7 Learning Situations and Instructional Models

Charles M. Reigeluth and Ruth V. Curtis
Syracuse University

Let's assume that you have been given the task of developing some instruction. The two most important decisions you will have to make are *what* to teach and *how* to teach it. Everything you do in the instructional-system design (ISD) process is directed toward these two fundamental decisions.

You have already analyzed the requirements for the instruction that you are developing, and have used much of the information from that analysis in performing a task or content analysis, which resulted in a complete determination of *what* to teach. Now it is time to decide *how* to teach it, usually with the help of a subject-matter expert. This activity will result in a "blueprint" of the instruction, much like an architect's blueprint of a building.

When this activity has been completed, you will then usually work with a subject-matter expert to develop the instructional displays and communication in accordance with your design specifications, much as an architect would work with a contractor to build the building in accordance with a blueprint. Finally, you will evaluate and revise the instruction before implementing it. The instruction which you are developing may be for any one of a wide variety of contexts, including such K–12 and higher-education forms of instruction as teacher lesson plans, textbooks, educational software, audiovisual materials, workbooks, handouts, educational films, tutoring programs, laboratory demonstrations, and role-playing activities, and such adult-education forms of instruction as health education, business training, professional updating and recertification, and even recreation- and hobby-related learning resources. As our information society increases its rate of change, the importance of good instruction is likely to increase dramatically (Naisbitt, 1982), as will the variety of contexts within which instructional design expertise will be valuable.

As we proceed with the design of your instruction in this chapter, we will look at a wide variety of situations for which each of those differences is most appropriate. But before we survey the current state of the art, a brief historical perspective may be useful for gaining insights into both the directions in which our knowledge about instruction is developing and the major shortcomings in our current knowledge about instructional design.

Trends in the Field of Instruction

For the first few centuries after the Renaissance, efforts to improve instruction were philosophical in nature. It wasn't until the 1950s that research became the prevalent mode of inquiry. With the quest for the "ideal" instructional model, there evolved a global perspective that attempted to identify *one* instructional method that was superior to all others. As a result, research tended to investigate very general, gross variables and focused on comparison between major methods of instruction. Lecture was compared with discussion. Inductive methods were compared with deductive methods. The discovery method was compared with the expository approach. Mediated instruction was compared with nonmediated instruction.

It soon became apparent that the research results were contradictory—that any one of these methods could be designed and utilized in such a way as to be better than the alternatives. These contradictory results led investigators to realize that there could be more variation within each category of methods than between them, that is, two different discovery methods could differ more than an expository and a discovery method. So the field of instruction entered into an *analysis* phase in which methods of instruction were broken down into elementary components, called instructional strategy components, such as rules and examples (e.g., the ruleg investigations; see Evans, Homme, & Glaser, 1964) and overt responses and reinforcement (e.g., the programmed-instruction investigations; see Crowder, 1960; Skinner, 1969).

Research on individual strategy components has built up a knowledge base of validated principles of instruction—that is, reliable statements about the effects of each component under different situations. The problem with this piecemeal knowledge base is that it is relatively difficult for instructional designers to "mix and match" these components into the best combination for each and every situation. So gradually, various investigators have begun to usher the field of instruction into a *synthesis* phase in which strategy components are combined into *models* of instruction, each of which is supposed to be better than any other known combination for a certain learning situation. Hence, situations provide the basis for prescribing instructional models. Although some promising progress has been made on synthesizing our current knowledge about instructional strategy components, much more work is needed.

Conceptual Framework

It may be helpful to summarize a few points about learning situations instructional models, in order to provide a conceptual framework that make it easier to understand the remainder of this chapter. An instructi strategy component is a part or aspect of a method of instruction. It ha influence on learning outcomes.

1. Knowledge about instruction has two major elements:
   (a) **instructional strategy components** (what kinds of compo exist?) and,
   (b) **learning situations** (when should we use each strategy ponent?).

2. Insofar as possible, strategy components should not be prescribed vidually; they should be combined into *optimal* models (each of whi better than any other set of components) for different learning situat (Incidentally, the models and the bases for prescribing them constitute is referred to as a theory of instruction; see Reigeluth, 1983a.)

3. Since some models differ only in minor ways from others (be their learning situations differ in only minor ways), it is more economic think in terms of just a few ***general models*** of instruction **plus** a seri ***variations*** which serve to tailor a general model to a precise learning tion (Gropper, 1983).

4. Different models and variations of those models are prescribe different kinds of learning situations, depending on the nature of the co and the desired outcome. (These will be discussed in further detail in s quent sections.)

Hence, the remainder of this chapter will describe: (a) the major *ge models* of instruction, plus the bases for prescribing each, and, (b) son the major *variations* on each general model, plus the bases for prescr each.

Let's return to your task: to develop some instruction. You have al analyzed the requirements for the instruction and have performed a ta content analysis which resulted in a complete determination of *what* to t Now you need to decide *how* to teach it. You should start by designin overall structure and sequence of the instruction, and then proceed to d the instruction on each piece of content within that sequence.

To make your work easier and more effective, you want to select the appropriate general model for the overall structure and sequence o course. On the most general level, you must determine whether your and objectives are *primarily* motor, affective, or cognitive (Bloom, Krathwohl, Bloom, & Masia, 1964) because the nature of the instruction will be very different for each of these three types of goals (i.e., situations on the broadest level of conceptualization).

Motor goals are desired outcomes largely related to performing a physical action, such as typing or swimming. *Affective* goals refer to the development of feelings, attitudes, and values, such as wanting to vote. Goals in the *cognitive* domain deal with learning intellectual knowledge and skills. Although most instruction includes goals in all three domains, one domain is usually dominant and therefore provides the basis for selecting one of the three classes of general models of instruction.

AFFECTIVE DOMAIN

The affective domain (Krathwohl et al., 1964) includes human attitudes and values. Over the years, schools and businesses have assumed an ever-growing role in the development of positive attitudes and values in their learners. If your goals are primarily in this area, then there's not much guidance from instructional design as to what to do. Three models that will be discussed briefly are values clarification (Harmin, Kirschenbaum, & Simon, 1973), cognitive moral development education (Kohlberg, 1976), and social modeling (Bandura & Walters, 1963).

The intention of the values clarification movement of the 1960s and 1970s was to encourage students to identify, select, and act on their currently held values and to motivate students to think about and discuss the moral issues. The values-clarification model requires students to confront a moral issue, state their position on that issue, and reflect on their position and the positions of others (Ryan, 1981).

Moral education is an area within the affective domain which has received growing attention over the last ten years. Perhaps the best known approach to moral education is Kohlberg's (1976) cognitive moral-development education. Kohlberg has identified three levels of moral development. The *preconventional level* is one in which the person approaches a moral question on the basis of his or her own personal interest or perspective. At the *conventional level,* the person approaches a moral question from the perspective of a member of the larger society. The final level is the *principled level,* in which the person makes moral decisions on the basis of his or her own developed set of ethics (Hersh et al., 1980; Ryan, 1981).

Kohlberg (1976) advocates an instructional model "in which the teacher Socratically elicits conflicting student views on a moral issue or dilemma" (p. 20) within an atmosphere of moral reasoning and discussion. The instruction not only corresponds to the student's specific level of moral development, but also attempts to influence and guide that development toward the next higher

level. The teacher's first task is to identify the student's present level moral development. The teacher then carefully chooses and poses a prob or dilemma to the student and provides an atmosphere which encourages discussion of conflicting moral views, thus helping to raise the student's l of moral reasoning to the next higher level.

Attempts to encourage positive behavior patterns as well as to cha negative behavior have also been common. One approach, for exam advocates the acquisition of knowledge through the observation of *hu models* (Bandura, 1963, 1969). This observational learning requires: exposure to a model, (2) acquisition of knowledge of the model's behav (3) acceptance or rejection of the model's behavior by the individual in fu performance (Liebert & Spiegler, 1974). It should be noted that this model of learning, not of instruction. Although it should be possibl develop a model of instruction based on Bandura's work, such has not been done.

Behavior modification extends the modeling approach through the us appropriate reinforcements for both desirable and undesirable behav Bandura (1965) found that modeling in which behavior is rewarded is n more likely to be imitated than modeling in which behavior is punis Therefore, although the behavior may have been learned through observa performance of that behavior is influenced by the type of reinforcement a ciated with the behavior. This is clearly an instructional prescription would be part of the instructional model.

Obviously, our knowledge about effective instructional strategies affective objectives is inadequate; it does not allow us to provide very u prescriptions for designing instruction in this domain. More work is ne on what strategy components to use when within each of these three mo but work is especially needed on identifying the situations for which ea these models is better than any alternatives, on identifying situation: which none of these models is very appropriate, and on developing mod instruction for each of those "new" situations.

MOTOR SKILL DOMAIN

Although largely ignored until recently, research into the learning of r skills has been mainly related to industrial training and sports training texts (Romiszowski, 1981). Several approaches to instruction have advocated in this domain: the traditional (or direct) approach and the r ment education approach. However, neither can be considered a mo instruction. The traditional approach has focused on selection of conte matching a series of formal motor activities to the stages of child dev ment (Wade & Davis, 1981). The movement education approach us organized set of play and dance experiences in order to provide the opportunity for children to discover a variety of fundamental motor behaviors in a problem-solving situation (Wade & Davis, 1981).

Mental practice (Singer, 1972; Singer & Witker, 1970) is an interesting strategy component, which requires the mental or imaginary rehearsal of overt performance of a particular task. Mental practice takes place between practice sessions in order to improve the effect of motor training. It is often intended to reduce anxiety.

In addition, some investigators have advocated the teaching of motor skills for purposes of enhancing cognitive-skill development (Doman et al., 1960), but such work is in the cognitive domain (because it is intended to achieve cognitive outcomes), even though the methods entail motor activities (motor means).

The only work we have found which approaches being an instructional model in the motor-skill domain is that of Gagné (1985; Gagné & Briggs, 1979). This very general model prescribes demonstrations, practice, and informative feedback as the major strategy components, and indicates that sometimes (presumably for more complex motor skills) it is beneficial to divide the motor skill into *part-skills,* each of which is taught in isolation, followed by instruction in putting them all together (Fitts & Posner, 1967; Naylor & Briggs, 1963; Singer, 1972, 1975). Gagné also recommends the use of verbal instructions, checklists, and/or pictures for teaching the learner how to put all the part-skills together.

One can readily see some similarities between this model and models of instruction in the cognitive domain. The relationship between motor-skill and cognitive-skill learning has only recently been recognized. Increasingly, strategy components are being prescribed for both of these domains (see, e.g., Landa, 1983). The roles of goal setting, sequencing, repeated practice, feedback, and motivational considerations are all very similar to their counterparts in the cognitive domain. Strategies such as backward and forward chaining (Gilbert, 1962) and the executive subroutine procedure (Fitts & Posner, 1967) have been used within both domains. In addition, such strategies from the cognitive domain as mastery learning, information processing, cybernetics, and behavior modification are often used in motor-skill instruction.

However, it is clear that much more work is needed in this domain. More detailed prescriptions are needed for each of the general components in Gagné's model, and it seems likely that additional strategy components will be found that are helpful. Furthermore, different types of motor skills are likely to require different treatment. Perhaps gross motor coordination and fine motor coordination each require some specialized strategy components that are not needed for the other. Skills differ with respect to such requirements as speed, accuracy, force, and smoothness (Gagné & Briggs, 1979).

Perhaps differences in such skill characteristics require different str: components. We hope to see much more research and model building ir domain over the next ten years or so.

COGNITIVE DOMAIN

Here we can provide you with more guidance than for either the affecti psychomotor domain because instructional researchers and theorists done far more work in this domain. To continue with your task of dev ing some instruction, let's assume that your goals are primarily cogn Most instructional theorists indicate that your first task is to decide ho sequence all of the content (skills and information) that you identified in task analysis as important to teach (see, e.g., Branson et al., 1975; Gag Briggs, 1979). Since this is the broadest level of instructional design, referred to as the *macro-level.*

Why is the sequencing of instruction important? Simply stated, il sequence of a piece of instruction is bad, people won't learn as well. A bel (1963) argued that the sequence in which learning occurs influence stability of cognitive structures and thereby influences long-term rete and transfer.

Gagné and Briggs (1979) recommend a "top-down" approach to desig an instructional sequence, in which you "work from more general goals objectives down to increasingly specific objectives" (p. 29). First, a n analysis is conducted to identify the broader "life-long objectives, w imply the continued future use of what is learned after the course is o (p. 137). Then successive levels of objectives are determined, begir with end-of-course objectives which state the performance expected imr ately after instruction is completed. Once you have identified the gen end-of-course objective, you identify major ***course units,*** each of which require several weeks of study. These units "define the performa expected on clusters of objectives having a common purpose in the orga tion of the total course" (p. 137). These unit objectives may be referr as ***target objectives,*** which you then cluster into groups and sequ thereby forming a general structure of the course.

This process of further analyzing objectives and then sequencing the repeated for several more levels. You derive *performance objectives,* w are the specific learning outcomes expected, and which are at the approp level for task analysis, including information-processing analysis hierarchical analysis. Then you sequence the performance objectives, of which will make up a ***lesson.*** Finally, these performance objectives broken down into ***enabling objectives,*** each of which may in turn several subordinate objectives. The enabling objectives "support the lear of performance objectives either because they are essential prerequisite s required to learn target objectives or because they facilitate such learning" (p. 137). And, of course, you sequence these enabling objectives within each lesson.

Once the sequence has been designed, you need to design the instruction on each individual skill or piece of information in that sequence. This entails deciding such things as the number and types of examples, practice, visuals, memory aids, attention-focusing devices, and the like. If time and budget permit, a learner analysis should be conducted to provide information on the difficulty level of the content in relation to ability levels of the entry learners. Often, however, constraints on time and budget require reliance on an experienced teacher to provide that information. The result of this process is the listing of strategy components to be used for each skill and piece of information in the sequence, and the order in which those strategy components should be presented.

SEQUENCING STRATEGIES

Many different sequencing strategies have been proposed. Posner and Strike (1976) suggest that five types of organizing principles may be combined to create instructional sequences. The five organizing principles are:

1. World-related sequences—the consistency and relationships among phenomena as they exist in the world;
2. Conceptual-related sequences—the organization of the conceptual world as it relates to the real world;
3. Inquiry-related sequences—"those that derive from the nature of the process of generating, discovering or verifying knowledge" (p. 676);
4. Learning-related sequences—based on knowledge about the psychology of learning; and
5. Utilization-related sequences—either through procedural sequences for problem solving or based on the utilization potential of the content.

Posner and Strike (1976) also identify a variety of sequences within each of these five categories. However, this perplexing plethora of possible sequences can be reduced to a few major types of sequences which researchers, educators, and instructional designers have found to be most helpful to learners. Almost universally, these major types of sequences are some form of simple-to-complex sequence. The following is a brief description of each.

Bruner's Spiral Curriculum

Bruner (1960, 1966) suggests that if an idea is determined to be important for a student to know, it should be introduced as early as possible on an intuitive, experiential *(enactive)* level. The idea is then developed and redeveloped as the learner matures intellectually. This continuous exposure

to the idea provides the learner with a deeper and more meaningful und standing of that idea.

Hence, Bruner's spiral sequence prescribes that content be sequenced co mensurately with the learner's intellectual development and that the seque be built around the fundamental ideas in the subject. This approach dema that the same fundamental ideas of a subject be taught at each grade but w increasing levels of sophistication. Therefore, a **spiral** is produced by periodical recycling of the same ideas through progressively greater degr of complexity.

The spiral approach to curriculum sequencing has been used occasiona Bruner himself was involved in the design of *Man: A Course of Study* social-studies text that utilized a spiral approach (Bruner, 1966). Howe Bruner did not provide specific guidance as to how to create a spiral curri lum. Hence, it has not been easy for designers to use this sequencing st tegy.

Ausubel's Progressive Differentiation

Ausubel (1963) constructed an instructional theory based on his theory learning, which assumes that learners' cognitive structures are "hierarchic organized in terms of highly inclusive concepts under which are subsu less inclusive subconcepts and informational data" (1960, p. 267). instructional theory proposes ***advance organizers,*** in which general inclusive ideas are presented first, followed by related ideas of gre specificity and detail. This sequence provides ***progressive differentiatio*** the initial ideas, such that the learner ***subsumes*** new, detailed knowle under previous more general knowledge, resulting in stable cognitive st tures that are resistant to forgetting.

In accordance with this theory, Ausubel (Ausubel, Novak, & Hanes 1978) advocates a general-to-detailed sequence that begins with more gen and inclusive *anchoring ideas,* which in turn serve as organizers for the level of detail and specificity. The ideas on that next level in turn serv advance organizers for another level, and so on until the desired leve detail is reached. Unfortunately, Ausubel's instructional theory was marily intended for the social sciences and other highly conceptual, ve types of content. For more structured procedural content such as mathe ics, his general-to-detailed sequence has not been adequately develo Also, like Bruner, Ausubel has not provided specific guidance as to ho create this type of simple-to-complex sequence, making its use difficult instructional design.

Gagné's Hierarchical Sequence

Gagné (1968, 1985) advocates the hierarchical analysis of intellectual sk A *learning hierarchy* is formed by breaking each intellectual skill simpler component parts. The component skills are then taught in a parts-to-whole sequence which follows the hierarchy in a "bottom-up" fashion, first teaching the most elemental parts at the bottom of the hierarchy, followed by progressively more complex combinations of the parts. It was found that teaching the prerequisite knowledge first facilitates the learning of the higher-order skills more than teaching the prerequisite knowledge out of sequence (Gagné, 1962; White & Gagné, 1974, 1978). However, there are relatively few unmastered prerequisites for most of the skills taught in most courses. Also, there are other kinds of relationships among skills in a course (besides the prerequisite relationship) that influence the kind of sequence that will most facilitate learning. Therefore, the hierarchical approach is a necessary but not sufficient basis for sequencing instructional content.

Shortest Path Sequence

Procedural content—content which is algorithmic in nature—has long been analyzed by performing an information-processing analysis. P. Merrill (1978) and Scandura (1973, 1983) are among the first who also advocated that a *path analysis* be conducted to identify all possible paths through a flow chart of the procedure (see Chapter 6). The path analysis provides the basis for designing yet another type of simple-to-complex sequence, one in which the operations constituting the shortest path are taught first. The remainder of the sequence consists of a series of paths (expanding sets of operations) which are progressively longer, that is, there are progressively more operations in each path. Therefore, as the instruction proceeds, the procedure or rule, as it is known to the learner, becomes more complex and detailed. This kind of sequence has much intuitive appeal. But what about courses within which procedural content is a relatively insignificant part of the subject matter, such as a social-studies course or an introductory course in economics? Again, this is an important but not sufficient sequencing strategy.

A GENERAL SEQUENCING MODEL

All four of the sequencing strategies described above for the cognitive domain—spiral, progressive differentiation, hierarchical, and shortest path—are variations of the simple-to-complex pattern. The Reigeluth-Merrill Elaboration Theory (Reigeluth & Stein, 1983) proposes an elaboration approach to sequencing which integrates and builds upon all four of these strategies; it uses both an analysis of the structure of knowledge and an understanding of learning theories and cognitive processes to design an instructional sequence.

The elaboration approach has two major features: (1) The earlier ideas *epitomize* rather than summarize the ideas that follow; and (2) The sequence is based on a *single* content orientation (Reigeluth & Stein, 1983). To epi-

tomize is to present a few of the most fundamental and representative i at a concrete application (or skill) level (Reigeluth, 1979). Subsequent sons add complexity or detail to one part or aspect of the overview in la (called elaborations). The nature of the elaborations will differ, depen on the content orientation: whether the instruction should focus primaril "what" (concepts), "how" (procedures), or "why" (principles). Ca analysis has shown that virtually every course holds one of these three t more important than the other two. Hence, the Elaboration Theory prop that the nature of the simple-to-complex sequence must differ, dependin the kind of content that is considered to be most important to the goals o instruction.

The Elaboration Theory views an instructional sequence much like s ing a picture through the zoom lens of a camera. A person starts w wide-angle view, allowing the viewing of major parts of the picture an major relationships among the parts, but without any detail. Once the p zooms in on a part of the picture, more about each of the major subpart be seen. After studying those subparts and their interrelationships, the son can then zoom back out to the wide-angle view to review the other of the whole picture and to review the context of that one part withi whole picture. Continuing in this "zooming in" pattern, the person grad progresses to the level of detail and breadth desired.

The Elaboration Theory starts the instruction with a special kind of view containing the simplest and most fundamental ideas, called the *epi* Then, subsequent lessons add complexity or detail to one part or asp the overview in layers *(elaborations)*, while periodically reviewing and tifying relationships between the most recent ideas and those presente lier. This pattern of elaboration followed by summary and synthesis c ues until the desired level of complexity has been reached. The elabo sequence is highly detailed and precise in terms of its actual operation tion and allows sufficient freedom for the learner to select which p zoom in on next and how far to zoom in on each one of the major idea

In spite of the detail and precision of Elaboration Theory and its basis in cognitive-learning theory and the structure of knowledge, ma the prescriptions for this sequencing strategy have not yet been suffic tested. Much more research is needed to validate and revise the strategy

Variations on the Sequencing Model

In reviewing the sequencing strategies of Bruner, P. Merrill, Ausube others, Reigeluth and M. D. Merrill found that each of these strategie a simple-to-complex sequence (see Reigeluth & Stein, 1983). Howeve dimension upon which those sequences were elaborating was differe each of them. That is, Bruner used *principles,* while P. Merrill utilize *cedures,* and *concepts* were the primary target of Ausubel's sequence.

In all the work that has been done on sequencing, the elaboration of concepts, principles, and procedures are the only three we have found, although additional ones may be identified in the future. This finding is consistent with M. D. Merrill's (Merrill, 1983; Merrill & Wood, 1974) identification of three content types for generalizable knowledge. Therefore, the Elaboration Theory proposes three different ways of elaborating, based on those three content types.

Hence, at this point in the development of your instruction, you must decide whether your goals are primarily conceptual (focusing on the "what"), procedural (focusing on the "how"), or theoretical (focusing on the "why"). If your goals are primarily **conceptual** in nature, as is usually the case in an introductory biology course, then the elaboration sequence should follow the process of meaningful assimilation of *concepts* to memory (Ausubel, 1968; Mayer, 1977). First, according to Elaboration Theory (Reigeluth & Darwazeh, 1982), you analyze and organize the concepts into **conceptual** structures, which show their superordinate, coordinate, and subordinate relationships. Then you design the instructional sequence by selecting the most important, comprehensive, and fundamental conceptual structure and sequencing its concepts from the **top down** (i.e., from the most general and inclusive concepts to progressively more detailed and less inclusive concepts). Finally, other concepts and other types of content, including learning prerequisites (Gagné, 1968), must be fleshed onto that skeleton of a sequence at the point where each is most relevant (Reigeluth & Darwazeh, 1982).

Alternatively, your goals might be primarily **procedural** (addressing the "how"), as in an English composition course. In this case, the elaboration sequence should follow the optimal process of *procedural skill* acquisition. Your first activity is to identify the simplest possible version of the task (usually equivalent to the shortest path through the procedure in P. Merrill's path-analysis methodology) and to identify the *simplifying assumptions* which define that simplest version. Your next task is to design the instructional sequence by gradually relaxing the simplifying assumptions in the order of most important, comprehensive, and fundamental ones first, such that progressively more complex paths are taught. Then the other types of content, including concepts, principles, learning prerequisites, and factual information, are "plugged into" that sequence at the point where each is most relevant (Reigeluth & Rodgers, 1980).

The final possibility is that your goals are primarily **theoretical** (addressing the "why"), as in an introductory economics course. In this case, the elaboration sequence follows the psychological process of developing an understanding of natural processes (primarily causes and effects), which is usually the same as the order of the historical discovery of such knowledge. After identifying the breadth and depth of principles that should be taught, you design the instructional sequence by asking the question "What principle(s) would you teach if you only had the learners for **one hour**?" and ". . . one

more hour?" and so on until all the principles have been arranged sequence that progresses from the most basic and fundamental principlc the most detailed, complex, and restricted principles. During this proces is often helpful to look at an earlier principle and ask "Why?", "W way?", "How much?", or "What else?" to identify more complex princ which elaborate on the earlier one. Other types of content are then plu into that sequence at the point where each is most relevant (Reigelutl press; Sari & Reigeluth, 1982).

When you finish designing the sequence, you will have a macro-l blueprint similar to the one shown in Fig. 7.1. It shows all of the organi content (in this case, principles) allocated to lessons, and it shows the

		ORGANIZING CONTENT	SUPPORTING		CONTENT		
LEVEL	LESSON	(PRINCIPLES)	CONCEPTS	PRINCIPLES	PROCEDURES	LEARNING PREREQUISITES	FACTS
Epitome	1	•The body gets energy and nutrients from food.		•Different ages and sizes of people require different amounts of energy and nutrients.		•Energy •Nutrients	•4 food groups
1	2	•The body gets energy from food containing protein, carbohydrates, or fat.	•Kinds of food.			•Protein •Carbohydrates •Fat	•List and defini each other kind (remember level
2	3	•Energy is used through exercise and physical activity. •If too much food is eaten, energy from that food is stored as fat. •Body fat is changed back into energy by reducing the amount of energy readily available.	•Kinds of exercise. •Kinds of physical activity.		•How to figure out amount of energy needed. •How to reduce amount of energy readily available.	•Calorie •Exercise •Physical activity	•One pound of fa by using 3500 c •List and defin each kind of ex physical activ (remember leve
2	4	•Protein from food gives you energy and helps develop muscles. •Carbohydrates give you quick energy. •Ingested fat gives you twice as much energy as anything else.				•Muscles •Ingested fat	•Number of calo common food.
1	5	•Vitamins and minerals provide essential nutrients for proper body growth and function.	•Kinds of vitamins. •Kinds of minerals.	•Vitamin deficiencies cause diseases. •Mineral deficiencies cause diseases.		•Nutrient •Vitamin •Mineral •Body function •Vitamin deficiency	•List of each ki vitamin. •List of each k mineral.
2	6	•Vitamin A makes smooth, healthy skin, develops "night" sight and reduces the chances of catching a cold. •Vitamin B_1 (thiamin) keeps nerves healthy, aids good digestion, and helps your body use other foods for energy. •Vitamin B_2 (riboflavin) keeps mouth and eyes healthy and helps your body use oxygen. •Niacin keeps skin and nerves healthy. •Vitamin C (ascorbic acid) keeps your gums, skin, and muscles healthy, helps keep you from catching a cold. •Vitamin D helps build strong teeth and bones, and makes legs straight and strong.			•How to meet your vitamin needs.	•Definitions of any unknown terms in the principles	•Vitamin content common foods.
2	7	•Calcium builds strong bones and teeth, and stops bleeding when you cut yourself. •Phosphorus builds bones, teeth and nerves and helps you use other nutrition for energy. •Iron builds healthy red blood. Copper helps build healthy red blood. •Iodine controls how you use energy.			•How to meet your mineral needs.	•Definitions of any unknown terms in the principles.	•Mineral conten common foods.

FIGURE 7.1. A macro-level blueprint for a course on nutrition.

porting concepts and procedures, learning prerequisites, and factual supporting content for each lesson.

Within-lesson sequence. Next, you need to design a sequence for all content *within* each lesson. The Elaboration Theory offers several guidelines here: (1) Usually put supporting content immediately after the organizing content to which it is most closely related, (2) Put each learning prerequisite immediately before the content for which it is prerequisite, (3) Group coordinate concepts together, and (4) Teach a principle (meaningful understanding of processes) before any related procedure (see Fig. 7.2 for an example of a lesson sequence). Other macro-strategy components are integrated into the lesson sequence, such as summarizers, synthesizers, analogies, cognitive-strategy activators, macro-level motivational-strategy components, and macro-level learner-control options (Reigeluth & Stein, 1983).

Summarizers. A summarizer is a strategy component used to review systematically what has been learned (Reigeluth & Stein, 1983). It provides (1) a concise statement of each idea or fact that has been taught, (2) a typical,

LESSON 3 SEQUENCE

1. Contextual synthesizer.
2. Learning Prerequisites: Exercise, physical activity.
3. Organizing Content: Energy is used through exercise or physical activity.
4. Supporting Concepts: Kinds of exercise. Kinds of physical activity.
5. Organizing Content: If too much food is eaten, energy from that food is stored as fat.
6. Supporting Procedure: How to figure amount of energy needed.
7. Organizing Content: Fat is changed back into energy by reducing the amount of energy readily available.
8. Learning Prerequisite: definition of calorie.
9. Supporting Fact: One pound of fat is "burned" by using an equivalent of 3500 calories of energy.
10. Supporting Procedure: How to reduce the amount of energy readily available.
11. Supporting Fact: List and definition of each kind of exercise and physical activity.
12. Summarizer.
13. Post-synthesizer.

FIGURE 7.2. An example of a within-lesson sequence for one lesson of a course on nutrition.

easy-to-remember example, and (3) some diagnostic, self-test, practice for each idea. ***Internal summarizers*** appear at the end of each lesson, ***within-set summarizers*** summarize all of the ideas and facts that have taught so far in an entire set of lessons. A set of lessons is all those lc that elaborate directly on a single lesson.

Synthesizers. A synthesizer is used to interrelate and integrate ideas. intended to (1) provide the learner with a valuable kind of knowledg facilitate a deeper understanding of the individual ideas, (3) increas meaningfulness and motivational appeal of the instruction (Ausubel, Keller, 1983), and (4) increase retention. The Elaboration Theory pre prescribes three types of synthesizers, each of which interrelates ideas single content type (Reigeluth & Stein, 1983).

Analogies. An analogy relates new information to a more familia hence more meaningful context of organized knowledge that the lc already possesses (Ortony, 1979; Verbrugge & McCarrell, 1977). It re the learner of something more concrete within the learner's experier order to prepare him or her for understanding a more abstract, comple: of idea (Curtis & Reigeluth, 1984; Reigeluth, 1983b).

Cognitive-strategy activators. A cognitive-strategy activator, which act the learner's use of a generic skill, can be used for any content area. I be *embedded* into the instruction, as when a mnemonic or analc presented, or it may be *detached,* as is the case when the learner is prc only with the directions to use a previously learned cognitive strategy ney, 1978), such as "think up an analogy," or "try to come up v mnemonic."

Learner control. Learner control may offer the learner options for the tion and sequencing of his or her content and instructional strategie thereby control over how he or she will study and learn (M. D. M 1979, 1983, 1984; Reigeluth & Stein, 1983). Learner control of c offers selection of any lesson for which the learner has already acquir prerequisites, while learner control of ***instructional strategies*** offers se of the type, order, and number of such micro-strategy components as ples, practice items, and alternative representations, and type and tim such macro-strategy components as summarizers, synthesizers, and anal

At this point, you have designed the following aspects of your instru

1. An elaboration sequence of lessons,
2. A within-lesson sequence for each lesson, including any nec learning-prerequisite sequences,
3. A summarizer for each lesson,

4. A synthesizer for each lesson,
5. Analogies as needed,
6. Cognitive-strategy activators as needed, and
7. Learner control to the extent appropriate.

MICRO-LEVEL STRATEGIES

Now that you have selected and sequenced all of the skills and information that need to be taught, you need to design the instruction on each individual skill and piece of information (micro-level design). This entails making a number of decisions about a variety of different micro-strategy components, such as examples, practice, feedback, representation forms, memory devices, and attention-focusing devices. The decisions include: (1) which components should be used, (2) how much of each should be used, and (3) what should each component be like.

The macro-level blueprint shown in Figs. 7.1 and 7.2 indicates the sequence for instruction related to nutrition and energy. Micro-design for that course would specify how to teach such ideas as "calories," "the relationship of age and size to nutrition and energy," "how vitamins are used in the body," and others of this general sort.

Much work has been done on each of a wide variety of micro-strategy components. This work has contributed greatly toward the building of a common knowledge base from which much needed optimal models of instruction are beginning to emerge (Reigeluth, 1984b). Evans, Homme, and Glaser (1962) developed prescriptions for the use of rules and examples (ruleg). Skinner's work (1954, 1965) includes prescriptions on the use of overt responses, reinforcement, and shaping. Bruner's work (1960, 1966) includes prescriptions for the use of a variety of representation forms, specifically enactive (the real thing), iconic (representations which bear some resemblance to the real thing), and symbolic (ones which bear no resemblance to the real thing). Rothkopf (1976) has developed prescriptions for the use of *mathemagenic information,* forms of guidance which help the learner to understand new knowledge or to acquire new skills. Kulhavy (1977) has done much work on prescriptions for the optimal form of feedback on practice. Landa's work (1974, 1976, 1983) includes prescriptions for the use of algorithms to aid skill acquisition. Horn (1976) has developed some useful prescriptions for *information mapping* to isolate and label the nature of each component of the instruction.

Most of the work mentioned previously was fairly piecemeal in that it made no attempt to prescribe the full variety of strategy components that should be included in any module of instruction. However, some important efforts have been undertaken to identify optimal combinations of strategy components, which are far more useful to instructional designers than piece-

meal prescriptions. Gagné (1968) was a pioneer in attempts to integrat piecemeal knowledge about instructional strategies on the micro-level identified nine *events of instruction* considered to be critical for effe instruction. They include: (1) *gaining attention* through the use of sti change; (2) *informing the learner of the objective* to help the learner r nize the importance and relevance of the instruction; (3) *stimulating rec prerequisite learnings* so that the learner may combine them with new l ing; (4) *presenting the stimulus material* in an appropriate manner t learner; (5) *providing learning guidance* in accordance with the level of plexity and difficulty of the material to be learned and the level of know and ability of the learner; (6) *eliciting the performance* which represen desired learning; (7) *providing feedback about performance correctne* order to establish reinforcement of appropriate performance and pr further inappropriate performance; (8) *assessing performance* in ord evaluate learning; and (9) *enhancing retention and transfer* by providing and strategies for retrieval.

Gagné, Wager, and Rojas (1981) assert that all nine events of instr should be considered, but decisions about which events to include and h represent and sequence them are dependent on the nature of the le objective and the intended learners. Gagné and Briggs (1979) pr prescriptions for each event of instruction depending on the type of le objective—intellectual skill, cognitive strategy, verbal information, att or motor skill—by combining them into a matrix of five distinct mod instruction. An example of their model for teaching *verbal inforı* includes 1. gaining attention (introducing stimulus change); 2. informi learner of the objective (specifying the type of verbal question answered); 3. stimulating recall of prerequisite learning (recalling a c of organized information); 4. presenting the stimulus material (pres information in propositional form); 5. providing learning guidance (su ing verbal links to a larger meaningful context); 6. eliciting the perfor (asking the learner to respond through paraphrasing of information); 7 viding feedback (informing about the correctness of a response); 8. ass performance (requiring the learner to restate the response); and 9. enh retention and transfer (providing verbal links to additional comple information) (Gagné & Briggs, 1979, p. 166).

Although they have provided some useful examples, Gagné and have not provided many generalizable prescriptions as to specific i tional strategy components for designers to use to accomplish each i tional event for any given type of objective. Since Gagné and developed their notion of the nine events of instruction, much work ha done to develop detailed prescriptions about what specific kinds of st change to use when, how to present information in propositional form kinds of verbal links to use when, and what type of feedback to e

Generalizable prescriptions have been developed for such specific strategy components as mnemonics, visual images, a variety of attention-focusing devices, and other strategies. Although the nine events of instruction do not provide detailed generalizable guidance for instructional designers, this work has made several extremely important contributions to our knowledge base. First, it provides a useful, broad framework that integrates many prescriptions that have been generated about particular instructional-strategy components. Second, it also introduced the notion that different models of instruction were needed for different learning situations, and that the most important type of learning situation for prescribing instructional models is the nature of what is to be learned.

George Gropper (1973, 1974, 1975, 1983) has also done much work to integrate our piecemeal knowledge base about micro-level strategy components into models of instruction. Like Gagné and Briggs (1979) and most other instructional theorists, he prescribes different instructional-strategy components for different types of objectives. Some of those strategy components are always used when teaching most types of objectives. They are called *routine treatments* and include (1) telling students what to do and how to do it, (2) providing a variety of examples, (3) providing rules governing performance, and (4) requiring practice of an intact criterion behavior (Gropper, 1983). But not all of these components are used for every kind of objective. For example, objectives that entail "recalling facts" require only the first and the fourth: "telling students what the facts are" and "requiring students to practice . . . the facts" (Gropper, 1983, p. 149).

In Gropper's instructional theory, other strategy components are included for all types of objectives, but only when the objective is fairly difficult for the learners. They are called *shaping progressions* and include: (1) increasing the strength of cues, (2) reducing the size of the unit of behavior, (3) introducing *recognize* and *edit* as intermediate modes of practice before requiring the learner to *produce,* and (4) introducing easier practice examples before more difficult ones (Gropper, 1983).

Still other strategy components are also used when the objective is fairly difficult for learners, but are idiosyncratic to the specific objective. They are called *specialized treatments.* For example, instruction on objectives that call for defining concepts would use "special cues such as diagrams or information maps that distinguish between instance and noninstance" (Gropper, 1983, p. 151), and instruction on objectives that entail following procedural rules would use "backward chaining for long chains" and "job aids or checklists (cues) to overcome difficulties traceable to the length of a chain" (pp. 153–154). These three types of strategy components are listed here in order of their priority for use, which is based on their relative efficiencies. Each type of component results in progressively longer (less efficient) instruction, and should therefore only be used when the higher-priority components are inade-

quate. Gropper provides much detailed guidance to the designer a: specific strategy components to use in the micro-level design of instructio

Concept classification is one of the types of objectives used both by G: and Briggs and by Gropper to prescribe an instructional model. Markle Tiemann (1969), M. D. Merrill and Tennyson (1977), and Klausmeier, (tala, and Frayer (1974) have all developed many useful strategies specifi for teaching concepts, including "matched" or "close-in" nonexamples stages in the development of a learner's knowledge of concepts.

THREE INSTRUCTIONAL MODELS FOR THE MICRO-LEVEL

M. D. Merrill's Component Display Theory (Merrill, 1983; Me Reigeluth, & Faust, 1979; Merrill et al., 1977) builds on the Gagné-B framework and integrates into it much existing knowledge about m design considerations. It is comprised of *three models* of instruction, ea which can be used in varying degrees of richness, and a system for *three categories of objectives* to prescribe those models. The three typ objectives include: (1) Remember a generality or an instance (rote rec meaningful understanding), (2) Use a generality on new instances (skill a cation), and (3) Discover a new generality (cognitive-strategy applica These correspond roughly to Gagné's verbal information, intellectual s and cognitive strategies, respectively. Component Display Theory ((indicates what combination of instructional-strategy components is likely to optimize achievement of each of these three desired outcomes.

At this point in the development of your instruction, you must pic skill or piece of information (concept, principle, procedure, or fact) fro lesson and decide which of the three levels is represented by its objectiv

Remember-Level General Model

If the objective for your piece of content calls for it to be learned b recall or meaningful understanding with no intention that the learner b to generalize it to a variety of cases (that would be skill application). CDT prescribes that the primary components in the instruction b presentation of the information that is to be remembered and (2) pract recalling that information. CDT also prescribes a variety of secondary ponents: mnemonics, attention-focusing devices, and of course imm feedback on the practice (M. D. Merrill, 1983). These are simi Gropper's *shaping progressions* and *specialized treatments.*

Variations of the Remember-Level Model

There are several learning situations that call for modifications in this g model. One is that the *richness* of the instruction needs to vary, dep on the difficulty of the content. The easier and more familiar the content, the fewer secondary components are needed. The other modification is that some strategy components will be different, depending on whether the objective calls for remembering *verbatim* (rote recall) or *paraphrased* (meaningful understanding). CDT prescribes that a prototypical example (for remembering a generality) and an alternative representation (e.g., a diagram or paraphrase of the content to be remembered) be included in the instruction only for remembering the paraphrased form.

Reigeluth (1984b) has expanded on this model and its variations. The following strategy components are not necessarily used sequentially:

a. Stimulate and maintain *interest* (if necessary)
   —question —demonstration —game
   —novelty —analogy
b. Create or activate a *meaningful context* (if appropriate)
   —related learner experience (experiential knowledge)
   —subsuming ideas (superordinate knowledge) if any
c. Present the *information*
   —consistent with the postinstructional requirements
   —separated and labeled
d. Provide *enrichment* on the presentation (if appropriate)
   —spaced repetition (for different information)
   —simplified early presentations (for difficult information)
   —bite-sized chunks (for a lot of information)
   —attention-focusing devices (when there is much irrelevant information)
   —alternative representations (for meaningful understanding)
   —reference example (for understanding of a generality)
   —memory devices (for rote recall)
e. Provide *practice* on the information
   —consistent with the post-instructional requirements
   —separated and labeled
   —as soon as possible after presentation of information
f. Provide *enrichment* on the practice (if necessary)
   —spaced repetition (for difficult information) including recognition before recall form of practice
   —bite-sized chunks (for a lot of information)
g. Provide *reinforcement* and feedback
   —immediately after each practice
   —continuous-to-intermittent reinforcement
   —correct answer
   —intrinsic reinforcement

h. Provide *enrichment* on the feedback (if necessary)
   —praise
   —attention-focusing devices (when there is much irrelevant infor tion)
   —alternative representations (for meaningful understanding)
   —repeat the memory devices (for difficult rote information)

Skill-Application General Model

If the objective for your next piece of content calls for learning to app skill, the CDT prescribes that the instruction should contain three prin components: a generality, examples, and practice items (M. D. Me 1983). A *generality* is the definition of a concept, description of a proced or explanation of a principle, any one of which can be applied to a variet different cases. For example: "An adjective is a word that is use describe a noun or a noun equivalent." An *example* is an instance or spe case of that generality, such as "slow is an adjective." A *practice* offers the learner an opportunity to apply the generality to an instance previously encountered, such as "Which of the following words is an a tive? *cow . . . pretty . . . jump*" (where none of those words was use previous instruction on adjectives). Practice items should be followe some type of *feedback* informing the learner as to whether his or response was correct, and, if incorrect, it should explain why or should the process for arriving at the correct response.

When more than one example and/or practice item is required fo instruction, they should be *divergent*—that is, the instances should b different as possible from each other. In addition, the examples and pra should be presented in a *progression of difficulty* from easy to difficult.

Finally, CDT prescribes the use of several *secondary components:* alt tive representations of the generality, examples, and practice; atter focusing devices on the generality, examples, and practice feedback; a gies; mnemonics; algorithms; and matched example–nonexample pair concepts (M. D. Merrill, 1983).

Variations on the Skill-Application Model

There are several learning situations that call for modifications in this ge model (M. D. Merrill, 1983). As with the remember-level model, the *ness* of the instruction needs to vary, depending on the difficulty of the tent. The easier and more familiar the content, the fewer examples, tice, and secondary components needed.

Another variation relates to *content types.* The nature of the gener examples, and practice is different for different content types. For exa the generality for a concept should identify the name of the concep superordinate concept, its critical (defining) attributes, and the nature relationship among the attributes (conjunctive or disjunctive). On the other hand, the generality for a procedure should identify the name of the procedure (if any), its goal, and its steps in sequential order, including any decision steps and branches. And the generality for a principle should identify the changes and the relationship between them, which usually means identifying the cause, the effect, and the fact that the cause caused the effect. The nature of examples, practice, and enrichment components is also different for each type of content. (See M. D. Merrill, 1983, pp. 313–320, for details.)

The *sequence* of the primary components can be varied, depending on whether a deductive or inductive approach is desired. A ***deductive approach*** requires presentation of the generality before the examples and practice. An *inductive approach* requires presentation of the examples or even just the practice first, so that the learner is required to induce or discover the generality (cf. Collins & Stevens, 1983). The selection of approach depends on the amount of time available for instruction (the inductive approach takes longer), the motivational requirements of the learners regarding the content (the inductive approach is usually more motivational), the age of the learners (younger learners usually benefit from receiving examples first), and whether the ability to discover is a desirable secondary objective (Landa, 1983). One should also keep in mind that the inductive approach tends to facilitate transfer and long-term retention. However, it is less efficient because it takes the learners longer to achieve mastery (Shulman & Keislar, 1966).

Finally, *learner control* (M. D. Merrill, 1984) offers yet another variation. Instruction may be designed so that the learner can easily select which strategy component to study when. If each component is labeled, then the learner can construct his or her own sequence of components. For instance, a learner could skip to the examples first, then go back to the generality, try a few practice items, look at a few more examples, and then go to the more difficult practice. However, research results indicate that learner control is only helpful when the learners have learned how to use it effectively (M. D. Merrill, 1983).

Reigeluth (1984c) has extended CDT's skill-application model of instruction. The following strategy components are not necessarily included sequentially:

a. Stimulate and maintain *interest* (if necessary)
   —question —demonstration —game
   —novelty —analogy
b. Review *prerequisites* (if necessary)
c. Present the *generality*
   —consistent with the postinstructional environment
   —separated and labeled

d. Provide *enrichment* on the generality (if necessary)
   —bite-sized —alternative representation
   —memory devices —repetition (spaced)
   —attention-focusing
e. Present some *examples*
   —consistent with the postinstructional environment
   —separated and labeled —divergent (varied)
   —easy-to-difficult
f. Provide *enrichment* on the examples (if necessary)
   —amount —alternative representation
   —attention-focusing
g. Provide *practice*
   —consistent with the postinstructional environment
   —separated and labeled —divergent (varied)
   —easy-to-difficult
h. Provide *enrichment* on the practice (if necessary)
   —amount
i. Provide *reinforcement* and *feedback*
   —immediate —correct answer
   —intrinsic —continuous-to-intermittent reinforcement
j. Provide *enrichment* on the feedback (if necessary)
   —praise —attention-focusing
   —process —alternative representation

Cognitive-Strategy-Application General Model

Finally, the objective for your next piece of content may call for lear cognitive strategy. Cognitive strategies are ways the learner us approach novel problems, and if properly applied will facilitate acqui retention, and retrieval (Rigney, 1978). They can be thought of as th skills and learning skills that can be applied across a variety of differen ject areas (Reigeluth, 1983b). There have been many cognitive stra investigated over the years. Examples are strategies for creating imagery, for creating analogies, for discovering, problem solving, not ing, response review, self-programming, and self-monitoring (Dans 1978; Weinstein, 1978).

Although cognitive strategies take longer to learn than intellectual their acquisition may be facilitated through a variety of techniques mentioned previously, Gagné and Briggs (1979) have advocated pres *novel problems* in teaching cognitive strategies. However, it also likely that virtually all of the strategy components from the skill-appli model can and should be used for teaching cognitive strategies. For example, discovery (a cognitive strategy) can be taught by providing a generality about how to discover new ideas, presenting examples of that generality being used to discover new ideas, and providing practice with feedback on applying the generality to novel problems.

Variations on the Cognitive-Strategy-Application Model

It seems likely at present to assume that all of the variations of the skill-application model would also hold here. However, much more work needs to be done in this area.

MOTIVATIONAL-STRATEGY COMPONENTS

As you design the instruction on each piece of content in your macro-level blueprint, you should also be thinking about the motivational requirements for the instruction, given the nature of the content and the learners. The inclusion of motivational principles in instructional design has only recently begun to receive systematic attention. Keller (1979) has done some integrative and highly innovative work in developing a descriptive theory of motivation as it relates to instruction and performance. Keller's theory is founded upon *environmental theories* concerned with conditioning principles and physiologically based drives (e.g., Hull, 1943; Skinner, 1953); *humanistic theories* attributing free will as the basis for motivation (e.g., Rogers, 1969); and *social-learning theories* which look at the interaction between person and environment (e.g., Bandura, 1969; Rotter, 1954, 1966). In addition, Keller's theory of motivation draws on a broad variety of other ideas, particularly expectancy-value theory (e.g., Porter & Lawler, 1968), which includes the notion that motivation is a multiplicative function of expectancies and values.

Furthermore, Keller has extended his descriptive theory by developing *prescriptions* for the motivational design of instruction (Keller, 1983; Keller & Dodge, 1982). These prescriptions are divided into four types of motivational requirements, represented by ARCS: *Attention* (arouse and sustain), *Relevance* (instruction linked to important needs), *Confidence* (feelings of competence), and *Satisfaction* (reinforcement). A special combination of learner and content analyses identifies the motivational requirements of the instruction, which in turn provide the basis for prescribing specific motivational-strategy components.

These four types of motivational requirements may be related to Gagné's nine events of instruction. Attention corresponds to Gagné's first event: gaining attention. Relevance is provided when the learner is informed of the objective and is stimulated to recall past learning before encountering the stimulus material. Confidence may be achieved through "learning guidance."

Finally, the learner's feelings of satisfaction may be enhanced by provi(positive feedback on the learner's performance.

Keller and Dodge have further identified specific strategy components each of the four dimensions that may be applied to the design of a piec(instruction. Examples for each motivational requirement are:

1. Vary the appearance of the instructional materials (attention);
2. Relate the content to the learner's past experience (relevance);
3. Sequence and present material in gradually increasing levels of difficulty (confidence);
4. Provide positive reinforcement and feedback (satisfaction) (Kelle & Dodge, 1982).

The nature of various primary and secondary presentation forms ma\ greatly influenced by the types of motivational considerations outlined h For example, in order to sustain attention, lower-ability students c require less print, more illustrations, and more attention-focusing device a page of text than higher-ability students. There is much need to integ this highly innovative work into our expanding knowledge base of inst tional models.

APPROACHES TO INSTRUCTION

Once the richness and motivational requirements for the instruction are d mined and the appropriate components are prescribed for the instruction, must then decide on an approach or combination of approaches by whicl instruction should occur (Reigeluth, et al., 1982). However, the appr selected for the presentation of instruction is largely based on what sequencing strategy requirements are for that instruction.

Reigeluth et al. (1982) have organized the types of present approaches into a matrix based on the *source* of instruction and the *rec* of that instruction. The source can be either human or nonhuman. If human, it can be a trained professional or an amateur; and similarly, if nonhuman, it can be instructionally designed or not designed specificall instructional purposes. For any one of those kinds of sources of the ins tion, the receiver can be an individual learner or a group of learners. result of this conceptualization is a 4 × 2 matrix defining eight di approaches to instruction (see Fig. 7.3). The label most closely assoc with each of these eight approaches is shown in the matrix, but in cases common use of those labels does not perfectly match the catego defined by the matrix.

		Source of Instruction			
		Human		Nonhuman	
		Professional	Non-Professional	Instructionally Designed Environment	Not Designed for Instruction
Receiver of Instruction	Individual	Tutoring	Peer Tutoring	Individualized Resources	Individual Projects
	Group	Exposition (Lecture)	Group Discussion	Group Activities	Group Projects

FIGURE 7.3. Eight instructional approaches as defined by the nature of the source and receiver of the instruction.

Often instructional designers think only of individualized resources when they design instruction. This is not a good practice because other approaches are often more effective or less expensive. **The selection of the most** appropriate approach or combination of approaches for your instruction should be based on a number of criteria, including practice and feedback requirements, content characteristics, student characteristics, teamwork requirements, and resource considerations. A guide to the selection of these approaches, according to specified conditions, is presented in Fig. 7.4. Also, Reigeluth et al. (1982) provide specific prescriptions for using each approach. These prescriptions identify additional strategy considerations (especially management considerations, as described in the following section) particular to each of the eight approaches, and they integrate those considerations with the Component Display Theory and Elaboration Theory prescriptions.

MANAGEMENT STRATEGIES

Management strategies are methods for deciding when and where to use other instructional strategies. Perhaps the most important model for management-strategy components is mastery learning (Block, 1971; Bloom, 1968, 1971; Carroll, 1971). The major components in this model are: (1) identification of competencies to be mastered by all learners; (2) diagnosis of the learners at the end of the instruction on a competency to determine whether mastery has been reached; and (3) remediation whenever the diagnosis reveals that a learner has not achieved mastery of a competency.

Selection Criteria \ Alternate Presentational Formats	Individualized Instruction	Group Activities	Lecture or Demonstration	Teacher or Peer Tutoring	Group Discussions	Individual Projects	Group Projects
1. Practice and Feedback Requirements							
Not required			X				
Rote practice required		X		X			
Immediate, individual feedback neded	X			X			
Perspectives/attitudes of peers important					X		
Responses difficult to evaluate	X			X			
Wide range of responses possible	X			X			
Evaluation/practice conducted in natural environment		X		X		X	X
2. Content Characteristics							
Abstract/complex information	X			X			
Urgent/changing information			X				
Low priority information			X				
Easy to retain			X				
No/low active participation of learner required	X		X				
Problems with no clear answer					X		
Special presentation for special group			X				
Unique task for one/few learners				X			
3. Student Characteristics							
Homogenous	X		X				
Similar verbal/analytical aptitude					X		
Avove-average intelligence			X				
Low achievers	X	X	X	X	X		
Need to alleviate anxiety caused by group work	X			X		X	
Need affiliation with teacher				X			
Need affiliation with peers		X			X		X
Can work independently	X					X	
4. Teamwork Requirements							
Real-life team task		X					X
Interactive skills critical to task		X			X		X
Group consensus needed					X		
Student cooperation/group cohesiveness sought		X			X		X
5. Resource Considerations							
Large number of students	X		X				
Lack of teachers/money/materials			X	X			
Individual records to be managed	X			X		X	

FIGURE 7.4. Guidelines for selecting an instructional approach.

Another important model included in management strategies is learner control. Various components for providing learner control over macro strategies (especially sequencing) and micro-strategies were described earlier. Other management strategies are described in Chapters 14 and 15.

CONCLUSION

The failure of so many instructional programs and materials has often been the result of an emphasis solely on content, with little regard for principles of instructional design to produce effective, efficient, and appealing instruction. A knowledge of instructional models that adapt to a variety of learning situations provides the foundation for optimizing learning outcomes.

This chapter has described the results of some of the most comprehensive efforts to integrate our knowledge about instructional strategy components into theories of instruction, which prescribe different models of instruction for different learning situations. However, the field is just entering its adolescence. We can expect to see the development of a much more cohesive and powerful knowledge base about instruction over the next 10 to 20 years. Readers of this chapter may well become important contributors to that effort.

REFERENCES

Ausubel, D. P. (1960). The use of advance organizers in the learning of meaningful verbal material. *Journal of Educational Psychology, 51,* 267–272.

Ausubel, D. P. (1963). *Psychology of meaningful verbal learning.* New York: Grune & Stratton.

Ausubel, D. P. (1968). *Educational psychology: A cognitive view.* New York: Holt, Rinehart and Winston.

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). *Educational psychology: A cognitive view* (2nd Ed.). New York: Holt, Rinehart and Winston.

Bandura, A. (1969). *Principles of behavior modification.* New York: Holt, Rinehart and Winston.

Bandura, A. & Walters, R. H. (1963). *Social learning and personality development.* New York: Holt, Rinehart and Winston.

Block, J. H. (1971). *Mastery learning: Theory and practice.* New York: Holt, Rinehart and Winston.

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives. Handbook I: Cognitive domain.* New York: McKay.

Bloom, B. S. (1968). Learning for mastery. *Evaluation Comment, 1*(2) 1–12.

Bloom, B. S. (1971). Mastery learning. In J. H. Block (Ed.), *Mastery learning: Theory and practice.* New York: Holt, Rinehart and Winston.

Branson, R. K., Rayner, G. I., Cox, J. L., Furman, J. P., King, F. J., & Hannum, W. H. (1975). *Inter-service procedures for instructional system development* (5 vols.). Fort Monroe, VA: US Army Training and Doctrine Command (TRADOC PAM 350-30 and HAVEDTRA 196A).

Bruner, J. S. (1960). *The process of education.* New York: Random House.

Bruner, J. S. (1966). *Toward a theory of instruction.* New York: Norton.

Carroll, J. B. (1971). Problems of measurement related to the concept of learning for ma In J. H. Block (Ed.), *Mastery learning: Theory and practice.* New York: Holt, Ri and Winston.

Collins, A., & Stevens, A. L. (1983). A cognitive theory of inquiry teaching. In C Reigeluth (Ed.), *Instructional-design theories and models: An overview of their c status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Crowder, N. A. (1960). Automatic tutoring by intrinsic programming. In A. Lumsdaine Glaser (Eds.), *Teaching machines and programmed learning.* Washington, DC: Na Education Association.

Curtis, R. V., & Reigeluth, C. M. (1984). The use of analogies in written text. *Instruc Science, 13,* 99–117.

Dansereau, D. (1978). The development of a learning strategies curriculum. In H. F. O'Ne (Ed.), *Learning strategies.* New York: Academic Press.

Doman, R. J., Spitz, E.B., Zucman, E., & Delacato, C. H. (1960). Children with severe injuries: Neurological organization in terms of mobility. *Journal of the American M Association, 174,* 257–262.

Evans, J. L., Homme, L. E., & Glaser, R. (1962). The Ruleg system for the constructi programmed verbal learning sequences. *Journal of Educational Research, 55,* 513–518.

Fitts, P. M. & Posner, M. I. (1967). *Human performance.* Monterey, CA: Brooks/Cole.

Gagné, R. M. (1962). The acquisition of knowledge. *Psychological Review, 59,* 355–365.

Gagné, R. M. (1968). Learning and communication. In R. V. Wiman and W. C. Meier (Eds.), *Educational media: Theory into practice.* Columbus, OH: Merrill.

Gagné, R. M. (1985). *The conditions of learning* (4th ed.). New York: Holt, Rineha Winston.

Gagné, R. M. & Briggs, L. J. (1979). *Principles of instructional design* (2nd ed.). New Holt, Rinehart and Winston.

Gagné, R. M., Wager, W., & Rojas, A. (1981, September). Planning and authoring com assisted instruction lessons. *Educational Technology,* 17–26.

Gilbert, T. F. (1962). Mathetics: The technology of education. *Journal of Mathetics,* 7–73

Gropper, G. L. (1973). *A technology for developing instructional materials.* Pittsburgh: A can Institutes for Research.

Gropper, G. L. (1974). *Instructional Strategies.* Englewood Cliffs, NJ: Educational Techn Publications.

Gropper, G. L. (1975). *Diagnosis and revision in the development of instructional mat* Englewood Cliffs, NJ: Educational Technology.

Gropper, G. L. (1983). A behavioral approach to instructional prescription. In C. M. Rei (Ed.), *Instructional-design theories and models: An overview of their current status.* dale, NJ: Lawrence Erlbaum Associates.

Harmin, M., Kirschenbaum, H. & Simon, S. (1973). *Clarifying values through subject n* Minneapolis: Winston Press.

Hersh, R. H., Miller, J. P., & Fielding, G. D. (1980). *Models of moral educatio appraisal.* New York, Longman.

Horn, R. E. (1976). *How to write information mapping.* (Lexington, Mass: Inforn Resources.

Hull, C. L. (1943). *Principles of behavior.* New York: Appleton-Century-Crofts.

Keller, J. M. (1979). Motivation and instructional design: A theoretical perspective. *Jour Instructional Development,* 2(4), 26–34.

Keller, J. M. (1983). Motivational design of instruction. In C. M. Reigeluth *Instructional-design theories and models: An overview of their current status.* Hillsdal Lawrence Erlbaum Associates.

Keller, J. M. & Dodge, B. (1982, September). *The ARCS model of motivational strategies for course designers and developers.* Fort Monroe, VA: Training Developments Institute.

Klausmeier, H. J., Ghatala, E. S., & Frayer, D. A. (1974). *Conceptual learning and development: A cognitive view.* New York: Academic Press.

Kohlberg, L. (1976). The cognitive-developmental approach to moral education. In D. Purpel & K. Ryan (Eds.), *Moral education . . . it comes with the territory.* Berkeley, CA: McCutchan.

Krathwohl, D. R., Bloom, B. S. & Masia, B. B. (1964). *Taxonomy of educational objectives. Handbook II: Affective domain.* New York: McKay.

Kulhavy, R. W. (1977). Feedback in written instruction. *Review of Educational Research, 47,* 211-232.

Landa, L. N. (1974). *Algorithmization in learning and instruction.* Englewood Cliffs, NJ: Educational Technology.

Landa, L. N. (1976). *Instructional regulation and control: Cybernetics, algorithmization, and heuristics in education.* Englewood Cliffs, NJ: Educational Technology.

Landa, L. N. (1983). Descriptive and prescriptive theories of learning and instruction: An analysis of their relationships and interactions. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Liebert, R. M., & Spiegler, M. D. (1974). *Personality: Strategies for the study of man.* Homewood, IL: Dorsey.

Markle, S. M. & Tiemann, P. W. (1969). *Really understanding concepts.* Chicago: Tiemann Associates.

Mayer, R. E. (1977). The sequencing of instruction and the concept of assimilation-to-schema. *Instructional Science, 6,* 369-388.

Merrill, M. D. (1979, February). *Learner-controlled instructional strategies: An empirical investigation.* Final report on NSF Grant No. SED 76-01650.

Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Merrill, M. D. (1984). What is learner control? In R. K. Bass & C. Dills (Eds.), *Instructional development: The state of the art, II.* Dubuque, IA: Kendall-Hunt.

Merrill, M. D., Reigeluth, C. M., & Faust, G. W. (1979). The instructional quality profile: A curriculum evaluation and design tool. In H. F. O'Neil, Jr. (Ed.), *Procedures for instructional systems development.* New York: Academic Press.

Merrill, M. D., Richards, R. E., Schmidt, R. V., & Wood, N. D. (1977). *The instructional strategy diagnostic profile: Training manual.* San Diego: Courseware, Inc.

Merrill, M. D., & Tennyson, R. D. (1977). *Teaching concepts: An instructional design guide.* Englewood Cliffs, NJ: Educational Technology.

Merrill, M. D., & Wood, N. D. (1974). *Instructional strategies: A preliminary taxonomy.* Columbus, OH: Ohio State University (ERIC Document Reproduction Service No. SE 018-771)

Merrill, P. F. (1978). Hierarchical and information processing task analysis: A comparison. *Journal of Instructional Development, 1*(2), 35-40.

Naisbitt, J. (1982). *Megatrends: Ten new directions transforming our lives.* New York: Warner Books.

Naylor, J. C., & Briggs, G. E. (1963). Effects of task complexity and task organization on the relative efficiency of part and whole training methods. *Journal of Experimental Psychology, 65,* 217-224.

Ortony, A. (Ed.). (1979). *Metaphor and thought.* Cambridge: Cambridge University Press.

Porter, L. W., & Lawler, E. E. (1968). *Managerial attitudes and performance.* Homewood, IL: Irwin.

Posner, G. J., & Strike, K. A. (1976). Categorization scheme for principles of sequencing tent. *Review of Educational Research, 46,* 665-690.

Reigeluth, C. M. (1979). In search of a better way to organize instruction: The elabor theory. *Journal of Instructional Development, 2*(3), 8-15.

Reigeluth, C. M. (1983a). Instructional design: What is it and why is it? In C. M. Reig (Ed.), *Instructional-design theories and models: An overview of their current status.* H dale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M. (1983b). Meaningfulness and instruction: Relating what is being learne what a student knows. *Instructional Science, 12(3), ffR197-218.*

Reigeluth, C. M. (1984a, November). Toward a common knowledge base: The evolutio instructional science. *Educational Technology,* 20-26.

Reigeluth, C. M. (1984b, March). *An instructional model of remember-level learning: integration of instructional design prescriptions.* Paper presented at the annual conventio the American Educational Research Association, New Orleans, LA.

Reigeluth, C. M. (in press). Lesson blueprints based on the elaboration theory of instruction C. Reigeluth (Ed.), *Instructional theories in action: Lessons illustrating selected the and models.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M., & Darwazeh, A. N. (1982). The elaboration theory's procedure for desig instruction: A conceptual approach. *Journal of Instructional Development, 5(3),* 22-32.

Reigeluth, C. M., Doughty, P., Sari, I. F., Powell, C. J., Frey, L., & Sweeney, J. (1 *Extended development procedure: Users' manual.* Fort Monroe, VA: U. S. Army Trai and Doctrine Command.

Reigeluth, C. M., & Rodgers, C. A. (1980). The elaboration theory of instruction: Pres tions for task analysis and design. *NSPI Journal, 19*(1), 16-26.

Reigeluth, C. M. & Stein, F. S. (1983). The elaboration theory of instruction. In C. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their cu status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Rigney, J. W. (1978). Learning strategies: A theoretical perspective. In H. F. O'Neil, Jr. (*Learning strategies.* New York: Academic Press.

Rogers, C. R. (1969). *Freedom to learn.* Columbus, OH: Merrill.

Romiszowski, A. J. (1981). *Designing instructional systems: Decision making in course plan and curriculum design.* New York: Nichols.

Rothkopf, E. Z. (1976). Writing to teach and reading to learn: A perspective on the psych of written instruction. *National Social Studies Education Yearbook, 75*(1), 91-129.

Rotter, J. B. (1954). *Social learning and clinical psychology.* Englewood Cliffs, NJ: Pre Hall.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of rein ment. *Psychological Monographs, 80.*

Ryan, K. (1981). *Questions and answers on moral education.* Bloomington, IN: Phi Kappa Educational Foundation.

Sari, I. F., & Reigeluth, C. M. (1982). Writing and evaluating textbooks: Contributions instructional theory. In D. Jonassen (Ed.), *The technology of text: Principles for structu designing, and displaying text.* Englewood Cliffs, NJ: Educational Technology.

Scandura, J. M. (1973). *Structural learning I: Theory and research.* New York: Gordon Breach.

Scandura, J. M. (1983). Instructional strategies based on the structural learning theory. I M. Reigeluth (Ed.) *Instructional-design theories and models: An overview of their cu status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Shulman, L. S., & Keislar, E. R. (Eds.). (1966). *Learning by discovery: A critical appr* Chicago: Rand-McNally.

Singer, R. N. (1972). *Psychomotor domain: Movement behavior.* Philadelphia: Lea & Febi

Singer, R. N. (1975). *Motor learning and human performance* (2nd ed.). New York: Macmillan.
Singer, R. N., & Witker, J. (1970). Mental rehearsal and point of introduction within the context of overt practice. *Perceptual and Motor Skills, 31,* 169–170.
Skinner, B. F. (1953). *Science and human behavior.* New York: Macmillan.
Skinner, B. F. (1954). The science of learning and the art of teaching. *Harvard Educational Review, 24*(2), 86–97.
Skinner, B. F. (1965). Reflections on a decade of teaching machines, In R. Glaser (Ed.), *Teaching machines and programmed learning, II.* Washington, DC: National Educational Association.
Skinner, B. F. (1969). *Contingencies of reinforcement: A theoretical analysis.* New York: Appleton-Century-Crofts.
Verbrugge, R. R., & McCarrell, N. S. (1977). Metaphoric comprehension: Studies in reminding and resembling. *Cognitive Psychology, 9,* 494–533.
Wade, M. G., & Davis, W. W. (1981). *Motor skill development in young children: Current views on assessment and programming.* Washington, DC: National Institute of Child Health and Human Development. (ED 207 672)
Weinstein, C. E. (1978). Elaboration skills as a learning strategy. In H. F. O'Neil, Jr. (Ed.), *Learning strategies.* New York: Academic Press.
White, R. T., & Gagné, R. M. (1974). Past and future research on learning hierarchies. *Educational Psychologist, 11,* 19–28.
White, R. T., & Gagné, R. M. (1978). Formative evaluation applied to a learning hierarchy. *Contemporary Educational Psychology, 3,* 87–94.

AUTHOR NOTES

Charles M. Reigeluth is Associate Professor of Instructional Design at Syracuse University, and a consultant on educational software programs to Renaissance Learning Systems.

Ruth V. Curtis is an instructional development consultant, a Ph.D. graduate of Instructional Design, Development, and Evaluation, Syracuse University.