area may not have the experience to imagine how the content might be applied; consequently, provision of instruction with explicit practice items is very important.

The particulars of how practice is provided will vary considerably from learning type to learning type. For example, during concept learning, students may be given a variety of examples and nonexamples of the concept and be asked to identify those that are examples of the concept, or they may be asked to generate their own examples of the concept. For principle-learning goals, students may be asked to demonstrate the application of a principle. Students can practice problem solving if the instructor gives them a problem to solve and has them solve it or if students state which principles seem appropriate for the solution of this particular problem. In learning declarative knowledge students may be asked to state, summarize, recognize, or list part or all of the information they are to learn. Students learning psychomotor skills may be asked to demonstrate the whole or part of the skill as well as to recall the procedure that controls the skill.

When operating under the principles of behaviorism, designers created practice that was almost "errorproof," anticipating that a benefit of totally successful practice would be more motivated learners. More recently, designers have tended to design practice so that it might evoke any misconceptions that learners might have developed. This direct addressing of common misconceptions actually seems to pique learners' interest even more than successful experience. Thus, as you design the practice event, consider the ways that learners might go wrong with the content—how learners might overgeneralize or undergeneralize a concept, or how learners might draw incorrect inferences from declarative knowledge. Then you can design practice experiences that will allow them to confront these "bugs" in their learning.

Learner activity can be elicited in a number of well-known ways. Practice items, whether true/false, multiple choice, short answer, or essay, are probably the most widely used. Simulations, role-playing, or even on-the-job performance opportunities are all methods of practicing learning. Learners should have several opportunities to practice using the knowledge related to a specific goal to promote overlearning and automaticity of skilled performance. In addition, it is often useful to include an extra set of practice problems for learners who may have difficulty during the first set of practice exercises. These learners may benefit from the feedback from the initial set and need another opportunity to practice their skills. Current educational scholars have reminded designers that it is critical that practice experiences be relevant, authentic to the learners and their context, and "anchored" in a familiar situation (Brown, Collins, & Duguid, 1989). This is not a new principle for many instructional designers, or for educators in general. For example, Dewey (1924) recommended the use of community-related class projects to promote learners' application of knowledge. Whether under a traditional or recent rubric, contextualized, relevant problems are central to motivated, meaningful, transferable learning.

Computers are good tools for providing the practice event because they can interact with all learners, asking them to respond and then checking the accuracy of the learners' responses. Software can be designed to be used with individual learners so that they are required to respond in a particular way, eliminating the possibility of their "coasting" on other learners' performance, as can sometimes happen in group-based discussions and practice. A limitation of computer-based software, however, is that it is not generally "intelligent." That is, it cannot think or learn on its own. The computer's lack of intelligence has an impact on practice because the designer must be cautious in the types of questions or other response-eliciting situations the instruction poses. If the designer is to provide learners with accurate and meaningful feedback, she must ensure that the questions or situations posed will produce responses that can be judged by the computer. Intelligent tutoring systems can be developed to deal (to some degree) with production responses, such as short written answers. However, these systems can be very expensive and time-consuming to develop, so they will not be easily available across all content areas for some time (estimates have been offered at four to four-hundred years until such systems may become widely available). For practice in which open-ended responses are required, a teacher or other human will generally be needed to assess the appropriateness of the learners' responses.

EVALUATE FEEDBACK (PROVIDE FEEDBACK). Feedback is a critical event in instruction, and it is one that is too often slighted or overlooked. In fact, feedback is so important that we couldn't even discuss the previous event without mentioning it. Often educators use the term *feedback* to refer to the positive reinforcements, such as "good work," "good for you," and other responses to learners' efforts, that are primarily constructed to encourage. Although this type of reinforcement can be very important, the type of feedback to which we are referring in this event is called **informative** or **informational feedback,** rather than motivational feedback. The purpose of informative feedback is to give learners the opportunity to consider information about the appropriateness of their responses during practice.

In many cases, instruction can be constructed so that learners can, through observation, induce their progress from the natural consequences of their actions. Generative feedback is common to psychomotor skills but can also be fostered in computer simulations, microworlds, and physical or simulated construction kits. In situations in which learners cannot evaluate feedback without instructional support, several types of information can be provided through feedback:

1. Learners may simply be told if they are correct or incorrect. This type of feedback seems particularly appropriate for declarative knowledge learning.
2. If learners are incorrect, they may be given the correct answer. This type of feedback is often used with declarative knowledge and intellectual skills objectives.
3. Learners may be given information so they can determine if they are right or wrong and why they are right or wrong. This type of feedback is particularly appropriate for intellectual skills learning.
4. Learners may be given information about the faulty solution strategies they are using, with hints for more appropriate strategies, without being explicitly told whether they are correct or incorrect. This type of feedback is appropriate for problem-solving learning.
5. Learners may be shown the consequences of their responses. This type of feedback can be used for problem solving or principle learning, particularly with instruction that is delivered via a simulation.
6. Particularly with psychomotor skills, learners may experience proprioceptive (internal sensory) feedback during or after demonstration of a skill. Learners may have to be taught to recognize these sensory cues. Videotape replays, which allow learners to see themselves, are a form of augmentation of sensory feedback.
7. Learners may be given cumulative information on their progress during practice. For example, they might be told what pattern of errors they are making or how close they are to reaching mastery or a pre-stated criterion of performance (Smith & Ragan, 1993).

Feedback may be coupled with second tries at practice items so that if learners are incorrect, they can use the feedback to correct the error on that very problem. For example, all the feedback types just mentioned (except number 2, providing the correct answer) may be used in conjunction with several tries so that learners have the opportunity to apply the feedback to correct their own learning. In contrast to assessment, one expects learning to continue through the practice and feedback events. In other words, practice and feedback are formative, not summative.

As you might surmise, computers are especially good tools for providing individualized and immediate feedback to learners. Unlike most other instructional media—other than a human tutor—the feedback learners receive from a computer can be adjusted to the answers they gave. With other types of media, such as workbooks and conventional textbooks, you will probably be restricted to the question-and-answer method of feedback. Humans are the best at communicating feedback because of the nature of production responses in which many answers may be equally correct. However, as we mentioned during our discussion of learning strategies, it is unlikely that an instructor can give tailored feedback to each learner in a class after each practice response. This limitation often leads designers to provide more information than some learners might require to ensure that enough feedback is given. In some grouping situations, peers may provide feedback for open-ended questions. The success of this strategy depends on the competence of peers, both in content knowledge and in providing helpful feedback.

As you may have noticed in the preceding treatment of feedback, the range of generative to supplantive approaches to feedback is quite wide, with many techniques employing a mixture of generative and supplantive elements. One example is the third type of feedback, in which information is supplied which learners process in order to generate feedback on their progress. For a more complete discussion of feedback, see Mory (2004) and Dempsey & Sales (1993.)

Conclusion

The conclusion events allow learners to review and elaborate recent learning so that it can be available for further application and use. As time is often short at the end of a lesson, designers have a tendency to abbreviate these events. However, these events are critical in that they support learners' attempts to synthesize and consolidate new learning.

SUMMARIZE AND REVIEW (PROVIDE SUMMARY AND REVIEW). The purpose of the summary is to ensure that the learners recall and synthesize the critical parts of the lesson into a memorable and applicable whole. New learning can be quite confusing, so it is helpful at the conclusion of the lesson to remind learners of what they have just learned. As with many of the other instructional events, lesson summaries may be constructed by the learner or provided by the instruction. It is important that summaries provided to learners not include any new information, but rather restate the gist of the lesson itself. Often with transitory instruction, such as computer-, video-, or lecture-based instruction, learners can be given (or encouraged to produce) a permanent and portable summary in the form of print-based notes.

The actual content of the summary will vary depending on the learning outcome. For example, a review of a procedure might be a restatement of the steps in completing the procedure or a demonstration of the procedure itself. A review of declarative knowledge might include a restatement of a topical outline of main points; development of a concept map, perhaps supported by a computer-based tool such as *Insight*™, or a clustered review of paired information, such as acronyms and the words they represent. A summary of concepts might include a restatement of the definition or the critical attributes of the concepts that have been learned. One particularly useful technique for aiding summarizing is called a *graphic organizer;* it visually and spatially shows the main points in a lesson and how those points are related to one another. You have encountered graphic organizers at the conclusions of the chapters in this book. Designers have found that providing learners with partially completed graphic organizers that the learners must complete can be more effective than providing learners completed organizers or asking them to create the summary from scratch.

Review involves extended practice of the new learning. It can occur in the lesson itself, as an outside class assignment, or as the "review of prior knowledge" event in subsequent lessons. Review may also involve a cumulative practice over several lessons, which allows learners practice in distinguishing among newly learned facts, concepts, or principles. Learners also practice selecting the appropriate information, concepts, or principles from their new repertoire of knowledge to apply to specific situations. It is this ability to appropriately select and apply new learning that supports its integration and usefulness. In the case of declarative knowledge, intellectual skills, psychomotor skills, and perhaps cognitive strategies, spaced (over time) practice of the new learning can facilitate retention and recall. Of all the learning outcomes, declarative knowledge learning and psychomotor skill learning seem to require the most review. Older and more capable learners may be able to construct their own review schedules and their own review items. Younger and less capable learners generally need more assistance in preparing and conducting reviews.

TRANSFER LEARNING (ENHANCE TRANSFER). The process of transfer—the application of new knowledge and skills to a variety of real-life situations and future learning tasks—can be enhanced by giving learners opportunities to apply their learning to a variety of circumstances. Transfer is particularly critical for learning concepts, principles, procedures, problem solving, cognitive strategies, psychomotor skills, and attitudes. The primary transfer task for learning declarative knowledge is the ability to draw correct inferences from the information. Transfer of learning can be described in terms of a continuum from what is termed *near transfer* to what is termed *far transfer.* Near transfer is the application of learning in a way similar to the manner in which it is applied during learning and to situations similar to those in which it was exemplified and practiced. Far transfer is the ability to apply learning in different ways and in situations that are very different from those in which the learning was acquired and practiced.

For examples of near transfer and far transfer, let's consider a goal in our course on photography: "Given a correct exposure and information on aperture setting, shutter speed, and film speed, and given a description of a change in the situation, the learners can determine a setting in aperture, shutter speed, and/or film speed that can compensate for the change." Examples of the changes that the learners encountered in learning were adjusting to the subject's motion, the light's intensity, and the desired depth of field. Questions that assess the learners' ability to solve problems similar to those practiced and defined in the goal are near transfer. A far transfer task for the photography objective, as envisioned by Bromage and Mayer (1986), might be to describe a situation in which one or more of the components in a camera are malfunctioning and the learners must think of a way to compensate for this malfunction.

With regard to near transfer, the major goal of the transfer event is to enable learners to generalize their new learning to situations in which it is appropriate, but not to overgeneralize the learning to situations in which it is not applicable. This ability requires that learners be able to recognize key features of a new situation that are similar to the critical features of similar situations that they have learned. For learners to be able to do this, they must have experienced many situations in which the noncritical features of the situation varied greatly and the critical features were present. In addition, learners must have been either explicitly instructed or encouraged to explicitly elucidate the critical features of a task that call for application of a particular skill or body of knowledge. For example, learners will be more likely to appropriately transfer cognitive strategies to generalized situations if they are explicitly informed or are encouraged to explicitly express the characteristics of a learning task that might call for a particular strategy.

Encouraging learners to create "rules of thumb" to determine whether particular new learning is appropriate can promote their ability to apply this new learning. Transfer activities may involve asking students to find examples or apply principles in real-life conditions that they would anticipate encountering subsequent to instruction. Research suggests that spontaneous transfer rarely occurs. In many cases learners require prompting to see the connections between prior learning and a new situation.

The factors that contribute to far transfer are somewhat less clearly defined by instructional research. However, Clark and Voogle (1985) suggested several activities that may influence far transfer. These include encouraging learners to develop their own (1) examples and applications, (2) analogies between new learning and prior knowledge, and (3) paraphrases of declarative knowledge lessons. Other aspects of transfer are well described in Butterfield and Nelson (1989).

REMOTIVATE AND CLOSE (PROVIDE REMEDIATION AND CLOSURE). As you will read in Chapter W-3 in the Learning Resources Web site, learners' attitudes toward learning and new content will greatly influence how well the learning will be acquired initially and how well that learning will be retained. That is why we suggest that the lesson conclude as it began: with the learner's realization of the importance of the learning. In particular, learners should be encouraged to explore how they may use this new learning immediately and what future applications they envision. Note how this event supports transfer by allowing learners to consider possible situations to which their new knowledge may, indeed, be transferred. It is not uncommon for learners to be uncertain of the applicability of newly acquired information, so the instructor should be prepared to supply much of this event for the learners. It may also be helpful to point out the learners' success with learning the content to promote their satisfaction with their own learning.

The function of closure is twofold: (1) to let the learners know that, in fact, the lesson is over, and (2) to conclude the lesson on a positive note. Anyone who has ever written something, whether it was an essay, research review, or novel, will remember the difficulties in writing a satisfying conclusion. However, it is important that learners are cued that the lesson is completed so they can consolidate their thoughts and relax their mental efforts. In a video, this is often simply cued with a change in music and rolling the credits. In a textbook, it may be signaled with a listing of references. In teacher-led instruction, closure statements may be as simple as "You've all been very attentive; we'll study a related concept tomorrow. Class is dismissed." Note how ending the lesson positively may seamlessly merge with comments regarding students' successful learning in the remotivation phase. This merging might be accomplished by adding "I can tell that you are able to use concept *X* very well now" to the previous statement. In generative learning environments, such statements as "time's up" from an instructor or the learner's own schedule or weariness may generate "closure" for a session.

Assessment

ASSESS LEARNING (CONDUCT ASSESSMENT). The purpose of this event is to assess whether learners have achieved the goal(s) of the instruction. Assessment information is critical to the designer, instructor, and the learners. Designers use the information to continuously revise instruction. Teachers use the information to guide their plans for remediation and scheduling. Learners use the information to evaluate the efficacy of their study strategies, as well as to guide their search for remediation. This event differs from practice in two ways: The decisions made as a result of the measures are more summative (conclusive) in nature, for they lead to grading; and assessment instruments are developed more carefully than practice to obtain a reliable and valid measurement of learning. The way the attainment of a goal is assessed is closely related to the statement of the goal. (This relationship will be discussed further in the following chapters.) As discussed earlier, pencil-and-paper tests are only one of many methods of assessing learners' ability to provide evidence of learning. Assessments may include on-the-job performance and simulations of various levels of realism and complexity.

The assess learning event may not occur during the lesson itself. It is a common practice to combine the assessment of several goals into one assessment period, such as a unit test. If assessment is delayed, then it is important to plan review particularly carefully. Also, when many goals are assessed together, instruments can become quite lengthy, and designers may be forced to make tough decisions between practicality and reliability or validity. Consequently, careful planning for the assessment event may result in the specification of more than one assessment period so that adequately reliable and valid measurements can be employed.

EVALUATE FEEDBACK AND SEEK REMEDIATION (PROVIDE FEEDBACK AND REMEDIATION). The feedback learners receive after assessment is often more cumulative—such as a percent correct or a number of objectives mastered—than the feedback accompanying practice. Although item-by-item feedback may be provided upon request, it is not generally designed into the strategy, as the feedback is planned to be more informative than corrective. This evaluation usually leads to a conclusion on the learners' (and often the instructor's) part, such as a grade or an overall judgment of the learners' mastery of the content.

The designer may plan for remediation activities for learners, such as additional practice sets or another presentation of the body of the instruction in an alternate form (e.g., with a more concrete explanation, a different medium, or a more supplantive strategy).

Remediation may address specific goals, or it may address the learning strategies that the learners apparently failed to employ.

A highly generative form of this event could be seen in the learner's thinking, "Now, what do I need to do next?" on the basis of studying information about his learning. Facilitation of this highly self-regulated learning is a worthwhile learning goal and the object of much learning strategy instruction.

Hints on Sequencing the Expanded Events of Instruction

A typical supplantive lesson generally follows this sequence of events:

1. Introduction
2. Body
3. Body
4. Body
5. Conclusion
6. Assessment

The repetition of *body* indicates that in lessons that have several goals/objectives, the goals/objectives could be grouped in such a way that after the lesson introduction, information pertaining to the first group of goals is examined and that learning is practiced; then a second group of goals is presented and practiced, and so on through the groupings of goals. The exact number of goals that should be grouped together for presentation and practice depends on the relationships of the goals, the instructional context, and the characteristics of the learners. After teaching all groups of goals, the instructor provides lesson conclusion. Then he can conduct the assessment of all goals. Sometimes assessment is not conducted during a single lesson but is conducted at the same time for several lesson goals in the form of a unit test. This procedure seems to create efficient instruction.

Of course, many highly generative learning environments,* such as microworlds, simulations, problem-based, or exploratory learning, would not be organized in this way. Learners' efforts on different prerequisite knowledge elements within the instruction would be much more dependent on the learners' own sequencing of concentration on component knowledge needed to be successful in the learning environment. However, when designing the structure of a generative learning environment, attention must be paid to the relationship of goals and their associated activities, and the framework provided by consideration of events and their possible sequences of encounter is helpful in insuring that the learning environment is an effective one. Jonassen (2000) provides a helpful discussion of the use of activity theory to guide designers in structuring learning environments.

In most lessons, the order from introduction to body to conclusion rarely varies; however, the order of particular items within these events may not follow their numbered order or may be seamlessly combined into fewer perceivable events. They may even be interspersed across lesson sections. For example, the event involving recollection of relevant prior knowledge may start in the introduction and then be addressed more specifically in the body of the lesson. These events should be used creatively and considered a guideline rather than required protocol.

The sequencing of experiences in complex, multitopic or multiskill domains is critically important. The designer will be informed by task analysis (as well as learner and context analysis) in this activity, but must not mistake the sequence in which an expert performs a task with the sequence in which it must be learned. A major criticism of instruction based on traditional Gagné-type hierarchical analysis is that the "bottom-up" instructional sequence that is said to devolve from such analyses is frequently not ideal. We believe (and we think that Gagné would as well) that the sequence of encounter needs to be carefully designed and that such sequences are not always bottom-up. Gagné restricted the applicability of learning hierarchies to intellectual skills (discriminations, concepts, principles, and problem solving). No serious student of instructional design that we can find or think of has suggested that simple-to-complex is the ideal sequence for all material. (Chapter 16 includes practical suggestions for sequencing multitopic content.)

As mentioned earlier in the chapter, the instructional events may be provided by the instruction, prompted by the instruction, or provided by the learner. There are advantages and disadvantages to having the lesson facilitate the learners' processing or in expecting the learners to regulate their own processing. The next section will discuss these advantages and disadvantages.

*The concept *generative learning environment* will be defined and discussed in the following section.

EXERCISES B

Following are descriptions of several of the expanded instructional events. Decide which event (or events) is being delivered in each description.

1. A frame states that this lesson is about the "lifeboat ethic," a concept in the study of world ecology. Another frame tells students that they will learn the definition of "lifeboat ethic" and learn to recognize examples of its use.

2. In the lesson, the student is asked to recall situations in which lifeboats are used. Instruction reminds students of a previous lesson's description of the relationship between (1) waste of natural resources and (2) a nation's dependence on other countries for raw materials.

3. The first frame of the lesson shows an animated graphic, a cartoon of a globe sinking into an ocean with people rowing away. Some people are swimming in the ocean, and some are drowning. Boats are capsizing. Some people seem to be marooned on the sinking globe. A title, *Lifeboat Ethic*, is printed on the frame.

4. A frame points out that the "lifeboat ethic" has been used in this lesson to discuss exploitation of natural resources but that it can apply to national, international, and interpersonal relations in other areas. The lesson suggests that students review current periodicals to find examples of the "lifeboat ethic" in international monetary systems, military relations, and so on.

5. A frame presents a definition of "lifeboat ethic" and subsequent frames present examples in worldwide use of natural resources.

6. Scenarios are given and students are asked to classify them as examples or nonexamples of the concept "lifeboat ethic."

7. Information is given as to whether students' responses during event 6 were correct or incorrect. If they were incorrect, students are told the correct answer and why that answer is correct.

8. Examples and nonexamples of the "lifeboat ethic" are given, and students are asked to highlight portions of the scenarios that give clues as to whether the scenario is an example or nonexample. The student may check a later section to receive a more detailed explanation as to why the scenario is an example or nonexample of the "lifeboat ethic."

9. Students are presented with scenarios that are examples or nonexamples of the "lifeboat ethic," which they are to classify. No cues or explanations are given. After students have answered all questions, they are told which questions they missed, and this information is recorded on score sheets.

ALTERNATIVES IN LOCUS OF INFORMATION PROCESSING

Several years ago, we attended a discussion between Robert Gagné, one of the pioneers of the field of instructional design, and Claire Weinstein, a well-known researcher and writer in the area of learning strategies. The focus of the discussion was whether strategies should be "built" into the learner or into the materials. The issue that they addressed is critical to the field of instructional design: "Which should be the locus of control of information processing—the instruction or the learners?" Although most of us would immediately respond that it is most desirable that the learners themselves initiate and regulate their own processing, upon careful consideration one will notice that *any* instruction is designed to guide learners' processing to some extent. For example, we do not throw jumbled words at learners for them to decipher; we organize them into sentences and paragraphs. We do not leave students to imagine what a new component of equipment looks like; we provide an illustration. We do not inundate novice learners with unstructured databases from which to interpret procedures; we ensure the availability of procedural steps in a carefully selected sequence. So the question for designers is not which is preferable—learner processing or lesson facilitation of processing—but where on the processing continuum instruction should fall. Earlier we provided examples of varieties in this continuum; now we will look closely at what these alternatives mean to the instructional designer.

The availability of potentially exploratory learning environments, such as hypermedia and some forms of intelligent tutoring systems, has created situations in which implementation of many of the key instructional variables can be placed in the hands of learners. High technology is said to empower learners from a tool-using standpoint so that the learner learns through magnification of his own intellect, not through outside manipulation of material to be learned. Jonassen has used the term "mindtools" in his discussion of this concept (1996). So the question of locus of processing control has become even more pressing because we have the capability to mediate instruction in which the learner has much of the initiative in the learning process. This option has stimulated instructional designers to consider highly generative instructional strategies, which were not seriously utilized by some instructional designers in the past. **Generative strategies** (Wittrock, 1974, Grabowski, 2004) and open learning environments (Hannafin, Land, & Oliver, 1999) are those approaches in which learners encounter the content in such a way that they are encouraged or allowed to construct their own idiosyncratic meanings from the instruction by generating their own educational goals, organization, elaborations, sequencing and emphasis of content, monitoring of understanding, and transfer to other contexts. In other words, learners "generate" the preponderance of information processing during learning by providing much of the events of instruction themselves. Such instruction has low levels of scaffolding (instructional facilitation).

The outgrowth of Wittrock's model has been studies that contrasted supplying learners with "provided instructional devices" (i.e., instructional facilitation of processing), such as summaries, headings, underlining of key ideas, and pictures, which indicate the relationships among ideas for the learner, with asking the learners to generate these devices for themselves (e.g., asking the learners to generate summaries, headings, underlining, or pictures). Generally, studies of this sort have found that learners perform better on comprehension and recall tests if they have generated associations for themselves rather than having the associations supplied. Often, this effect is explained in terms of depth of processing (Craik & Lockhart, 1972): The more the learner is required to relate information to her own cognitive structure (termed *elaboration*), the greater the depth of processing, which results in better learning. In addition to supporting better learning, such strategies for knowledgeable and able students have been purported to be highly motivating by placing learners in an autonomous situation in which they may pursue their own specific interests regarding the content. Generative instructional strategies also allow learners to engage, practice, and refine their learning strategies. However, this approach can place a high cognitive demand on learners' working memory (particularly for less knowledgeable students) by requiring them to acquire new learning while taking the responsibility for structuring that learning situation. This could lead to cognitive overload, emotional frustration, and detract from learning.

SUPPLANTIVE AND GENERATIVE STRATEGIES OF INSTRUCTION

The large amount of processing required of the learner means that successful generative learning may require a large amount of time for learners who are first encountering content. For students who have extensive and frequently used prior knowledge and strategies, generative learning can be almost automatic. Its success highly depends upon the learner's prior knowledge of the content and the breadth of learning strategies the learner possesses. Because of the very nature of the strategy, learning outcomes and interpretations of content from such an approach can be idiosyncratic. Generative strategies do not directly lead to meaningful and motivated learning (or, in other words, just because a strategy is "learner centered," nondidactic, problem-based, or any of a galaxy of generative strategies does not mean it will be effective for facilitating learning). Learners may simply be motivated to complete an activity and not necessarily engage with the content. To promote generative learning, strategies that monitor and prompt learners must be provided.

Traditionally, instructional designers have elected to use relatively **supplantive strategies** (sometimes labeled *mathemagenic**) within their instruction. This instruction, as compared to generative instruction, tends to supplant (Salomon, 1979), facilitate, or scaffold more of the information processing for the learner by providing elaborations that supply all or part of the educational goal, organization, elaboration, sequencing and emphasis of content, monitoring of understanding, and suggestions for transfer to other contexts. In other words, supplantive strategies explicitly and overtly provide much of the events of instruction, actively gaining learners' attention, informing learners of the objective, explicitly providing a preview of the lesson, and so on.

Supplantive instruction tends to conserve novice learners' cognitive capacity for acquiring skills and knowledge related to the learning task by limiting the amount of responsibility they must carry for structuring the learning situation. It may lead to more focused and predictable learning outcomes. For less knowledgeable learners, it may be more efficient than generative learning strategies: More material may be learned in a shorter period of time. Learners with a limited level of prior knowledge and a limited repertoire of learning strategies might be expected to be more successful with this approach. However, if improperly implemented, a relatively supplantive strategy may engage fewer of the learners' mental processes, leading to less complete learning. It may lead to less personally meaningful learning: The meaningfulness of the instruction depends entirely on what kinds of connection the instruction guides the learners to make (and, of course, the connections that the learner actually makes). It may appear too contrived and sterile to the learner and be less challenging and, consequently, less motivating to some learners. Over time it may "short-circuit" learners' critical information-processing skills to the point where learners are dependent rather than independent learners.

It is important to note that instruction on both ends of the supplantive–generative continuum, as well as those combinations in between, can (1) lead to personal interpretations of knowledge, (2) involve high levels of activity on the learner's part, and (3) be interesting, relevant, and motivating. Some designers erroneously infer that the learner is a passive receiver of information in a supplantive lesson. For learning to occur, learners must actively process information. The difference in the two poles is how much scaffolding, support, or prompting is provided to the learner to encourage and bolster this processing.

**Mathemagenic* refers to processes or events that stimulate learning. The term, coined by Ernest Rothkopf in 1970, is composed of two Greek roots: *mathe* (learning) and *genic* (giving birth to).

Although the comparable advantages of these two diverse forms of environment have not yet been thoroughly empirically investigated, several bodies of theory and research suggest that neither approach is universally superior but that many factors may influence the efficacy of one instructional approach over the other. Among the related research areas are the following: research on generative versus mathemagenic teaching methods (Jonassen, 1985; Osborne & Wittrock, 1985; Wittrock, 1974), learner control in computer-based instruction (Hannafin, 1984; Steinberg, 1977; Tennyson, 1984), discovery versus expository learning (Herman, 1969; Ray, 1961), and cognitive capacity and allocation of mental resources (Britton, Westbrook, & Holdredge, 1978; Burton, Niles, & Lalik, 1986; Craik & Lockhart, 1972; Duncan, 1980; Watkins, 1983).

This research and theory suggests that the decision as to whether to design instruction with more generative or more supplantive strategies is not a simple one. As illustrated in Figure 7.2, the decision is like a balancing act. Generative strategies require greater mental effort and consequently lead to greater depth of processing that results in better learning. However, cognitive capacity in the form of working memory is limited, so if learners are required to carry too much of the instructional burden, they may be overloaded and unable to learn. When designing organizational strategies, the designer must balance these two competing demands: the need to require sufficient mental effort to lead toward learning, and the need to support the learners' processing sufficiently in a way that does not overload their working memory.

TYPES OF LEARNING AND INSTRUCTIONAL STRATEGIES

In Chapter 5, we described the considerable effort that can go into finding out as much as we can about the nature of learning tasks for instruction that we are designing. And, as we previewed in that chapter, this information about the cognitive requirements of different learning tasks has substantial bearing on what sorts of experience would be most helpful in achieving those learning tasks. As we said in Chapter 5, "Some learning tasks are substantially different from others in terms of the amount and kind of cognitive effort required in learning, in the kinds of learning conditions that support their learning, and in the ways to test for their achievement."

Imagine, if you will, one group of students in a physical education class is practicing free-throws on the basketball court, another group of students is learning what different actions are "fouls," and yet another has been challenged by the coach to formulate a strategy for tomorrow's game. As you know from your reading of Chapter 5, each of these learning activities is directed at a different kind of learning task, in this case a psychomotor skill, principles (with new concept learning as well), and problem-solving. As you also already know, the cognitive requirements for these different learning activities are different. Now we want to think about how the different cognitive requirements for different types of learning are reflected in the events of instruction.

When you reflect on an instructional event and a particular type of learning, such as thinking about practice

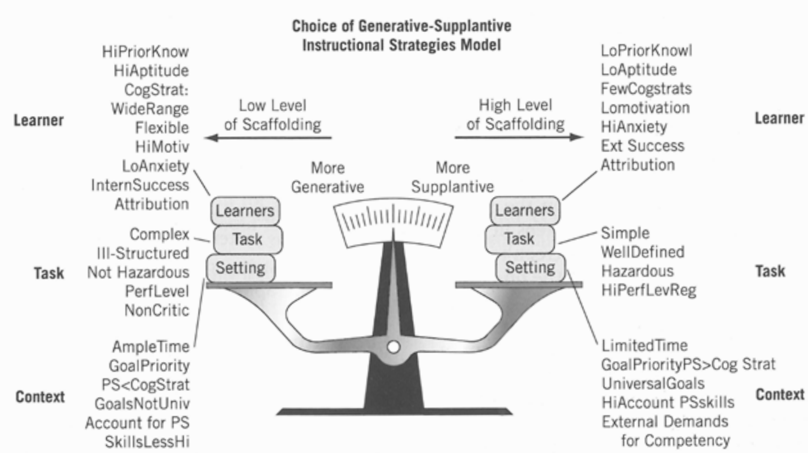

Figure 7.2 The Balance of Generative and Supplantive Strategies

for concept learning, or learning guidance for problem solving, or feedback for psychomotor learning, you are beginning to think at a level for which there is an enormous body of research and practical experience to guide you. Chapters 8 to 15 will make an effort to point out the salient features of facilitating learning for declarative knowledge, concepts, procedures, principles, problem solving, cognitive strategies, attitudes, and psychomotor skills. These chapters explore how events of instruction can best facilitate learning for the learning that is at hand. For more background on the research and theory behind this idea, see Ragan and Smith (2004).

Cognitive Load Theory

A considerable body of research has been conducted on the concept of "cognitive load." (e.g., Renkl & Atkinson, 2003; Mayer & Moreno, 2003; van Merriënboer et al., 2003). The central interest of cognitive load theory is "how constraints on our working memory help determine what kinds of instruction are effective" (Renkl & Atkinson, 2003, p.16).

Complex learning tasks may possess so much "intrinsic load" that overload occurs and learning suffers. Intrinsic load is load resulting from the number of elements a learner must simultaneously attend to in order to understand the material being learned. Mayer and Moreno described this overload as occurring when "the learner's intended cognitive processing exceeds the learner's available cognitive capacity" (Mayer & Moreno, 2003, p. 43). Essential processing refers to cognitive processing that is required by the learning task. Incidental processing is those cognitive processing demands that are built into the instruction, or "primed by the design of the learning task." For example, background music added to a narrated animation requires incidental processing and for that reason may contribute to excessive cognitive load.

Many of the currently popular techniques in technology-using instruction can contribute to overload. Here is Mayer and Moreno's description of a typical event: "A student is interesting in understanding how lighting works. She goes to a multimedia encyclopedia and clicks on the entry for 'lightning.' On the screen appears a 2-min animation depicting the steps in lightning formation along with concurrent on-screen text describing the steps in lightning formation. The on-screen text is presented at the bottom on the screen, so while the student is reading she cannot view the animation, and while she is viewing the animation she cannot read the text" (Mayer & Moreno, 2003, p. 45).

Mayer and Moreno (2003) described a number techniques for reducing cognitive load. All of the these techniques have received extensive treatment for many years in the instructional design and message design literature. Throughout this text, for example, you will find recommendations for most of these methods, and more. As well, texts on instructional message design such as Fleming and Levie (1993) and instructional text design such as Misanchuk (1992) supply many of the same recommendations as those provided by CLT. However, the focus and theoretic perspective provided by CLT have stimulated a great deal of helpful supporting research, and the following list provides strategy suggestions for which the relationship between cognitive load and the techniques themselves is clear.

Off-loading: moving some essential processing from the visual channel to the auditory channel in cases in which the essential processing in the learner's visual channel is greater than the cognitive capacity in that channel. For example, some things that a designer may wish to place in an already complex display, such as an aircraft instrument set—perhaps additional explanatory material—might be described in narration instead of added to the visual display.

Segmenting: allowing time between successive bit-size segments in cases in which both channels are overloaded by essential processing demands. We have all seen good instructors pause at important times to allow the learners to "absorb" information before moving on, and we've all seen both live instructors and mediated instruction in which the instructor charges on regardless, leaving everyone in the dust.

Pretraining: Providing instruction on prerequisites, such as training in the names and characteristics of components before training in their use.

Weeding: Eliminating interesting but extraneous material to reduce processing of it. Weeding may involve getting rid of the deadwood and superfluous ornamentation, either cognitive or sensory. It may also involve eliminating interesting but extraneous material to reduce processing of extraneous material when the combined load of essential and incidental processing exceeds cognitive capacity.

Signaling: Providing advance cues for how to process the material to reduce the processing demands of extraneous material which may be present.

Aligning: Placing printed words near corresponding parts of graphics to reduce the need for visual scanning.

Eliminating Redundancy: Avoiding the presentation of identical streams of printed and spoken words.

Synchronizing: simultaneous presentation of video with related audio material.

Individualizing: providing instruction in multiple forms, matched to the aptitudes of learners.

Although none of these recommendations is new or unique to CLT, each of them has been supported with research specifically based on the CLT theoretic perspective. CLT is a research-based approach which can help provide guidance on how much or what kind of supplantation may be needed, support which may be needed even within relatively generative learning environments, and the theory has supplied many helpful examples.

Principles for Determining Optimal Degree of Instructional Support

We have proposed some principles for making decisions regarding which side of the balance to lean to in design, depending upon factors within the learners, the learning context, and the learning task. Given the current state of theory and research, we can only hypothesize univariate principles, hence the statement "all else being equal" preceding each principle.* Even these univariate relationships are tentative, given the current status of research and theory with these variables.

LEARNERS' CHARACTERISTICS. Learners' characteristics are the most critical factor influencing the effective balance between generative and supplantive approaches.

1. All else being equal, the higher the level of prior knowledge, the more generative the instructional strategy can be.
2. All else being equal, instruction for learners who have a large and sophisticated repertoire of cognitive strategies can be more generative.
3. All else being equal, instruction for learners with generally high aptitude can be more generative.

3a. When learners possess aptitudes which specifically relate to generative strategy cognitive demands, more generative strategies can be employed (Shute & Towle, 2003).

4. All else being equal, instruction for learners who have a high level of motivation and interest can be more generative.
5. All else being equal, instruction for learners who have high levels of anxiety should have supplantive strategies available.
6. All else being equal, instruction for learners who tend to attribute learning success or failure to factors external to themselves should begin at a more supplantive point on the continuum and gradually move to a more generative level.

*All else is never equal, of course; however, research investigating interactions of these variables is not currently available.

CONTEXT CHARACTERISTICS. Context factors also significantly influence where a lesson falls on the generative–supplantive continuum.

1. All else being equal, when instructional time is limited, the instructional strategy should be more supplantive.
2. All else being equal, when goals for "learning to learn" are given higher priority than goals for domain-specific skills, a more generative strategy should be emphasized.
3. All else being equal, when high achievement of domain-specific goals is a higher priority than "learning to learn" skill, then a more supplantive strategy should be emphasized.
4. All else being equal, when achievement of domain-specific goals is universal for all learners (all learners are expected to learn to at least a minimum level of competence), then a more supplantive strategy should be available.
5. All else being equal, when the educational agency has high accountability, then more supplantive strategies should be available.

LEARNING TASKS. The nature of the learning task should also influence the effective balance between generative and supplantive strategies.

1. All else being equal, the higher in the intellectual skills (closer to domain-specific problem solving), the more generative the strategy.
2. All else being equal, the more complex the problem, the more supplantive the start point of the instruction, and the more critical the progression toward more largely generative instruction.
3. All else being equal, in situations in which learners' misconceptions during the learning process could translate into physical or emotional hazards for themselves or others, a more supplantive strategy should be employed.
4. All else being equal, learning goals that are associated with a critically high level of competence and consistency should utilize somewhat more supplantive strategies.

OVERALL PRINCIPLES. Two overarching principles can guide designers in determining the optimal level of instructional support.

1. An optimal instructional strategy goes as far toward the generative pole as possible while still providing sufficient support for learners to achieve learning in the time possible, with a lim-

ited and acceptable amount of frustration, anxiety, and danger.

2. During instruction in a particular knowledge area/learning task, the instruction should progressively move toward the generative pole, as learners gain skill, knowledge, motivation, and confidence.

We have described the expanded events of instruction in two ways to reflect both generative and supplantive strategy options. Using the events as labeled here, instruction can be designed so that the learners take more responsibility for their processing or so that the instruction itself guides the learners' processing. Of course, the degree of instructional support can be varied from learner to learner and adjusted to class needs as part of formative evaluation. The following chapters will continue to present these options so that you will be prepared to design on either end of the continuum or somewhere in the middle.

Alternatives to Instruction

We cannot leave the topic of instructional strategies without discussing a close relative: performance improvement aids and strategies.

As you may recall, in defining *instruction* as well as *instructional design* in Chapter 1, considerable care was taken to differentiate instruction from other related activities which may be confused with it. Performance support systems are alternatives to instruction and are often preferable because they are typically less expensive to develop and implement than equally effective instruction. Although performance support systems come in many forms, a particularly useful and interesting sort are *electronic performance support systems (EPSS)*. An EPSS is an electronic device, built into a larger device that provides information on how to operate, repair, or use the larger device.

A memorable and historically significant EPSS was one of the first devices of its sort. In the 1970s, Xerox Corporation's staff of engineers, psychologists, and educators at the Palo Alto Research Center (PARC) grappled with the problem of performing routine maintenance and fixing common malfunctions in office copiers, such as replacing paper, fixing a paper jam, and adding toner. Before Xerox's early EPSS, the copier user typically needed to use a manual that was often missing, interpret cryptic flowcharts printed on sheets glued to inside panels, and attend training seminars. The brainstorm was to use the display already in place on the Xerox machine (here, finally, we get to use the term correctly), adding to its function of showing the number of copies selected, collating options, and so forth. The addition was context-embedded instructions. The person who is credited with this innovation, John Seeley Brown, was for many years director of PARC, an organization from which has come many significant technological innovations as well as important ideas in learning and instruction (Suchman, 1987).

Fundamental to the concept of a performance support system, and well-exemplified by the Xerox instruction panel, is the idea that if job aids are appropriately situated within the workplace, they can support thinking (cognition) and work in ways that can reduce the amount of learning a person needs to engage in. Because learning to do something is generally more time-consuming than just doing it, performance support systems can save both time and money.

Performance support systems are widely used now to either replace training or supplement it. The concept of the EPSS has expanded from the earliest embodiments to include provision of learning experiences as well as information and advice. (Gery, 1991). An EPSS may also include tools such as word processors, spreadsheets, and databases that can be used *in situ* for learning and problem solving.

In Chapter 3, Context Analysis, the idea was stressed that instruction should only be developed if there is a need for it, and examples are provided there of situations in which something other than instruction was the preferred alternative. And, as noted in Chapters 1 and 20, many people who do instructional design see themselves within a broader context of performance engineering, in which provision of instruction is not the only way to help people function well at a job (see also, Raybould, 1995).

E X E R C I S E S C

1. Following are descriptions of events that occurred during a lesson. Identify whether the strategy leans more on the side of a generative strategy (G) or a supplantive strategy (S).

a. Students underline key points in a print-based lesson.

b. Students create their own mythical countries that exemplify the concept "fascism."

c. Students watch a video-based summary of factors leading to the Civil War.

d. Students select from a number of instances those that represent the concept "loose constructionism."

e. Students run a number of sample computer programs using subroutines and determine which procedural rules must be used to make programs that don't "crash."

2. Strategy A and Strategy B describe two instructional strategies to teach the same relational rule—the relationship of pitch to length, tightness, and thickness of a plucked string. One of the strategies is more generative; one is more supplantive. Write the type of strategy (A or B) in the blanks, and explain your answers.

_____ More Generative

_____ More Supplantive

STRATEGY A

Materials: Violin, other stringed instruments, tom-tom and other drums, whistle with sliding stopper, piano, xylophone, elastic string, and rubber bands.

Procedures: Teacher statement: We've been talking in this science unit about the "bounce of sound." You will remember that sound is caused by the vibration of the molecules in an object. For instance, when I strike this bell, I set the molecules in the bell vibrating. This causes sound. Yesterday we discussed what causes the pitch of a vibrating object to be low or high. The pitch of the sound an object makes when struck or plucked depends upon how fast the molecules in the object vibrate. Remember when we talk about high and low pitch (demonstrates) that we're not talking about loud and soft (demonstrates). A high pitch can be loud (demonstrates) or soft (demonstrates). Today we'll talk about why when some objects are struck, their molecules vibrate more rapidly and they have a higher pitch, and when other objects are struck, their molecules vibrate more slowly and they have a lower pitch. The pitch of the sound an object makes when struck or plucked depends upon the length, tightness, or thickness of the object. (Writes the words *thickness, length,* and *tightness* on chalkboard.)

Demonstration 1: Teacher demonstrates with running explanation that the thickness of the strings on a violin affects the pitch of the strings. Teacher presents the principle that the thicker the string, the lower the pitch.

Practice 1: Teacher asks students to experiment with various thicknesses and asks such questions as "What will happen to the pitch with that string, Judith?"

Demonstration 2: Teacher demonstrates with running explanation that tightening and loosening a string on the violin affects the pitch of the string. Teacher presents the principle that the tighter the string, the higher the pitch.

Practice 2: Students make predictions about the pitch of various degrees of tightness of a string and then try out their predictions, noting the pitches and the accuracy of their predictions.

Demonstration 3: Teacher has a student shorten or lengthen string and asks students to tell the teacher how this affects the pitch produced. Teacher presents the generalization that the shorter the string, the higher the pitch.

Practice 3: Students make predictions about the pitch with various lengths of string and then try out their predictions, noting the pitches and the accuracy of their predictions.

Demonstrations 4–10: Teacher demonstrates the principle on a variety of musical instruments and has the students predict the effects of changes in length, thickness, and tightness upon the pitch of the instruments. Students try out other instruments on their own. The lesson continues until the principles are obviously learned and the students' predictions are consistently true.

STRATEGY B

Materials: Ukuleles, xylophones, sliding whistles, rubber bands, chimes, drums, and strings.

Procedures: Teacher's statement: I saw many of you at the symphony orchestra's concert yesterday. Which songs were your favorites? Which instruments did you like the best? Have you ever wondered what it is about an instrument that enables it to make higher and lower pitches? Today we have a number of instruments with which you may experiment to try to find out what makes the pitch of instruments go from low to high. Why don't you start with a ukulele? Try to figure out what makes a ukulele string make a higher or lower tone.

Stimulating questions:

- Yes, I can feel that "buzzy" feeling when you strike the chime. What causes that? What happens with the shorter chime?
- Yes, striking harder on the xylophone makes the sound louder. Is that the same as higher? How can you make the pitch higher?
- How can you find out if thicker strings make lower tones?
- Carlos, what do you think of Sheila's idea that the pitch of the whistle has to do with how far the slide is pushed in?
- Zenia, how can you check out your guess about what makes one chime's pitch high and another's low?
- Kenneth, the pitch of your voice is very low, but Sue's voice is high. Why do you think that is so? Where can you go to find out?

Components of Instructional Strategies

Organizational Strategies	Delivery Strategies	Management Strategies
• Macro-Strategies—scope and sequence structures • Micro-Strategies—expanded instructional events	• Media selection • Grouping strategies	• Scheduling • Acquisition of resources

Expanded Instructional Events

Introduction	Body	Conclusion	Assessment
• Activate attention • Establish instructional purpose • Arouse interest and motivation • Preview lesson	• Recall prior knowledge • Process information • Focus attention • Employ learning strategies • Practice • Evaluate feedback	• Summarize and review • Transfer knowledge • Remotivate and close	• Assess performance • Evaluate feedback and remediate

Figure 7.3 Summary Diagram for Chapter 7

3. Discuss as completely as you can the comparative advantages and disadvantages of more generative and more supplantive strategies. Use examples from Question 2 to provide a context for your answer.

4. Suppose you were planning the organizational strategy to teach hiring practices that are in accordance with new federal laws to a group of fifty midlevel managers. The managers have only a three-hour class period available for the training. The learners are quite skilled but impatient with anything other than "the facts." The manager who will be delivering the instruction is very knowledgeable in the content but less skilled in modes of delivery other than lecture/discussion. Should you use a more supplantive or more generative strategy for this lesson? Explain your answer.

SUMMARY

During the *Develop the instructional strategy* stage, we take the information that we acquired during the analysis stage and use it to help us make decisions about the instructional strategy. At the lesson level, the designer can use the expanded instructional events as the framework of the lesson. A critical decision that designers make is whether to design the strategy to be more supplantive or generative in nature. At the conclusion of this stage, the designer has developed a strategy for the lesson. The lessons themselves are not produced yet. In other words, they are not in their mediated, or final, form. Figure 7.3 summarizes key points in this chapter.

EXTENDED EXAMPLE

Go to the Learning Resources Web site for a continuation the instructional design of the Photography Basics course. For this chapter, a discussion of instructional strategy approach from the generative–supplantive standpoint will be provided to overview the thinking behind specific instructional strategy decisions that will be illustrated for subsequent chapters which will discuss in detail strategies for different types of learning (Chapters 8 to 15).

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